Appendix A

Proposed Regulation Order
Airborne Toxic Control Measure
for Emissions of Chlorinated Toxic Air Contaminants
from Automotive Maintenance and Repair Activities

PROPOSED REGULATION ORDER
AIRBORNE TOXIC CONTROL MEASURE
FOR EMISSIONS OF CHLORINATED TOXIC AIR CONTAMINANTS
FROM AUTOMOTIVE MAINTENANCE AND REPAIR ACTIVITIES

Adopt new section 93111, title 17, California Code of Regulations, to read as follows:

17 CCR, section 93111. Chlorinated Toxic Air Contaminants Airborne Toxic Control Measure--Automotive Maintenance and Repair Activities.

(a) **Applicability**

(1) Except as provided in subdivision (b), this section applies to any person who sells, supplies, offers for sale, or manufactures automotive consumer products for use in automotive maintenance or repair activities in California.

(2) This section also applies to the owner or operator of any automotive maintenance facility or automotive repair facility that uses automotive consumer products in California.

(b) **Exemptions**

(1) This section does not apply to any automotive consumer product manufactured in California for shipment and use outside of California.

(2) This section does not apply to a manufacturer or distributor who sells, supplies or offers for sale in California an automotive consumer product that does not comply with the standards specified in subdivision (d) if the manufacturer or distributor can demonstrate to the satisfaction of the Executive Officer both of the following: (A) the automotive consumer product is intended for shipment and use outside of California, and (B) the manufacturer or distributor has taken reasonable prudent precautions to assure that the automotive consumer product is not sold, offered for sale, or distributed in California. This subdivision (2) does not apply to manufacturers or distributors of automotive consumer products if the products are sold, supplied, or offered for sale by any person to retail outlets in California.

(c) **Definitions**. For the purposes of this section, the following definitions apply:

(1) “Aerosol Product” means a pressurized spray system that dispenses product ingredients by means of a propellant or mechanically induced force. Any user-pressurized system that uses compressed air as a propellant is considered to be an “Aerosol Product”. “Aerosol Product” does not include pump sprayers.

(2) “ASTM” means the American Society for Testing and Materials.

(3) “Automotive Consumer Product” for the purposes of this section, means any of the following chemically formulated aerosol products or liquid products used in automotive maintenance or repair activities: (A) brake cleaners, (B) carburetor or fuel-injection air intake cleaners, (C) engine degreasers, and (D) general purpose degreasers intended for use in automotive maintenance or repair activities.

(4) “Automotive Maintenance Facility or Automotive Repair Facility (Facility)” means any establishment at which a person repairs, rebuilds, reconditions, services, or maintains in any way, motor vehicles. “Facility” includes entities required to be registered by the California Department of Consumer Affairs, Bureau of Automotive Repair, and entities that service or repair a fleet of ten or more motor vehicles. “Facility” does not include private residences or entities that are involved only in motor vehicle body work or painting.

(5) “Automotive Maintenance or Repair Activities” means any service, repair, restoration, or modification activity to a motor vehicle in which cleaning or degreasing products could be used including, but not limited to, brake work, engine work, machining operations, and general degreasing of engines, motor vehicles, parts, or tools.

(6) “Brake Cleaner” means a cleaning product designed, labeled, promoted or advertised (expressed or implied) to remove oil, grease, brake fluid, brake pad material or dirt from motor vehicle brake mechanisms and parts.

(7) “Carburetor or Fuel-Injection Air Intake Cleaner” means a product designed, labeled, promoted or advertised (expressed or implied) to remove fuel deposits, dirt, or other contaminants from a carburetor, choke, throttle body of a fuel-injection system, or associated linkages. “Carburetor or fuel-injection air intake cleaner” does not include products designed exclusively to be introduced directly into the fuel lines or fuel storage tank prior to introduction into the carburetor or fuel injectors.

(8) “CAS Registry Number” is a unique accession number assigned by the Chemical Abstracts Service, a division of the American Chemical Society.

(9) “Chlorinated Toxic Air Contaminant” for the purposes of this section, means methylene chloride, perchloroethylene, or trichloroethylene.

(10) “Consumer” means any person who seeks, purchases, or acquires any automotive consumer product for use in automotive maintenance and repair activities. Persons acquiring an automotive consumer product for resale are not “consumers” for that product.

(11) “Distributor” means any person to whom an automotive consumer product is sold or supplied for the purposes of resale or distribution in commerce, except that manufacturers, retailers, and consumers are not distributors.

(12) “Engine Degreaser” means a cleaning product designed, labeled, promoted or advertised (expressed or implied) to remove grease, grime, oil or other contaminants from the external surfaces of engines and other mechanical parts.

(13) “Executive Officer” means the Executive Officer of the California Air Resources Board, or his or her delegate.

(14) “General Purpose Cleaner” means a product designed for general all-purpose cleaning, in contrast to cleaning products designed to clean specific substrates in certain situations. “General Purpose Cleaner” includes products designed for general floor cleaning, kitchen or counter top cleaning, and cleaners designed to be used on a variety of hard surfaces.

(15) “General Purpose Degreaser” means any product designed, labeled, promoted or advertised (expressed or implied) to remove or dissolve grease, grime, oil and other oil-based contaminants from a variety of motor vehicle substrates or surfaces or miscellaneous metallic parts. “General Purpose Degreaser” does not include “Engine Degreaser”or “General Purpose Cleaner”.

(16) “Liquid” means a substance or mixture of substances which is capable of a visually detectable flow as determined under ASTM D-4359-90 which is incorporated by reference. “Liquid” does not include powders or other materials that are composed entirely of solid particles.

(17) “Liquid Product” means any product that is packaged and sold as a bulk liquid including liquid delivered by pump sprayers.

(18) “Manufacturer” means any person who imports, manufactures, assembles, produces, packages, repackages, or relabels an automotive consumer product.

(19) “Methylene Chloride” (CAS Registry Number 75-09-2) means the compound with the chemical formula 'CH_2Cl_2', also known by the name ‘dichloromethane’, which has been identified by the Air Resources Board and listed as a toxic air contaminant in section 93000, and which is a hazardous air pollutant designated as a toxic air contaminant in section 93001.

(20) “Motor Vehicle” means a self-propelled device by which any person or property may be propelled, moved, or drawn upon a highway, excepting a device moved exclusively by human power or used exclusively upon stationary rails or tracks. "Motor vehicle" does not include a self-propelled wheelchair, invalid tricycle, or motorized quadricycle when

operated by a person who, by reason of physical disability, is otherwise unable to move about as a pedestrian.

(21) "Owner or Operator" means a person who is the owner or the operator of an automotive maintenance facility or an automotive repair facility.

(22) "Perchloroethylene (Perc)" (CAS Registry Number 127-18-4) means the compound with the chemical formula 'C_2Cl_4', also known by the name 'tetrachloroethylene', which has been identified by the Air Resources Board and listed as a toxic air contaminant in section 93000, and which is a hazardous air pollutant designated as a toxic air contaminant in section 93001.

(23) "Person" means "person" as defined in Health and Safety Code section 39047.

(24) "Pump Sprayer" means a packaging system in which the product ingredients within the container are not under pressure and in which the product is expelled only while a pumping action is applied to a button, trigger or other actuator.

(25) "Retailer" means any person who sells, supplies, or offers for sale automotive consumer products directly to consumers.

(26) "Retail Outlet" means any establishment at which automotive consumer products are sold, supplied, or offered for sale directly to consumers.

(27) "Trichloroethylene" (CAS Registry Number 79-01-6) means the compound with the chemical formula 'C_2HCl_3', also known by the name 'TCE', which has been identified by the Air Resources Board and listed as a toxic air contaminant in section 93000, and which is a hazardous air pollutant designated as a toxic air contaminant in section 93001.

(d) **Standards for Automotive Consumer Products**

(1) Except as provided in subdivision (b), subdivision (e) and subdivision (g), after the effective dates specified in the following Table of Standards no person shall sell, supply, offer for sale, or manufacture for sale in California any automotive consumer product that, at the time of sale or manufacture, contains methylene chloride, perchloroethylene or trichloroethylene.

Table of Standards

Product Category	**Effective Date**
Brake Cleaner	December 31, 2002
Carburetor or Fuel-injection Air Intake Cleaners	December 31, 2002
Engine Degreaser	December 31, 2002
General Purpose Degreaser	December 31, 2002

(2) For the purposes of subdivision (d)(1), a product "contains methylene chloride, perchloroethylene or trichloroethylene" if the product contains 1.0 percent or more by weight (exclusive of the container or packaging) of any one of the compounds methylene chloride, perchloroethylene, or trichloroethylene as determined by the test method specified in subdivision (h).

(3) No owner or operator of an automotive maintenance facility or automotive repair facility shall use an automotive consumer product prohibited under subdivision (d)(1) after June 30, 2005.

(e) **Sell-through of products**

(1) Notwithstanding the provisions of subdivisions (d)(1) and (d)(2), an automotive consumer product manufactured prior to the effective date specified for that product category in the Table of Standards may be sold, supplied, or offered for sale for up to 18 months after the specified effective date.

(2) This subdivision (e) does not apply to any automotive consumer product if that product does not display, on the product container or package, the date on which the product was manufactured or a code indicating such date.

(f) **Administrative Requirements - Code-Dating**

(1) Each manufacturer of an automotive consumer product subject to this section shall clearly display on each automotive consumer product container or package, the day, month, and year on which the product was manufactured, or a code indicating the day, month, and year of manufacture. This date or code-date shall be displayed on each automotive consumer product container or package manufactured on or after the date no later than twelve months prior to the effective date of the applicable standard specified in subsection (d). No person shall erase, alter, deface or otherwise remove or make illegible

any date or code-date from any regulated product container or package without the express authorization of the manufacturer.

(2) If a manufacturer uses a code indicating the date of manufacture for any automotive consumer product subject to this section, the manufacturer shall file an explanation of the code with the Executive Officer of the ARB no later than twelve months prior to the effective date of the applicable standard specified in subdivision (d).

(g) **Variances**

(1) Applications for variances. Any person who cannot comply with the requirements set forth in subdivision (d) because of extraordinary reasons beyond the person's reasonable control may apply in writing to the Executive Officer for a variance. The variance application shall set forth:

(A) the specific grounds upon which the variance is sought;

(B) the proposed date(s) by which compliance with the provisions of subdivision (d) will be achieved; and

(C) a compliance report reasonably detailing the method(s) by which compliance will be achieved.

(2) Notices and public hearings for variances. Upon receipt of a variance application containing the information required in subdivision (g)(1), the Executive Officer will hold a public hearing to determine whether, under what conditions, and to what extent, a variance from the requirements in subdivision (d) is necessary and will be permitted. The Executive Officer will initiate a hearing no later than 75 days after receipt of a variance application. The Executive Officer will send notice of the time and place of the hearing to the applicant by certified mail not less than 30 days prior to the hearing. The Executive Officer will submit notice of the hearing for publication in the California Regulatory Notice Register, and not less than 30 days prior to the hearing, the Executive Officer will send a notice to every person who requests such notice. The notice will state that the parties may, but need not, be represented by counsel at the hearing. At least 30 days prior to the hearing, the Executive Officer will make the variance application available to the public for inspection. The Executive Officer will allow interested members of the public a reasonable opportunity to testify at the hearing and will consider their testimony.

(3) Treatment of confidential information. Information submitted to the Executive Officer by a variance applicant may be claimed as confidential, and such information will be handled in accordance with the procedures specified in sections 91000-91022. The Executive Officer may consider such confidential information in reaching a decision on a variance application.

(4) Necessary findings for granting variances. The Executive Officer will not grant a variance unless the Executive Officer finds that:

(A) because of reasons beyond the reasonable control of the applicant, requiring compliance with subdivision (d) would result in extraordinary economic hardship to the applicant; and

(B) the public interest in mitigating the extraordinary hardship to the applicant by issuing the variance outweighs the public interest in avoiding any increased emissions of toxic air contaminants that would result from issuing the variance; and

(C) the compliance report proposed by the applicant can reasonably be implemented and will achieve compliance as expeditiously as possible.

(5) Variance orders. Any variance order will specify a final compliance date by which the requirements of subdivision (d) will be achieved. Any variance order will contain a condition that specifies increments of progress necessary to assure timely compliance, and such other conditions that the Executive Officer, in consideration of the testimony received at the hearing, finds necessary to carry out the purposes of Division 26 of the Health and Safety Code.

(6) Situations in which variances will cease to be effective. A variance will cease to be effective upon failure of the party to whom the variance was granted to comply with any term or condition of the variance.

(7) Modification and revocation of variances. Upon the application of any person, the Executive Officer may review, and for good cause, modify or revoke a variance from requirements of subdivision (d) after holding a public hearing in accordance with the provisions of subdivision (g)(2).

(h) **Test Methods**

(1) Air Resources Board Method 310, Determination of Volatile Organic Compounds (VOC) in Consumer Products, adopted September 25, 1997, and as last amended on November 16, 1999, is incorporated herein by reference. Sections 3.5 and 3.7 will be used to perform the testing to determine compliance with the requirements of this section.

(2) References to “VOC” in Method 310 mean “chlorinated toxic air contaminants” when Method 310 is used to determine compliance with this section.

(3) Alternative methods which are shown to accurately determine the concentration of methylene chloride, perchloroethylene, or trichloroethylene in a subject product or its emissions may be used upon written approval of the Executive Officer.

Authority cited: Sections 39600, 39601, 39650, 39655, 39656, 39658, 39659, 39665, and 39666, Health and Safety Code.

Reference: Sections 39002, 39600, 39650, 39655, 39656, 39658, 39659, 39665, 39666, and 40000, Health and Safety Code.

Appendix B

Surveys

Survey 1. Brake Cleaner and Perc-Containing Automotive Products Survey

INSTRUCTIONS FOR COMPLETING THE BRAKE CLEANER AND PERC-CONTAINING AUTOMOTIVE PRODUCTS SURVEY

GENERAL INSTRUCTIONS

- Please type or print legibly in ink when filling out the survey form.
- Please review the instructions and the survey form prior to filling out the form.
- We suggest that you make extra copies of the form.
- If you have any questions on the survey or the information we have requested, please contact Mark Williams of the Air Resources Board (ARB) staff at (916) 327-5633.
- In order to get accurate data from this survey, we would appreciate it if you would consult your actual sales records for determining California sales.
- In filling out the survey form if you encounter any questions which do not apply in your situation, please enter "N/A" in the appropriate blanks.
- If you wish to clarify the information supplied by your company or would like to make additional comments, please use Section V to enter your comments. In clarifying the information your company has supplied, please refer to the appropriate table, column, and row or product name.

SECTION I. COMPANY INFORMATION

Company Name:	Enter the entire company name.
Division Name:	If the respondent to the survey is representing a division of the company please enter the division name. If the respondent to the survey is representing several divisions being reported under one company, please enter the additional division names in Section IV: Other Information at the end of the survey.
Contact Person:	Enter the name of the person to be contacted by the ARB if clarifications are needed.
Address:	Enter the mailing address of the company or division responsible for completing the survey.
Manufacturer/ Distributor:	Check the corresponding box to indicate whether you are a manufacturer or a distributor or both.
Phone/Fax Number:	Enter the phone and fax numbers of the contact person.
Confidential Information:	If you would like us to treat this information and data in a confidential manner, please check the box at the bottom of Section I.
E-mail Address:	Enter the E-mail address of the contact person, if available.

SECTION II. BRAKE CLEANER PRODUCT INFORMATION

Column	Instructions
• 1, 8:	List all of the products that your company either makes, formulates, fills for another company, or distributes. After having listed all the applicable products in column 1 of Section II., copy the product names in column 8 of the continuation section (Section II.) at the foot of the page. Be sure to list them in the same order.
• 2:	For those products which you either fill for another company, or distribute, please list the manufacturer's name in Section V, Other Comments.
• 3:	Enter the product form as either (A)erosol, (L)iquid, (P)ump spray, (G)el, (S)olid, or (O)ther. If the product falls into the "Other" category, please specify the form in Section V, Other Comments.
• 4:	What is the weight (ounces) of the product in the container or dispenser? If the product comes in more than one size, list the different sizes as separate entries. It is permissible to report the product size in fluid ounces or gallons, but we request that you enter either the product density in grams per milliliter (g/ml) or its specific gravity (see Section III.).
• 5-7:	What is the number of units of product sold or distributed in California (column 5)? If there are multiple sizes, list the number of units sold or distributed for each size. We are also interested in who the end users are. What percentage of the units are sold for industrial use in shops which do automotive brake repair and servicing (column 6)? What percentage of the units are sold through a retail store for individual or home use (column 7)?
• 9:	Write in the percentage of Perc by weight contained in the product. If this is a non-chlorinated product, please list the main ingredients in Section V, Other Comments.
• 10:	Does the product meet the Volatile Organic Compound (VOC) limit of 50 percent content by weight as required by Article 2 of the Consumer Products Regulation? (Title 17, California Code of Regulations, Section 94509)
• 11-13:	These columns deal with product reformulation. In column 11, please enter whether your company intends to reformulate the product by simply answering "yes" or "no". In column 12 we would like you to enter an estimated date when the product will be reformulated, if applicable. This date would be when the product is estimated to be sold as a commercial product. If the product is to be reformulated, please enter whether the Perc content will increase as a result of the reformulation along with an estimate of what the new Perc content (percent weight) will be (column 13).

SECTION III. LIQUID BRAKE CLEANERS

Column	Instructions
• 1:	Enter any products from Section II. which come in liquid form. These products would be those where "L" is entered in column 3 of Section II.
• 2:	What is the volume (fluid ounces or gallons) of the product in the container or dispenser? If the product comes in more than one size, list the different sizes as separate entries. Please note that we are asking for the amount of product measured by volume, and not by weight as was requested in column 4 of Section II.
• 3:	Please enter either the product density in grams per milliliter (g/ml) or its specific gravity.
• 4:	After product purchase for industrial or home use, does the product need to be diluted prior to its use or application?
• 5,6:	If the producted is diluted, what is the recommended amount of product (column 5) for the given amount of diluent (column 6) per the container instructions? Please specify whether the amounts are given in terms of volume or weight and the units.
• 7:	If the product is diluted, what is the recommended diluent per the instructions?

SECTION IV. OTHER AUTOMOTIVE PRODUCTS CONTAINING PERC

Column	Instructions
• 1:	This column lists other products which could contain Perc.
• 2:	Please answer "Yes" or "No" in the blank by each product category whether your company manufactures, formulates, fills, or distributes that type of product. For those products which you either fill for another company, or distribute, please list the manufacturer's name in Section V, Other Comments.
• 3:	If you answered yes in column 2 to any of the product categories, please answer whether the product(s) contain Perc?
• 4-6:	These columns deal with product reformulation. In column 4, please enter whether your company intends to reformulate the product by simply answering "yes" or "no". In column 5 we would like you to enter an estimated date when the product will be reformulated, if applicable. This date would be when the product is estimated to be sold as a commercial product. If the product is to be reformulated, please enter whether the Perc content will increase as a result of the reformulation along with an estimate of what the new Perc content (percent weight) will be (column 6).

SECTION V. OTHER COMMENTS

If you wish to clarify the information you have supplied or make additional miscellaneous comments on the survey, please enter the comments in this box. In clarifying the information your company has supplied, please refer to the appropriate table, column and row or product name.

