

**MATES III**  
**Draft Protocol for the**  
**Development of the Toxics Emissions Inventory**  
*March 24, 2004*

**OVERVIEW**

An emission inventory of air pollutants and their sources is essential in order to identify the major contributors of air contaminants and the measures required to reduce air pollution. Information necessary to produce an emission inventory for the South Coast Air Basin (Basin) is obtained from the South Coast Air Quality Management District (SCAQMD) and other government agencies including: California Air Resources Board (ARB), California Department of Transportation (Caltrans), and Southern California Association of Governments (SCAG).

Each of these agencies is responsible for collecting data (e.g., industry growth factors, socio-economic projections, travel activity levels, emission factors, emission speciation profiles, etc.) and developing methodologies (e.g., model and demographic forecast improvements) required to generate a comprehensive emission inventory. ARB is the primary agency responsible for developing the emission inventory for all mobile sources. SCAG is the primary agency for projecting population and activity growth in the Basin. ARB provides on-road and off-road inventories from their EMFAC and Off-Road Models, respectively. Caltrans provides SCAG with highway network, traffic counts, and road capacity data. SCAG incorporates these data into their Travel Demand Model for estimating/projecting vehicle miles traveled (VMT) and speed. ARB's on-road inventory also relies on SCAG's VMT estimates.

The 2003 Air Quality Management Plan (AQMP) is the basis for the toxics emission inventory developed for MATES-III with a few exceptions and enhancements. In the 2003 AQMP, point source emissions are developed from a 1997 baseline, whereas for MATES-III, point source emissions are estimated from fiscal year (FY) 2002-03 annual emission reports. Also, for several area source categories (i.e., retail gasoline service stations, perchloroethylene dry cleaners, and metal plating facilities), "bottom-up" inventories are developed using reported emissions or activity. Lastly, recent inventories developed by the Ports of Los Angeles and Long Beach and by the ARB for the Wilmington area (ZIP code 90744) are incorporated into the MATES-III inventory.

**METHODOLOGY**

The toxic emission inventory for MATES-III consists of four components: (1) point sources, (2) area sources, (3) on-road mobile sources, and (4) off-road (or other) mobile sources. Point source emissions are from facilities having one or more pieces of equipment registered and permitted with the SCAQMD and with emissions above threshold levels. Area sources represent numerous small sources of emissions that can collectively have significant emissions and can contribute high health risks (e.g., dry cleaners, retail gasoline stations, auto body shops, residential heating, etc.). On-road mobile sources include cars, trucks, buses, and motorcycles. All mobile sources not

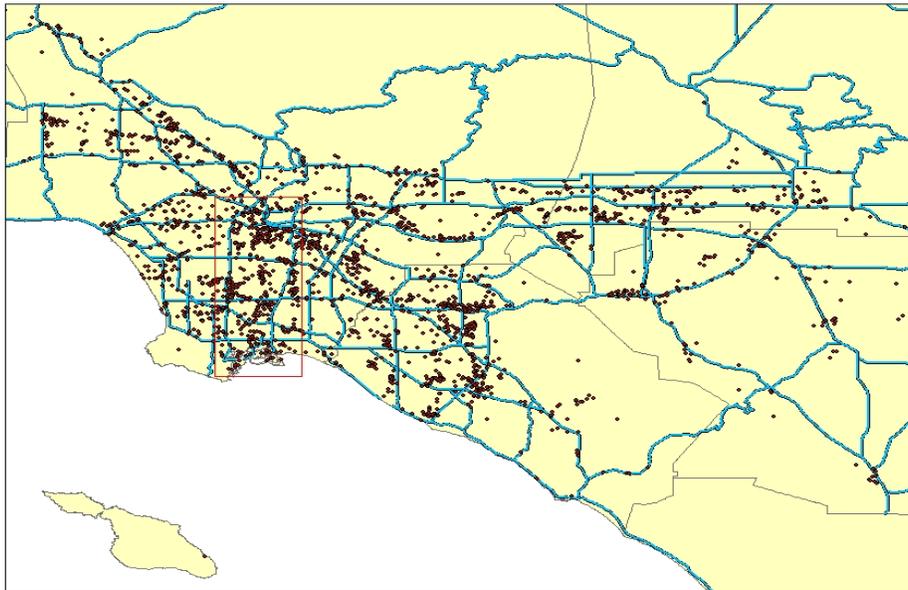
included in the on-road mobile source inventory are considered as “off-road” mobile sources, which include aircraft, ships, commercial boats, trains, recreational vehicles, construction equipment, etc. Currently, the AQMD has a variety of databases and data sources that contain emissions data. Table 1 provides a general summary of the five existing toxic emissions inventory data sources maintained at the AQMD.

**Table 2.** AQMD Sources of Toxic Emissions Data

<b>Data Source</b>	<b>Source Categories</b>	<b>Pollutants</b>	<b>Comments</b>
Assembly Bill 2588 (AB2588)	Point sources (approx.1000 facilities)	<ul style="list-style-type: none"> <li>• 170+ carcinogenic and non-carcinogenic compounds</li> <li>• Reported once every 4 years</li> </ul>	<ul style="list-style-type: none"> <li>• Emission updates since the year 2000.</li> <li>• Complete refresh of the database by spring 2005</li> <li>• Emissions based on material/fuel usage, source test data, &amp; emission factors.</li> <li>• Reported under the AER program.</li> </ul>
Annual Emissions Reporting (AER)	Point sources (approx. 3000 facilities)	<ul style="list-style-type: none"> <li>• 6 criteria pollutants (VOC, SPOG, NO<sub>x</sub>, SO<sub>x</sub>, PM, &amp; CO) and 24 toxics</li> <li>• Reported annually</li> </ul>	<ul style="list-style-type: none"> <li>• Emissions based on material/fuel usage, source test data, &amp; emission factors.</li> </ul>
2003 AQMP inventory	<ul style="list-style-type: none"> <li>• Point source emissions developed from AER.</li> <li>• Area source emissions based on specific methodologies.</li> <li>• On-road &amp; off-road mobile sources</li> </ul>	<ul style="list-style-type: none"> <li>• Carcinogens and non-carcinogens speciated from PM and VOC emissions</li> </ul>	<ul style="list-style-type: none"> <li>• ARB continually updates speciation profiles as data become available.</li> </ul>
Rule development efforts and rule reporting requirements	<ul style="list-style-type: none"> <li>• Select point sources</li> <li>• Select area sources</li> </ul>	<ul style="list-style-type: none"> <li>• Carcinogens and non-carcinogens based on industry and source category.</li> </ul>	<ul style="list-style-type: none"> <li>• Development efforts for Rule 1468 and Proposed Rule 1469</li> <li>• Reporting requirements for rules 461, 1421, &amp; 1469.</li> </ul>
Clean Air Support System (CLASS)	<ul style="list-style-type: none"> <li>• Point sources</li> <li>• Selected area source categories (e.g., gas stations, dry cleaners, auto-body shops, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Criteria pollutants</li> <li>• Selected toxics</li> </ul>	<ul style="list-style-type: none"> <li>• Permitted emission levels</li> <li>• Maximum potential-to-emit activity</li> </ul>

## Point Sources

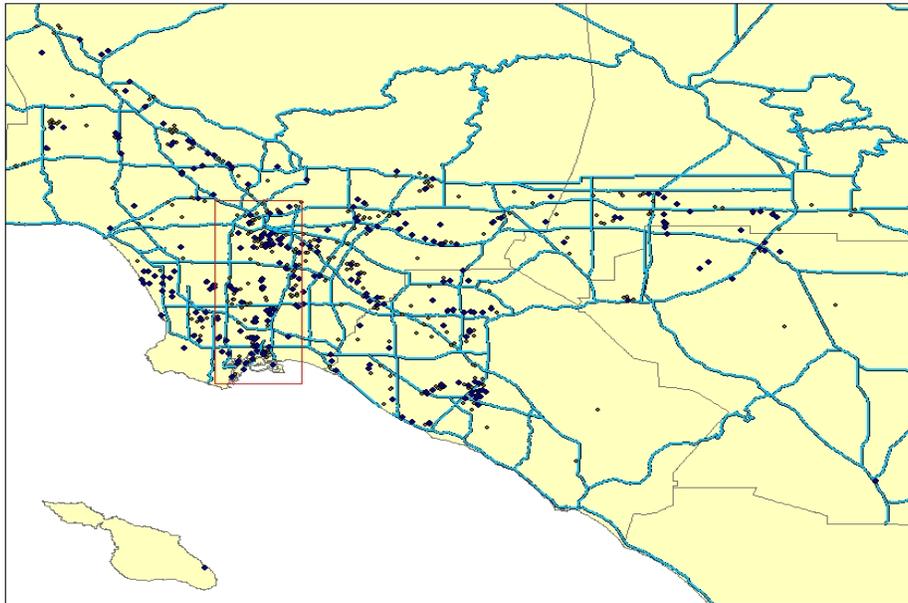
The AB2588 and AER databases listed in Table 1 are used to develop the point source toxic inventory for MATES-III. The data collected in FY 2002-03 (i.e., 7/1/2002 to 6/30/2003) is used to represent calendar year 2004 emissions. (It is necessary to use FY 2002-03 data since complete FY 2003-04 data will not be available until spring 2005, significantly delaying the completion of the study.) The AER database includes facilities that have the potential to emit four or more tons per year of VOC, NO<sub>x</sub>, SO<sub>x</sub>, or PM or 100 or more tons per year of CO. Facilities subject to the AER Program calculate and report their emissions primarily based on their throughput data (e.g., fuel usage, material usage, etc.), appropriate emission factors, and control efficiency (if applicable). The forms used for reporting the emissions are available on the SCAQMD website.<sup>1</sup> The 24 toxic air contaminants (TACs) listed in Table 2 are also reported each year under this program. Emissions from important unreported compounds such as naphthalene can be estimated from the reported PAHs using the representative fuel/equipment emission factors in Appendix A. For example for boilers burning natural gas, about 75 percent of the total PAH is naphthalene (see Table A-1). Thus naphthalene emissions can be estimated from the reported PAH emissions. A toxics inventory for AER facilities is developed from these reported and estimated emissions. There are approximately 3000 facilities subject to the AER program; their distribution throughout the Basin is illustrated in Figure 1.



**Figure 1.** Distribution of AER Facilities.  
(The area outlined is the Alameda Corridor.)

**Table 2.** Reported TACs under the AER Program.

Ammonia	Chlorinated dioxins & dibenzofurans	Lead
Asbestos	Chlorofluorocarbons	Methylene chloride
Arsenic (inorganic)	1,4-Dioxane	Nickel
Benzene	Ethylene dibromide	Perchloroethylene
Beryllium	Ethylene dichloride	Polynuclear aromatic hydrocarbons (PAH)
1,3-Butadiene	Ethylene oxide	1,1,1-Trichloroethane
Cadmium	Formaldehyde	Trichloroethylene
Carbon tetrachloride	Hexavalent chromium	Vinyl chloride



**Figure 2.** Distribution of AB2588 Facilities.  
(The area outlined is the Alameda Corridor.)

There are about 1000 facilities in the AB2588 Program which are required to report their toxic emissions once every four years (or quadrennially) through the AER Program. AB2588 facilities must report emissions of over 170 compounds or elements (see Appendix C). The reported toxics are used directly in MATES-III emission inventory. The 2004 inventory for MATES-III is developed from toxic emissions reported over the following FYs: 2000-01, 2001-02, 2002-03, and 2003-04. (Complete FY 2003-04 data will not be available until spring 2005 but given the relatively small number of AB2588 facilities reporting in FY 2003-04 [approx. 250] and their importance, every attempt will be made to include them in the inventory and modeling.) Reported toxic emissions for FYs 2000-01 and 2001-02 are adjusted using throughput or activity given in the FY 2002-03 annual emission reports when available, otherwise the most recently reported

emissions are assumed to represent calendar year 2004. Figure 2 illustrates the distribution of the approximately 1000 facilities subject to the AB2588 program. Since some facilities are in both the AB2588 and AER programs, there is some overlap between Figures 1 and 2. AB2588 facilities must report a more comprehensive set of toxics than AER facilities (note the AB2588 pollutant list in Appendix C compared to AER toxic list in Table 2). Therefore, AB2588 inventory reports take precedent over annual emission reports for facilities in both programs.