California Environmental Protection Agency

Air Resources Board

BRAKE CLEANER AND PERC-CONTAINING AUTOMOTIVE PRODUCTS SURVEY

(Please use extra sheets if necessary)

SECTION I. COMPANY INFORMATION

COMPANY NAME		ADDRESS		
DIVISION NAME				
CONTACT PERSON		CITY	STATE	ZIP
MANUFACTURER? ☐	DISTRIBUTOR? ☐	PHONE ( )	FAX ( )	
CHECK THE BOX IF THIS INFORMATION IS **CONFIDENTIAL**? ☐		E-MAIL ADDRESS		

SECTION II. BRAKE CLEANER PRODUCT INFORMATION (Please see attached instructions)

COLUMN 1	2	3	4	5	6	7
PRODUCT NAME	OWN PRODUCT LINE?	FORM	NET SIZE (Weight in ounces)	UNITS SOLD IN CALIFORNIA	INSTITUTIONAL/ INDUSTRIAL SALES (%)	RETAIL/ HOUSEHOLD SALES (%)

SECTION II. BRAKE CLEANER PRODUCT INFORMATION (Continued)

COLUMN 8	9	10	11	12	13
PRODUCT NAME	PERC CONTENT (Weight percent)	MEETS 50% VOC LIMIT?	WILL PRODUCT BE REFORMULATED	ESTIMATED REFORMULATION DATE	WILL PERC CONTENT INCREASE WITH REFORMULATION?

SECTION III. BRAKE CLEANER PRODUCT INFORMATION (For liquids only)

COLUMN 1	2	3	4	5	6	7
PRODUCT NAME	NET SIZE (Fluid oz. or gallons)	DENSITY(g/ml)/ SPECIFIC GRAVITY	IS THE PRODUCT DILUTED?	AMOUNT OF PRODUCT	AMOUNT OF DILUENT	TYPE OF DILUENT

SECTION IV. OTHER AUTOMOTIVE PRODUCTS CONTAINING PERC

COLUMN 1	2	3	4	5	6
PRODUCT CATEGORY	DO YOU MANUFACTURE A PRODUCT IN THIS CATEGORY?	DOES IT CONTAIN PERC?	WILL THE PRODUCT BE REFORMULATED?	ESTIMATED REFORMULATION DATE	WILL PERC CONTENT INCREASE WITH REFORMULATION?
Brake Anti-squeal compounds					
Bug and tar removers					
Carburetor and choke cleaners					
Engine Degreasers					
Lubricants (excluding engine oil)					
Penetrants					
Undercoatings					
Upholstery fabric cleaners					

SECTION V. OTHER COMMENTS

CONFIDENTIAL INFORMATION SUBMITTAL FORM

If you wish to designate any information contained in your survey data as **CONFIDENTIAL INFORMATION**, please provide the data requested below and return it with your completed survey form.

In accordance with Title 17, California Code of Regulations (CCR), Section 91000 to 91022, and the California Public Records Act (Government Code Section 6250 et seq.), the information that a company provides to the Air Resources Board (ARB) may be released (1) to the public upon request, except trade secrets which are not emissions data or other information which is exempt from disclosure or the disclosure of which is prohibited by law, and (2) to the Federal Environmental Protection Agency (EPA), which protects trade secrets as provided in Section 114(c) of the Clean Air Act and amendments thereto (42 USC 7401 et seq.) and in federal regulation, and (3) to other public agencies provided that those agencies preserve the protections afforded information which is identified as a trade secret, or otherwise exempt from disclosure by law (Section 39660(e)).

Trade secrets as defined in Government Code Section 6254.7 are not public records and therefore will not be released to the public. However, the California Public Records Act provides that air pollution emission data are always public records, even if the data comes within the definition of trade secrets. On the other hand, the information used to calculate information is a trade secret.

If any company believes that any of the information it may provide is a trade secret or otherwise exempt from disclosure under any other provision of law, **it must identify the confidential information as such at the time of submission to the ARB and must provide the name address, and telephone number of the individual to be consulted**, if the ARB receives a request for disclosure or seeks to disclose the data claimed to be confidential. The ARB may ask the company to provide documentation of its claim of trade secret or exemption at a later date. Data identified as confidential will not be disclosed unless the ARB determines, in accordance with the above referenced regulations, that the data do not qualify for a legal exemption from disclosure. The regulations establish substantial safeguards before any such disclosure.

In accordance with the provisions of Title 17, California Code of Regulations, Section 91000 to 91022, and the California Public Records Act (Government Code Sections 6250 et seq.),

Company Name: ____ declares that all the information submitted in response to the California Air Resources Board's information request on the brake cleaner and perc-containing automotive products survey is confidential "trade secret" information, and request that it be protected as such from public disclosure. All inquiries pertaining to the confidentiality of this information should be directed to the following person:

Date:____________________ Mailing Address:

______________________________ (Signature) ______________________________

______________________________ (Printed Name) ______________________________

______________________________ (Title) ______________________________

______________________________ (Telephone Number) ______________________________

Survey 2. Brake/Automotive Repair Shop Survey

California Environmental Protection Agency

Air Resources Board

BRAKE/AUTOMOTIVE REPAIR SHOP SURVEY

Date:________________

Facility:____

Address: ____

____

Cross Street:____

Contact:__________________________ Title:________________________

Phone #:_________________

SHOP DESCRIPTION

The approximate dimensions of the entire shop area, include units (m. or ft.). Interior dimensions include storage and other areas not partitioned off as separate rooms. Exterior dimensions include all connecting structures.:

Interior Height____________, Width____________, Length_______________

Exterior Height____________, Width____________, Length_______________

UTM from 1 corner:____________

Type(s) of ventilation used:

Wall fan ☐ Ceiling or exhaust fan ☐ open doors ☐ other____________________

If fan is used give fan specifications (i.e. CFM, or horsepower & size)____________________

Nominal Dimensions (include units)

Number and ave. size of servicing bays:_____________ L__________ W__________

Number of normally open doors:___________________ H__________ W__________

Number of normally open windows:________________ H__________ W__________

Number of normally open servicing bay doors:__________ H__________ W__________

Nearest offsite receptor distance (incl. units):

Business_________ UTM _______________________ Direction from facility (in degrees) __________

Residential__________UTM ______________________ Direction from facility (in degrees) __________

Distance from the facility building to the facility fence line__________

Provide a sketch of the facility, any adjoining structures (for example: if facility is attached to a strip mall or similar), orientation of the nearest receptor, and indicate the direction North)**:**

SHOP DESCRIPTION (continued)

Normal business operating schedule (e.g. M-F 7am-7pm, Sat-Sun 10am-4pm):

____

How many bays are used for brake services?__________

Are ventilation practices different between mild and inclement weather? Explain:

____

____

OPERATION DESCRIPTION

Number of employees:________________________

Average number of employees in service area each day:_____________________________

Number of people performing brake services each day:______________________________

Number of automotive services performed per week:________________________________

Number of automobiles requiring brake work per week:______________________________

Number of axles serviced per week:_________________________________

Amount of time to perform a brake job (1 or 2 axles) _______

Are there Proposition 65 warnings posted?_______

Comments:____

____

PRODUCT INFORMATION

Number of different brake cleaning product(s) used:_________________________

Has the shop used any other type of brake cleaner? If so, what type of product was used? What was the outcome? Is there a preference of the type of product used?______________________

____

____

If an aqueous type product is used, please list shop's reasons for using product (i.e. product cheaper, etc.)

____

____

____

If an aqueous product is used, has drying time been a concern in the brake repairs? (Explain)

____

____

If an aerosol product is used, list the reasons or situations why the product is used instead of an aqueous product____

____

Are the brakes wiped with rags after using the aerosol spray?_________

If yes, how are the rags stored and disposed of?_____________________________________

If used, what is the approximate fate of all Perc usage (e.g. 50% air, 40% reclaimed for proper disposal, 9% sewer, 1% storm drain)____

PRODUCT INFORMATION (continued)

Ask for a unit of the product(s) used to inspect the label; copy the following information:

1. Product name:____

Manufacturer:____

Address:____ Phone #:_______________

e-mail:____________________________

Part Number:________________________ UPC Code: _________________________

size:_________________ (fl oz., wt oz, gal.) Code date:_______________

Product form: Aerosol ☐ Liquid ☐ Pump Spray ☐ Other_____________________

Active ingredients:____

____

% Perc:_________________

Usage (application) information:____

____

____

____

____

____

____

____

Does the product require dilution ____ (Y / N)

Dilute ________________ **(amount product)** _____ **(units)** of product into ______________ **(amount diluent)** ______ **(units)** of

________________________ **(diluent used)** Apply with _______________________________ **(application equipment used, wipe, spray bottle, etc.)**

Number of product units used per week by facility____________

Volume of diluted product used in a week________________

Number of cans aerosol used per brake job _______

Is the product used for any other application other than brakes? If so what other applications is it used for (i.e. general degreasing, etc.):____

How often and how much of the product used for other purposes:_________________________________

____ (give time frame and amount used)

Did you see a demonstration of the product in use?_____

PRODUCT INFORMATION (continued)

Ask for a unit of the product(s) used to inspect the label; copy the following information:

2. Product name:_______________________________________

Manufacturer:_______________________________________

Address:_______________________________________ Phone #:_______________

e-mail:___________________________

Part Number:________________________ UPC Code: _________________________

size:_________________ (fl oz., wt oz, gal.) Code date:_______________

Product form: Aerosol ☐ Liquid ☐ Pump Spray ☐ Other_____________________

Active ingredients:____

____

% Perc:_________________

Usage (application) information:____

____

____

____

____

____

____

____

Does the product require dilution ____ (Y / N)

Dilute ________________ ______ of product into ______________ _______ of
(amount product) **(units)** **(amount diluent)** **(units)**

________________________ Apply with ________________________________
(diluent used) **(application equipment used, wipe, spray bottle, etc.)**

Number of product units used per week by facility____________

Volume of diluted product used in a week________________

Number of cans aerosol used per brake job ________

Is the product used for any other application other than brakes? If so what other applications is it used for (i.e. general degreasing, etc.):____

How often and how much of the product used for other purposes:_________________________________

____ (give time frame and amount used)

Did you see a demonstration of the product in use?_____

PRODUCT INFORMATION (continued)

Ask for a unit of the product(s) used to inspect the label; copy the following information:

3. Product name:____

Manufacturer:____

Address:____ Phone #:_______________

e-mail:____________________________

Part Number:__________________________ UPC Code: _________________________

size:_________________ (fl oz., wt oz, gal.) Code date:_______________

Product form: Aerosol ☐ Liquid ☐ Pump Spray ☐ Other_____________________

Active ingredients:____

____

% Perc:__________________

Usage (application) information:____

____

____

____

____

____

____

____

Does the product require dilution ____ (Y / N)

Dilute ________________ ______ of product into ______________ _______ of
(amount product) **(units)** **(amount diluent)** **(units)**

_________________________ Apply with _________________________________
(diluent used) **(application equipment used, wipe, spray bottle, etc.)**

Number of product units used per week by facility____________

Volume of diluted product used in a week________________

Number of cans aerosol used per brake job ________

Is the product used for any other application other than brakes? If so what other applications is it used for (i.e. general degreasing, etc.):____

How often and how much of the product used for other purposes:__________________________________

____ (give time frame and amount used)

Did you see a demonstration of the product in use?______

General comments/observations:____

Survey 3. Automotive Service Facility Questionaire

California Environmental Protection Agency
Air Resources Board

AUTOMOTIVE SERVICE FACILITY QUESTIONNAIRE

(Please type or print legibly in ink)

I. LABEL AND CONTACT INFORMATION

The peel-off label on your envelope is designed to speed questionnaire processing. Please cross out any errors in your facility name or address, print the correct information on the label, and affix it to Section I. where indicated. If the label has been damaged, you may print or type the information requested. Additionally, please enter your phone number and a contact person in the space provided.

Affix the ARB label provided on the envelope here.

FACILITY NAME:	
ADDRESS:	
CITY:	ZIP:

CONTACT PERSON:
PHONE ( )

II. SOLVENT USAGE INFORMATION

Do you use brake cleaners, engine degreasers, carburetor cleaners, or multi-purpose lubricants in your facility?

NO **STOP**; Ensure Section I. is complete and return the survey package to us in the enclosed envelope.

YES **CONTINUE**; Proceed to Section III.

III. GENERAL PRODUCT INFORMATION

Indicate the average number of brake jobs your facility performs each week and the amount of product used for each brake job. For aerosols, usage will be in cans per job; for bulk liquids, usage will be in ounces per job. Also indicate whether you use a water-based brake washer for brake parts cleaning (e.g., Safety-Kleen, Ammco, Bird Bath, etc.) The sections below ask more specific questions about the products you use.

Approximately how many brake jobs does your facility perform each week? ____________
If aerosol cans are used, approximately how many cans are used per brake job? ____________
If bulk liquid brake cleaners are used, approximately how many ounces are used per brake job? ____________

Do you use a water-based brake washer? Yes No

IV. AEROSOL BRAKE CLEANER INFORMATION

- For each aerosol brake cleaning product your facility uses, list the product name, manufacturer (for example: Berryman, CRC, Radiator Specialty Corp., etc.) and product size (in ounces) as listed on the product label.
- Enter the 12 digit number located at the bottom of the bar code (the numbers circled in the example to the right). <u>Be sure to include the single digits to the left and right of the bars</u>. ***If the product label does not have a bar code, please enter the part number, if available.***

Bar Code Example:

IV. AEROSOL BRAKE CLEANER INFORMATION (continued)

- Estimate how many cans of product the facility uses each week. ***Your estimate should include all product used, even if the product is used for other purposes such as general purpose cleaning.***

PRODUCT NAME	MANUFACTURER	PRODUCT SIZE (oz.)	12 DIGIT BAR CODE NUMBER OR PART NUMBER	NUMBER OF CANS USED PER WEEK

V. BULK LIQUID BRAKE CLEANER INFORMATION

Complete this section for bulk liquid brake cleaners. Fill out the information the same way as for Section IV., but in column 3 - PRODUCT SIZE, list the volume of the product in **gallons** and in column 5 - AMOUNT USED PER MONTH, list the average amount of product used in **gallons** per month.

PRODUCT NAME	MANUFACTURER	PRODUCT SIZE (gal.)	12 DIGIT BAR CODE NUMBER OR PART NUMBER	AMOUNT USED PER MONTH

VI. AEROSOL AUTOMOTIVE PRODUCTS

Complete this section for engine degreasers, carburetor cleaners, and multi-purpose lubricants used by your facility and not listed in Section IV. Fill out the information the same way as for Section IV. Please make additional copies of the survey form if more space is needed.

PRODUCT NAME	MANUFACTURER	PRODUCT SIZE (oz.)	12 DIGIT BAR CODE NUMBER OR PART NUMBER	NUMBER OF CANS USED PER WEEK

Do you wish to be notified of upcoming workshops/meetings? **YES** **NO**

Please mail your questionnaire back to us in the enclosed business reply envelope by January 27, 1998. If you have any questions on the questionnaire or the information we have requested, please contact Mark Williams of the Air Resources Board staff at (916) 327-5633.

(12/97)

Survey 4. Vehicle Maintenance and Repair Facility Flammability Survey

California Environmental Protection Agency

Air Resources Board

VEHICLE MAINTENANCE AND REPAIR FACILITY FLAMMABILITY SURVEY

Date:________________

Facility:____

Address: ____

____

Contact:__________________________ Title:________________________

Phone #:_________________

GENERAL INFORMATION

Do any of the employees smoke while performing vehicle maintenance or repair? Yes ☐ No ☐

Types of ignition sources (flame or heat) within facility:

Welding ☐ Torch ☐ Propane space heater ☐ Lit cigarettes ☐ AC Leak sensor w/ flame ☐

Fan-forced portable space heater ☐ other____

Specific ventilation practices associated with use of ignition (flame or heat) sources:
Wall fan ☐ Ceiling or exhaust fan ☐ open doors ☐ other____________________

If an ignition source is present (flame or heat), what is the general proximity of the source to where automotive consumer products are being used? (feet, next bay, etc.) __________________

____

Number of different automotive cleaning product(s) used:_______________

Have there been any accidents or incidents related to the use of flammable products?
Yes ☐ No ☐
If yes, state number and explain incident(s):____

____

____

For the different type of automotive products used in the facility, has product flammability ever been a factor in choosing one product over another? Yes ☐ No ☐
If yes, why?:____

____

____

PRODUCT INFORMATION

Ask for a unit of the product(s) used to inspect the label; copy the following information:

1. Product Type:

☐ Brake Cleaner ☐ Carburetor Cleaner ☐ Engine Degreaser ☐ General Degreaser ☐ Other:_________

Product name:____

Manufacturer:____

Part # or UPC code:____

Product form: Aerosol ☐ Liquid ☐ Pump Spray ☐ Other__________________

Listed on label as Flammable? Yes ☐ No ☐

Chlorinated? Yes ☐ No ☐

Notes:____

____

2. Product Type:

☐ Brake Cleaner ☐ Carburetor Cleaner ☐ Engine Degreaser ☐ General Degreaser

☐ Other:_________

Product name:____

Manufacturer:____

Part # or UPC code:____

Product form: Aerosol ☐ Liquid ☐ Pump Spray ☐ Other__________________

Listed on label as Flammable? Yes ☐ No ☐

Chlorinated? Yes ☐ No ☐

Notes:____

____

3. Product Type:

☐ Brake Cleaner ☐ Carburetor Cleaner ☐ Engine Degreaser ☐ General Degreaser

☐ Other:_________

Product name:____

Manufacturer:____

Part # or UPC code:____

Product form: Aerosol ☐ Liquid ☐ Pump Spray ☐ Other__________________

Listed on label as Flammable? Yes ☐ No ☐

Chlorinated? Yes ☐ No ☐

Notes:____

____

PRODUCT INFORMATION (continued)

4. Product Type:

☐ Brake Cleaner ☐ Carburetor Cleaner ☐ Engine Degreaser ☐ General Degreaser

☐ Other:_________

Product name:____

Manufacturer:____

Part # or UPC code:____

Product form: Aerosol ☐ Liquid ☐ Pump Spray ☐ Other__________________

Listed on label as Flammable? Yes ☐ No ☐

Chlorinated? Yes ☐ No ☐

Notes:____

____

5. Product Type:

☐ Brake Cleaner ☐ Carburetor Cleaner ☐ Engine Degreaser ☐ General Degreaser

☐ Other:_________

Product name:____

Manufacturer:____

Part # or UPC code:____

Product form: Aerosol ☐ Liquid ☐ Pump Spray ☐ Other__________________

Listed on label as Flammable? Yes ☐ No ☐

Chlorinated? Yes ☐ No ☐

Notes:____

____

General comments/observations:____

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Appendix C

Methodology for Estimating the Potential Health Impacts from Automotive Maintenance and Repair Facilities

Appendix C. Methodology for Estimating the Potential Health Impacts from Automotive Maintenance and Repair Facilities

This appendix steps through an example calculation to illustrate the procedures that ARB staff used to estimate the potential health impacts from Perchloroethylene (Perc), Methylene Chloride (MeCl), and Trichloroethylene (TCE) usage in aerosol brake cleaning products at automotive maintenance and repair (AMR) facilities. In order to estimate the impacts, product usage information, physical descriptions of the source, and emission release parameters were collected during site visits. This information is used to estimate the facility's Perc, MeCl, and TCE emission rates and to model the facility's emissions using the SCREEN3 and ISCST3 air dispersion models. The modeling results are then used to determine the potential health impacts. The information in this appendix should not be used to compare in any way the SCREEN3 and ISCST3 air dispersion models or their results.

ARB staff used the Brake/Automotive Repair Shop survey form in Appendix B to collect the necessary information to model each facility's potential health impacts. The more pertinent information collected includes the facility's building dimensions, distance to the nearest residential and business receptors, the operating schedule of the service area, and information about the products and their use in brake cleaning. This example calculation uses data collected from one of the site visits and focuses only on Perc emissions to illustrate the methodology.

A. Chronic and Acute Calculations

The calculation begins with the determination of the facility's Perc usage and Perc emission rate, steps through the modeling inputs, and concludes with the calculation of potential health impacts. For our example, we have selected a minimum receptor distance of 32 meters from the center of the volume source (the building) to define a near-source location. For ease of illustration, we assume that both the maximum exposed individual resident (MEIR) and the maximum exposed individual (offsite) worker (MEIW) occur at this location.

1. Determining a Facility's Perc Usage

In order to determine a facility's Perc usage, the following information is needed: the weight percent of Perc in the brake cleaning product, the approximate number of product units used per week, and the weight of the product unit itself. Our example facility was using 19 ounce cans of aerosol product with a 94 percent Perc content by weight and they reported using an average of 624 cans of product each year. The weight percent is obtained either directly from the product label or from the material safety data sheet (MSDS) for the product. The Perc usage in terms of grams per year is given by Equation 1.

(1) $$\left(19\ \begin{matrix}\textit{ounces of}\\ \textit{product per}\\ \textit{can}\end{matrix}\right)\left(\frac{624\ cans}{year}\right)\left(\frac{28.35\ grams}{ounce}\right)\left(94\%\ \begin{matrix}Perc\\ Content\end{matrix}\right) = 315{,}951\ grams/year$$

It should be noted that MeCl and TCE usage can be calculated by substituting in their corresponding percent content by weight in place of Perc in Equation 1.

2. Determining the Perc Emission Rate

With the Perc usage calculated, we now estimate the acute and annualized emission rates in terms of grams per second. These conversions are necessary because they are required input parameters for the SCREEN3 and ISCST3 models. The acute emission rate is determined by calculating the emissions from the number of brake jobs that are performed each hour by the facility. Based on information collected from the site visits, the facilities visited did not perform more than one brake service (job) in any given hour (usually limited by available manpower, tools, and equipment). Our example facility reported that they performed approximately 624 brake services per year (12 services per week). Using this information, Equation 2 calculates the acute emission rate.

(2) $$\begin{matrix}\textit{Emission Rate}\\ (\textit{Acute})\end{matrix} = \left(\frac{315{,}951\ grams}{year}\right)\left(\frac{year}{624\ jobs}\right)\left(\frac{1\ job}{hour}\right)\left(\frac{1\ hour}{3600\ secs}\right) = 0.1407\ grams/\mathrm{sec}$$

The annualized Perc emission rate is determined by dividing the Perc usage calculated by Equation 1 by the facility's reported operating schedule. Our example facility reported that their service area operated 3016 hours per year. Using this information, Equation 3 gives the annualized emission rate uniformly distributed over the operating schedule.

(3) $$\begin{matrix}\textit{Emission Rate}\\ (\textit{Annualized})\end{matrix} = \left(\frac{315{,}951\ grams}{year}\right)\left(\frac{year}{3016\ hours}\right)\left(\frac{1\ hour}{3600\ secs}\right) = 0.0291\ grams/\mathrm{sec}$$

3. Air Dispersion Modeling

a. Running the SCREEN3 Air Dispersion Model

Now that we know the facility's acute and annualized Perc emission rates, physical descriptions of the source, and emission release parameters, we can run the SCREEN3 air dispersion model. Table C-1 summarizes the modeling input parameters for this example. For the AMR facilities, we assumed that the single-story source release height is one-half of the building height. The initial lateral dimension of volume is assumed to be the shortest side of the building exterior divided by the factor 4.3 and the initial vertical dimension of volume is assumed to be the exterior building height divided by the factor 2.15 (U.S. EPA, 1995a). These particular dimension assumptions were selected to represent a modeling scenario that can be generally applied to various sized (e.g., rectangular) AMR facilities. Our example facility is located in an urban area.

Table C-1. SCREEN3 Modeling Input Parameters for Example Facility

Perc Emission Rate (acute) [grams/s]	0.1407
Perc Emission Rate (annualized) [grams/s]	0.0291
Receptor Height [meters][1]	0
Source Release Height [meters][2]	2.3
Initial Lateral Dimension of Volume (σ_{yo}) [meters][3]	2.5
Initial Vertical Dimension of Volume (σ_{zo}) [meters][4]	2.1
Meteorology Option	Full (Acute)/Class 4 (Annual)
Land Type (Urban or Rural)	Urban
Receptor Distance (from center of source)	32
Operating Schedule [hrs/yr]	3016

1. Selected by convention as a ground-level receptor.
2. One-half of building height (15 feet, 4.6 meters)
3. Exterior building width (35 feet, 10.7 meters) divided by factor 4.3 per SCREEN3 User's Guide
4. Exterior building height (15 feet, 2.1 meters) divided by factor 2.15 per SCREEN3 User's Guide

The SCREEN3 model uses these inputs to estimate the downwind, ground-level, maximum 1-hour concentrations for designated distances from the center of the volume source. The estimated acute maximum 1-hour concentration at 32 meters from the center of the facility is 1463 $\mu g/m^3$ and the estimated annualized (chronic) 1-hour concentration is 176 $\mu g/m^3$. It should be noted that the SCREEN3 model must be run twice; once using the acute emission rate and once using the annualized emission rate.

Since potential cancer risks and non-cancer chronic health impacts require an assessment of the annual average concentration of Perc, the U.S. EPA conversion factor of 0.08 (U.S. EPA, 1992) is used to estimate the maximum annual average concentration from the annualized maximum 1-hour concentration. In addition, the maximum annual average concentration is discounted by the operating schedule for the hours the facility does not emit. The maximum annual average concentration is calculated by using Equation 4.

(4)

$$\begin{matrix} Max\ Ann.\ Avg. \\ Concentration \end{matrix} = \begin{pmatrix} Maximum\ 1\text{-}hr \\ Concentration \\ (annualized) \end{pmatrix} \begin{pmatrix} Operating \\ Schedule \\ [hours/year] \end{pmatrix} \left(\frac{year}{8760\ hours} \right) 0.08$$

Substituting in the example data, Equation 5 gives the maximum annual average concentration of 4.848 $\mu g/m^3$.

(5)

$$\begin{matrix} Max\ Ann.\ Avg. \\ Concentration \end{matrix} = \left(176\ \frac{\mu g}{m^3} \right) \left(3016\ \frac{hours}{year} \right) \left(\frac{1\ year}{8760\ hours} \right) 0.08 = 4.848\ \mu g/m^3$$

A summary of the output from the SCREEN3 modeling is shown in Appendix D (Modeling Results). For more information on the SCREEN3 model, please refer to the SCREEN3 model user's guide (U.S. EPA, 1995).

b. Running the ISCST3 Air Dispersion Model Using Regional-Specific Meteorology

Where regional-specific meteorology information is available, the ISCST3 air dispersion model can be used to provide a more refined analysis of a facility's emissions. Table C-2 summarizes the modeling input parameters for this example using the same example facility and source characteristic assumptions made for SCREEN3.

With ISCST3, you have the option of using a meteorological data set that represents the meteorology in the region the facility is located in. As a result, SCREEN3 and ISCST3 may not necessarily yield the same results for a given facility. In order to estimate what the difference would be, both models would need to be run and compared bearing in mind that each models treats the volume source differently. It should be noted that the ISCST3 model must also be run twice if discrete annual and acute emission rates are being used. While this approach is convenient with the SCREEN3 model, the ISCST3 model is considerably more resource intensive and time consuming to execute. Modeling scenarios under ISCST3 can be greatly simplified if an emission rate of 1 gram per second is used (commonly referred to as an unit emission rate).

Table C-2. ISCST3 Modeling Input Parameters for Example Facility Using Regional-Specific Meteorology

Perc Emission Rate (acute) [grams/s]	0.1407
Perc Emission Rate (annual) [grams/s]	0.0291
Modeled Unit Emission Rate [grams/s]	1.0
Receptor Height [meters][1]	0
Source Release Height [meters][2]	2.3
Initial Lateral Dimension of Volume (σ_{yo}) [meters][3]	4.7
Initial Vertical Dimension of Volume (σ_{zo}) [meters][3]	2.1
Averaging Period	Hourly and Annual
Meteorology	Representative Regional
Land Type (Urban or Rural)	Urban
Receptor Locations	Cartesian Grid Network[4]
Receptor Distance (from center of source)	32
Operating Schedule [hrs/yr]	3016

1. Selected by convention as a ground-level receptor.
2. One-half of building height (15 feet, 4.6 meters)
3. Calculated per ISCST3 User's Guide
4. See Appendix D, Section X., Table 2.

With the unit emission rate, the estimated annual and acute unit concentrations are 113 $\mu g/m^3$ and 5027 $\mu g/m^3$, respectively. Equation 6 is then used to calculate the concentrations for the discrete emission rate scenarios given in Equations 2 and 3.

(6)

$$\begin{matrix} Scenario \\ Concentration \\ (Annual/Acute) \end{matrix} = \left(\begin{matrix} Unit \\ Concentration \\ (1.0\ g/s) \end{matrix} \right) \left(\begin{matrix} Scenario \\ Emission\ Rate \\ (Annual/Acute) \end{matrix} \right)$$

Substituting in the emission rates from Equation 2 and 3, Equations 7 and 8 give the maximum annual concentration of 3.288 $\mu g/m^3$ and the maximum 1-hour (acute) concentration of 707 $\mu g/m^3$.

(7)

$$\begin{matrix} Maximum \\ Concentration \\ (Annual) \end{matrix} = \left(113\ \frac{\mu g}{m^3} \right) \left(\frac{\text{sec}}{1.0\ gram} \right) \left(0.0291\ \frac{grams}{\text{sec}} \right) = 3.288\ \mu g/m^3$$

(8)

$$\begin{matrix}Maximum \\ Concentration \\ (Acute)\end{matrix} = \left(5027\ \frac{\mu g}{m^3}\right)\left(\frac{\text{sec}}{1.0\ gram}\right)\left(0.1407\ \frac{grams}{\text{sec}}\right) = 707\ \mu g/m^3$$

Since ISCST3 directly calculates the maximum annual and acute concentrations using the facility's operating schedule when using regional-specific meteorology, neither the 0.08 conversion factor adjustment nor the operating schedule adjustment is required.

c. Running the ISCST3 Air Dispersion Model Using Default Meteorology

If regional-specific meteorological data is not available, the ISCST3 model can be run using default meteorological data. The model inputs are substantially similar to those required for regional meteorological data and are summarized in Table C-3.

Table C-3. ISCST3 Modeling Input Parameters for Example Facility Using Default Meteorology

Perc Emission Rate (acute) [grams/s]	0.1407
Perc Emission Rate (annual) [grams/s]	0.0291
Receptor Height [meters][1]	0
Source Release Height [meters][2]	2.3
Initial Lateral Dimension of Volume (σ_{yo}) [meters][3]	4.7
Initial Vertical Dimension of Volume (σ_{zo}) [meters][3]	2.1
Meteorology	Default
Land Type (Urban or Rural)	Urban
Receptor Locations	Cartesian Grid Network
Receptor Distance (from center of source)	32
Operating Schedule [hrs/yr]	3016

1. Selected by convention as a ground-level receptor.
2. One-half of building height (15 feet, 4.6 meters)
3. Calculated per ISCST3 User's Guide

When using default meteorological data, ISCST3 calculates only a maximum 1-hr (acute) concentration instead of both acute and annual concentrations. Under this scenario, again using a unit emission rate, the estimated acute unit concentration is 7845 $\mu g/m^3$ at 32 meters from the center of the facility. Equation 6 is again used to calculate the concentrations for the acute emission rate given in Equation 2. Substituting in the acute emission rate from Equation 2, Equation 9 gives the maximum 1-hour (acute) concentration of 1104 μg/m^3.

(9)
$$\begin{matrix} Maximum \\ Concentration \\ (Acute) \end{matrix} = \left(7845 \ \frac{\mu g}{m^3}\right)\left(\frac{\sec}{1.0 \ gram}\right)\left(0.1407 \ \frac{grams}{\sec}\right) = 1104 \ \mu g/m^3$$

The maximum annual concentration is calculated by using U.S. EPA conversion factor 0.08 (U.S. EPA, 1992) and adjusting the operating schedule for the hours the facility does not emit, as described by Equation 4. However, the annualized maximum 1-hour concentration must first be calculated as shown in Equation 10. Using Equation 4 with the result from Equation 10, Equation 11 gives the maximum annual average concentration of 6.280 μg/m^3.

(10)
$$\begin{matrix} Maximum \ 1-hr \\ Concentration \\ (Annulized) \end{matrix} = \left(7845 \ \frac{\mu g}{m^3}\right)\left(\frac{\sec}{1.0 \ gram}\right)\left(0.0291 \ \frac{grams}{\sec}\right) = 228 \ \mu g/m^3$$

(11)
$$\begin{matrix} Maximum \\ Concentration \\ (Annual) \end{matrix} = \left(228 \ \frac{\mu g}{m^3}\right)\left(3016 \ \frac{hours}{year}\right)\left(\frac{1 \ year}{8760 \ hours}\right) \ 0.08 = 6.280 \ \mu g/m^3$$

A summary of the output from the ISCST3 modeling is shown in Appendix D (Modeling Results). For more information on the ISCST3 model, please refer to the ISCST3 model user's guide (U.S. EPA, 1995b).

4. Calculation of Potential Cancer Risk and Non-Cancer Acute and Chronic Hazard Indices

In this example, SCREEN3 and the two ISCST3 calculations predicted slightly different maximum concentrations. While either of the three can be used to calculate the potential health impacts, the example calculation will continue with the estimated concentrations from the ISCST3 model using regional-specific meteorological data. We can combine the modeling output with the unit risk factor (cancer effects) or the reference exposure level (non-cancer effects) to determine the potential cancer risk and corresponding acute and chronic hazard indices. The risk assessments are conducted using guidance from the California Air Pollution Control Officers Association (CAPCOA), Revised 1992, Air Toxic "Hot Spots" Program Risk Assessment Guidelines (CAPCOA, 1993). For this example, we calculated the potential cancer and non-cancer health impacts at a near-source location of 32 meters from the center of the volume source (five meters away from the edge of the building). We also assumed that a MEIR (resident) and a MEIW (worker) are exposed to the same concentration. The inhalation unit risk factor (URF) for Perc is 5.9 x 10^{-6} $(\mu g/m^3)^{-1}$; the acute non-cancer reference exposure level (REL) is 20.0 x 10^3 $\mu g/m^3$ and the chronic REL is 35 $\mu g/m^3$ (CAPCOA, 1993). Equation 12 shows the basic algorithm for determining the potential cancer risk, in chances per million, for a residential location (MEIR).

(12)

$$\begin{matrix}\textit{Cancer Risk}\\ (\textit{Resident})\end{matrix} = \begin{pmatrix}\textit{Max. Ann. Avg.}\\ \textit{Concentration}\end{pmatrix}(\textit{URF})\left(\frac{10^6}{\textit{million}}\right)$$

The factor 10^6/million is used to convert the result into the standard reporting unit, chances per million. Substituting in the maximum annual average concentration from Equation 7 and the Perc URF, Equation 13 gives us the potential cancer risk for a residential receptor 32 meters away from the center of the building.

(13)

$$\begin{matrix}\textit{Cancer Risk}\\ (\textit{Resident})\end{matrix} = \left(3.288\ \frac{\mu g}{m^3}\right)\left(5.9\ x\ 10^{-6}\frac{m^3}{\mu g}\right)\left(\frac{10^6}{\textit{million}}\right) = 19.4\ \textit{chances per million}$$

Equation 14 gives the formula for calculating the potential risk for an off-site worker (MEIW). Using guidance from OEHHA, the exposure period of an off-site worker is adjusted to allow for a shorter working lifetime and a shorter operating schedule. This first adjustment is made to allow for a shorter working lifetime, 46 years, rather than a 70-year exposure lifetime which is assumed for residential exposure. The second adjustment is appropriate only when the offsite worker schedule does not coincide with or is shorter than that of the facility being assessed (OEHHA, 1997). It is assumed that a nearby worker would be exposed 8 hours a day, 240 days a year (1920 hours/year) for 46 years (CAPCOA, 1993).

(14)

$$\begin{matrix}\textit{Cancer Risk}\\ (\textit{Worker})\end{matrix} = \begin{pmatrix}\textit{Max Ann. Avg.}\\ \textit{Concentration}\end{pmatrix}(\textit{URF})\left(\frac{\begin{matrix}\textit{Offsite Worker Coincident}\\ \textit{Operating Schedule } [hr/yr]\end{matrix}}{\begin{matrix}\textit{Facility Operating}\\ \textit{Schedule } [hr/yr]\end{matrix}}\right)\left(\frac{\begin{matrix}46\textit{-year}\\ \textit{Working Lifetime}\end{matrix}}{\begin{matrix}70\textit{-year}\\ \textit{Residential Lifetime}\end{matrix}}\right)\left(\frac{10^6}{\textit{million}}\right)$$

Substituting in the maximum annual average concentration from Equation 7, the URF, and the operating schedule (3016 hours per year, for this example), Equation 15 gives the risk for an offsite worker.

(15)

$$\begin{matrix}\textit{Cancer Risk}\\ (\textit{Worker})\end{matrix} = \left(3.288\ \frac{\mu g}{m^3}\right)\left(5.9x10^{-6}\ \frac{m^3}{\mu g}\right)\left(\frac{1920\ hrs/yr}{3016\ hrs/yr}\right)\left(\frac{46\ \ years}{70\ \ years}\right)\left(\frac{10^6}{\textit{million}}\right) = 8.1\ \begin{matrix}\textit{chances}\\ \textit{per million}\end{matrix}$$

Equations 16 and 17 give the formulas for calculating the non-cancer acute and chronic hazard indices, respectively. The acute hazard index is determined by taking the acute maximum 1-hour concentration (acute exposure) and dividing by the acute REL of 20,000 µg/m^3.

(16)
$$\begin{matrix}Acute\\Hazard\\Index\end{matrix} = \frac{\begin{pmatrix}Maximum\ 1-hr.\\Concentration\\(Acute)\end{pmatrix}}{\begin{pmatrix}Acute\\REL\end{pmatrix}}$$

(17)
$$\begin{matrix}Chronic\\Hazard\\Index\end{matrix} = \frac{\begin{pmatrix}Max.\ Ann.\ Avg.\\Concentration\end{pmatrix}}{\begin{pmatrix}Chronic\\REL\end{pmatrix}}$$

Similarly, the chronic hazard index is determined by taking the maximum annual average concentration (chronic exposure) and dividing by the chronic REL of 35 µg/m^3. Finally, Equations 18 and 19 solve for the acute and chronic hazard indices, respectively.

(18)
$$\begin{matrix}Acute\\Hazard\\Index\end{matrix} = \frac{\left(707\ \frac{\mu g}{m^3}\right)}{\left(20000\ \frac{\mu g}{m^3}\right)} = 0.035$$

(19)
$$\begin{matrix}Chronic\\Hazard\\Index\end{matrix} = \frac{\left(3.288\ \frac{\mu g}{m^3}\right)}{\left(35\ \frac{\mu g}{m^3}\right)} = 0.094$$

Tables C-3 summarizes the results that have been calculated in this example for ISCST3 using regional-specific meteorology.

Table C-3. Summary of ISCST3 Results from Example Calculation

Parameter	Result	Reference
Perc Emission Rate (acute), [grams/s]	0.1407	Equation 2
Perc Emission Rate (annualized) [grams/s]	0.0291	Equation 3
Maximum Concentration (unit annual), [µg/m^3]	113	ISCST3 Model Output
Maximum Concentration (unit acute), [µg/m^3]	5027	ISCST3 Model Output
Maximum Concentration (annual) , [µg/m^3]	3.288	Equation 7
Maximum Concentration (acute), [µg/m^3]	707	Equation 8
Cancer Risk (Resident) [chances per million]	19.4	Equation 13
Cancer Risk (Worker) [chances per million]	8.1	Equation 15
Non-Cancer Acute Hazard Index	0.035	Equation 18
Non-Cancer Chronic Hazard Index	0.094	Equation 19

As previously mentioned, this methodology can be extended to MeCl and TCE (or any other pollutant of interest) by using Equation 1 to calculate MeCl and TCE emission rates. Additionally, the URF and acute and chronic RELs for these toxic pollutants will also be needed. Table C-4 summarizes the necessary health values. A summary of results from the modeling performed on each of the facilities visited, as well as the generic facilities, is presented in Appendix D.