In order to prepare the point source inventory, emissions data for each facility are categorized based on the U.S. EPA’s Source Classification Codes (SCCs) for each source category. Since the AER Program collects emissions data on an aggregate basis (i.e., equipment and processes with the same emission factor are grouped and reported together), the facilities’ permitted equipment data is used in conjunction with the reported data to assign the appropriate SCC and develop the inventory at the SCC level. This approach is primarily applicable to combustion-type activity where the reported, aggregated emissions will have to be de-aggregated into SCC codes. For modeling purposes, facility location is specified in Universal Transverse Mercator (UTM) coordinates.

**Area Sources**

SCAQMD and ARB share responsibility for developing the emission inventory for the approximately 350 area source categories considered in the 2003 AQMP.<sup>2</sup> For each area source category, a specific methodology is used for estimating emissions. For the 2003 AQMP, a number of existing methodologies were used with updated activity such as fuel or sales data (e.g., fuel combustion categories, landfills, oil/gas production); new methodologies were developed for several categories (i.e., agricultural pumps, residential wood combustion); three new categories were added to the inventory (i.e., composting, cargo tanks, and gas cans); and other existing methodologies were refined based on more recent studies (e.g., consumer products, architectural coatings).

The area source emissions developed for the 2003 AQMP<sup>2</sup> and projected to the year of interest (i.e., 2004) are used for MATES-III. Emissions are spatially allocated to 2 km by 2 km grids using spatial surrogates. Some commonly used spatial surrogates are listed in Table 3. Toxic emissions are calculated by applying the latest ARB speciation profiles<sup>3</sup> to the hydrocarbon and particulate matter emissions. Table 4 illustrates a portion of the speciation profile for the area source category of construction dust. Using the profile, one can easily apportion the particulate mass into its component parts.

**Table 3.** Commonly Used Spatial Surrogates.

Population	Total employment
VMT	Retail employment
Industrial employment	Single dwelling units
Total housing	Rural land cover – forest
Agricultural land cover	Rural land cover – range land
National forest > 5000 ft	

Source: <http://eos.arb.ca.gov/eos/projects/surrogates/>

Based on recently approved Rules 461, 1421, and 1469, retail gas stations, perchloroethylene dry cleaners, and metal plating facilities, respectively, are required to report their emissions or activity. In the past, emissions from these source categories were developed using a “top-down” approach; that is, county-wide emissions were spatially allocated using spatial surrogates. For MATES-III, “bottom-up” inventories are developed using reported emissions or activity as discussed next for retail gasoline service stations, perchloroethylene dry cleaners, and metal plating and finishing facilities. Bottom-up inventories for autobody shops and crematoriums are also being considered for MATES-III but the methods are currently uncertain.

**Table 4.** Portion of the Speciation Profile for Construction Dust.

Pollutant	Wt. % of TSP	Wt. % of PM <sub>10</sub>	Wt. % of PM <sub>2.5</sub>
Aluminum	7.240	9.491	9.046
Ammonia	0.012	0.016	0.026
•••	•••	•••	•••
Lead	0.056	0.070	0.083
Manganese	0.095	0.115	0.116
•••	•••	•••	•••
Zinc	0.052	0.066	0.082
Zirconium	0.011	0.012	0.010
Unknown	56.509	44.724	46.198

Source: PM profile No. 420 at the following link: <http://www.arb.ca.gov/emisinv/speciate/speciate.htm>

#### Retail Gasoline Service Stations

There are approximately 3600 retail gasoline service stations in the Basin (see Figure 3). Rule 461 is designed to regulate gasoline vapor emissions from gasoline transfer and dispensing processes which contain volatile organic compounds (VOCs) and TACs such as benzene, toluene, xylenes, and methyl tertiary butyl ether (MTBE). The rule was initially adopted in 1976 and has been amended a number of times, most recently on June 15, 2001. The rule requires that service stations report their gasoline throughput annually.

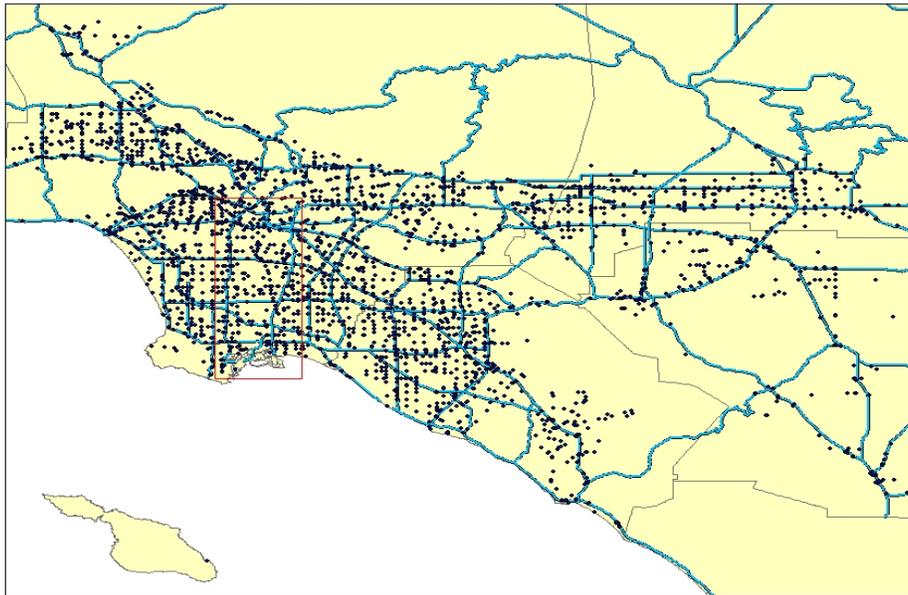
Emissions from gasoline transfer and dispensing mainly occur during loading, breathing, refueling, and spillage as described below:

Loading – Emissions occur when a fuel tanker truck unloads gasoline to the storage tanks. The storage tank vapors, displaced during loading, are emitted through its vent pipe. A pressure/vacuum valve installed on the tank vent pipe significantly reduces these emissions.

Breathing – Emissions occur through the storage tank vent pipe as a result of temperature and pressure changes in the tank vapor space.

Refueling – Emissions occur during motor vehicle refueling when gasoline vapors escape through the vehicle/nozzle interface.

Spillage – Emissions occur from evaporating gasoline that spills during vehicle refueling.



**Figure 3.** Distribution of retail gasoline service stations.  
(The area outlined is the Alameda Corridor.)

All retail service stations under AQMD jurisdiction have Phase I and II vapor recovery systems to control gasoline emissions. Phase I vapor recovery refers to the collection of gasoline vapors displaced from storage tanks when cargo tank trucks make gasoline deliveries. Phase II vapor recovery systems control the vapors displaced from the vehicle fuel tanks during refueling. In addition, all gasoline is stored underground with valves installed on the tank vent pipes to further control gasoline emissions. Under these conditions, the VOC emission factors for each of the four processes are summarized in Table 5. The factors given in the table follow the California Air Pollution Control Officer’s Association (CAPCOA) recommended guidelines.<sup>4</sup> Local studies have shown that a substantial number of service stations do not fully comply with the Phase II vapor recovery rate of 95 percent. Therefore, CAPCOA suggests an overall control efficiency of 90 percent for Phase II vapor recovery.

**Table 5.** Emission Factors for Retail Service Stations

Process	VOC Emission Factor (lbs/1000 gal)
Loading	0.084
Breathing	0.025
Refueling	0.74
Spillage	0.42

Source: <http://www.arb.ca.gov/ab2588/rrap-iwra/GasIWRA.pdf>

VOC emissions at each service station are estimated from its 2003 throughput and the emission factors given in Table 5. (Throughput for 2004 will not be available in sufficient time to complete the study on schedule.) If actual gasoline throughput is not available, then the facility's permitted throughput or an average (or median) throughput calculated from the available data is used to estimate the VOC emissions. The VOC is partitioned into its toxic components using ARB speciation profiles. Profile No. 422 is applicable to loading, breathing, and refueling; Profile No. 419 should be used for gasoline spillage. These two profiles are provided in Appendix D.

#### Perchloroethylene Dry Cleaners

There are approximately 2100 perchloroethylene dry cleaners in the Basin (see Figure 4). Rule 1421 is designed to reduce perchloroethylene emissions from dry cleaning systems. The rule was initially adopted in 1994, and recently amended on December 6, 2002. As part of reporting requirements in the amendments, the AQMD requires an initial survey, due July 1, 2003, to obtain throughput and receptor information for estimating health risks from the dry cleaning facilities. The form used for the facility survey is contained in Appendix E.



**Figure 4.** Distribution of perchloroethylene dry cleaners.  
(The area outlined is the Alameda Corridor.)

Perchloroethylene emissions from dry cleaners primarily originate from leaks and from the loading door and other maintenance ports. Emissions are estimated by a material mass balance calculation as follows:

$$\text{Perc Emissions} = \text{Perc Consumption} - \text{Perc Waste Credit}$$

where,

$$\text{Perc Consumption} = \text{Perc Purchases} + \text{Initial Perc Inventory} - \text{Final Perc Inventory}$$

and

$$\text{Perc Waste Credit} = (\text{Total Gallons of Still Oil})(\% \text{ Perc in Still Oil}) + (\text{No. of Filter Cartridges})(\text{Gallons of Perc/Cartridge})$$

Rule 1421 requires that facilities provide the information needed to perform the above calculations. However, if the above information is not available, then emissions can alternately be calculated as follows:

$$\text{Perc Emissions} = (0.5)(\text{Perc Purchases})$$

The 50 percent fraction given in the above equation is based on limited testing data and is currently under review by the AQMD and the dry cleaning industry.

An initial review of the survey data indicates that approximately 300 facilities have not submitted the survey and a number of facilities have incomplete or inaccurate data. If actual activity data is missing or unreliable, then the facility's permitted usage or an average (or median) usage calculated from the available data is used to estimate the perchloroethylene emissions.

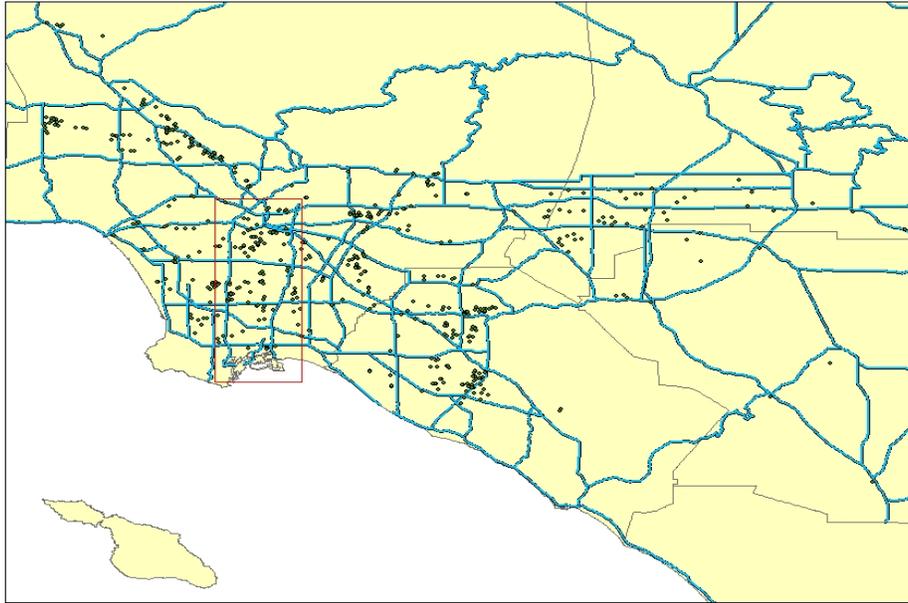
#### Metal Plating and Finishing Facilities

The inventory for the metal plating and finishing facilities consists of appropriate facilities (or AQMD identification numbers), their corresponding location (as UTM coordinates), and their corresponding actual (controlled) annual emissions (pounds per year). The initial list of metal plating and finishing facilities is a composite of the AB2588 industrywide billing list (developed in April/May each year), the Rules 1469 and 1426 Compliance Reports (collected in February 2004), and the Air Toxics Control Plan update (data prepared in November 2003). Using CLASS (the AQMD permit database), facility status and their corresponding permits (number and status) are extracted. The final list of facilities consists of facilities with "active" status, and at least one "active" permit or "pending" permit that is over one year. Figure 5 shows the distribution of metal plating and finishing facilities based on the FY 2002-03 industrywide billing list.