Table C-4. Pollutant-Specific Health Values

Pollutant	Unit Risk Factor (URF)	Acute Reference Exposure Level	Chronic Reference Exposure Level
Perchloroethylene (Perc)	5.9×10^{-6} $(\mu g/m^3)^{-1}$	20,000 $\mu g/m^3$	35 $\mu g/m^3$
Methylene Chloride (MeCl)	1.0×10^{-6} $(\mu g/m^3)^{-1}$	14,000 $\mu g/m^3$	3000 $\mu g/m^3$
Trichloroethylene (TCE)	2.0×10^{-6} $(\mu g/m^3)^{-1}$	none	640 $\mu g/m^3$

B. Calculation of the Regional Cancer Risk from Specific Facilities

To perform an assessment of the potential regional cancer risk at the thirteen specific facilities an assessor would start by running a refined air dispersion model. For this analysis, concentration estimates were produced using ISCST3 and multiple years of meteorological data. An example of the input for the ISCST3 model is provided in Table C-2.

The output from the ISCST3 model consists of concentrations at specified locations around a facility that can be referred to as a grid of receptor points. Based on the spatial resolution of the available population data and existing software tools, a 31-kilometer by 31-kilometer system of one-kilometer, square grid-cells was established for each facility as a spatial basis of analysis. Each grid system is centered on the represented facility.

After the modeling is complete, further post processing is performed to produce one concentration estimate per grid-cell. Two receptor networks were used for estimating concentrations with ISCST3 (at each receptor a concentration, exclusive to each facility's emissions, is estimated). One network consists of receptors spaced one-kilometer apart, coincident with the center of each of the one-kilometer, square grid-cells in the 31-kilometer by 31-kilometer grid system. These sparsely spaced receptors are used to represent the homogeneous, low grid-cell concentrations experienced outside of the 9 most central grid-cells where concentrations tend to be less uniform. However, because a large concentration gradient is experienced close to the source (i.e., inhomogeneous emissions), a network consisting of many receptors per grid-cell (100 meters apart) was used. Concentrations estimated at these receptors were averaged, per grid-cell, to produce average concentrations for the nine most central cells.

Census tract population data were acquired from the State Department of Finance. Spatially, this data represents California census tract population estimates for 1998, grown from 1990 Census data. A census tract, generally, represents an area larger than one square kilometer. Data processing of population data took into consideration that grid-cell boundaries overlap with census tract boundaries. Where multiple grid-cells split a census block population estimate, the population data for the single census tract is allocated based on the relative area of the census tract falling in each grid-cell. This is consistent with past population exposure analyses and assumes a homogeneous distribution of population within the tract.

Population data and modeled concentration results were processed to represent the average population and average concentration within each of the one-kilometer square grid-cells in the 31-kilometer by 31-kilometer grid system. The averaged population and concentration data for each grid-cell were overlaid. The concentration and population estimates were then merged based on the represented grid-cell and frequency distributions of the regional population exposure to each of the annual modeling results were created, based on a uniform range of receptor concentrations. See Appendix D, Section E for a complete listing of all thirteen facilities population exposure estimates and Table C-5 for an example.

In Table C-5, the left column presents the modeled annual concentration estimate based on a unit emission rate of one gram per second and the next 6 columns present the estimated population exposed to that concentration per meteorology year. In this example, the five columns right of the concentration are for Oakland 1960 to 1964. The last column is the average population surrounding this facility in Oakland over the years 1960 to 1964.

For example, the results from Table C-5 indicate that within one-kilometer of this facility, on average, 5,843 persons are estimated to be exposed to concentrations of 0.163 $\mu g/m^3$ up to 6.28 $\mu g/m^3$ (based on a one gram per second emissions rate) using Oakland meteorological data for years 1960 through 1964.

To make this table more meaningful, the unit emission rates can be converted to potential cancer risk estimates. To perform this calculation the additional information that is needed is actual emission rate for the facility being evaluated and the pollutant-specific unit risk factor (URF). From Table C-3, the annual emission rate for this facility is 0.0291 grams per second. See Appendix D for a listing of the emission rates used for each modeled facility. The URF for Perc is 5.9×10^{-6} (microgram per cubic meter)$^{-1}$ or $(\mu g/m^3)^{-1}$. Equation 20 shows the algorithm for converting a unit emission rate into an estimate of the potential cancer risk reported in chances per million.

(20)

$$Cancer\ Risk = \begin{pmatrix} Facility\text{-}Specific \\ Annual\ Emissions \\ Rate \end{pmatrix} \begin{pmatrix} Modeled\ Annual \\ Average \\ Concentration \end{pmatrix} (URF) \left(\frac{10^6}{million} \right)$$

Table C-5. Example Table of Population Exposure Estimates

μg/m³ >=	OAK60	OAK61	OAK62	OAK63	OAK64	AVG
0.000	1,300,824	1,300,824	1,300,824	1,300,824	1,300,824	1,300,824
0.001	593,781	610,692	638,801	610,352	618,981	614,521
0.003	377,141	385,071	401,672	391,357	423,603	395,769
0.004	268,996	281,562	283,035	268,881	312,438	282,982
0.006	192,742	203,315	220,437	216,063	234,450	213,401
0.007	176,510	174,360	181,645	165,209	194,184	178,382
0.009	132,661	143,847	149,503	143,106	142,784	142,380
0.010	112,796	115,642	119,774	119,184	131,794	119,838
0.011	103,975	106,927	105,949	105,949	119,588	108,478
0.013	95,571	90,808	99,529	100,217	95,886	96,402
0.014	87,623	86,550	91,753	78,587	87,623	86,427
0.016	80,258	69,719	87,623	70,114	79,699	77,483
0.017	59,443	61,804	61,804	66,517	67,676	63,449
0.020	56,185	58,546	54,494	63,259	55,002	57,497
0.024	52,133	52,133	52,133	56,185	44,033	51,323
0.031	38,289	42,785	38,289	42,785	38,289	40,087
0.041	29,615	33,907	33,907	33,907	29,615	32,190
0.047	25,101	25,101	25,101	25,101	25,101	25,101
0.054	12,008	12,008	20,702	16,407	20,702	16,365
0.163	4,302	4,302	12,008	4,302	4,302	**5,843**

The factor 10^6/million in Equation 20 is used to convert the result into the standard reporting unit, chances per million. Substituting in the facility's actual emission rate from Table C-3, the maximum annual average concentration from the left hand column of Table C-5, and the Perc URF, Equation 21 gives us the potential cancer risk for the population estimates listed in the right six columns.

(21) $$Cancer\ Risk = (0.0291)(0.163)\left(5.9\ x\ 10^{-6}\frac{m^3}{\mu g}\right)\left(\frac{10^6}{million}\right) = 0.03\ chances\ per\ million$$

Returning to the earlier example from Table C-5, where the results indicate that within one-kilometer of this facility, on average, 5,843 persons are estimated to be exposed to concentrations of 0.163 $\mu g/m^3$ to 6.28 $\mu g/m^3$, we now see that this unit-emissions-based concentration translates to an estimated cancer risk of 0.03 chances per million to 19 chances per million. See Table VI-6 in Chapter VI for a list of the estimated regional cancer risks for the one-kilometer grid-cell concentrations at all thirteen specific facilities.

Although the potential cancer risk from the one-kilometer grid-cell concentration is not very large, this does not mean that higher potential cancer risks are not present within the one-kilometer grid-cell. High concentration gradients have been shown to exist within 100 meters of a facility. Examples of higher potential cancer risks within the one-kilometer grid-cell at the thirteen specific facilities have been estimated at the near source, MEIR, and MEIW locations and are presented in Table VI-6 in Chapter VI.

REFERENCES FOR APPENDIX C

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Appendix E

Statewide Population Exposure Estimate Modeling Memorandums

Memorandum 1. Analysis and Population Exposure Estimates for Perchloroethylene Needs Assessment for Brake Cleaning Products, Updated With 1997 Data (April 7, 1999)

MEMORANDUM

TO: Todd Wong, Manager
Emissions Evaluation Section
Stationary Source Division

FROM: Bob Effa, Manager
Client Support Services Section
Planning & Technical Support Division

DATE: April 7, 1999

SUBJECT: ANALYSIS AND POPULATION EXPOSURE ESTIMATES FOR PERCHLOROETHYLENE NEEDS ASSESSMENT FOR BRAKE CLEANING PRODUCTS, **UPDATED WITH 1997 DATA**

This memorandum is in response to your request for an update of an additional year of data to our March 26, 1998, memo of the same subject regarding an analysis of ambient perchloroethylene data and population-weighted exposure. All remarks regarding data and methods used in the previous memo apply to this work. Due to time constraints, we did not attempt to refine the previous analyses. All tables of results follow the same format as those in the March 26, 1998, memo, with the addition of 1997 statistics. The same information for 1990-1996 are reprinted for ease of comparison. In addition, a table displaying site names and their site numbers is part of the new Appendix. The following highlights some additional information.

ADDITIONAL DATA

This analysis is based on ambient data collected by the Air Resources Board (ARB) and compiled in the ARB Air Toxics database. The 1997 data were extracted on March 29, 1999. Thus, this analysis does not reflect any changes that may have occurred since that time. In 1997, one site in the San Francisco Bay Area (Richmond) closed and was replaced by a site in San Pablo. Also, the addition of the Salton Sea Air Basin added Calexico to the monitoring network. Since this site only has data from July 1995 to December 1997, and this analysis examines perchloroethylene exposure trends from 1990 to 1997, the data from this site were not used in the calculation of population exposure.

Missing data points in 1997

During the analysis of 1997 data, we encountered 5 sites with missing data as shown in Table 1. To develop the population-weighted perchloroethylene exposure estimates, we had to populate the data set with the most accurate data estimates available for the calculation of the mean of monthly means. In the case of Richmond being replaced by San Pablo in the San Francisco Bay Area, we simply combined the data into one set for one site (Richmond). For the other sites with missing 1997 data, we incorporated 1996 data in the same manner used in our previous memo. Riverside-Rubidoux had only one value for 1997; therefore, we used its 1996 data completely in the calculation of population-weighted exposure.

TABLE 1

Perchloroethylene Data Analysis
Missing Values in 1997 Data Set and
the Mean of Monthly Means Based on Replaced Data

Site Name	Year	Month(s) Missing	Calculated Mean of Monthly Means
Richmond-13th St	1997	May-Dec	0.040 ppbv
San Pablo-El Portal	1997	Jan-April	(replaces Richmond)
Chico-Manzanita Ave	1997	May	0.040 ppbv
Fremont-Chapel Way	1997	March-September	0.044 ppbv
Los Angeles-N. Main St	1997	Aug-September	0.324 ppbv
Riverside-Rubidoux	1997	February-Dec	0.175 ppbv

There were no unusual observations in 1997, hence no need for an update to Table 2 of our previous memo.

CLARIFICATION ON METHODOLOGY

Although we used the same methodology as that in the March 26, 1998 memo, some clarification is in order.

On page 5 of the previous memo, in the second paragraph of the "Methodology" section, the calculation of population exposure estimates for basins other than the South Coast and San Francisco Bay reduces to using the basin-wide mean of monthly mean concentrations, with missing values handled as described above.

On page 6 of the previous memo, the second sentence should state that "the overall statewide population-weighted exposure was calculated by multiplying the estimated annual average perchloroethylene exposure for a given air basin by its population, added across all basins, then divided by the total population of the state". In other words, the statewide exposure estimate is a weighted average of the basin exposures, with weights determined by the basin populations.

On page 8 of the previous memo, the last paragraph should detail the calculation of basin-specific summary statistics as follows. The minimum, maximum, arithmetic mean, standard deviation and the number of sites are calculated from all values from all sites within the basin. For the basin mean of monthly means, the basin monthly mean is first calculated for each month based on site means for the month. Then the twelve basin monthly means are averaged to obtain the basin-wide annual mean of monthly means. Missing 1997 data have been estimated using 1996 information in the calculation of basin-wide mean of monthly means.

UNCERTAINTY AND LIMITATIONS OF ANALYSIS

There are a number of factors that contribute to uncertainty in the data and in the conclusions drawn from the data. These are not necessarily easy to quantify. Three such factors are discussed below, and they underscore the need to use caution when drawing conclusions from a limited set of data.

One source of uncertainty in our results is attributable to having a very limited number of sites throughout the state and to the infrequency of sampling. As discussed in the March 26, 1998, memo, the statewide population-weighted perchloroethylene exposure is calculated based on a limited data set derived from a statewide network of only 21 or 22 sites that collect one 24-hour sample every twelve days.

MLD conducts performance audits of the toxics program through both laboratory and field audits. Laboratory audits test the analytical methods and are conducted semi-annually. Field audits test the accuracy of the full toxics sampling procedure through a method referred to as "through-the-probe" (TTP) performance audits. These audits test the sample collection, transport, storage and analytical integrity of the toxics sampling effort. TTP audits are quite time consuming and are only conducted annually at each site. MLD publishes the results on the Internet. For perchloroethylene, the latest TTP audit information on the ARB web site indicates an average accuracy for the 20-plus sites to range from -21.5% to +7.2% between 1993 and 1997.

Yet another assumption to keep in mind is that the ambient concentrations of perchloroethylene we used in our analysis represent only outdoor exposures. Essentially, the exposure estimates assume 24 hours a day of outdoor exposure, without considering indoor exposure to this compound. Therefore, caution should be exercised when using these population exposure estimates.

RESULTS

The results of the exposure analysis are summarized in Table 3, with 1997 results added to the far-right column. The estimated statewide population-weighted perchloroethylene exposure, shown at the bottom of the table, decreases from 0.203 ppb-year/person in 1996 to 0.168 ppb-year/person in 1997. The general trend for statewide perchloroethylene population-weighted exposure is downward in all basins, with the exception occurring in San Francisco Air Basin (slight increase from 0.068 in 1996 to 0.071 ppb-year/person in 1997).

TABLE 3

Estimated Air Basin Population-Weighted* Perchloroethylene Exposure
based on 1990 Census (ppb-year/person)**

Air Basin	1990	1991	1992	1993	1994	1995	1996	1997
South Coast	0.590	0.542	0.430	0.472	0.410	0.392	0.330	0.264
South Central Coast	0.181	0.160	0.124	0.095	0.110	0.100	0.104	0.081
San Diego	0.280	0.261	0.262	0.193	0.204	0.244	0.133	0.124
San Francisco	0.196	0.223	0.158	0.124	0.082	0.091	0.068	0.071
San Joaquin Valley	0.121	0.131	0.105	0.410	0.067	0.070	0.064	0.056
Sacramento Valley	0.070	0.075	0.058	0.051	0.181	0.053	0.054	0.053

Air Basin Population Data Used in Calculating
Statewide Perchloroethylene Exposure

Air Basin	1990	1991	1992	1993	1994	1995	1996	1997
South Coast	10684933	10910823	11124105	11206222	11298530	11372003	11441517	11608906
South Central Coast	1041100	1055600	1072600	1080800	1092900	1104100	1108500	1128000
San Diego	2511400	2560800	2611500	2625100	2650700	2669200	2694900	2763400
San Francisco	4324700	4377500	4451700	4511100	4543300	4569800	4649400	4743500
San Joaquin Valley	1977876	2040876	2097395	2130385	2158376	2192027	2226921	2260164
Sacramento Valley	1377350	1413279	1440859	1458943	1469597	1482705	1502236	1524248
SUM	21917359	22358878	22798159	23012550	23213403	23389835	23623474	24028218

Estimated Statewide Population-Weighted Perchloroethylene Exposure
ppb-year/person**

Statewide WTD AVG	0.382	0.362	0.290	0.322	0.262	0.251	0.203	0.168

* Only air basins with perchloroethylene monitoring included in this table. Air basin population-weighted exposure is calculated using mean of monthly means for all sites within basin.

** Population exposure units are a concentration for a given duration per person; For this analysis, the units are ppb-year/person.

In summary, this exposure analysis was developed with data from the six air basins listed above. The South Coast and San Francisco Bay basins were population-weighted using census tract data, and the rest of the basins were estimated using basin-wide annual mean of monthly mean concentrations. The six areas represent approximately 72% of the statewide population. Details of the analysis methods can be found in the March 26, 1998, memo.

SUMMARY TABLES IN APPENDIX

The site and air basin annual summary statistics have been updated with 1997 results. Table A-3 has also been added to aid in identifying the sites.

cc: Bart Croes, PTSD
Hien Tran, PTSD

APPENDIX

TABLE A-1

Site Summary Table

Annual Site Specific Summary Statistics

ARB SITE	YEAR	Air Basin	County	NO_ OBS	Site Mean (ppbv)	Standard Deviation (ppbv)	Mean of Monthly Mean (ppbv)	Site Maximum (ppbv)	Site Minimum (ppbv)
7000069	1990	SC	LA	31	1.193	1.087	1.191	5.000	0.200
7000069	1991	SC	LA	29	0.761	0.615	0.785	2.400	0.070
7000069	1992	SC	LA	30	0.615	0.305	0.609	1.500	0.110
7000069	1993	SC	LA	33	0.601	0.472	0.620	1.700	0.040
7000069	1994	SC	LA	29	0.641	0.530	0.663	2.100	0.040
7000069	1995	SC	LA	31	0.494	0.360	0.487	1.700	0.030
7000069	1996	SC	LA	30	0.428	0.230	0.440	1.400	0.090
7000069	1997	SC	LA	29	0.379	0.234	0.356	1.200	0.100
7000072	1990	SC	LA	31	0.475	0.359	0.477	1.500	0.090
7000072	1991	SC	LA	29	0.341	0.292	0.355	1.100	0.040
7000072	1992	SC	LA	30	0.353	0.247	0.349	1.200	0.100
7000072	1993	SC	LA	32	0.384	0.462	0.433	1.500	0.010
7000072	1994	SC	LA	30	0.301	0.335	0.321	1.300	0.010
7000072	1995	SC	LA	31	0.317	0.346	0.318	1.600	0.030
7000072	1996	SC	LA	25	0.241	0.266	0.226	1.100	0.010
7000072	1997	SC	LA	30	0.228	0.182	0.225	0.500	0.020
7000087	1990	SC	LA	29	0.545	0.256	0.551	1.100	0.240
7000087	1991	SC	LA	28	0.608	0.540	0.604	2.800	0.070
7000087	1992	SC	LA	31	0.519	0.209	0.536	1.000	0.200
7000087	1993	SC	LA	26	0.535	0.326	0.588	1.100	0.050
7000087	1994	SC	LA	30	0.522	0.425	0.503	2.000	0.030
7000087	1995	SC	LA	31	0.581	0.380	0.574	1.400	0.060
7000087	1996	SC	LA	28	0.492	0.315	0.502	1.500	0.120
7000087	1997	SC	LA	22	0.339	0.150	0.337	0.700	0.060
3300144	1990	SC	RIV	28	0.235	0.127	0.237	0.440	0.030
3300144	1991	SC	RIV	29	0.266	0.200	0.276	0.870	0.060
3300144	1992	SC	RIV	30	0.200	0.119	0.201	0.420	0.020
3300144	1993	SC	RIV	29	0.199	0.167	0.198	0.700	0.020
3300144	1994	SC	RIV	31	0.184	0.181	0.191	0.950	0.020
3300144	1995	SC	RIV	31	0.183	0.146	0.177	0.530	0.030
3300144	1996	SC	RIV	31	0.178	0.200	0.176	1.100	0.040
3300144	1997	SC	RIV	1	0.050	n/a	0.050	0.050	0.050
3600175	1990	SC	SBD	27	0.434	0.201	0.423	1.000	0.210
3600175	1991	SC	SBD	28	0.675	1.233	0.717	6.800	0.150

ARB SITE	YEAR	Air Basin	County	NO_ OBS	Site Mean (ppbv)	Standard Deviation (ppbv)	Mean of Monthly Mean (ppbv)	Site Maximum (ppbv)	Site Minimum (ppbv)
3600175	1992	SC	SBD	27	0.360	0.180	0.364	0.680	0.070
3600175	1993	SC	SBD	29	0.392	0.286	0.398	1.100	0.040
3600175	1994	SC	SBD	31	0.284	0.165	0.286	0.820	0.030
3600175	1995	SC	SBD	31	0.265	0.143	0.263	0.550	0.060
3600175	1996	SC	SBD	28	0.203	0.122	0.199	0.530	0.050
3600175	1997	SC	SBD	30	0.198	0.090	0.193	0.400	0.070
4200388	1990	SCC	SBA	27	0.171	0.117	0.176	0.540	0.040
4200388	1991	SCC	SBA	34	0.133	0.093	0.124	0.420	0.040
4200388	1992	SCC	SBA	28	0.098	0.057	0.095	0.310	0.020
4200388	1993	SCC	SBA	31	0.075	0.055	0.075	0.280	0.020
4200388	1994	SCC	SBA	30	0.092	0.118	0.095	0.490	LOD
4200388	1995	SCC	SBA	29	0.075	0.062	0.082	0.280	0.020
4200388	1996	SCC	SBA	30	0.120	0.253	0.120	1.400	0.010
4200388	1997	SCC	SBA	29	0.103	0.088	0.095	0.300	0.010
5600434	1990	SCC	VEN	29	0.190	0.115	0.199	0.520	0.030
5600434	1991	SCC	VEN	28	0.186	0.136	0.192	0.670	0.040
5600434	1992	SCC	VEN	29	0.149	0.097	0.152	0.450	0.020
5600434	1993	SCC	VEN	28	0.116	0.108	0.111	0.580	0.020
5600434	1994	SCC	VEN	29	0.129	0.124	0.122	0.490	0.010
5600434	1995	SCC	VEN	31	0.126	0.110	0.125	0.440	0.020
5600434	1996	SCC	VEN	30	0.087	0.058	0.088	0.300	0.030
5600434	1997	SCC	VEN	29	0.061	0.046	0.068	0.200	0.010
8000114	1990	SD	SD	31	0.235	0.107	0.236	0.480	0.080
8000114	1991	SD	SD	30	0.228	0.129	0.229	0.530	0.060
8000114	1992	SD	SD	30	0.213	0.130	0.208	0.650	0.060
8000114	1993	SD	SD	31	0.141	0.110	0.144	0.530	0.020
8000114	1994	SD	SD	31	0.123	0.121	0.132	0.510	LOD
8000114	1995	SD	SD	29	0.147	0.133	0.146	0.540	0.020
8000114	1996	SD	SD	27	0.124	0.100	0.129	0.450	0.020
8000114	1997	SD	SD	29	0.111	0.099	0.102	0.400	0.010
8000131	1990	SD	SD	31	0.324	0.258	0.329	1.100	0.050
8000131	1991	SD	SD	29	0.293	0.268	0.308	1.300	0.040
8000131	1992	SD	SD	29	0.311	0.222	0.319	0.800	0.060
8000131	1993	SD	SD	28	0.245	0.200	0.256	0.890	0.020
8000131	1994	SD	SD	29	0.285	0.321	0.291	1.600	0.010
8000131	1995	SD	SD	29	0.342	0.585	0.352	3.200	0.040
8000131	1996	SD	SD	30	0.142	0.149	0.168	0.580	0.020
8000131	1997	SD	SD	26	0.147	0.127	0.146	0.500	0.010

ARB SITE	YEAR	Air Basin	County	NO_ OBS	Site Mean (ppbv)	Standard Deviation (ppbv)	Mean of Monthly Mean (ppbv)	Site Maximum (ppbv)	Site Minimum (ppbv)
6000336	1990	SFBA	ALA	30	0.187	0.137	0.189	0.550	0.040
6000336	1991	SFBA	ALA	30	0.210	0.146	0.210	0.540	0.020
6000336	1992	SFBA	ALA	30	0.136	0.119	0.134	0.630	0.030
6000336	1993	SFBA	ALA	30	0.114	0.103	0.114	0.450	0.010
6000336	1994	SFBA	ALA	31	0.095	0.072	0.086	0.290	LOD
6000336	1995	SFBA	ALA	30	0.121	0.077	0.118	0.290	0.030
6000336	1996	SFBA	ALA	31	0.068	0.043	0.069	0.210	0.010
6000336	1997	SFBA	ALA	13	0.062	0.066	0.063	0.200	0.010
0700433	1990	SFBA	CC	29	0.121	0.070	0.121	0.300	0.030
0700433	1991	SFBA	CC	29	0.148	0.077	0.147	0.310	0.030
0700433	1992	SFBA	CC	29	0.097	0.055	0.094	0.240	0.020
0700433	1993	SFBA	CC	30	0.092	0.081	0.092	0.420	0.020
0700433	1994	SFBA	CC	31	0.057	0.057	0.056	0.260	LOD
0700433	1995	SFBA	CC	30	0.043	0.025	0.043	0.100	0.010
0700433	1996	SFBA	CC	31	0.030	0.023	0.031	0.090	LOD
0700433	1997	SFBA	CC	9	0.068	0.060	0.066	0.200	0.010
0700440	1990	SFBA	CC	28	0.325	0.248	0.337	1.000	0.040
0700440	1991	SFBA	CC	29	0.438	0.450	0.419	1.700	0.030
0700440	1992	SFBA	CC	31	0.391	0.404	0.390	1.600	0.040
0700440	1993	SFBA	CC	30	0.207	0.254	0.204	1.100	0.010
0700440	1994	SFBA	CC	32	0.102	0.099	0.098	0.390	LOD
0700440	1995	SFBA	CC	30	0.157	0.242	0.147	1.100	0.020
0700440	1996	SFBA	CC	31	0.082	0.112	0.082	0.600	0.010
0700440	1997	SFBA	CC	29	0.097	0.130	0.102	0.400	0.010
0700445	1997	SFBA	CC	20	0.030	0.044	0.028	0.200	0.005
4300382	1990	SFBA	SCL	27	0.163	0.127	0.161	0.530	0.050
4300382	1991	SFBA	SCL	28	0.152	0.098	0.153	0.410	0.040
4300382	1992	SFBA	SCL	31	0.100	0.073	0.100	0.370	0.030
4300382	1993	SFBA	SCL	30	0.096	0.088	0.094	0.310	0.010
4300382	1994	SFBA	SCL	31	0.072	0.091	0.064	0.440	LOD
4300382	1995	SFBA	SCL	30	0.074	0.070	0.069	0.350	0.020
4300382	1996	SFBA	SCL	31	0.069	0.079	0.068	0.310	LOD
4300382	1997	SFBA	SCL	27	0.099	0.122	0.097	0.500	0.005
9000306	1990	SFBA	SF	28	0.191	0.103	0.199	0.390	0.040
9000306	1991	SFBA	SF	26	0.226	0.182	0.229	0.810	0.030
9000306	1992	SFBA	SF	31	0.133	0.081	0.131	0.360	0.030
9000306	1993	SFBA	SF	28	0.133	0.108	0.133	0.480	0.010
9000306	1994	SFBA	SF	30	0.105	0.100	0.105	0.390	0.010
9000306	1995	SFBA	SF	29	0.097	0.083	0.092	0.380	0.020

ARB SITE	YEAR	Air Basin	County	NO_ OBS	Site Mean (ppbv)	Standard Deviation (ppbv)	Mean of Monthly Mean (ppbv)	Site Maximum (ppbv)	Site Minimum (ppbv)
9000306	1996	SFBA	SF	31	0.084	0.085	0.084	0.420	0.010
9000306	1997	SFBA	SF	29	0.065	0.054	0.064	0.200	0.010
1000246	1990	SJV	FRE	27	0.117	0.095	0.119	0.470	0.040
1000246	1991	SJV	FRE	30	0.140	0.128	0.142	0.690	0.020
1000246	1992	SJV	FRE	30	0.103	0.055	0.102	0.270	0.040
1000246	1993	SJV	FRE	30	0.098	0.091	0.100	0.450	0.020
1000246	1994	SJV	FRE	31	0.063	0.067	0.062	0.250	LOD
1000246	1995	SJV	FRE	30	0.068	0.071	0.065	0.310	0.020
1000246	1996	SJV	FRE	31	0.040	0.029	0.041	0.150	0.010
1000246	1997	SJV	FRE	29	0.044	0.028	0.042	0.100	0.010
1500203	1990	SJV	KER	32	0.093	0.058	0.087	0.290	0.030
1500203	1991	SJV	KER	29	0.126	0.112	0.127	0.520	0.030
1500203	1992	SJV	KER	31	0.077	0.043	0.075	0.200	0.030
1500203	1993	SJV	KER	30	1.299	5.306	1.481	28.000	0.010
1500203*	1993	SJV	KER	29	0.378	1.678	0.317	9.100	0.010
1500203	1994	SJV	KER	9	0.059	0.060	0.050	0.210	0.020
1500255	1994	SJV	KER	23	0.054	0.072	0.055	0.330	LOD
1500255	1995	SJV	KER	32	0.098	0.182	0.092	1.000	0.010
1500255	1996	SJV	KER	32	0.104	0.264	0.119	1.500	LOD
1500255	1997	SJV	KER	32	0.036	0.035	0.036	0.200	0.005
3900252	1990	SJV	SJ	30	0.129	0.068	0.129	0.300	0.040
3900252	1991	SJV	SJ	29	0.115	0.050	0.113	0.220	0.040
3900252	1992	SJV	SJ	28	0.120	0.076	0.120	0.380	0.040
3900252	1993	SJV	SJ	34	0.125	0.173	0.120	0.860	0.020
3900252	1994	SJV	SJ	31	0.066	0.062	0.066	0.240	LOD
3900252	1995	SJV	SJ	30	0.063	0.044	0.061	0.220	0.020
3900252	1996	SJV	SJ	31	0.069	0.075	0.068	0.350	0.010
3900252	1997	SJV	SJ	28	0.096	0.114	0.095	0.400	0.005
5000568	1990	SJV	STA	31	0.144	0.097	0.145	0.370	0.040
5000568	1991	SJV	STA	30	0.142	0.173	0.150	0.870	0.020
5000568	1992	SJV	STA	31	0.120	0.140	0.118	0.790	0.030
5000568	1993	SJV	STA	30	0.116	0.178	0.109	0.850	0.020
5000568	1994	SJV	STA	31	0.093	0.198	0.087	1.100	LOD
5000568	1995	SJV	STA	30	0.052	0.053	0.053	0.230	0.010
5000568	1996	SJV	STA	31	0.043	0.042	0.044	0.220	0.010
5000568	1997	SJV	STA	29	0.049	0.061	0.050	0.300	0.005
1300698	1997	SS	IMP	30	0.105	0.161	0.099	0.800	0.005
0400628	1992	SV	BUT	16	0.053	0.033	0.051	0.120	LOD
0400628	1993	SV	BUT	30	0.056	0.046	0.057	0.190	LOD

* Site 1500203 without 28 ppbv value included

ARB SITE	YEAR	Air Basin	County	NO_ OBS	Site Mean (ppbv)	Standard Deviation (ppbv)	Mean of Monthly Mean (ppbv)	Site Maximum (ppbv)	Site Minimum (ppbv)
0400628	1994	SV	BUT	31	0.299	1.376	0.266	7.700	LOD
0400628	1995	SV	BUT	30	0.052	0.052	0.047	0.210	0.010
0400628	1996	SV	BUT	31	0.048	0.054	0.049	0.260	LOD
0400628	1997	SV	BUT	28	0.041	0.058	0.039	0.300	0.005
0400633	1990	SV	BUT	29	0.047	0.016	0.047	0.080	0.020
0400633	1991	SV	BUT	28	0.055	0.025	0.054	0.110	0.020
0400633	1992	SV	BUT	15	0.047	0.024	0.046	0.090	0.020
3100822	1993	SV	PLA	23	0.045	0.024	0.045	0.090	0.010
3100822	1994	SV	PLA	31	0.062	0.080	0.065	0.440	LOD
3100822	1995	SV	PLA	30	0.054	0.034	0.051	0.160	0.010
3100822	1996	SV	PLA	30	0.060	0.070	0.061	0.340	0.010
3100822	1997	SV	PLA	29	0.065	0.061	0.065	0.200	0.010
3400293	1990	SV	SAC	28	0.092	0.049	0.095	0.260	0.040
3400293	1991	SV	SAC	29	0.095	0.047	0.094	0.230	0.030
3400293	1992	SV	SAC	31	0.075	0.039	0.076	0.180	0.020
3400293	1993	SV	SAC	6	0.053	0.010	0.054	0.070	0.040

TABLE A-2

Air Basin Summary Table

Air Basin Annual Summary Statistics

Air Basin	Year	Number of Sites	Air Basin Arithmetic Mean (ppbv)	Standard Deviation (ppbv)	Air Basin Mean of Monthly Means (ppbv)	Air Basin Maximum (ppbv)	Air Basin Minimum (ppbv)
SC	1990	5	0.588	0.636	0.576	5.000	0.030
SC	1991	5	0.529	0.694	0.530	6.800	0.040
SC	1992	5	0.411	0.263	0.409	1.500	0.020
SC	1993	5	0.424	0.389	0.422	1.700	0.010
SC	1994	5	0.383	0.387	0.386	2.100	0.010
SC	1995	5	0.368	0.327	0.368	1.700	0.030
SC	1996	5	0.309	0.264	0.309	1.500	0.010
SC	1997	5	0.279	0.187	0.255	1.200	0.020
SCC	1990	2	0.181	0.115	0.181	0.540	0.030
SCC	1991	2	0.157	0.116	0.160	0.670	0.040
SCC	1992	2	0.124	0.084	0.124	0.450	0.020
SCC	1993	2	0.094	0.086	0.095	0.580	0.020
SCC	1994	2	0.110	0.121	0.110	0.490	0.005
SCC	1995	2	0.101	0.093	0.100	0.440	0.020
SCC	1996	2	0.104	0.183	0.104	1.400	0.010
SCC	1997	2	0.082	0.073	0.082	0.300	0.010
SD	1990	2	0.280	0.201	0.280	1.100	0.050
SD	1991	2	0.260	0.210	0.261	1.300	0.040
SD	1992	2	0.261	0.186	0.262	0.800	0.060
SD	1993	2	0.190	0.166	0.193	0.890	0.020
SD	1994	2	0.201	0.251	0.204	1.600	0.005
SD	1995	2	0.244	0.432	0.244	3.200	0.020
SD	1996	2	0.134	0.128	0.133	0.580	0.020
SD	1997	2	0.128	0.114	0.124	0.500	0.010
SFBA	1990	5	0.197	0.162	0.197	1.000	0.030
SFBA	1991	5	0.235	0.255	0.235	1.700	0.020
SFBA	1992	5	0.173	0.225	0.172	1.600	0.020
SFBA	1993	5	0.128	0.147	0.128	1.100	0.010
SFBA	1994	5	0.086	0.086	0.086	0.440	0.005
SFBA	1995	5	0.098	0.129	0.098	1.100	0.010
SFBA	1996	5	0.067	0.077	0.067	0.600	0.005
SFBA	1997	5	0.074	0.095	0.070	0.500	0.005
SJV	1990	4	0.121	0.082	0.121	0.470	0.030

Air Basin	Year	Number of Sites	Air Basin Arithmetic Mean (ppbv)	Standard Deviation (ppbv)	Air Basin Mean of Monthly Means (ppbv)	Air Basin Maximum (ppbv)	Air Basin Minimum (ppbv)
SJV	1991	4	0.131	0.123	0.131	0.870	0.020
SJV	1992	4	0.104	0.088	0.105	0.790	0.030
SJV	1993	4	0.400	2.630	0.410	28.000	0.010
SJV*	1993	4	0.176	0.823	0.179	9.100	0.010
SJV	1994	5	0.069	0.113	0.067	1.100	0.005
SJV	1995	4	0.071	0.105	0.070	1.000	0.010
SJV	1996	4	0.064	0.142	0.064	1.500	0.005
SJV	1997	4	0.055	0.070	0.056	0.400	0.005
SS	1997	1	0.105	0.161	0.099	0.800	0.005
SV	1990	2	0.069	0.042	0.070	0.260	0.020
SV	1991	2	0.075	0.043	0.075	0.230	0.020
SV	1992	3	0.063	0.036	0.058	0.180	0.005
SV	1993	3	0.051	0.036	0.051	0.190	0.005
SV	1994	2	0.181	0.974	0.181	7.700	0.005
SV	1995	2	0.053	0.043	0.053	0.210	0.010
SV	1996	2	0.054	0.062	0.054	0.340	0.005
SV	1997	2	0.053	0.061	0.053	0.300	0.005

* SJV value with 28 ppbv value excluded

TABLE A-3

Site Identification Table

Site Number and Site Name, by Basin and County

ARB Site	Site Name	Air Basin	County
7000069	Burbank-W Palm Avenue	SC	LA
7000072	North Long Beach	SC	LA
7000087	Los Angeles-North Main Street	SC	LA
3300144	Riverside-Rubidoux	SC	RIV
3600175	Upland-San Bernardino Road	SC	SBD
4200388	Santa Barbara-W Carillo Street	SCC	SBA
5600434	Simi Valley-Cochran Street	SCC	VEN
8000114	Chula Vista	SD	SD
8000131	El Cajon-Redwood Avenue	SD	SD
6000336	Fremont-Chapel Way	SFBA	ALA
0700433	Richmond-13th Street	SFBA	CC
0700440	Concord-2975 Treat Blvd	SFBA	CC
0700445	San Pablo-El Portal	SFBA	CC
4300382	San Jose-4th Street	SFBA	SCL
9000306	San Francisco-Arkansas Street	SFBA	SF
1000246	Fresno-1st Street	SJV	FRE
1500255	Bakersfield-5558 California Avenue	SJV	KER
3900252	Stockton-Hazelton Street	SJV	SJ
5000568	Modesto-14th Street	SJV	STA
1300698	Calexico-Ethel Street	SS	IMP
0400628	Chico-Manzanita Avenue	SV	BUT
3100822	Roseville-N Sunrise Blvd	SV	PLA

Memorandum 2. Analysis and Population Exposure Estimates for Perchloroethylene Needs Assessment for Brake Cleaning Products (March 26, 1998)

Cal/EPA

California Environmental Protection

Air Resources Board

P.O. Box 2815
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Governor

Peter M. Rooney
Secretary for Environmental Protection

MEMORANDUM

TO: Todd Wong
Stationary Source Division

FROM: Bob Effa
Technical Support Division

DATE: March 26, 1998

SUBJECT: ANALYSIS AND POPULATION EXPOSURE ESTIMATES FOR PERCHLOROETHYLENE NEEDS ASSESSMENT FOR BRAKE CLEANING PRODUCTS

This memorandum is in response to your request for an analysis of ambient perchlorethylene data and population-weighted exposure. It is our understanding that this analysis is to be used for a perc needs assessment of brake repair facilities to serve as the basis for determining whether an airborne toxic control measure (ATCM) is needed for these products. This analysis is based on ambient data, and as such, includes perchlorethylene emissions from all sources. There is no way to differentiate in the ambient air between perchloroethylene emissions from one source versus another. If the potential risk from brake cleaning products alone is to be assessed, the contribution from other sources would need to be quantified and subtracted from the ambient data.