The emissions (pollutant and amount) are extracted from Rules 1469 and 1426 Compliance Reports and the AB2588, AER, or CLASS databases. The Rule 1469 Compliance Reports are limited to hexavalent chromium plating emissions. The Rule 1426 Compliance Reports address nickel, cadmium, lead, copper plating emissions, as well as acid and base tank emissions. Priority is given to the Rule 1469 and 1426 Initial Compliance Reports as they contain the most recent and detailed plating emissions (per tank); an example of the initial compliance report for Rule 1469 is provided in Appendix F. AER and AB2588 are used as a secondary source of an emission profile (per facility). The CLASS database is the last resort for an emission profile (per permit). The use of these various databases allows for some level of data validation.

It is anticipated that an inventory of chromate spraying facilities will be developed in support of Proposed Rule 1468 by May 2004. When available, the data developed for the

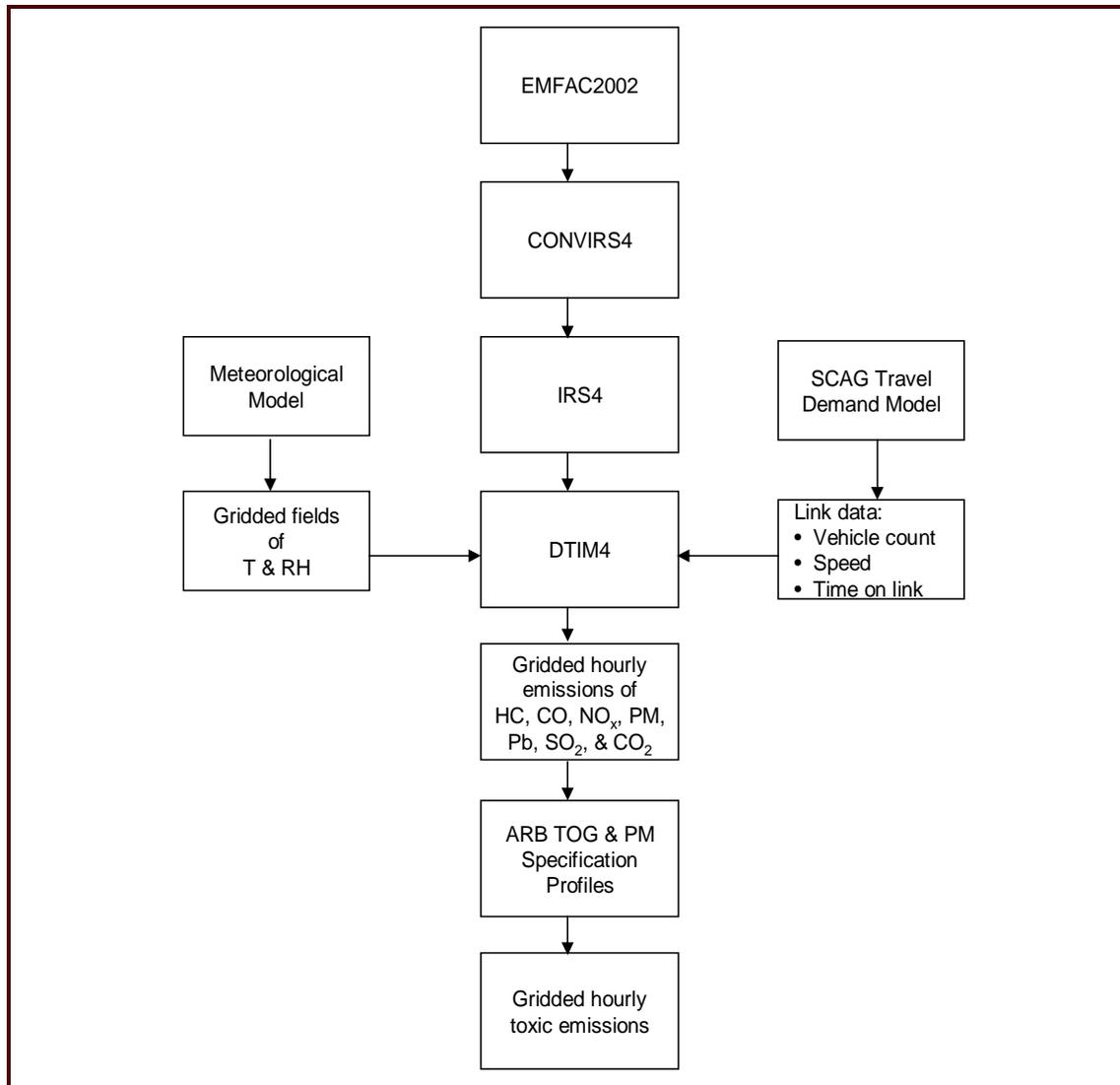
rulemaking effort will be considered for the MATES III inventory. The AER, AB2588, and CLASS databases provide emissions and/or activity for some spray operations. The hierarchy for activity and emissions information is as follows: (1) the staff report for Proposed Rule 1468, (2) AER and AB2588 databases, and (3) the CLASS database.



**Figure 5.** Distribution of metal plating and finishing facilities.  
(The area outlined is the Alameda Corridor.)

### **On-road Mobile Sources**

On-road emissions are the product of emission factors and vehicular activity. The emissions developed for the 2003 AQMP<sup>2</sup> and projected to calendar year 2004 is used for MATES-III. For the 2003 AQMP, ARB's EMFAC2002 emission factors<sup>5</sup> were used and link-based traffic volumes and speeds were obtained from the SCAG regional transportation modeling. The Direct Travel Impact Model (DTIM) was used to link emission factors and transportation modeling results and generate hourly gridded emissions of criteria pollutants (i.e., TOG, NO<sub>x</sub>, PM, CO, and SO<sub>x</sub>). Toxic emissions are calculated by applying the latest ARB speciation profiles<sup>3</sup> for mobile sources to the hydrocarbon and particulate matter emissions. A flow chart illustrating this process is provided in Figure 6. Some of the key steps in the process are discussed in more detail in the next subsections.



**Figure 6.** Flow diagram for on-road emissions processing.

### EMFAC

EMFAC stands for EMISSION FACTOR. It is a FORTRAN computer model that estimates the on-road emissions of hydrocarbons (HC), CO, NO<sub>x</sub>, PM, lead, SO<sub>2</sub>, and CO<sub>2</sub> for calendar years 1970 to 2040. EMFAC considers 1965 and newer vehicles powered by gasoline, diesel, or electricity and reports for 13 broad vehicle classes as shown in Table 6. Over 100 different technology groups are accounted for within each class (e.g., catalyst, non-catalyst, three-way catalyst, carbureted, multi-port fuel injection, LEV, TLEV, SULEV, etc.).

**Table 6.** Broad Vehicle Classes Considered by EMFAC.

Vehicle Class	Weight (lbs)	Vehicle Class	Weight (lbs)
Passenger cars	All	Heavy-Heavy-Duty Truck	33,001 – 60,000
Light Truck I	0 – 3,750	Line-Haul Vehicles	60,001 +
Light Truck II	3,751 – 5,750	Urban Diesel Bus	All
Medium-Duty Truck	5,751 – 8,500	Motorcycle	All
Light-Heavy-Duty Truck I	8,501 – 10,000	School Bus	All
Light-Heavy-Duty Truck II	10,001 – 14,000	Motor Homes	All
Medium-Heavy-Duty Truck	14,001 – 33,000		

Source: Adopted from Table 1 of User's Guide for EMFAC2001 / EMFAC2002.

EMFAC currently considers the following county-specific information when calculating emissions:

- Ambient air temperature (denoted by T in Figure 6),
- Relative humidity (denoted by RH in Figure 6),
- Vehicle population,
- Fleet composition,
- Fleet growth rates,
- Mileage accrual rates,
- Vehicle age distribution,
- Distribution of VMT by speed,
- Smog check regulations,
- Fuel properties, and
- Altitude.

Some on-road activity information for the four counties in the Basin is summarized in Table 7. Four of the top seven counties in California in terms of vehicle population, VMT, and trips are in the Basin.

**Table 7.** Vehicle Activity Information for the Counties in the Basin.

County	Vehicle Population	VMT/day	Trips/day	Miles per Vehicle-Day	Mean Age of Passenger Car Fleet
Los Angeles	5,811,255	197,059,000	39,896,020	33.91	9.36
Orange	2,071,490	65,359,000	14,058,600	31.55	10.46
Riverside	1,014,703	42,170,000	6,890,676	41.56	11.91
San Bernardino	1,064,007	39,152,000	7,298,540	36.80	9.99

Source: <http://www.arb.ca.gov/msei/on-road/briefs/activity.pdf>

The output from EMFAC is a text file containing HC, CO, NO<sub>x</sub>, PM, lead, SO<sub>2</sub>, and CO<sub>2</sub> emission rates for 45 model years for each vehicle class within each calendar year, for 24

hourly periods, and for each month of the year for each county/air basin specified. Processing continues with the DTIM modeling system, which prepares gridded hourly on-road emissions for photochemical grid modeling.

#### DTIM4

The DTIM processing system consists of three FORTRAN program modules: CONVIRS4, IRS4, and DTIM4. The main function of CONVIRS4 is to re-format the emission rate file output from EMFAC into a form compatible with IRS4. IRS4 creates fleet average emission rates by ambient air temperature, relative humidity, and vehicle speed.

The DTIM4 module prepares gridded, hourly on-road emissions of HC, CO, NO<sub>x</sub>, PM, lead, SO<sub>2</sub>, and CO<sub>2</sub> link by link in the transportation network. SCAG's Travel Demand Model provides the following for each link in the transportation network: the number of vehicles, their average speed, and time on the link. Separate files containing hourly gridded temperature (T in Figure 6) and relative humidity (RH in Figure 6) are provided as input to DTIM4. Knowing the air temperature and relative humidity representative of the link and the average vehicle speed on the link, DTIM4 looks up the fleet average emission rate in the file prepared by IRS4, and multiplies these by the number of vehicles and the average time on the link.

ARB speciation profiles<sup>3</sup> are used to speciate the on-road HC and PM emissions into its toxic components. Several important HC and PM speciation profiles are contained in Appendices D and G, respectively.

#### **Off-road Mobile Sources**

The off-road emissions developed for the 2003 AQMP<sup>2</sup> are used for MATES-III. For the 2003 AQMP, ARB's OFF-ROAD model was used to estimate emissions for all off-road categories (100+ source categories) except commercial ships, aircraft, locomotive, and recreational vehicles. This model incorporates various aspects of off-road elements, such as the effects of various adopted regulations, technology types, and seasonal conditions on emissions. The model combines population, activity, horsepower, load factors, and emission factors to yield the annual equipment emissions by county, air basin, or state. Spatial and temporal features are incorporated to estimate seasonal emissions. Aircraft and ship emissions for the 2003 AQMP were developed by SCAQMD and SCAG sponsored studies. Emissions are spatially allocated to 2 km by 2 km grids using spatial surrogates. Toxic emissions are calculated by applying the latest ARB speciation profiles<sup>3</sup> for off-road mobile sources to the hydrocarbon and particulate matter emissions.

The Ports of Los Angeles (PoLA) and Long Beach (PoLB) are currently developing spatially and temporally resolved inventories of their most important source categories: commercial marine vessels; harbor craft; dockside equipment such as yard hostlers, top loaders, side loaders, forklifts, off-road trucks, portable equipment, and rubber tire gantry cranes; on-road vehicles (idling and operating); and locomotive operation. PoLA and PoLB are estimating the emissions of these activities within their respective properties which are incorporated into the inventory developed for MATES-III.