BACKGROUND

This analysis is based on ambient data collected by the Air Resources Board (ARB) and compiled in the ARB Air Toxics database. The data used in this analysis cover the time period from January 2, 1990 to December 29, 1996. All data used in this analysis were extracted on November 14, 1997. As of February 25, 1998, there have been no changes to the data. This analysis does not reflect any changes that may have occurred since that time. The data used in this analysis are available on CD (*California Ambient Air Quality Data CD# TSD-97-008*) from the Technical Support Division (TSD).

DATA

Ambient Sampling and Analysis

Perchloroethylene data are collected by the ARB toxics sampling network, which currently consists of 21 monitoring sites located throughout the state. All data used in this analysis were collected during routine toxics pollutant monitoring. They come from a total of 24 sites. Seventeen of these sites have been in operation from 1990 to 1996. Three sites have been closed and replaced by three new sites in the same general area (Bakersfield-Chester Ave with Bakersfield-California Ave, Citrus Heights-Sunrise Blvd with Roseville N. Sunrise Blvd, and Chico-Salem St with Chico-Manzanita Ave). The 24th site, in Calexico, has been in operation since July, 1995. Since this site only has data for one complete year (1996), and this analysis examines perchloroethylene trends over 7 years, the data from this site were not used in this analysis. There is also a 25th site at Fresno-Olive St., but this site has only one observation and is being discarded. As noted, some sites have moved within air basin boundaries, and this move did not pose a problem for the purpose of our analysis.

The data analysis and population exposure estimates presented below are based on data collected from the ARB toxics sampling network. These data are collected over a 24 hour period every twelve days by the Monitoring and Laboratory Division (MLD). The data are analyzed by MLD staff using Method MLD052 (Cryogenic Trap Preconcentration with Capillary Column Gas Chromatography-PID/ECD Detectors). Perchloroethylene concentrations are measured using Electron Capture Detector (ECD).

The number of samples available per site during the study period ranged from 42 to 213 observations. Of the 4206 observations collected during this time, 35 were below the limit of detection (LOD) of 0.01 ppbv for the study period. These values pose a problem to the analysis but they cannot be ignored since a mean calculated without these observations would overestimate the true mean. To account for these below LOD values, we estimated their values to be ½ of the LOD.

Missing data points

In the course of analyzing the data for this analysis, we found that some data points were missing. This is to be expected, but it can pose problems to the analysis. If the pollutant being measured has seasonal patterns, and several points are missing from the same season, the analysis results could be skewed either high or low. If there are no data collected at a given site during a month, a mean of monthly means cannot be calculated for that year and the rest of the data for that site/year must be thrown out.

During this analysis, we encountered 8 sites with missing data as shown in Table 1. To develop the population-weighted perchloroethylene exposure estimates, we had to populate the data set with the most accurate data estimates available. We used two different methods to estimate the missing data. The first method applied to five sites where data were missing for only one month, with data from adjacent months available. For these sites, we simply took the average of the monthly means from the two adjacent months to impute the missing values. The second method was applied to the remaining three sites. One site was missing only one month of data, but it did not have a value for the previous month available as it was the first month of our sample period (January 1990). The other two sites were missing a three month block of data. All three sites used the same methodology to estimate the missing data. For these sites, we took the mean of monthly means for the months of data available, and for the same months of data in an adjacent (following) year. From this data we calculated the ratio of the mean of monthly means. To complete the data set, we took the months with missing data and populated them with data from an adjacent (following) year. To correct for different magnitudes of emissions from the two years, this data was then adjusted using the ratio of mean of monthly means. For example, we will look at the January 1990 value. To estimate the missing value, we calculated a mean of monthly means using the remaining months of the year (1990) from the site with missing data. We then calculated a mean of monthly means for the following year (1991) using the same months of data. The next step was to calculate the ratio of means of monthly means to account for the difference in air quality for the two years of interest. The January (1990) monthly mean was then imputed by multiplying the January (1991) value by the ratio of the means of monthly means to more accurately describe the missing value.

A simpler approach would have been to calculate a mean value from the existing data. The problem with this approach is that you would effectively be populating the missing data with the average site value for the year. Thus, this would not reflect any seasonal patterns the data may possess, and would result in a less accurate estimate that could skew the analysis results.

TABLE 1

Perchloroethylene Data Analysis Missing Values in Data Set			
Site Name	Year	Month(s) Missing	Calculated Value(s)
Chula Vista	1996	September	0.127 ppbv
El Cajon-Redwood Ave	1994	December	0.458 ppbv
Richmond-13th St	1990	January	0.145 ppbv
San Francisco-Arkansas St	1990	May	0.174 ppbv

Perchloroethylene Data Analysis Missing Values in Data Set			
San Francisco-Arkansas St	1993	December	0.176 ppbv
Stockton-Hazelton St	1993	January	0.108 ppbv
Fresno-1st St	1990	January-March	0.140, 0.157, 0.077 ppbv
North Long Beach	1996	August-October	0.116, 0.168, 0.155 ppbv

Unusual Observation

The highest concentration reported during the study period was 28 ppbv at the Bakersfield-Chester St. site in the San Joaquin Valley Air Basin on February 12, 1993. The second highest concentration was 9.1 ppbv at the Bakersfield-Chester St. site on January 31, 1993. The 28 ppbv value is much higher than the remaining data collected and is subject to scrutiny. The Monitoring and Laboratory Division (MLD) checked and confirmed the value. There is no valid reason to discard the value, so it remains in our database. To assess the sensitivity of our estimates to such high concentrations, we performed two analyses by including or excluding the data point. When this value is compared to the remaining values at the Chester St. site, it is more than 21 times higher than the average for that site. A brief summary of the effects of this data point are shown in Table 2.

TABLE 2

Results of Perchloroethylene Data Analysis Bakersfield-Chester St Site for 1993			
	with 28 ppbv value	without 28 ppbv value	Percent Change
Site Arithmetic Mean Concentration	1.299 ppbv	0.378 ppbv	-71%
Air Basin Arithmetic Mean Concentration	0.400 ppbv	0.176 ppbv	-56%

Results of Perchloroethylene Data Analysis Bakersfield-Chester St Site for 1993			
Statewide Arithmetic Mean Concentration	0.253 ppbv	0.207 ppbv	-18%
Statewide Population-Weighted Exposure	0.322 ppb/year	0.301 ppb/year	-7%

Unless otherwise noted, all results presented in this report are calculated with the 28 ppbv value included.

Population Data

Population data used in the exposure analysis come from two sources: the 1990 census and the California Department of Finance (DOF). The census data is used in the South Coast and San Francisco Air Basins as an input to the population exposure weighting program, while the DOF data is used in all areas to represent the actual population. The study area for this analysis covers six air basins, and approximately 72% of the statewide population.

METHODOLOGY

The population exposure estimate consists of two parts. The first part is an estimate of the pollutant exposure in a given air basin. This will yield an average exposure for each air basin in the study. Due to data limitations, population exposure estimates were calculated differently for different air basins. For the South Coast Air Basin and the San Francisco Air Basin, the exposure estimates are calculated using a population exposure weighting program that interpolates site-specific mean of monthly mean perchloroethylene concentrations to population values assigned to census tract centroids (a census tract centroid is the approximate center of a United States Census Bureau census tract). The population exposure weighting program used 1990 census data in the South Coast and San Francisco Air Basins. There are no growth factors available by census tract, so 1990 census data was used for the population estimate for all years of the analysis.

For the other air basins for which we have data, the number of monitors are too limited to represent the entire air basin. For those areas, we limited our analysis to the counties which had monitors. First, we computed a "basin wide" mean concentration from the mean of monthly means of the basin. Then, we assumed that all people in counties with monitoring sites are exposed to this estimated mean annual concentration (i.e., if an air basin contains four counties, and only two of the counties had monitors, the population of the two counties with monitors would be used in the exposure analysis). The population estimates for these areas of the study used DOF data for this step.

The results of this first step are presented in the top portion of Table 3. This is the population-weighted perchloroethylene exposure by air basin. For example, the per capita average concentration to which the population in the South Coast Air Basin were exposed during 1990 was 0.590 ppb. This declined to 0.330 ppb for 1996. For the San Joaquin Valley Air Basin, the average concentration for the population represented by the four counties included in the analysis was 0.121 ppb in 1990, dropping to 0.064 ppb in 1996.

The second step of the exposure calculation was the same for all air basins. The overall statewide population-weighted exposure was calculated by multiplying the estimated annual average perchloroethylene concentration for a given air basin by its population (represented as a fraction of the total of the air basin populations in this study). This value was calculated for each air basin in the study, and the results are summed to create an estimated overall statewide population-weighted exposure estimate. The DOF population figures are shown in the middle portion of Table 3.

RESULTS

The results of the exposure analysis are summarized in Table 3. The estimated statewide perchloroethylene exposure, shown at the bottom of the table, decreases from 0.382 to 0.203 ppbv from 1990 to 1996. The highest air basin concentrations (shown at the top of the table) occurred in the South Coast, where the annual mean perchloroethylene concentrations decreased from 0.590 ppbv in 1990 to 0.330 ppbv in 1996. The general trend for statewide is decreasing, except for a slight increase from 1992 to 1993 due to the 28 ppbv value in the San Joaquin Valley. If the 28 ppbv value is not included in the analysis, the trend decreases for all years.

TABLE 3

Estimated Air Basin Population-Weighted* Perchloroethylene Exposure ppb-year/person**							
Air Basin	1990	1991	1992	1993	1994	1995	1996
South Coast	0.590	0.542	0.430	0.472	0.410	0.392	0.330
South Central Coast	0.181	0.160	0.124	0.095	0.110	0.100	0.104
San Diego	0.280	0.261	0.262	0.193	0.204	0.244	0.133
San Francisco	0.196	0.223	0.158	0.124	0.082	0.091	0.068
San Joaquin Valley	0.121	0.131	0.105	0.410	0.067	0.070	0.064
Sacramento Valley	0.070	0.075	0.058	0.051	0.181	0.053	0.054
Air Basin Population Data Used in Calculating Statewide Perchloroethylene Exposure							
Air Basin	1990	1991	1992	1993	1994	1995	1996
South Coast	10684933	10910823	11124105	11206222	11298530	11372003	11441517
South Central Coast	1041100	1055600	1072600	1080800	1092900	1104100	1108500
San Diego	2511400	2560800	2611500	2625100	2650700	2669200	2694900
San Francisco	4324700	4377500	4451700	4511100	4543300	4569800	4649400
San Joaquin Valley	1977876	2040876	2097395	2130385	2158376	2192027	2226921
Sacramento Valley	1377350	1413279	1440859	1458943	1469597	1482705	1502236
SUM	21917359	22358878	22798159	23012550	23213403	23389835	23623474
Estimated Statewide Population-Weighted Perchloroethylene Exposure ppb-year/person**							
Statewide WTD AVG	0.382	0.362	0.290	0.322	0.262	0.251	0.203

* Only air basins with perchloroethylene monitoring included in this table. Air basin population-weighted exposure is calculated using mean of monthly means for all sites within basin.

** Population exposure units are a concentration for a given duration per person; For this analysis, the units are ppb-year/person.

In summary, this exposure analysis was developed with data from the six areas listed above. The South Coast and San Francisco Bay Area were population-weighted using census tract data, and the rest of the areas were population-weighted using county (with monitoring data) population data. The six areas represent approximately 72% of the statewide population.

LIMITATIONS OF ANALYSIS

This analysis was designed to produce a statewide population-weighted perchloroethylene exposure. Ideally, to complete such an analysis, daily perchloroethylene concentrations from all areas of the state would be available. Unfortunately, this is not the case. Currently, our monitoring network operates on a one in twelve day sampling schedule, at only 21 sites within six air basins throughout California. At this time, the minimum number of sites and frequency of sampling required to accurately represent the true statewide exposure are uncertain. Therefore, caution should be exercised when using these exposure estimates.

SUMMARY TABLES IN APPENDIX

Annual summary statistics for each site during the study period are listed in the appendix in the Site Summary Table. These statistics include the annual site minimum, maximum, arithmetic mean, standard deviation, mean of monthly means, and number of observations. The annual mean concentration for the site is calculated as the mean of monthly means for the site. The standard deviation is calculated using all values rather than the monthly means. When a site contains a reading below the LOD for a particular year, the mean concentration and standard deviation are calculated using ½ LOD as an estimate for the below LOD value.

Basin-specific summary statistics are calculated on an annual basis and are listed in the Appendix in the Air Basin Summary Table. These statistics are calculated using the values from each site within an air basin. These statistics include the minimum and maximum, the arithmetic mean, standard deviation of values from all sites within the air basin, the mean of monthly site means, and the number of sites in the air basin.

cc: Bart Croes, TSD
Tom Lusk , TSD

APPENDIX

Site Summary Table

Annual Site Specific Summary Statistics

ARB SITE	YEAR	Air Basin	County	NO_ OBS	Site Mean (ppbv)	Standard Deviation (ppbv)	Mean of Monthly Mean (ppbv)	Site Maximum (ppbv)	Site Minimum (ppbv)
7000069	1990	SC	LA	31	1.193	1.087	1.191	5.000	0.200
7000069	1991	SC	LA	29	0.761	0.615	0.785	2.400	0.070
7000069	1992	SC	LA	30	0.615	0.305	0.609	1.500	0.110
7000069	1993	SC	LA	33	0.601	0.472	0.620	1.700	0.040
7000069	1994	SC	LA	29	0.641	0.530	0.663	2.100	0.040
7000069	1995	SC	LA	31	0.494	0.360	0.487	1.700	0.030
7000069	1996	SC	LA	30	0.428	0.230	0.440	1.400	0.090
7000072	1990	SC	LA	31	0.475	0.359	0.477	1.500	0.090
7000072	1991	SC	LA	29	0.341	0.292	0.355	1.100	0.040
7000072	1992	SC	LA	30	0.353	0.247	0.349	1.200	0.100
7000072	1993	SC	LA	32	0.384	0.462	0.433	1.500	0.010
7000072	1994	SC	LA	30	0.301	0.335	0.321	1.300	0.010
7000072	1995	SC	LA	31	0.317	0.346	0.318	1.600	0.030
7000072	1996	SC	LA	25	0.241	0.266	0.226	1.100	0.010
7000087	1990	SC	LA	29	0.545	0.256	0.551	1.100	0.240
7000087	1991	SC	LA	28	0.608	0.540	0.604	2.800	0.070
7000087	1992	SC	LA	31	0.519	0.209	0.536	1.000	0.200
7000087	1993	SC	LA	26	0.535	0.326	0.588	1.100	0.050
7000087	1994	SC	LA	30	0.522	0.425	0.503	2.000	0.030
7000087	1995	SC	LA	31	0.581	0.380	0.574	1.400	0.060
7000087	1996	SC	LA	28	0.492	0.315	0.502	1.500	0.120
3300144	1990	SC	RIV	28	0.235	0.127	0.237	0.440	0.030
3300144	1991	SC	RIV	29	0.266	0.200	0.276	0.870	0.060
3300144	1992	SC	RIV	30	0.200	0.119	0.201	0.420	0.020
3300144	1993	SC	RIV	29	0.199	0.167	0.198	0.700	0.020
3300144	1994	SC	RIV	31	0.184	0.181	0.191	0.950	0.020
3300144	1995	SC	RIV	31	0.183	0.146	0.177	0.530	0.030
3300144	1996	SC	RIV	31	0.178	0.200	0.176	1.100	0.040
3600175	1990	SC	SBD	27	0.434	0.201	0.423	1.000	0.210
3600175	1991	SC	SBD	28	0.675	1.233	0.717	6.800	0.150
3600175	1992	SC	SBD	27	0.360	0.180	0.364	0.680	0.070
3600175	1993	SC	SBD	29	0.392	0.286	0.398	1.100	0.040
3600175	1994	SC	SBD	31	0.284	0.165	0.286	0.820	0.030
3600175	1995	SC	SBD	31	0.265	0.143	0.263	0.550	0.060

ARB SITE	YEAR	Air Basin	County	NO_ OBS	Site Mean (ppbv)	Standard Deviation (ppbv)	Mean of Monthly Mean (ppbv)	Site Maximum (ppbv)	Site Minimum (ppbv)
3600175	1996	SC	SBD	28	0.203	0.122	0.199	0.530	0.050
4200388	1990	SCC	SBA	27	0.171	0.117	0.176	0.540	0.040
4200388	1991	SCC	SBA	34	0.133	0.093	0.124	0.420	0.040
4200388	1992	SCC	SBA	28	0.098	0.057	0.095	0.310	0.020
4200388	1993	SCC	SBA	31	0.075	0.055	0.075	0.280	0.020
4200388	1994	SCC	SBA	30	0.092	0.118	0.095	0.490	LOD
4200388	1995	SCC	SBA	29	0.075	0.062	0.082	0.280	0.020
4200388	1996	SCC	SBA	30	0.120	0.253	0.120	1.400	0.010
5600434	1990	SCC	VEN	29	0.190	0.115	0.199	0.520	0.030
5600434	1991	SCC	VEN	28	0.186	0.136	0.192	0.670	0.040
5600434	1992	SCC	VEN	29	0.149	0.097	0.152	0.450	0.020
5600434	1993	SCC	VEN	28	0.116	0.108	0.111	0.580	0.020
5600434	1994	SCC	VEN	29	0.129	0.124	0.122	0.490	0.010
5600434	1995	SCC	VEN	31	0.126	0.110	0.125	0.440	0.020
5600434	1996	SCC	VEN	30	0.087	0.058	0.088	0.300	0.030
8000114	1990	SD	SD	31	0.235	0.107	0.236	0.480	0.080
8000114	1991	SD	SD	30	0.228	0.129	0.229	0.530	0.060
8000114	1992	SD	SD	30	0.213	0.130	0.208	0.650	0.060
8000114	1993	SD	SD	31	0.141	0.110	0.144	0.530	0.020
8000114	1994	SD	SD	31	0.123	0.121	0.132	0.510	LOD
8000114	1995	SD	SD	29	0.147	0.133	0.146	0.540	0.020
8000114	1996	SD	SD	27	0.124	0.100	0.129	0.450	0.020
8000131	1990	SD	SD	31	0.324	0.258	0.329	1.100	0.050
8000131	1991	SD	SD	29	0.293	0.268	0.308	1.300	0.040
8000131	1992	SD	SD	29	0.311	0.222	0.319	0.800	0.060
8000131	1993	SD	SD	28	0.245	0.200	0.256	0.890	0.020
8000131	1994	SD	SD	29	0.285	0.321	0.291	1.600	0.010
8000131	1995	SD	SD	29	0.342	0.585	0.352	3.200	0.040
8000131	1996	SD	SD	30	0.142	0.149	0.168	0.580	0.020
6000336	1990	SFBA	ALA	30	0.187	0.137	0.189	0.550	0.040
6000336	1991	SFBA	ALA	30	0.210	0.146	0.210	0.540	0.020
6000336	1992	SFBA	ALA	30	0.136	0.119	0.134	0.630	0.030
6000336	1993	SFBA	ALA	30	0.114	0.103	0.114	0.450	0.010
6000336	1994	SFBA	ALA	31	0.095	0.072	0.086	0.290	LOD
6000336	1995	SFBA	ALA	30	0.121	0.077	0.118	0.290	0.030
6000336	1996	SFBA	ALA	31	0.068	0.043	0.069	0.210	0.010
0700433	1990	SFBA	CC	29	0.121	0.070	0.121	0.300	0.030
0700433	1991	SFBA	CC	29	0.148	0.077	0.147	0.310	0.030
0700433	1992	SFBA	CC	29	0.097	0.055	0.094	0.240	0.020
0700433	1993	SFBA	CC	30	0.092	0.081	0.092	0.420	0.020

ARB SITE	YEAR	Air Basin	County	NO_ OBS	Site Mean (ppbv)	Standard Deviation (ppbv)	Mean of Monthly Mean (ppbv)	Site Maximum (ppbv)	Site Minimum (ppbv)
0700433	1994	SFBA	CC	31	0.057	0.057	0.056	0.260	LOD
0700433	1995	SFBA	CC	30	0.043	0.025	0.043	0.100	0.010
0700433	1996	SFBA	CC	31	0.030	0.023	0.031	0.090	LOD
0700440	1990	SFBA	CC	28	0.325	0.248	0.337	1.000	0.040
0700440	1991	SFBA	CC	29	0.438	0.450	0.419	1.700	0.030
0700440	1992	SFBA	CC	31	0.391	0.404	0.390	1.600	0.040
0700440	1993	SFBA	CC	30	0.207	0.254	0.204	1.100	0.010
0700440	1994	SFBA	CC	32	0.102	0.099	0.098	0.390	LOD
0700440	1995	SFBA	CC	30	0.157	0.242	0.147	1.100	0.020
0700440	1996	SFBA	CC	31	0.082	0.112	0.082	0.600	0.010
4300382	1990	SFBA	SCL	27	0.163	0.127	0.161	0.530	0.050
4300382	1991	SFBA	SCL	28	0.152	0.098	0.153	0.410	0.040
4300382	1992	SFBA	SCL	31	0.100	0.073	0.100	0.370	0.030
4300382	1993	SFBA	SCL	30	0.096	0.088	0.094	0.310	0.010
4300382	1994	SFBA	SCL	31	0.072	0.091	0.064	0.440	LOD
4300382	1995	SFBA	SCL	30	0.074	0.070	0.069	0.350	0.020
4300382	1996	SFBA	SCL	31	0.069	0.079	0.068	0.310	LOD
9000306	1990	SFBA	SF	28	0.191	0.103	0.199	0.390	0.040
9000306	1991	SFBA	SF	26	0.226	0.182	0.229	0.810	0.030
9000306	1992	SFBA	SF	31	0.133	0.081	0.131	0.360	0.030
9000306	1993	SFBA	SF	28	0.133	0.108	0.133	0.480	0.010
9000306	1994	SFBA	SF	30	0.105	0.100	0.105	0.390	0.010
9000306	1995	SFBA	SF	29	0.097	0.083	0.092	0.380	0.020
9000306	1996	SFBA	SF	31	0.084	0.085	0.084	0.420	0.010
1000246	1990	SJV	FRE	27	0.117	0.095	0.119	0.470	0.040
1000246	1991	SJV	FRE	30	0.140	0.128	0.142	0.690	0.020
1000246	1992	SJV	FRE	30	0.103	0.055	0.102	0.270	0.040
1000246	1993	SJV	FRE	30	0.098	0.091	0.100	0.450	0.020
1000246	1994	SJV	FRE	31	0.063	0.067	0.062	0.250	LOD
1000246	1995	SJV	FRE	30	0.068	0.071	0.065	0.310	0.020
1000246	1996	SJV	FRE	31	0.040	0.029	0.041	0.150	0.010
1500203	1990	SJV	KER	32	0.093	0.058	0.087	0.290	0.030
1500203	1991	SJV	KER	29	0.126	0.112	0.127	0.520	0.030
1500203	1992	SJV	KER	31	0.077	0.043	0.075	0.200	0.030
1500203	1993	SJV	KER	30	1.299	5.306	1.481	28.000	0.010
1500203*	1993	SJV	KER	29	0.378	1.678	0.317	9.100	0.010
1500203	1994	SJV	KER	9	0.059	0.060	0.050	0.210	0.020
1500255	1994	SJV	KER	23	0.054	0.072	0.055	0.330	LOD
1500255	1995	SJV	KER	32	0.098	0.182	0.092	1.000	0.010
1500255	1996	SJV	KER	32	0.104	0.264	0.119	1.500	LOD

* Site 1500203 without 28 ppbv value included

ARB SITE	YEAR	Air Basin	County	NO_ OBS	Site Mean (ppbv)	Standard Deviation (ppbv)	Mean of Monthly Mean (ppbv)	Site Maximum (ppbv)	Site Minimum (ppbv)
3900252	1990	SJV	SJ	30	0.129	0.068	0.129	0.300	0.040
3900252	1991	SJV	SJ	29	0.115	0.050	0.113	0.220	0.040
3900252	1992	SJV	SJ	28	0.120	0.076	0.120	0.380	0.040
3900252	1993	SJV	SJ	34	0.125	0.173	0.120	0.860	0.020
3900252	1994	SJV	SJ	31	0.066	0.062	0.066	0.240	LOD
3900252	1995	SJV	SJ	30	0.063	0.044	0.061	0.220	0.020
3900252	1996	SJV	SJ	31	0.069	0.075	0.068	0.350	0.010
5000568	1990	SJV	STA	31	0.144	0.097	0.145	0.370	0.040
5000568	1991	SJV	STA	30	0.142	0.173	0.150	0.870	0.020
5000568	1992	SJV	STA	31	0.120	0.140	0.118	0.790	0.030
5000568	1993	SJV	STA	30	0.116	0.178	0.109	0.850	0.020
5000568	1994	SJV	STA	31	0.093	0.198	0.087	1.100	LOD
5000568	1995	SJV	STA	30	0.052	0.053	0.053	0.230	0.010
5000568	1996	SJV	STA	31	0.043	0.042	0.044	0.220	0.010
0400628	1992	SV	BUT	16	0.053	0.033	0.051	0.120	LOD
0400628	1993	SV	BUT	30	0.056	0.046	0.057	0.190	LOD
0400628	1994	SV	BUT	31	0.299	1.376	0.266	7.700	LOD
0400628	1995	SV	BUT	30	0.052	0.052	0.047	0.210	0.010
0400628	1996	SV	BUT	31	0.048	0.054	0.049	0.260	LOD
0400633	1990	SV	BUT	29	0.047	0.016	0.047	0.080	0.020
0400633	1991	SV	BUT	28	0.055	0.025	0.054	0.110	0.020
0400633	1992	SV	BUT	15	0.047	0.024	0.046	0.090	0.020
3100822	1993	SV	PLA	23	0.045	0.024	0.045	0.090	0.010
3100822	1994	SV	PLA	31	0.062	0.080	0.065	0.440	LOD
3100822	1995	SV	PLA	30	0.054	0.034	0.051	0.160	0.010
3100822	1996	SV	PLA	30	0.060	0.070	0.061	0.340	0.010
3400293	1990	SV	SAC	28	0.092	0.049	0.095	0.260	0.040
3400293	1991	SV	SAC	29	0.095	0.047	0.094	0.230	0.030
3400293	1992	SV	SAC	31	0.075	0.039	0.076	0.180	0.020
3400293	1993	SV	SAC	6	0.053	0.010	0.054	0.070	0.040

Air Basin Summary Table

Air Basin Annual Summary Statistics

Air Basin	Year	Number of Sites	Air Basin Arithmetic Mean (ppbv)	Standard Deviation (ppbv)	Air Basin Mean of Monthly Means (ppbv)	Air Basin Maximum (ppbv)	Air Basin Minimum (ppbv)
SC	1990	5	0.588	0.636	0.576	5.000	0.030
SC	1991	5	0.529	0.694	0.530	6.800	0.040
SC	1992	5	0.411	0.263	0.409	1.500	0.020
SC	1993	5	0.424	0.389	0.422	1.700	0.010
SC	1994	5	0.383	0.387	0.386	2.100	0.010
SC	1995	5	0.368	0.327	0.368	1.700	0.030
SC	1996	5	0.309	0.264	0.309	1.500	0.010
SCC	1990	2	0.181	0.115	0.181	0.540	0.030
SCC	1991	2	0.157	0.116	0.160	0.670	0.040
SCC	1992	2	0.124	0.084	0.124	0.450	0.020
SCC	1993	2	0.094	0.086	0.095	0.580	0.020
SCC	1994	2	0.110	0.121	0.110	0.490	0.005
SCC	1995	2	0.101	0.093	0.100	0.440	0.020
SCC	1996	2	0.104	0.183	0.104	1.400	0.010
SD	1990	2	0.280	0.201	0.280	1.100	0.050
SD	1991	2	0.260	0.210	0.261	1.300	0.040
SD	1992	2	0.261	0.186	0.262	0.800	0.060
SD	1993	2	0.190	0.166	0.193	0.890	0.020
SD	1994	2	0.201	0.251	0.204	1.600	0.005
SD	1995	2	0.244	0.432	0.244	3.200	0.020
SD	1996	2	0.134	0.128	0.133	0.580	0.020
SFBA	1990	5	0.197	0.162	0.197	1.000	0.030
SFBA	1991	5	0.235	0.255	0.235	1.700	0.020
SFBA	1992	5	0.173	0.225	0.172	1.600	0.020
SFBA	1993	5	0.128	0.147	0.128	1.100	0.010
SFBA	1994	5	0.086	0.086	0.086	0.440	0.005
SFBA	1995	5	0.098	0.129	0.098	1.100	0.010
SFBA	1996	5	0.067	0.077	0.067	0.600	0.005
SJV	1990	4	0.121	0.082	0.121	0.470	0.030
SJV	1991	4	0.131	0.123	0.131	0.870	0.020
SJV	1992	4	0.104	0.088	0.105	0.790	0.030
SJV	1993	4	0.400	2.630	0.410	28.000	0.010
SJV*	1993	4	0.176	0.823	0.179	9.100	0.010
SJV	1994	5	0.069	0.113	0.067	1.100	0.005
SJV	1995	4	0.071	0.105	0.070	1.000	0.010
SJV	1996	4	0.064	0.142	0.064	1.500	0.005
SV	1990	2	0.069	0.042	0.070	0.260	0.020

* SJV value with 28 ppbv value excluded

Air Basin	Year	Number of Sites	Air Basin Arithmetic Mean (ppbv)	Standard Deviation (ppbv)	Air Basin Mean of Monthly Means (ppbv)	Air Basin Maximum (ppbv)	Air Basin Minimum (ppbv)
SV	1991	2	0.075	0.043	0.075	0.230	0.020
SV	1992	3	0.063	0.036	0.058	0.180	0.005
SV	1993	3	0.051	0.036	0.051	0.190	0.005
SV	1994	2	0.181	0.974	0.181	7.700	0.005
SV	1995	2	0.053	0.043	0.053	0.210	0.010
SV	1996	2	0.054	0.062	0.054	0.340	0.005

* SJV value with 28 ppbv value excluded

Appendix F

Selection of Specific and Generic Facilities for ISCST3 Modeling

Appendix F. Selection of Specific and Generic Facilities for ISCST3 Modeling

The majority of the modeling performed was done using the SCREEN3 air dispersion model because it is easy to use and allows the consideration of many modeling scenarios in a relatively short period of time. The ISCST3 air dispersion models offers the opportunity to perform a more refined analysis of a facility's potential risk; however, modeling scenarios considered under this model are more resource intensive. As a result, only a limited number of facilities could be selected for modeling using ISCST3. Thirteen specific facilities from the site visits as well as 3 generic facilities that were developed to represent a broad range of facilities statewide, were selected. This appendix outlines how the specific facilities were selected, how the generic facilities were developed, and how representative product formulations for the generic facilities were derived.

A. Selection of the 13 Specific Facilities

The main goal in selecting the 13 specific facilities was to obtain good representation of the five facility types (general automotive, fleets, service stations, dedicated brake shops, and dealerships) defined in the Status Report (ARB, 1997a) in several locations throughout the state with good population densities. In order to conduct this type of analysis, meteorological (met) and census data needs to be available for any selected area; therefore, facilities located in areas without met data or good census information could not be candidates for selection.

Another goal was to select facilities representing five key population areas revealed by the site visits. Those areas are: Sacramento, Los Angeles, the San Francisco Bay Area, San Joaquin Valley, and the North State area. Combined, these regions represent mostly urban areas which is appropriate because the majority of California's population lives in largely urban areas. Additionally, potential residential and business receptors in these areas tend to be located nearby the automotive maintenance and repair facilities.

The site visits showed that 55 facilities were using chlorinated products, all of which were modeled using the SCREEN3 air dispersion model. Thirty-two of these facilities showed potential risks greater than 10 chances per million (based on Perc usage and modeling using SCREEN3). The 10 chances per million level was selected because it is a common public risk notification level used in many local air districts; it should not be construed as any sort of regulatory guideline. Since public health protection is a major concern, the higher risk facilities were selected as candidates for ISCST3 modeling so long as the above criteria was able to be satisfied. As a result, facilities with lower risk values were selected in some cases to ensure that all the facility types and the five population areas were represented. Using these criteria, 13 specific facilities were selected. Table F-1 summarizes the five regions, the selected met sets for each region, and the represented facility types.

Table F-1. Met Data Sets and Facility Types per Region

Geographic Region	Met Data Sets	Facility Types
Los Angeles	Anaheim 1981 Burbank 1958-62 LAX 1985-89	General Automotive
North State	Redding 1987-89	General Automotive
Sacramento	Sac Exec 1987, 1989-92 Mather AFB 1953-57 McClellan AFB 1953-57	Brake Shop Fleet
San Francisco Bay Area	Concord 1991-96 Oakland 1960-64	General Automotive
San Joaquin Valley	Fresno 1985-89	Dealership Service Station

B. Development of the 3 Generic Facilities

The purpose of developing the 3 generic facilities was to provide a mechanism for estimating potential health impacts for all facilities statewide, including facilities located in areas where met data is not available. The basis for the generic facilities came from the 137 site visits, the statewide survey of automotive maintenance and repair facilities, as well as follow-up visits and telephone calls used to verify collected information. Using this information, the universe of facilities was separated into three representative groups: generic facility G-01 (small), generic facility G-02 (medium), and generic facility G-03 (large).

The site visit data was analyzed to determine the source characteristics of the generic facilities. Several approaches were considered including averaging the facility volumes over a specified range and focusing on the smaller facility volumes. These approaches were rejected because they would have either underestimated or overestimated potential health impacts. The data revealed that product usage was not related to facility size which means that both low and high usage rates can be found at small and large facilities. Additionally, a comparison of the facility volumes showed gaps that naturally separated the facilities into five groupings or facility size ranges. The very smallest group and largest group of facilities were excluded to avoid unnecessarily underestimating or overestimating potential health impacts. This approach created a rough cut of facility sizes for each generic facility.

Due to the limited availability of modeling resources, one representative building size needed to be selected for each of the three facility size ranges. Before selecting the discrete building size, however, the number of brake jobs that were being performed in each facility size range was examined (note: a typical brake job can consist of either one-axle or two-axle jobs). The data showed that the overall number of brake jobs ranged from 1 to 160 jobs per week and that facilities doing more brake work (and therefore using more chlorinated product) populated all three size ranges. An interesting observation was that the facility with the greatest number of brake jobs was at the lower end of each size range (in terms of facility volume) which indicates that facilities at the higher end of the size range would most likely be able to handle the same throughput. It also means that setting the building size for each generic facility at the lower end of the range would not overestimate potential health impacts. As a result, the building dimensions were set at the lower end of each facility size range. The throughput of brake jobs was then set to approximate the throughput at the lower end facilities. While the throughput of brake jobs for these facilities is higher than others in the range, it creates a health-protective facility that can effectively handle the variations in usage rates. It also allows for the capture of product use on other activities and, therefore, is a more realistic model of total product usage that minimizes the frequency that a generic facility would underestimate potential health impacts. Table F-2 summarizes what had been developed at this point.

Table F-2. Proposed Generic Facilities

Facility	Facility Size Range (by volume)	Proposed Representative Volume	Number of Brake Jobs at Proposed Volume [per week]
G-01	453 m^3 to 2140 m^3	453 m^3	18
G-02	2230 m^3 to 8494 m^3	2230 m^3	58
G-03	9241 m^3 to 37167 m^3	10157 m^3	54

Now that the generic facilities had been roughly identified, several quality control checks were employed to verify that the building dimensions and throughput of brake jobs were set properly and could adequately characterize automotive service and repair facilities statewide. Sales by facility size and number of service bays reported in the May 1996 Brake & Front End Brake Repair Survey (MarketScope, 1996) were compared to site visit data to check for consistency. This check underscores that the facility size ranges for the generic facilities are consistent with trends that have been observed nationwide. Additionally, the number of bays that were dedicated to brake work were compared with site visit data to determine if they were consistent with the generic volumes and reported number of jobs per week. This comparison was necessary to minimize the possibility that a generic facility would assume that a facility would be doing more work than it was physically capable of doing. Finally, a random selection of respondents to the Automotive Service Facility Questionnaire (Facility Survey) were polled to verify the accuracy of the reported data (a copy of the survey form can be found in Appendix B). Additional site visits were then made to several of these facilities to obtain source characteristic information. The information obtained from these additional site visits confirmed that the building dimensions and throughput of brake jobs for the generic facilities was reasonable.

In order to gain an idea of the statewide representativeness of the generic facilities, the sales/service bay distribution reported in the May 1996 Brake & Front End Brake Repair Survey (MarketScope, 1996) and the distribution of the number of service bays per facility reported in the Norton study (Norton, 1993) was compared to the ARB data. With this information, it was estimated that generic facility G-01 represents approximately 37% of California automotive service facilities, G-02 represents approximately 43%, and G-03 represents approximately 20%. Table F-2 summarizes the generic facility characteristics that were used in the modeling scenarios under ISCST3. A summary of the generic facility modeling results, including modeling input parameters and assumptions, are presented in Appendix D.

Table F-3. Summary of Generic Facility Characteristics

Facility	Brake Job Range [per week]	Facility Volume [m^3]	Height [m]	Length [m]	Width [m]	Number of Brake Jobs [per week]	Represented Facility Types
G-01	1 to 75	453	4.9	12.2	7.6	20	Brake Shop Dealership General Automotive Service Station
G-02	1 to 115	2230	7.6	21.3	13.7	60	Brake Shop Dealership Fleet General Automotive Service Station
G-03	1 to 160	10157	7.6	62.5	21.3	60	Dealership Fleet General Automotive

C. Development of Perc, MeCl, and TCE Usage Rates in Brake Cleaners, Carburetor Cleaners, Engine Degreasers, and General Degreasers

An important observation made during the site visits was that products labeled as brake cleaners, carburetor cleaners, engine degreasers, and general degreasers were often used on a variety of tasks. For example, several facilities reported using aerosol brake cleaning products to do engine degreasing work while others used general degreasers to clean brake parts. Many technicians indicated that this cross usage occurs because the products in each of these categories are designed to remove grime, grease, oil and dirt and, therefore, are suitable for tasks for which they may not be labeled.

Since products from these categories represent a varying range of compositions with regard to Perc, MeCl, and TCE, each category was separated into representative formulations based on available data. The data sources for this exercise where the Facility Survey and the 1997 Consumer and Commercial Products Survey. The Facility Survey provided information on product usage rates and was used to estimate the average cans per week of product usage in each category. Formulation information was also extracted from this database. The 1997 Consumer and Commercial Products Survey also contained formulation information as well as sales information. The sales information was used to weight the relative contributions of the formulations into one composite. The site visits also provided usage and formulation information on brake cleaning products.

In order to simplify the presentation of data associated with this task, the contributions to total generic facility risk from carburetor cleaners, engine degreasers, and general degreasers is combined into two health impact estimates for each generic facility: one estimate for default meteorology and another which is the average of the health impacts for the 10 specific met locations. Since more information was available for brake cleaners than the other three categories, the representative formulations derived for this category are used discretely for each met set including the default. A summary of the representative product formulations used is presented in Table F-4.