## TASKS AND SCHEDULE

Task	Description	Schedule
1	Emission Inventory Protocol	March 2004
2	Development of point source toxic inventory	February to July 2004
3	Development of Basin-wide toxic inventory	July to September 2004
4	Presentation of Basin-wide toxic inventory at meeting	October 2004
5	Development of gridded toxic inventory	October to December 2004
6	Presentation of gridded toxic inventories at meeting	January 2005
7	Presentation of outline for inventory report at meeting	January 2005
8	Draft inventory report	March 2005
9	Final inventory report	May 2005

## REFERENCES

1. Forms used by the SCAQMD in their AER program are available at the following SCAQMD link: <http://www.ecotek.com/aqmd/index2.htm>.
2. A copy of the 2003 AQMP can be viewed or downloaded at the following SCAQMD link: <http://www.aqmd.gov/aqmp/AQMD03AQMP.htm>.
3. ARB speciation profiles can be viewed or downloaded from the following ARB link: <http://www.arb.ca.gov/emisinv/speciate/speciate.htm>.
4. CAPCOA industrywide risk assessment guidelines for retail gasoline service stations can be viewed or downloaded from the following ARB link: <http://www.arb.ca.gov/ab2588/rrap-iwra/GasIWRA.pdf>.
5. EMFAC2002 can be obtained at the following ARB link: [http://www.arb.ca.gov/msei/on-road/latest\\_version.htm](http://www.arb.ca.gov/msei/on-road/latest_version.htm).

**Appendix A**  
**Default Emission Factors**

Default toxic emission factors for form TAC associated with combustion equipment reported on forms B1, B1U, B2, B2U, E1, E1U, and R2 are listed on the following pages. If any of combustion sources has district-approved source tests, facilities are required to use the emission factors developed from the source tests for calculating emissions.

DRAFT

Table A-1: DEFAULT EF FOR NATURAL GAS COMBUSTION (LB / MMCF)

**SOURCE: External Combustion Equipment (Boiler, Oven, Dryer, Furnace, Heater, Afterburner)**

TAC Code	POLLUTANT	CAS NO.	<10 MMBTUH	10-100 MMBTUH	>100 MMBTUH
2	Benzene	71432	0.0080	0.0058	0.0017
12	Formaldehyde	50000	0.0170	0.0123	0.0036
19	Total PAHs (excluding Naphthalene)	1151	0.0001	0.0001	0.0001
19	Naphthalene	91203	0.0003	0.0003	0.0003
29	Acetaldehyde	75070	0.0043	0.0031	0.0009
30	Acrolein	107028	0.0027	0.0027	0.0008
40	Ethyl benzene	100414	0.0095	0.0069	0.0020
44	Hexane	110543	0.0063	0.0046	0.0013
68	Toluene	108883	0.0366	0.0265	0.0078
70	Xylene	1330207	0.0272	0.0197	0.0058

**SOURCE: Flare, Non-Refinery**

TAC Code	POLLUTANT	CAS NO.	ALL SIZES
2	Benzene	71432	0.159
12	Formaldehyde	50000	1.169
19	Total PAHs (excluding Naphthalene)	1151	0.003
19	Naphthalene	91203	0.011
29	Acetaldehyde	75070	0.043
30	Acrolein	107028	0.010
40	Ethyl benzene	100414	1.444
44	Hexane	110543	0.029
68	Toluene	108883	0.058
70	Xylene	1330207	0.029

**SOURCE: Turbine**

TAC Code	POLLUTANT	CAS NO.	TURBINE
2	Benzene	71432	0.0122
4	1,3-Butadiene	106990	0.000439
12	Formaldehyde	50000	0.724
19	Naphthalene	91203	0.00133
19	PAHs (excluding Naphthalene)	1151	0.000918
29	Acetaldehyde	75070	0.0408
30	Acrolein	107028	0.00653
40	Ethylbenzene	100414	0.0326
62	Propylene oxide	75569	0.0296
68	Toluene	108883	0.133
70	Xylene	1330207	0.0653

(continued)

Table A-1: DEFAULT EF FOR NATURAL GAS COMBUSTION (LB / MMCF) (continued)

**SOURCE: Stationary and Portable Internal Combustion Engines (ICE)**

TAC Code	POLLUTANT	CAS NO.	2 Stroke-Lean Burn	4 Stroke-Lean Burn	4 Stroke-Rich Burn
2	Benzene	71432	1.98	0.449	1.61
4	1,3-Butadiene	106990	0.836	0.272	0.676
6	Carbon Tetrachloride	56235	0.0619	0.0374	0.0181
9	Ethylene Dibromide	106934	0.0749	0.0452	0.0217
10	1,2-Dichloroethane	107062	0.0430	0.0241	0.0115
12	Formaldehyde	50000	56.3	53.9	20.9
16	Methylene Chloride	75092	0.150	0.0204	0.0420
19	2-Methylnaphthalene	91576	0.0218	0.0339	0
19	Acenaphthene	83329	0.00136	0.00128	0
19	Acenaphthylene	208968	0.00323	0.00564	0
19	Anthracene	120127	0.000732	0	0
19	Benz(a)anthracene	56553	0.000343	0	0
19	Benzo(a)pyrene	50328	0.00000579	0	0
19	Benzo(b)fluoranthene	205992	0.00000868	0.000169	0
19	Benzo(e)pyrene	192972	0.0000239	0.000423	0
19	Benzo(g,h,i)perylene	191242	0.0000253	0.000422	0
19	Benzo(k)fluoranthene	207089	0.00000435	0	0
19	Chrysene	218019	0.000685	0.000707	0
19	Fluoranthene	206440	0.000368	0.00113	0
19	Fluorene	86737	0.00172	0.00578	0
19	Indeno(1,2,3-c,d)pyrene	193395	0.0000101	0	0
19	Naphthalene	91203	0.09823	0.0759	0.0990
19	Perylene	198550	0.00000507	0	0
19	Phenanthrene	85018	0.00360	0.0106	0
19	Pyrene	129000	0.000596	0.00139	0
21	Vinyl Chloride	75014	0.0252	0.0152	0.00732
24	1,1,2,2-Tetrachloroethane	79345	0.0676	0.0408	0.0258
25	1,1,2-Trichloroethane	79005	0.0538	0.0324	0.0156
26	1,2,4-Trimethylbenzene	95636	0.113	0.0146	0
27	1,2-Dichloropropane	78875	0.0455	0.0274	0.0133
28	1,3-Dichloropropene	542756	0.0447	0.0269	0.0130
29	Acetaldehyde	75070	7.92	8.53	2.85
30	Acrolein	107028	7.94	5.24	2.68
35	Chloroform	67663	0.0480	0.0291	0.0140
40	Ethylbenzene	100414	0.110	0.0405	0.0253
44	n-Hexane	110543	0.454	1.13	0
51	Methanol	67561	2.53	2.55	3.12
66	Styrene	100425	0.0559	0.0241	0.0121
68	Toluene	108883	0.982	0.416	0.569
70	Xylene	1330207	0.273	0.188	0.199

Table A-2: DEFAULT EF FOR DIESEL / DISTILLATE OIL FUEL COMBUSTION  
(LB / 1000 GAL)

**SOURCE: External Combustion Equipment (Boiler, Oven, Dryer, Furnace, Heater, Afterburner)**

TAC			
Code	POLLUTANT	CAS NO.	ALL SIZES
2	Benzene	71432	0.0044
4	1,3-Butadiene	106990	0.0148
5	Cadmium	7440439	0.0015
12	Formaldehyde	50000	0.3506
13	Hexavalent chromium	18540299	0.0001
14	Arsenic	7440382	0.0016
15	Lead	7439921	0.0083
17	Nickel	7440020	0.0039
19	Total PAHs (excluding Naphthalene)	1151	0.0445
19	Naphthalene	91203	0.0053
29	Acetaldehyde	75070	0.3506
30	Acrolein	107028	0.3506
36	Copper	7440508	0.0041
40	Ethyl Benzene	100414	0.0002
44	Hexane	110543	0.0035
46	Hydrogen chloride	7647010	0.1863
49	Manganese	7439965	0.0031
50	Mercury	7439976	0.0020
64	Selenium	7782492	0.0022
68	Toluene	108883	0.0044
70	Xylenes	1330207	0.0016

**SOURCE: Stationary and Portable Internal Combustion Engines (ICE) and Turbines**

TAC			
Code	POLLUTANT	CAS NO.	ALL SIZES
2	Benzene	71432	0.1863
4	1,3-Butadiene	106990	0.2174
5	Cadmium	7440439	0.0015
12	Formaldehyde	50000	1.7261
13	Hexavalent chromium	18540299	0.0001
14	Arsenic	7440382	0.0016
15	Lead	7439921	0.0083
17	Nickel	7440020	0.0039
19	Naphthalene	91203	0.0197
19	PAHs (excluding Naphthalene)*	1151	0.0362
29	Acetaldehyde	75070	0.7833
30	Acrolein	107028	0.0339
36	Copper	7440508	0.0041
40	Ethyl Benzene	100414	0.0109
44	Hexane	110543	0.0269
46	Hydrogen Chloride	7647010	0.1863
49	Manganese	7439965	0.0031
50	Mercury	7439976	0.0020
64	Selenium	7782492	0.0022
68	Toluene	108883	0.1054
70	Xylenes	1330207	0.0424

Table A-3: DEFAULT EF FOR LPG, BUTANE, OR PROPANE COMBUSTION (LB / 1000 GAL)

**SOURCE: External Combustion Equipment (Boiler, Oven, Dryer, Furnace, Heater, Afterburner))**

TAC Code	POLLUTANT	CAS NO.	<10 MMBTUH	10-100 MMBTUH	>100 MMBTUH
2	Benzene	71432	0.00072	0.00052	0.00015
12	Formaldehyde	50000	0.00153	0.00110	0.00032
19	PAHs (excluding Naphthalene)	1151	0.00001	0.00001	0.00001
19	Naphthalene	91203	0.00003	0.00003	0.00003
29	Acetaldehyde	75070	0.00039	0.00028	0.00008
30	Acrolein	107028	0.00024	0.00024	0.00007
40	Ethyl benzene	100414	0.00085	0.00062	0.00018
44	Hexane	110543	0.00057	0.00041	0.00012
68	Toluene	108883	0.00328	0.00238	0.00070
70	Xylene	1330207	0.00244	0.00177	0.00052

**SOURCE: Turbine**

TAC Code	POLLUTANT	CAS NO.	ALL SIZES
2	Benzene	71432	0.00109
4	1,3-Butadiene	106990	0.0000389
12	Formaldehyde	50000	0.0643
19	Naphthalene	91203	0.000118
19	PAHs (excluding Naphthalene)	1151	0.0000815
29	Acetaldehyde	75070	0.00362
30	Acrolein	107028	0.000579
40	Ethylbenzene	100414	0.00290
62	Propylene oxide	75569	0.00262
68	Toluene	108883	0.0118
70	Xylene	1330207	0.00579

(Continued)

Table A-3: DEFAULT EF FOR LPG, BUTANE, OR PROPANE COMBUSTION (LB / 1000 GAL)

(continued)

**SOURCE: Stationary and Portable Internal Combustion Engines (ICE)**

TAC Code	POLLUTANT	CAS NO.	2 Stroke-Lean Burn	4 Stroke-Lean Burn	4 Stroke-Rich Burn
2	Benzene	71432	0.17751	0.0403	0.145
4	1,3-Butadiene	106990	0.0750	0.0244	0.0607
6	Carbon Tetrachloride	56235	0.00555	0.00336	0.00162
9	Ethylene Dibromide	106934	0.00672	0.00405	0.00195
10	1,2-Dichloroethane	107062	0.00386	0.00216	0.00103
12	Formaldehyde	50000	5.05	4.83	1.88
16	Methylene Chloride	75092	0.0135	0.00183	0.00377
19	2-Methylnaphthalene	91576	0.00196	0.00304	0
19	Acenaphthene	83329	0.000122	0.000114	0
19	Acenaphthylene	208968	0.000290	0.000506	0
19	Anthracene	120127	0.0000657	0	0
19	Benz(a)anthracene	56553	0.0000307	0	0
19	Benzo(a)pyrene	50328	0.00000520	0	0
19	Benzo(b)fluoranthene	205992	0.00000779	0.0000152	0
19	Benzo(e)pyrene	192972	0.00000214	0.0000380	0
19	Benzo(g,h,i)perylene	191242	0.00000227	0.0000379	0
19	Benzo(k)fluoranthene	207089	0.00000390	0	0
19	Chrysene	218019	0.0000615	0.0000634	0
19	Fluoranthene	206440	0.0000330	0.000102	0
19	Fluorene	86737	0.000155	0.000519	0
19	Indeno(1,2,3-c,d)pyrene	193395	0.00000909	0	0
19	Naphthalene	91203	0.00881	0.00681	0.00888
19	Perylene	198550	0.00000455	0	0
19	Phenanthrene	85018	0.000323	0.000952	0
19	Pyrene	129000	0.0000534	0.000124	0
21	Vinyl Chloride	75014	0.00226	0.00136	0.000657
24	1,1,2,2-Tetrachloroethane	79345	0.00607	0.00366	0.00231
25	1,1,2-Trichloroethane	79005	0.00482	0.00291	0.00140
26	1,2,4-Trimethylbenzene	95636	0.0102	0.00131	0
27	1,2-Dichloropropane	78875	0.00408	0.00246	0.00119
28	1,3-Dichloropropene	542756	0.00401	0.00242	0.00116
29	Acetaldehyde	75070	0.710	0.765	0.255
30	Acrolein	107028	0.712	0.470	0.241
35	Chloroform	67663	0.00431	0.00261	0.00125
40	Ethylbenzene	100414	0.00988	0.00363	0.00227
44	n-Hexane	110543	0.0407	0.102	0
51	Methanol	67561	0.227	0.229	0.280
66	Styrene	100425	0.00501	0.00216	0.00109
68	Toluene	108883	0.0881	0.0373	0.0511
70	Xylene	1330207	0.0245	0.0168	0.0178

Table A-4: DEFAULT EF FOR GASOLINE COMBUSTION (LB / 1000 GAL)

**SOURCE: Stationary and Portable Internal Combustion Engines (ICE)**

TAC Code	POLLUTANT	CAS NO.	Non-catalyst (Portable and Stationary)	Catalyst, Portable	Catalyst, Stationary
2	Benzene	71432	3.8061	1.5726	0.1564
4	1,3-Butadiene	106990	0.9183	0.3240	0.0322
12	Formaldehyde	50000	3.4520	1.0131	0.1007
17	Nickel	7440020	0.0033	0.0033	0.0033
19	Naphthalene	91203	0.1438	0.0295	0.0029
26	1,2,4-Trimethylbenzene	95636	1.3941	0.5890	0.0586
29	Acetaldehyde	75070	0.8298	0.1473	0.0146
30	Acrolein	107028	0.1992	0.0825	0.0082
34	Chlorine	7782505	0.4550	0.4550	0.4550
36	Copper	7440508	0.0033	0.0033	0.0033
40	Ethyl benzene	100414	1.6596	0.6420	0.0638
44	Hexane	110543	1.4494	0.9424	0.0937
49	Manganese	7439965	0.0033	0.0033	0.0033
51	Methanol	67561	0.7745	0.2415	0.0240
53	Methyl ethyl ketone - MEK	78933	0.0664	0.0118	0.0012
55	Methyl tert-butyl ether (MTBE)	1634044	2.0579	1.1544	0.1148
66	Styrene	100425	0.1438	0.0707	0.0070
68	Toluene	108883	7.5125	3.5046	0.3485
70	m-Xylene	108383	4.9235	2.1734	0.2161
70	o-Xylene	95476	1.7149	0.7539	0.0750

Table A-5: EF FOR JET FUEL COMBUSTION (LB / 1000)

**SOURCE: Turbine**

TAC Code	POLLUTANT	CAS NO.	ALL SIZES
2	Benzene	71432	0.9377
4	1,3-Butadiene	106990	0.8563
5	Cadmium	7440439	0.0168
12	Formaldehyde	50000	7.2700
14	Arsenic	7440382	0.1776
15	Lead	7439921	0.1843
17	Nickel	7440020	0.0168
19	Naphthalene	91203	0.2740
29	Acetaldehyde	75070	2.2478
30	Acrolein	107028	1.0961
40	Ethylene benzene	100414	0.0813
64	Selenium	7782492	0.0168
66	Styrene	100425	0.1927
68	Toluene	108883	0.2526
70	Xylene	1330207	0.2312

Table A-6: DEFAULT EF FOR LANDFILL GAS COMBUSTION (LB / MMCF)

**SOURCE: External Combustion Equipment (Boiler, Oven, Dryer, Furnace, Heater, Afterburner)**

TAC Code	POLLUTANT	CAS NO.	ALL SIZES
3	Beryllium	7440417	0.0011
5	Cadmium	7440439	0.0067
7	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746016	0.000000727
7	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321764	0.000000727
7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653857	0.000000727
7	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	0.00000145
7	1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin	3268879	0.00000145
7	2,3,7,8-Tetrachlorodibenzofuran	51207319	0.000000727
7	1,2,3,7,8-Pentachlorodibenzofuran	57117416	0.000000727
7	1,2,3,6,7,8-Hexachlorodibenzofuran	57117449	0.000000727
7	1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	0.00000145
7	1,2,3,4,5,6,7,8-Octachlorodibenzofuran	39001020	0.00000145
12	Formaldehyde	50000	0.134
13	Hexavalent chromium	18540299	0.000714
14	Arsenic	7440382	0.00394
15	Lead	7439921	0.00685
17	Nickel	7440020	0.115
19	Acenaphthene	83329	0.000419
19	Acenaphthylene	208968	0.000419
19	Anthracene	120127	0.000419
19	Benzo(a)anthracene	56553	0.000419
19	Benzo(a)pyrene	50328	0.000419
19	Benzo(b)fluoranthene	205992	0.000419
19	Benzo(g,h,i)perylene	191242	0.000419
19	Benzo(k)fluoranthene	207089	0.000419
19	Chrysene	218019	0.000419
19	Dibenz(a,h)anthracene	53703	0.000419
19	Fluoranthene	206440	0.000419
19	Fluorene	86737	0.000419
19	Indeno(1,2,3-cd)pyrene	193395	0.000419
19	Naphthalene	91203	0.259
19	Phenanthrene	85018	0.000419
19	Pyrene	129000	0.0004419
32	Ammonia	7664417	2.3500
36	Copper	7440508	0.0111
49	Manganese	7439965	0.3790
50	Mercury	7439976	0.0000786
64	Selenium	7782492	0.000508

(continued)

Table A-6: DEFAULT EF FOR LANDFILL GAS COMBUSTION (LB / MMCF)  
(continued)

**SOURCE: Flare, Non-Refinery**

TAC Code	POLLUTANT	CAS NO.	ALL SIZES
2	Benzene	71432	0.159
12	Formaldehyde	50000	1.169
19	Total PAHs (excluding Naphthalene)	1151	0.003
19	Naphthalene	91203	0.011
29	Acetaldehyde	75070	0.043
30	Acrolein	107028	0.010
40	Ethyl benzene	100414	1.444
44	Hexane	110543	0.029
68	Toluene	108883	0.058
70	Xylene	1330207	0.029

**SOURCE: Stationary and Portable Internal Combustion Engines (ICE) and Turbines**

TAC Code	POLLUTANT	CAS NO.	ALL SIZES
2	Benzene	71432	0.00840
6	Carbon tetrachloride	56235	0.000720
16	Methylene chloride	75092	0.000920
18	Perchloroethylene	127184	0.00100
20	Trichloroethylene	79016	0.000760
21	Vinyl chloride	75014	0.000640
35	Chloroform	67663	0.000560
68	Toluene	108883	0.0440
70	Xylenes	1330207	0.0124

Table A-7: DEFAULT EF FOR DIGESTER GAS COMBUSTION (LB / MMCF)

**SOURCE: External Combustion Equipment (Boiler, Oven, Dryer, Furnace, Heater, Afterburner)**

<b>TAC</b>					
<b>Code</b>	<b>POLLUTANT</b>	<b>CAS NO.</b>	<b>&lt;10 MMBTUH</b>	<b>10-100 MMBTUH</b>	<b>&gt;100 MMBTUH</b>
2	Benzene	71432	0.0080	0.0058	0.0017
12	Formaldehyde	50000	0.0170	0.0123	0.0036
19	Total PAHs (excluding Naphthalene)	1151	0.0001	0.0001	0.0001
19	Naphthalene	91203	0.0003	0.0003	0.0003
29	Acetaldehyde	75070	0.0043	0.0031	0.0009
30	Acrolein	107028	0.0027	0.0027	0.0008
40	Ethyl benzene	100414	0.0095	0.0069	0.0020
44	Hexane	110543	0.0063	0.0046	0.0013
68	Toluene	108883	0.0366	0.0265	0.0078
70	Xylene	1330207	0.0272	0.0197	0.0058

**SOURCE: Flare, Non-Refinery**

<b>TAC</b>			
<b>Code</b>	<b>POLLUTANT</b>	<b>CAS NO.</b>	<b>ALL SIZES</b>
2	Benzene	71432	0.159
12	Formaldehyde	50000	1.169
19	Total PAHs (excluding Naphthalene)	1151	0.003
19	Naphthalene	91203	0.011
29	Acetaldehyde	75070	0.043
30	Acrolein	107028	0.010
40	Ethyl benzene	100414	1.444
44	Hexane	110543	0.029
68	Toluene	108883	0.058
70	Xylene	1330207	0.029

**SOURCE: Stationary and Portable Internal Combustion Engines (ICE) and Turbines**

<b>TAC</b>			
<b>Code</b>	<b>POLLUTANT</b>	<b>CAS NO.</b>	<b>ALL SIZES</b>
4	1,3 Butadiene	106990	0.00588
5	Cadmium	7440439	0.000348
6	Carbon tetrachloride	56235	0.0120
10	Ethylene dichloride	107062	0.00900
12	Formaldehyde	50000	0.1140
14	Arsenic	7440382	0.00138
15	Lead	7439921	0.00204
16	Methylene chloride	75092	0.00780
17	Nickel	7440020	0.00120
18	Perchloroethylene	127184	0.0126
20	Trichloroethylene	79016	0.0108
21	Vinyl chloride	75014	0.0216
29	Acetaldehyde	75070	0.0318
35	Chloroform	67663	0.0102
57	1,4 Dichlorobenzene	106467	0.0120
64	Selenium	7782492	0.00660

## Appendix B

### Default Emission Factors for Calculating Plating Emissions

Table B-1 lists uncontrolled emission factors for hexavalent chromium (Cr+6), nickel (Ni), cadmium (Cd), and total particulate matter (PM). The factors are provided in pounds per 1000 ampere-hours. Tables B-2 and B-3 provide the control efficiencies for various control methods and devices. If the process is controlled with a combination of control methods, then apply the control efficiency (CE) additively except for HEPA filter as follows:

$$\text{Overall CE} = 1 - (1 - \text{CE}_1) \times (1 - \text{CE}_2) \times \dots$$

The maximum control efficiency for any combination of control methods, which includes HEPA filter, is 99.97%. The emission factors and control efficiencies given in Tables B-1, B-2, and B-3 are for reporting emissions under consolidated Annual Emission Reporting program only. For permit applications, facilities should consult with permit processing engineers for specific instructions regarding control methods and control efficiencies.

It is expected that many facilities have greater levels of control; therefore, facilities are encouraged to use emission factors specific to their operations. Supporting documentation must be provided for any non-default emission factors. If any plating process has a district-approved source test, then facilities should use the emission factors developed from the source tests for calculating emissions.

Table B-1. Emission Factors for Plating Operations

TAC/Process	Emission factor (lb/1000 ampere-hr)	
	Toxic Metal	Total Particulates <sup>[5]</sup>
Uncontrolled hexavalent chromium (Cr <sup>+6</sup> ) plating emission factor <sup>[1]</sup>	0.0097	0.020
Uncontrolled nickel (Ni) plating emission factor <sup>[2]</sup>	0.00051	0.0011
Uncontrolled cadmium (Cd) plating emission factor <sup>[3]</sup>	0.0057	0.012
Cadmium rotating barrel plating <sup>[4]</sup>	0.000020	0.000041

[1] Estimated from the equation,  $EF = 0.505(w)(100-N)$  where,  
 EF = emission factor in mg/amp-hr,  
 w = weight fraction of hexavalent chromium in solution, and  
 N = plating efficiency in percent

The representative chrome plating bath contains a chromic acid of 32 to 34 oz/gal, which equates to a weight fraction of approximately 10.9%. The assumed plating efficiency is 20%.  $EF = 4.4 \text{ mg/amp-hr} = 0.0097 \text{ lb/1000 amp-hr}$ .

[2] SCAQMD and Metal Finishers Association of Southern California, 1998 (Source Test No. 98-109 through 111)

[3] AP-42 Table 12.20-4, July 1996.

[4] SCAQMD (Source Test No. 02-0192)

[5] Assumes that 48% of particulate matter consists of the toxic metal. The relationship is derived from Table 12.20-1 of AP-42 dated July 1996 for plating operations with add-on control equipment.

Table B-2. Approved Control Efficiencies for Plating Operations

Control Method	Control Efficiency
Mist eliminator	50%
Scrubber	70%
Unspecified air pollution control device	70%
Chemical fume suppressant <sup>[1]</sup>	95% – 99%
Mesh pad	95%
HEPA filter <sup>[2]</sup>	99.97%

[1] Refer to Table B-3 for the exact control efficiency.

[2] Use 99.97% for any combination of HEPA filter and other control methods.

Table B-3. Approved Control Efficiencies for Fume Suppressants

<b>Fume Suppressant</b>	<b>Process</b>	<b>Control Efficiency</b>	<b>Comments</b>
Fumetrol 101	Hard	95%	Must be used with polyballs
Fumetrol 140	Decorative/hard/anodizing	99%	
Foam-Lok L	Hard	95%	Must be used with polyballs
Harshaw MSP-ST	Anodizing	95%	
Dis-Mist NP	Decorative	99%	
Zero-Mist Liquid	Decorative	99%	

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## **Appendix C**

### **AB2588 List of Toxics**

Table C-1 contains the list of compounds to be reported by AB2588 facilities preparing their quadrennial emissions inventory under the AER Program. The table provides the compound name, its TAC code and CAS number, and the degree of accuracy for each toxic. The table is alphabetically sorted by name. Multiple compounds within a TAC code group are listed in alphabetical order and shown in italics. The degree of accuracy is nothing more than a de minimis emission level for reporting. As a result, facility-wide emissions of toxics greater than one-half of their corresponding degree of accuracy must be inventoried and reported. Conversely, total facility toxic emissions less than one-half of the degree of accuracy do not need to be reported for TAC Codes 24 through 73. Table C-1 lists the family name and the individual species within the family for the following toxic air contaminants (TACs):

- Chlorinated dioxins and dibenzofurans (TAC code #7)
- Fluorocarbons (chlorinated) (TAC code #22)
- Glycol ethers and their acetates (TAC code #41)
- Hexachlorocyclohexanes (TAC code #43)
- Isocyanates and diisocyanates (TAC code #48)
- Mercury and mercury compounds (TAC code #50)
- PAHs (TAC code #19)
- Phosphorous compounds (TAC code #60)
- POMS and PAH-derivatives (TAC code #61)
- Selenium and compounds (TAC code #64)
- Sulfuric acid and oleum (TAC code #67)
- Xylenes (TAC code #70)

**Table C-1. DeMinimis Reporting Limits for Toxics.**

TAC Code	CAS Number	Substance	Degree of Accuracy (lbs/yr)
29	75070	Acetaldehyde	20
30	107028	Acrolein	0.05
31	107131	Acrylonitrile	0.1
32	7664417	Ammonia	200
14	7440382	Arsenic and Compounds (inorganic)	0.01
1	1332214	Asbestos	0.0001
2	71432	Benzene	2
3	7440417	Beryllium	0.001
4	106990	Butadiene [1,3]	0.1
5	7440439	Cadmium	0.01
6	56235	Carbon tetrachloride	1
33	463581	Carbonyl sulfide	100
34	7782505	Chlorine	0.5
35	67663	Chloroform	10
13	18540299	Chromium, hexavalent (and compounds)	0.0001
36	7440508	Copper	0.1
37	7631869	Crystalline silica	0.1
38	117817	Di(2-ethylhexyl) phthalate {DEHP}	20
7	1080	Chlorinated dioxins and dibenzofurans	0.00002
	67562394	1,2,3,4,6,7,8-Heptachlorodibenzofuran [POM]	0.000001
	55673897	1,2,3,4,7,8,9-Heptachlorodibenzofuran [POM]	0.000001
	35822469	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin [POM]	0.000001
	70648269	1,2,3,4,7,8-Hexachlorodibenzofuran [POM]	0.000001
	57117449	1,2,3,6,7,8-Hexachlorodibenzofuran [POM]	0.000001
	72918219	1,2,3,7,8,9-Hexachlorodibenzofuran [POM]	0.000001
	60851345	2,3,4,6,7,8-Hexachlorodibenzofuran [POM]	0.000001
	39227286	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin [POM]	0.000001
	57653857	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin [POM]	0.000001
	19408743	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin [POM]	0.000001
	39001020	1,2,3,4,5,6,7,8-Octachlorodibenzofuran [POM]	0.000001
	3268879	1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin [POM]	0.000001
	57117416	1,2,3,7,8-Pentachlorodibenzofuran [POM]	0.000001
	57117314	2,3,4,7,8-Pentachlorodibenzofuran [POM]	0.000001
	40321764	1,2,3,7,8-Pentachlorodibenzo-p-dioxin [POM]	0.000001
51207319	2,3,7,8-Tetrachlorodibenzofuran [POM]	0.000001	
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin {TCDD} [POM]	0.000001	
27	78875	1,2-Dichloropropane {Propylene dichloride}	20
28	542756	1,3-Dichloropropene	10
72	9901	Diesel exhaust particulates	10
39	131113	Dimethyl phthalate	50
8	123911	1,4-Dioxane	5
40	100414	Ethyl benzene	200
9	106934	Ethylene dibromide {1,2-Dibromoethane}	0.5
10	107062	Ethylene dichloride {1,2-Dichloroethane}	2
11	75218	Ethylene oxide	0.5

(continued)

**Table C-1. (continued)**

TAC Code	CAS Number	Substance	Degree of Accuracy (lbs/yr)
22	1104	Fluorocarbons (chlorinated)	1
	76131	<i>Trichlorotrifluoroethane {CFC-113}</i>	1
	75434	<i>Dichlorofluoromethane {Freon 12}</i>	1
	75694	<i>Trichlorofluoromethane {Freon 11}</i>	1
12	50000	Formaldehyde	5
41	1115	Glycol ethers and their acetates	100
	111466	<i>Diethylene glycol</i>	100
	111966	<i>Diethylene glycol dimethyl ether</i>	100
	112345	<i>Diethylene glycol monobutyl ether</i>	100
	111900	<i>Diethylene glycol monoethyl ether</i>	100
	111773	<i>Diethylene glycol monomethyl ether</i>	100
	25265718	<i>Dipropylene glycol</i>	100
	34590948	<i>Dipropylene glycol monomethyl ether</i>	100
	629141	<i>Ethylene glycol diethyl ether</i>	100
	110714	<i>Ethylene glycol dimethyl ether</i>	100
	111762	<i>Ethylene glycol monobutyl ether</i>	200
	110805	<i>Ethylene glycol monoethyl ether</i>	50
	111159	<i>Ethylene glycol monoethyl ether acetate</i>	100
	109864	<i>Ethylene glycol monomethyl ether</i>	10
	110496	<i>Ethylene glycol monomethyl ether acetate</i>	200
	2807309	<i>Ethylene glycol monopropyl ether</i>	100
107982	<i>Propylene glycol monomethyl ether</i>	200	
108656	<i>Propylene glycol monomethyl ether acetate</i>	100	
112492	<i>Triethylene glycol dimethyl ether</i>	100	
42	118741	Hexachlorobenzene	0.1
43	608731	Hexachlorocyclohexanes	0.1
	319846	<i>alpha-Hexachlorocyclohexane</i>	0.1
	319857	<i>beta-Hexachlorocyclohexane</i>	0.1
	58899	<i>Lindane {gamma-Hexachlorocyclohexane}</i>	0.1
44	110543	Hexane	200
45	302012	Hydrazine	0.01
46	7647010	Hydrochloric acid	20
73	7664393	Hydrogen fluoride (hydrofluoric acid)	20
47	7783064	Hydrogen sulfide	5
48	1125	Isocyanates and diisocyanates	0.05
	822060	<i>Hexamethylene-1,6-diisocyanate</i>	0.05
	624839	<i>Methyl isocyanate</i>	1
	101688	<i>Methylene diphenyl diisocyanate {MDI} [POM]</i>	0.1
	1204	<i>Toluene diisocyanates</i>	0.1
	584849	<i>Toluene-2,4-diisocyanate</i>	0.1
91087	<i>Toluene-2,6-diisocyanate</i>	0.1	
15	7439921	Lead compounds (inorganic)	0.5
49	7439965	Manganese	0.1

(continued)

**Table C-1. (continued)**

<b>TAC Code</b>	<b>CAS Number</b>	<b>Substance</b>	<b>Degree of Accuracy (lbs/yr)</b>
<b>50</b>	7487947	Mercury and mercury compounds <i>Mercuric chloride</i>	1
	7439976	<i>Mercury</i>	1
	593748	<i>Methyl mercury {Dimethylmercury}</i>	1
<b>51</b>	67561	Methanol	200
<b>52</b>	74873	Methyl chloride {Chloromethane}	20
<b>23</b>	71556	Methyl chloroform {1,1,1-Trichloroethane}	1
<b>53</b>	78933	Methyl ethyl ketone {2-Butanone}	200
<b>54</b>	108101	Methyl isobutyl ketone {Hexone}	20
<b>55</b>	1634044	Methyl tert-butyl ether	200
<b>16</b>	75092	Methylene chloride {Dichloromethane}	50
<b>17</b>	7440020	Nickel	0.1
<b>57</b>	106467	p-Dichlorobenzene {1,4-Dichlorobenzene}	5
<b>19</b>	1151	PAHs, total, w/o individ. components reported [PAH, POM]	0.2
	83329	<i>Acenaphthene [PAH, POM]</i>	1
	208968	<i>Acenaphthylene [PAH, POM]</i>	1
	120127	<i>Anthracene [PAH, POM]</i>	1
	56553	<i>Benz[a]anthracene [PAH, POM]</i>	0.5
	50328	<i>Benzo[a]pyrene [PAH, POM]</i>	0.05
	205992	<i>Benzo[b]fluoranthene [PAH, POM]</i>	0.5
	192972	<i>Benzo[e]pyrene [PAH, POM]</i>	0.5
	191242	<i>Benzo[g,h,i]perylene [PAH, POM]</i>	0.5
	205823	<i>Benzo[j]fluoranthene [PAH, POM]</i>	0.5
	207089	<i>Benzo[k]fluoranthene [PAH, POM]</i>	0.5
	218019	<i>Chrysene [PAH, POM]</i>	1
	53703	<i>Dibenz[a,h]anthracene [PAH, POM]</i>	0.1
	192654	<i>Dibenzo[a,e]pyrene [PAH, POM]</i>	0.05
	189640	<i>Dibenzo[a,h]pyrene [PAH, POM]</i>	0.001
	189559	<i>Dibenzo[a,i]pyrene [PAH, POM]</i>	0.001
	191300	<i>Dibenzo[a,l]pyrene [PAH, POM]</i>	0.001
	206440	<i>Fluoranthene [PAH, POM]</i>	0.5
86737	<i>Fluorene [PAH, POM]</i>	0.5	
193395	<i>Indeno[1,2,3-cd]pyrene [PAH, POM]</i>	0.5	
91576	<i>2-Methyl naphthalene [PAH, POM]</i>	1	
91203	<i>Naphthalene [PAH, POM]</i>	1	
198550	<i>Perylene [PAH, POM]</i>	0.5	
85018	<i>Phenanthrene [PAH, POM]</i>	0.5	
129000	<i>Pyrene [PAH, POM]</i>	0.5	
<b>56</b>	1336363	PCBs (Polychlorinated biphenyls) [POM]	0.01
<b>58</b>	87865	Pentachlorophenol	10
<b>18</b>	127184	Perchloroethylene {Tetrachloroethene}	5
<b>59</b>	7723140	Phosphorus	0.1

(continued)

**Table C-1. (continued)**

<b>TAC Code</b>	<b>CAS Number</b>	<b>Substance</b>	<b>Degree of Accuracy (lbs/yr)</b>
<b>60</b>		Phosphorous compounds	
	7803512	<i>Phosphine</i>	0.01
	7664382	<i>Phosphoric acid</i>	50
	10025873	<i>Phosphorus oxychloride</i>	0.1
	10026138	<i>Phosphorus pentachloride</i>	0.1
	1314563	<i>Phosphorus pentoxide</i>	0.1
	7719122	<i>Phosphorus trichloride</i>	0.1
	126738	<i>Tributyl phosphate</i>	100
	78400	<i>Triethyl phosphine</i>	100
	512561	<i>Trimethyl phosphate</i>	100
	78308	<i>Triorthocresyl phosphate [POM]</i>	0.5
	115866	<i>Triphenyl phosphate [POM]</i>	100
	101020	<i>Triphenyl phosphite [POM]</i>	100
<b>61</b>		POMS and PAH-derivatives	
	226368	<i>Dibenz[a,h]acridine [POM]</i>	0.5
	224420	<i>Dibenz[a,j]acridine [POM]</i>	0.5
	194592	<i>7H-Dibenzo[c,g]carbazole</i>	0.05
	57976	<i>7,12-Dimethylbenz[a]anthracene [PAH-Derivative, POM]</i>	0.0001
	42397648	<i>1,6-Dinitropyrene [PAH-Derivative, POM]</i>	0.001
	42397659	<i>1,8-Dinitropyrene [PAH-Derivative, POM]</i>	0.05
	56495	<i>3-Methylcholanthrene [PAH-Derivative, POM]</i>	0.001
	3697243	<i>5-Methylchrysene [PAH-Derivative, POM]</i>	0.05
	101779	<i>4,4'-Methylenedianiline (and its dichloride) [POM]</i>	0.1
	602879	<i>5-Nitroacenaphthene [POM]</i>	1
	7496028	<i>6-Nitrochrysene [PAH-Derivative, POM]</i>	0.001
	607578	<i>2-Nitrofluorene [PAH-Derivative, POM]</i>	5
	5522430	<i>1-Nitropyrene [PAH-Derivative, POM]</i>	0.5
57835924	<i>4-Nitropyrene [POM]</i>	1	
<b>62</b>	75569	Propylene oxide	10
<b>63</b>	91225	Quinoline	100
<b>64</b>		Selenium and compounds	
	7783075	<i>Hydrogen selenide</i>	0.5
	7782492	<i>Selenium</i>	0.5
	7446346	<i>Selenium sulfide</i>	0.5
<b>65</b>	1310732	Sodium hydroxide	2
<b>66</b>	100425	Styrene	100
<b>24</b>	79345	1,1,2,2-Tetrachloroethane	1
<b>67</b>		Sulfuric acid and oleum	
	8014957	<i>Oleum</i>	2
	7664939	<i>Sulfuric acid</i>	2
	7446719	<i>Sulfur trioxide</i>	2
<b>68</b>	108883	Toluene	200
<b>25</b>	79005	1,1,2-Trichloroethane { Vinyl trichloride }	50
<b>20</b>	79016	Trichloroethylene	20
<b>26</b>	95636	1,2,4-Trimethylbenzene	5

(continued)

**Table C-1. (concluded)**

<b>TAC Code</b>	<b>CAS Number</b>	<b>Substance</b>	<b>Degree of Accuracy (lbs/yr)</b>
69	51796	Urethane {Ethyl carbamate}	0.1
21	75014	Vinyl chloride	0.5
70	1330207	Xylenes	200
	108383	<i>m-Xylene</i>	200
	95476	<i>o-Xylene</i>	200
	106423	<i>p-Xylene</i>	200
71	75456	Chlorodifluoromethane {Freon 22}	200

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## Appendix D

### Selected TOG Speciation Profiles

Speciation profiles are used to estimate the amounts of various organic compounds that make up TOG. A speciation profile contains a list of organic compounds and the weight fraction that each compound composes of the TOG emissions from a particular source type. Each process or product category is keyed to one of several hundred currently available speciation profiles. The speciation profiles are applied to TOG to develop both the photochemical model inputs and the emission inventory for ROG.

To the extent possible given available data, ARB's organic gas speciation profiles contain all emitted organic species that can be identified (ideally, detected to very low levels). This includes reactive compounds, unreactive and "exempt" compounds, and to the extent the data are available, "low vapor pressure" compounds. Research studies are conducted regularly to improve ARB's species profiles. These profiles support ozone modeling studies but are also designed to be used for aerosol modeling. The profiles are also used to support other health or welfare related modeling studies where the compounds of interest cannot always be anticipated. Therefore, organic gas emission profiles should be as complete and accurate as possible. (This discussion was extracted from <http://www.arb.ca.gov/emisinv/speciate/speciate.htm>.)

The following TOG speciation profiles are included here:

- Profile No. 419: Liquid gasoline – MTBE 11% - Commercial Grade – MTBE/EtOH program
- Profile No. 422: CBG – hot soak – ARB IUS 1999-2000 – LDV
- Profile No. 442: Gasoline – catalyst – stabilized exhaust – ARB IUS summer 2004

Profile 419 is used to speciate vapors from gasoline spillage, profile 422 is used to speciate on-road evaporatives, and profile 442 is used to speciate gaseous exhaust from passenger vehicles.

**Table D-1.** Profile No. 419: Liquid gasoline – MTBE 11% - Commercial Grade – MTBE/EtOH program

CAS	Specie	Weight % of TOG
1634044	METHYL T-BUTYL ETHER (MTBE)	11.550
78784	ISOPENTANE	9.800
108883	TOLUENE	6.690
540841	2,2,4-TRIMETHYLPENTANE	5.450
107835	2-METHYLPENTANE	4.170
108383	M-XYLENE	3.530
589344	3-METHYLHEXANE	2.860
565593	2,3-DIMETHYLPENTANE	2.780
99999	UNIDENTIFIED	2.670
591764	2-METHYLHEXANE	2.610
96140	3-METHYLPENTANE	2.330
100414	ETHYLBENZENE	2.150
95476	O-XYLENE	2.100
95636	1,2,4-TRIMETHYLBENZENE {1,3,4-TRIMETHYLBENZENE}	1.870
106423	P-XYLENE	1.820
109660	N-PENTANE	1.810
108087	2,4-DIMETHYLPENTANE	1.720
142825	N-HEPTANE	1.640
96377	METHYLCYCLOPENTANE	1.540
565753	2,3,4-TRIMETHYLPENTANE	1.420
620144	1-METHYL-3-ETHYLBENZENE	1.340
79298	2,3-DIMETHYLBUTANE	1.310
110543	N-HEXANE	1.190
560214	2,3,3-TRIMETHYLPENTANE	1.050
106978	N-BUTANE	1.010
71432	BENZENE	1.000
589435	2,4-DIMETHYLHEXANE	0.850
108872	METHYLCYCLOHEXANE	0.750
589811	3-METHYLHEPTANE	0.740
3522949	2,2,5-TRIMETHYLHEXANE	0.690
592278	2-METHYLHEPTANE	0.690
108678	1,3,5-TRIMETHYLBENZENE	0.680
111659	N-OCTANE	0.630
592132	2,5-DIMETHYLHEXANE	0.620
513359	2-METHYL-2-BUTENE	0.610
584941	2,3-DIMETHYLHEXANE	0.600
622968	1-METHYL-4-ETHYLBENZENE	0.570
2532583	CIS-1,3-DIMETHYLCYCLOPENTANE	0.490
1759586	TRANS-1,3-DIMETHYLCYCLOPENTANE	0.450
646048	TRANS-2-PENTENE	0.400
103651	N-PROPYLBENZENE	0.380
611143	1-METHYL-2-ETHYLBENZENE	0.370
822504	TRANS-1-2-DIMETHYLCYCLOPENTANE	0.360
526738	1,2,3-TRIMETHYLBENZENE	0.320
15890401	CIS-1,TRANS-2,3-TRIMETHYLCYCLOPENTANE	0.300
589537	4-METHYLHEPTANE	0.290
617787	3-ETHYLPENTANE	0.280
934805	1,2-DIMETHYL-4-ETHYLBENZENE	0.280
1074437	1-METHYL-3N-PROPYLBENZENE	0.240
75832	2,2-DIMETHYLBUTANE	0.240
563462	2-METHYL-1-BUTENE	0.230

(continued)

Table D-1. (continued)

CAS	Specie	Weight % of TOG
2216333	3-METHYLOCTANE	0.230
934747	1,3-DIMETHYL-5-ETHYLBENZENE	0.220
627203	CIS-2-PENTENE	0.220
110827	CYCLOHEXANE	0.220
	C8 CYCLOPARAFFINS	0.210
1640897	ETHYLCYCLOPENTANE	0.210
3221612	2-METHYLOCTANE	0.210
625274	2-METHYL-2-PENTENE	0.190
3404737	3,3-DIMETHYL-1-PENTENE	0.180
91203	NAPHTHALENE	0.180
	CIS-1-2-DIMETHYLCYCLOPENTANE	0.170
4050457	TRANS-2-HEXENE	0.170
496117	INDAN	0.170
693890	1-METHYLCYCLOPENTENE	0.170
	CIS-1,TRANS-2,4-TRIMETHYLCYCLOPENTANE	0.170
75285	ISOBUTANE	0.170
111842	N-NONANE	0.160
10574364	3-METHYL-CIS-2-HEXENE	0.160
562492	3,3-DIMETHYLPENTANE	0.160
2216344	4-METHYLOCTANE	0.160
527537	1,2,3,5-TETRAMETHYLBENZENE	0.150
2216300	2,5-DIMETHYLHEPTANE	0.150
1758889	1,4-DIMETHYL-2-ETHYLBENZENE	0.150
287923	CYCLOPENTANE	0.140
874419	1,3-DIMETHYL-4-ETHYLBENZENE	0.140
20710387	3-METHYL-TRANS-2-HEXENE	0.140
3788327	ISOBUTYLCYCLOPENTANE	0.140
91576	2-METHYLNAPHTHALENE	0.140
590738	2,2-DIMETHYLHEXANE	0.140
824635	2-METHYLINDAN	0.130
1074551	1-METHYL-4N-PROPYLBENZENE	0.130
14686147	TRANS-3-HEPTENE	0.130
564023	2,2,3-TRIMETHYLPENTANE	0.130
109671	1-PENTENE	0.120
874351	5-METHYLINDAN	0.120
921471	2,3,4-TRIMETHYLHEXANE	0.110
763291	2-METHYL-1-PENTENE	0.110
95932	1,2,4,5-TETRAMETHYLBENZENE	0.110
1120623	3-METHYLCYCLOPENTENE	0.110
141935	1,3-DIETHYLBENZENE (META)	0.110
7094271	1,1,4-TRIMETHYLCYCLOHEXANE	0.100
	TRANS-1,CIS-2,3-TRIMETHYLCYCLOPENTANE	0.090
13269528	TRANS-3-HEXENE	0.090
7688213	CIS-2-HEXENE	0.090
1067089	3-METHYL-3-ETHYLPENTANE	0.080
1069530	2,3,5-TRIMETHYLHEXANE	0.080
3074713	2,3-DIMETHYLHEPTANE	0.080
583482	3,4-DIMETHYLHEXANE	0.080
871830	2-METHYLNONANE	0.070
	4,4-DIMETHYL-2-PENTENE	0.070
6876239	TRANS-1,2-DIMETHYLCYCLOHEXANE	0.070

(continued)

Table D-1. (continued)

CAS	Specie	Weight % of TOG
2207047	TRANS-1,4-DIMETHYLCYCLOHEXANE	0.070
638040	CIS-1,3-DIMETHYLCYCLOHEXANE	0.070
5911046	3-METHYLNONANE	0.070
16747254	2,2,3,TRIMETHYLHEXANE	0.070
2613696	CIS-1,CIS-2,3-TRIMETHYLCYCLOPENTANE	0.070
142290	CYCLOPENTENE	0.070
674760	4-METHYL-TRANS-2-PENTENE	0.070
124185	N-DECANE	0.060
592416	1-HEXENE	0.060
28729524	DIMETHYLCYCLOPENTANE	0.060
14686136	TRANS-2-HEPTENE	0.060
90120	1-METHYLNAPHTHALENE	0.060
98828	ISOPROPYLBENZENE (CUMENE)	0.060
104518	N-BUTYLBENZENE	0.060
6443921	CIS-2-HEPTENE	0.060
	TRANS-2-ETHYLMETHYLCYCLOPENTANE	0.060
619998	3-ETHYLHEXANE	0.060
933982	1,2-DIMETHYL-3-ETHYLBENZENE	0.050
3899363	3-METHYL-TRANS-3-HEXENE	0.050
16021208	1-ETHYL-2N-PROPYLBENZENE	0.050
15869893	2,5-DIMETHYLOCTANE	0.050
563166	3,3-DIMETHYLHEXANE	0.050
15869804	3-ETHYLHEPTANE	0.050
922281	3,4-DIMETHYLHEPTANE	0.050
4032864	3,3-DIMETHYLHEPTANE	0.050
609267	2-METHYL-3-ETHYLPENTANE	0.050
3683225	4-METHYL-TRANS-2-HEXENE	0.050
2040962	PROPYLCYCLOPENTANE	0.040
922623	3-METHYL-CIS-2-PENTENE	0.040
4914890	3-METHYL-CIS-3-HEXENE	0.040
577559	1,4-ISODIPROPYLBENZENE	0.040
4110445	3,3-DIMETHYLOCTANE	0.040
	1-METHYL-4-N-PENTYLBENZENE	0.040
464062	2,2,3-TRIMETHYLBUTANE	0.040
538932	(2-METHYLPROPYL)BENZENE	0.040
17171721	1,3-DIPROPYLBENZENE	0.040
1120214	N-UNDECANE	0.030
45245	C11 DIALKYL BENZENES	0.030
135988	(1-METHYLPROPYL)BENZENE	0.030
110838	CYCLOHEXENE	0.030
13389429	TRANS-2-OCTENE	0.030
112403	N-DODECANE	0.030
2004708	TRANS-1,3-PENTADIENE	0.030
692240	2-METHYL-TRANS-3-HEXENE	0.030
1069195	4,4-DIMETHYLHEPTANE	0.030
535773	1-METHYL-3-ISOPROPYLBENZENE	0.030
4032944	2,4-DIMETHYLOCTANE	0.030
691372	4-METHYL-1-PENTENE	0.030
816795	3-ETHYL-2-PENTENE	0.030
7642093	CIS-3-HEXENE	0.030
	1,3-N-DIPROPYLBENZENE	0.030

(continued)

Table D-1. (continued)

CAS	Specie	Weight % of TOG
29316050	S-PENTYLBENZENE	0.030
824226	4-METHYLINDAN	0.030
15869859	5-METHYLNONANE	0.030
4926903	1-METHYL-1-ETHYLCYCLOHEXANE	0.030
1795273	CIS-1,CIS-3,5-TRIMETHYLCYCLOHEXANE	0.030
2207014	CIS-1,2-DIMETHYLCYCLOHEXANE	0.030
3769231	4-METHYL-1-HEXENE	0.020
24910632	3,4-DIMETHYL-2-PENTENE	0.020
527844	1-METHYL-2-ISOPROPYLBENZENE	0.020
2051301	2,6-DIMETHYLOCTANE	0.020
135013	1,2-DIETHYLBENZENE (ORTHO)	0.020
926829	3,5-DIMETHYLHEPTANE	0.020
2207036	TRANS-1,3-DIMETHYLCYCLOHEXANE	0.020
700129	PENTAMETHYLBENZENE	0.020
98511	1-METHYL-4-T-BUTYLBENZENE	0.020
2040951	N-BUTYLCYCLOPENTANE	0.020
20237461	CIS-3-NONENE	0.020
7667609	CIS-1,TRANS-2,TRANS-4-TRIMETHYLCYCLOHEXANE	0.020
4259001	1,1,2-TRIMETHYLCYCLOPENTANE	0.020
760203	3-METHYL-1-PENTENE	0.020
16747265	2,2,4-TRIMETHYLHEXANE	0.020
71238	N-PROPYL ALCOHOL	0.020
563451	3-METHYL-1-BUTENE	0.020
106989	1-BUTENE	0.010
624646	TRANS-2-BUTENE	0.010
590181	CIS-2-BUTENE	0.010
	C12 DIALKYL BENZENES	0.010
16747301	2,4,4-TRIMETHYLHEXANE	0.010
67561	METHYL ALCOHOL	0.010
124118	1-NONENE	0.010
7642048	CIS-2-OCTENE	0.010
14850238	TRANS-4-OCTENE	0.010
78795	ISOPRENE	0.010
563780	2,3-DIMETHYL-1-BUTENE	0.010
2870044	1,3-DIMETHYL-2-ETHYLBENZENE	0.010
3404624	5-METHYL-CIS-2-HEXENE	0.010
590352	2,2-DIMETHYLPENTANE	0.010
15869871	2,2-DIMETHYLOCTANE	0.010
2213232	2,4-DIMETHYLHEPTANE	0.010
463821	2,2-DIMETHYLPROPANE	0.010
30498636	TRIMETHYLCYCLOHEXANE	0.010
1077163	N-HEXYLBENZENE	0.010
887441	1,2,4-TRIETHYLBENZENE	0.010
102250	1,3,5-TRIETHYLBENZENE	0.010
19781181	2,3-DIMETHYL-2-OCTENE	0.010
5881174	3-ETHYLOCTANE	0.010
15869940	3,6-DIMETHYLOCTANE	0.010
10063927	TRANS-3-NONENE	0.010
7094260	1,1,2-TRIMETHYLCYCLOHEXANE	0.010
4588185	2-METHYL-1-OCTENE	0.010
3073663	1,1,3-TRIMETHYLCYCLOHEXANE	0.010

(continued)

**Table D-1.** (concluded)

<b>CAS</b>	<b>Specie</b>	<b>Weight % of TOG</b>
16747505	1,1-METHYLETHYLCYCLOPENTANE	0.010
	3-ETHYLNONANE	0.010
99876	1-METHYL-4-ISOPROPYLBENZENE	0.010
590669	1,1-DIMETHYLCYCLOHEXANE	0.010
3524730	5-METHYL-1-HEXENE	0.010
696297	ISOPROPYLCYCLOHEXANE	0.010
1678939	BUTYLCYCLOHEXANE	0.010
2213323	2,4-DIMETHYL-1-PENTENE	0.010
	DIHYDRONAPHTHALENE	0.010
542927	1,3-CYCLOPENTADIENE	0.010

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**Table D-2.** Profile No. 422: CBG – hot soak – ARB IUS 1999-2000 - LDV

CAS	Specie	Weight % of TOG
78784	2-METHYLBUTANE	20.057
106978	N-BUTANE	15.150
1634044	METHYL T-BUTYL ETHER (MTBE)	12.662
109660	N-PENTANE	6.077
75285	METHYLPROPANE	5.201
107835	2-METHYLPENTANE	3.560
108883	TOLUENE	3.419
74986	PROPANE	2.119
108383	M & P-XYLENE	2.011
96140	3-METHYLPENTANE	1.957
96377	METHYLCYCLOPENTANE	1.896
110543	N-HEXANE	1.416
79298	2,3-DIMETHYLBUTANE	1.225
513359	2-METHYL2BUTENE	1.138
540841	2,2,4-TRIMETHYLPENTANE	1.068
565593	2,3-DIMETHYLPENTANE	0.898
71432	BENZENE	0.838
646048	TRANS-2-PENTENE	0.815
589344	3-METHYLHEXANE	0.739
591764	2-METHYLHEXANE	0.712
95476	O-XYLENE	0.665
75832	2,2-DIMETHYLBUTANE	0.658
110827	CYCLOHEXANE	0.627
108087	2,4-DIMETHYLPENTANE	0.622
563462	2-METHYL-1-BUTENE	0.617
624646	TRANS-2-BUTENE	0.616
108872	METHYLCYCLOHEXANE	0.577
590181	CIS-2-BUTENE	0.567
287923	CYCLOPENTANE	0.566
100414	ETHYLBENZENE	0.527
115071	PROPENE	0.477
142825	N-HEPTANE	0.473
565753	2,3,4-TRIMETHYLPENTANE	0.441
95636	1,2,4-TRIMETHYLBENZENE	0.437
627203	CIS-2-PENTENE	0.433
74840	ETHANE	0.429
115117	2-METHYLPROPENE	0.427
67561	METHANOL	0.393
109671	1-PENTENE	0.333
617787	3-ETHYLPENTANE	0.314
1759586	TRANS-1,3-DIMETHYLCYCLOPENTANE	0.305
620144	1-METHYL-3-ETHYLBENZENE	0.297
2532583	CIS-1,3-DIMETHYLCYCLOPENTANE	0.266
106989	1-BUTENE	0.261
64175	ETHANOL	0.235
589811	3-METHYLHEPTANE	0.216
589435	2,4-DIMETHYLHEXANE	0.213
592132	2,5-DIMETHYLHEXANE	0.201
592278	2-METHYLHEPTANE	0.199
625274	2-METHYL-2-PENTENE	0.184
142290	CYCLOPENTENE	0.158

(continued)

Table D-2. (continued)

CAS	Specie	Weight % of TOG
622968	1-METHYL-4-ETHYLBENZENE	0.151
584941	2,3-DIMETHYLHEXANE	0.149
108678	1,3,5-TRIMETHYLBENZENE	0.147
111659	NOCTANE	0.138
638040	CIS-1,3-DIMETHYLCYCLOHEXANE	0.126
563451	3-METHYL-1-BUTENE	0.124
4050457	TRANS-2-HEXENE	0.121
2216344	4-METHYLOCTANE	0.115
3522949	2,2,5-TRIMETHYLHEXANE	0.107
611143	1-METHYL-2-ETHYLBENZENE	0.101
1120623	3-METHYLCYCLOPENTENE	0.099
526738	1,2,3-TRIMETHYLBENZENE	0.090
103651	N-PROPYLBENZENE	0.089
1640897	ETHYLCYCLOPENTANE	0.089
763291	2-METHYL-1-PENTENE	0.084
871830	2-METHYLNONANE	0.084
13269528	TRANS-3-HEXENE	0.080
2815589	1,2,4-TRIMETHYLCYCLOPENTANE	0.077
926829	3,5-DIMETHYLHEPTANE	0.076
589537	4-METHYLHEPTANE	0.072
674760	4-METHYLTRANS-2-PENTENE	0.069
496117	2,3-DIHYDROINDENE (INDAN)	0.066
2216333	3-METHYLOCTANE	0.065
7688213	CIS-2-HEXENE	0.063
74851	ETHENE	0.062
111842	N-NONANE	0.061
760203	3-METHYL-1-PENTENE	0.060
2207036	TRANS-1,3-DIMETHYLCYCLOHEXANE	0.059
1074437	1-METHYL-3-NPROPYLBENZENE	0.057
124185	N-DECANE	0.054
934747	1,3-DIMETHYL-5-ETHYLBENZENE	0.053
14686147	TRANS-3-HEPTENE	0.052
463821	2,2-DIMETHYLPROPANE	0.049
10574364	3-METHYLCIS-2-HEXENE	0.049
110838	CYCLOHEXENE	0.048
2613652	TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.046
934805	1,2-DIMETHYL-4-ETHYLBENZENE	0.043
2207047	TRANS-1,4-DIMETHYLCYCLOHEXANE	0.041
2091956	2,2,5-TRIMETHYLHEPTANE	0.041
15890401	(1A,2A,3B)1,2,3-TRIMETHYLCYCLOPENTANE	0.040
592416	1-HEXENE	0.039
1072055	2,6-DIMETHYLHEPTANE	0.039
78795	2-METHYL-1,3-BUTADIENE	0.038
16747505	CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.037
2738194	2-METHYL-2-HEXENE	0.036
590738	2,2-DIMETHYLHEXANE	0.034
3683225	4-METHYLTRANS-2-HEXENE	0.033
1678917	ETHYLCYCLOHEXANE	0.032
822504	TRANS-1,2-DIMETHYLCYCLOPENTANE	0.030
1758889	1,4-DIMETHYL-