Table F-4. Representative Product Formulations Used in Generic Facility Modeling

Product Category			
Brake Cleaners	**Carburetor Cleaners**	**Engine Degreasers**	**General Degreasers**
All met locations: ➜ 94% Perc ➜ 65% Perc Four met locations[1]: ➜ 55% Perc, 25% MeCl ➜ 40% Perc, 30% MeCl, 20% TCE ➜ 55% Perc, 43% TCE	Single composite based on[2]: ➜ 68% Perc ➜ 57% MeCl	Single composite based on[2]: ➜ 47% Perc ➜ 99% TCE	Single composite based on[2]: ➜ 24% Perc ➜ 41% Perc, 55% MeCl ➜ 46% MeCl ➜ 97% TCE

1. Burbank, Anaheim, Oakland and default met for chronic effects; Fresno, Concord, Mather, and default met for acute effects.
2. Composite is based on average of 10 met sets. Default meteorology is considered independently.

In order to estimate the total health impacts (or some desired subset) at a generic facility, the individual contributions must be added. For example, let's assume that we are looking at generic facility G-01 located in the Burbank, California area where a 94% Perc brake product is being used. Let's assume further that this facility also uses products from the other three product categories and that we are interested in estimating potential health impacts at 20 meters from the center of the facility. Using Appendix D, we would look up the corresponding health impact values. Table F-5 summarizes the calculation method and provides give the results.

Table F-5. Facility G-01 Health Impacts at Burbank at 20 Meters Using a 94% Perc Aerosol Brake Cleaning Product and other Automotive Consumer Products

Product Category	Potential Cancer Risk [chances per million]		Hazard Index	
	Resident	Worker	Acute	Chronic
94% Perc Brake Cleaner[1]	47.41	20.18	0.0727	0.2296
Carburetor Cleaner	0.74	0.32	0.0164	0.0017
Engine Degreaser	2.19	0.93	0.0109	0.0061
General Purpose Degreaser	1.37	0.58	0.0040	0.0017
Total Impacts:	**51.71**	**22.01**	**0.1040**	**0.2391**

1. These health values assume a 20 brake job per week throughput and 1 19-oz can per job used. Please see Appendix D for more information.

If we consider the same example but instead assume that a multicomponent brake cleaning product containing 55% Perc and 25% MeCl is being used, Table F-6 would then summarize the calculation method and provide the results for this scenario.

Table F-6. Facility G-01 Health Impacts at Burbank at 20 Meters Using a Multicomponent Aerosol Brake Cleaning Product and other Automotive Consumer Products

Product Category	Potential Cancer Risk [chances per million]		Hazard Index	
	Resident	Worker	Acute	Chronic
55% Perc, 25% MeCl Brake Cleaner[1]	29.87	12.71	0.0701	0.2303
Carburetor Cleaner	0.74	0.32	0.0164	0.0017
Engine Degreaser	2.19	0.93	0.0109	0.0061
General Purpose Degreaser	1.37	0.58	0.0040	0.0017
Total Impacts:	**34.17**	**14.54**	**0.1014**	**0.2398**

1. These health values assume a 20 brake job per week throughput and 1 19-oz can per job used. Please see Appendix D for more information.

Using these examples as a guideline in conjunction with the data in Appendix D, the total potential health impacts at a generic facility under a variety of conditions can be estimated.

It is expected that the usage estimates for carburetor cleaners, engine degreasers, and general degreasers underestimate their contribution to the overall risk. This expectation is based on the limited data available with regard to product usage rates in these categories. Due to this limitation, usage rates were capped at three and one-third (3⅓)14-ounce cans per week for carburetor cleaners, three 18-ounce cans per week for engine degreasers, and three 16-ounce cans for general degreasers. These amounts are the average usage rates for each category found in the Facility Survey supported by sales data in the 1997 Consumer and Commercial Products Survey. While it seems reasonable that these products would most likely be used at a greater rate than indicated here, the ARB currently does not possess sufficient data to justify higher usage rates. As a result, potential health impacts from these three categories may be underestimated by an unknown degree.

REFERENCES FOR APPENDIX F

ARB, 1997a. Perchloroethylene Need Assessment for Automotive Consumer Products: Status Report, California Air Resources Board, June 1997.

MarketScope, 1996. "1996 Brake Repair Study", prepared by MarketScope for Brake and Front End Magazine, May 1996.

Norton, 1993. "Usage of Chemical Brake Cleaners in Automotive Repair Facilities", John Norton, School of Business Administration, George Mason University, Fairfax, VA, November 8, 1993.

Appendix G

Compounds in Products

Appendix G. Compounds in Products

The compounds listed in Table H-1 were compiled from material safety data sheets of brake cleaners, carburetor and air intake cleaners, engine degreasers and general purpose degreasers that are currently being used in California or were stated as being used in responses to the Automotive Service Facility Questionnaire (Automotive Survey).

Table G-1. Compounds Currently Found In Automotive Consumer Products

COMPOUND NAME	CAS No.[1]	VOC [2]	TAC [3]	Candidate TAC [4]	URF [5]	AREL [6]	CREL [7]
Acetone	67641						
Aliphatic Petroleum Distillates (Petroleum Naphtha)	64742898	Yes					
Ammonia	7664417			Yes		3.20e+03	1.00e+02
Aromatic Solvent (petroleum)	68477316	Yes					
Benzene	71432	Yes	Yes		2.90e-05	1.30e+03	7.10e+01
Butane	106978	Yes					
Butanol	78922	Yes		Yes			
2-Butoxyethanol (EGBE; Ethylene Glycol Monobutyl Ether)	111762	Yes				1.40e+04	2.00e+01
1,2 Butylene Oxide (inhibitor) (1,2 Epoxybutane)	106887	Yes	Yes				2.00e+01
Carbon Dioxide	124389						
2-Chlorotoluene	95498	Yes					
Cyclohexane	110827	Yes		Yes			
Diacetone Alcohol	123422	Yes					
Diesel no. 2	68476346	Yes					
Diethylene Glycol Mono-Butyl Ether	112345	Yes					
Dimethoxymethane (inhibitor)	109875	Yes					
1,3-Dioxolane	646060	Yes					
Dipentane	68956569	Yes					
Dipropylene Glycol Methyl Ether	34590948	Yes					

Table G-1. Compounds Currently Found In Automotive Consumer Products (cont.)

COMPOUND NAME	CAS No.[1]	VOC [2]	TAC [3]	Candidate TAC [4]	URF [5]	AREL [6]	CREL [7]
2-Ethanol-1,3-Hexanediol	94962	Yes					
Ethoxylated Alkyl Amine Nonionic Surfactant	9036195	Yes					
Ethyl Acetate	141786	Yes					
Ethyl Benzene	100414	Yes	Yes				1.00e+03
Heavy Aromatic Solvent Naptha	64742945	Yes					
Heptane	142825	Yes					
Hexane	110543	Yes	Yes				2.00e+02
Hydrocarbon Propellant A-46 (Propane/ Isobutane)	68476868	Yes					
Hydrocarbon Propellant A-85	684768857	Yes					
Hydrotreated Heavy Naphtha	64742489	Yes					
Hydrotreated Heavy Paraffinic Distillate (Petroleum)	64742547	Yes					
Hydrotreated Light Petroleum Distillates	64742478	Yes					
Isobutane	75285	Yes					
Isohexane	107835	Yes					
Isopropyl Alcohol	67630	Yes		Yes		3.20e+03	
Kerosene (fuel oil #1)	8008206	Yes					
Light Aromatic Solvent Naphtha	64742956	Yes					
d-Limonene	5989275	Yes					
Medium Aliphatic Solvent Naphtha	64742887	Yes					
Methanol	67561	Yes	Yes			2.80e+04	6.20e+02
Methyl Chloroform (1,1,1-Trichloroethane)	71556		Yes			6.80e+04	3.20e+02
Methyl Ethyl Ketone (2-Butanone)	78933	Yes	Yes			1.30e+04	1.00e+03
Methyl Isobutyl Ketone	108101	Yes	Yes				

Table G-1. Compounds Currently Found In Automotive Consumer Products (cont.)

COMPOUND NAME	CAS No.[1]	VOC [2]	TAC [3]	Candidate TAC [4]	URF [5]	AREL [6]	CREL [7]
4-Methyl-2-Pentanol (Methyl Amyl Alcohol)	108112	Yes					
n-Methyl Pyrrolidone	872504	Yes					
Methylene Chloride	75092		Yes		1.00e-06	1.40e+04	3.00e+03
Mineral Oil	8012951	Yes					
Mineral Spirits; Stoddard Solv.; Petroleum Distillates	8052413	Yes					
Monochlorotoluene	25168052	Yes					
Monoethanolamine	141435	Yes					
Monoisopropylbiphenols	25640782	Yes					
Morpholine	110918	Yes					
Naphtha (Benzin)	8030306	Yes					
Naphthalene	91203	Yes	Yes				1.40e+01
Nonane	111842	Yes					
Nonionic Surfactant NP4/NP9 (p-Nonylphenol Polyethylene Glycol Ether)	26027383	Yes					
9-Octadecenoic Acid (2)-Ammonium Salt	544605	Yes					
Octylphenolpolyethoxylate	9004879	Yes					
Oleic Acid	112801	Yes					
Perchloroethylene	127184		Yes		5.90e-06	2.00e+04	3.50e+01
Petroleum Products Liquified Gas Sweetened	68476868	Yes					
Primary Alcohol Ethoxylate	68131395	Yes					
Propane	74986	Yes					
Propane/ Isobutane/ n-Butane	68476857	Yes					
2-Propanol Titanate	546689	Yes					
Propylene Glycol	5131668	Yes					

Table G-1. Compounds Currently Found In Automotive Consumer Products (cont.)

COMPOUND NAME	CAS No.[1]	VOC [2]	TAC [3]	Candidate TAC [4]	URF [5]	AREL [6]	CREL [7]
Propylene Glycol Monomethyl Ether (Glycol Ether)	107982	Yes					2.00e+03
Propylene Glycol T-Butyl Ether	57018527	Yes					
Sodium Benzoate	532321						
Sodium Metasilicate	10213793						
Tergitol np-40 (Nonylphenoxypoly(ethylene oxy)ethanol)	9016459	Yes					
tert-Butyl Alcohol (inhibitor)	75650	Yes		Yes			
Tetrapotassium Pyrophosphate	7320345						
Toluene	108883	Yes	Yes			3.70e+04	4.00e+02
Trichloroethylene	79016	Yes	Yes		2.00e-06		6.40e+02
1,2,4 Trimethylbezene	95636	Yes		Yes			
Trimethylbenzene	25551137	Yes					
Water	7732185						
Xylene	1330207	Yes	Yes			2.20e+04	3.00e+02

1. Chemical Abstract Service (CAS) number.
2. Volatile Organic Compound as defined in the Glossary (Appendix I).
3. Substances identified as Toxic Air Contaminants by the Air Resources Board, pursuant to the provisions of AB 1807 and AB 2728, including hazardous air pollutants listed in the Federal Clean Air Act Amendments of 1990 (ARB, 1996).
4. Substances which are being evaluated for review as a Toxic Air Contaminant (ARB, 1996).
5. AB 2588 Hot Spots Unit Risk and Cancer Potency Values (OEHHA, 1999b).
6. Acute Reference Exposure Levels (RELs) (OEHHA, 1999a).
7. Noncancer Reference Exposure Levels (Chronic) (CAPCOA, 1993).

REFERENCES FOR APPENDIX G

ARB, 1996. "Toxic Air Contaminant Identification List." California Air Resources Board. June 1996.

OEHHA, 1999a. Part I The Determination of Acute Reference Exposure Levels for Airborne Toxicants, Office of Environmental Health Hazard Assessment (OEHHA), March 1999.

OEHHA, 1999b. Part II Technical Support Document for Describing Available Cancer Potency Factors, Office of Environmental Health Hazard Assessment (OEHHA), April 1999.

CAPCOA, 1993. CAPCOA Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines, Toxics Committee of the California Air Pollution Control Officers Association (CAPCOA), October 1993.

U.S. EPA, 1996. Integrated Risk Information System (IRIS), United States Environmental Protection Agency (U.S. EPA), Washington , D.C., 1996.

Appendix I

Glossary

Appendix I. Glossary

Acute Exposure:	One or a series of short-term exposures generally lasting less than 24 hours.
Air Dispersion Model:	A mathematical model or computer simulation used to estimate the concentration of toxic air pollutants at specific locations as a result of mixing in the atmosphere.
Airborne Toxic Control Measure:	Section 39655 of the Health and Safety Code, defines an"Airborne Toxic Control Measure" means either of the following: 1) Recommended methods, and, where appropriate, a range of methods, that reduce, avoid, or eliminate the emissions of a toxic air contaminant. Airborne toxic control measures include, but are not limited to, emission limitations, control technologies, the use of operational and maintenance conditions, closed system engineering, design equipment, or work practice standards, and the reduction, avoidance, or elimination of emissions through process changes, substitution of materials, or other modifications. 2) Emission standards adopted by the U.S. Environmental Protection Agency pursuant to Section 112 of the federal act (42 U.S.C. Sec. 7412).
AMR Activities:	means any service, repair, restoration, or modification activity to a motor vehicle in which cleaning or degreasing products could be used including, but not limited to, brake work, engine work, machining operations, and general degreasing of engines, motor vehicles, parts, or tools.
AMR Facilities:	means any entity or entities that repairs, rebuilds, reconditions, services, or maintains in any way, motor vehicles. "Facility" includes entities required to be registered by the California Department of Consumer Affairs, Bureau of Automotive Repair, and entities that service or repair a fleet of ten or more motor vehicles. "Facility" does not include private residences or entities that are involved only in motor vehicle body work or painting.
Cancer Risk:	The theoretical probability of contracting cancer when exposed for a lifetime to a given concentration of a substance usually calculated as an upper confidence limit. The maximum estimated risk may be presented as the number of chances in a million of contracting cancer.
Chlorinated Automotive Consumer Product:	means an automotive consumer product (brake cleaner, carburetor cleaner, engine degreaser, or general purpose degreaser) that contains perchloroethylene (Perc), methylene chloride (MeCl), or trichloroethylene (TCE).

Chronic Exposure:	Long-term exposure usually lasting from one year to a lifetime.
Hazardous Air Pollutant or HAP:	Means a substance that the U.S. Environmental Protection Agency has listed in, or pursuant to, Section 112 subsection (b) of the federal Clean Air Act Amendments of 1990 (42 U.S. Code, Section 7412(b)).
Hazard Index:	The ratio of the concentration of a toxic pollutant with non-cancer health effects and the reference exposure level for that pollutant.
Health Risk Assessment (HRA):	A comprehensive analysis of the dispersion of hazardous substances in the environment, the potential for human exposure, and a quantitative assessment of both individual and population-wide health impacts associated with the level of exposure.
Inhalation Reference Concentration (RfC):	An estimate, derived by the U.S. EPA (with an uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population, (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime of exposure. The RfC is derived from a no or lowest observed adverse effect level from human or animal exposures, to which uncertainty or "safety" factors are applied.
MEIR:	Maximum exposed individual resident. The residential receptor location that receives the estimated maximum exposure from a facility's emissions relative to other residential locations.
MEIW:	Maximum exposed individual worker. The off-site industrial or commercial location that receives the estimated maximum exposure from a facility's emissions relative to other industrial or commercial locations. This receptor is a subset of non-residential receptors.
Near Source Location:	The location closest to a facility where concentrations could be estimated through air dispersion modeling.
Non-cancer Risk:	Refers to non-cancer health effects due to acute and/or chronic exposure. This may be illustrated as an estimate of the hazard index or total hazard index (by endpoint) resulting from exposure to toxic air pollutants.
Non-Residential Location:	A receptor that is not residentially located. This category could include receptors at off-site industrial locations, at on-site locations of public access for acute exposure, or employees at sensitive receptor locations, including but not limited to, schools, hospitals, and care facilities.

Reference Exposure Level (REL):	These are used as indicators of potential non-cancer adverse health effects. An REL is a concentration level at or below which no adverse health effects are anticipated. RELs are designed to protect most sensitive individuals in the population by including safety factors in their development.
Risk:	The possibility of injury or disease, which may result from exposure to toxic air pollutants.
Scientific Review Panel on Toxic Air Contaminants (SRP):	A nine-member panel appointed to advise the Air Resources Board and the Department of Pesticide Regulation in their evaluation of the adverse health effects toxicity of substances being evaluated as Toxic Air Contaminants.
Toxic Air Contaminant (TAC)	Section 39655 of the Health and Safety Code, defines a TAC as an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health. A substance that is listed as a hazardous air pollutant pursuant to subsection (b) of Section 112 of the federal act (42 U.S.C. Sec. 7412(b)) is a TAC. TACs that are pesticides are regulated in their pesticidal use by the Department of Pesticide Regulation.
Total Hazard Index:	The sum of hazard indices for pollutants with non-cancer health effects that have the same or similar adverse health effects (endpoints).
Unit Risk Factor: (URF):	The estimated upper-confidence limit (usually 95%) probability of a person contracting cancer as a result of a constant exposure to 1µg/m^3 of a substance over a 70-year lifetime.
Volatile Organic Compound (VOC):	Means any compound containing at least one atom of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and excluding the following: (1) methane, methylene chloride (dichloromethane), 1,1,1-trichloroethane (methyl chloroform), trichlorofluoromethane (CFC-11), dichlorodifluoromethane (CFC-12), 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113), 1,2-dichloro-1,1,2,2-tetrafluoroethane (CFC-114), chloropentafluoroethane (CFC-115), chlorodifluoromethane (HCFC-22), 1,1,1-trifluoro-2,2-dichloroethane (HCFC-123), 1,1-dichloro-1-fluoroethane (HCFC-141b), 1-chloro-1,1-difluoroethane (HCFC-142b), 2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124), trifluoromethane (HFC-23), 1,1,2,2-tetrafluoroethane (HFC-134), 1,1,1,2-tetrafluoroethane (HFC-134a), pentafluoroethane (HFC-125), 1,1,1-trifluoroethane (HFC-143a), 1,1-difluoroethane (HFC-152a), cyclic,

branched, or linear completely methylated siloxanes, the following classes of perfluorocarbons: (A) cyclic, branched, or linear, completely fluorinated alkanes; (B) cyclic, branched, or linear, completely fluorinated ethers with no unsaturations; (C) cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and (D) sulfur-containing perfluorocarbons with no unsaturations and with the sulfur bonds to carbon and fluorine, and (2) the following low-reactive organic compounds which have been exempted by the U.S. EPA: acetone, ethane, methyl acetate, parachlorobenzotrifluoride (1-chloro-4-trifluoromethyl benzene), perchloroethylene (tetrachloroethylene).

Acronyms

AB	Assembly Bill
ARB	Air Resources Board
AMR Activities	Automotive Maintenance and Repair Activities
AMR Facilities	Automotive Maintenance and Repair Facilities
APCD	Air Pollution Control District
AQMD	Air Quality Management District
ATCM	Airborne Toxic Control Measure
BAR	California Department of Consumer Affairs, Bureau of Automotive Repair
Cal/OSHA	California Occupational Safety and Health Act
DHS	California Departent of Health Services
Districts	Local Air Pollution Control and Air Quality Management Districts
DOF	California Department of Finance
DTSC	California Department of Toxics Substances Control
HAP	Hazardous Air Pollutant
HSC	Health and Safety Code
IARC	International Agency for Research on Cancer
OEHHA	Office of Environmental Health Hazard Assessment
MeCl	Methylene Chloride (dichloromethane)
MEIR	Maximum Exposed Individual Resident
MEIW	Maximum Exposed Individual Worker
MSDS	Material Safety Data Sheet
Perc	Perchloroethylene (tetrachloroethylene)
PMI	Point of Maximum Impact
RfC	Reference Concentration
RfD	Reference Dose
REL	Reference Exposure Level
SB	Senate Bill
SRP	Scientific Review Panel on Toxic Air Contaminants
TAC	Toxic Air Contaminant
TCA	1,1,1-Trichloroethane
TCE	Trichloroethylene
URF	Unit Risk Factor
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound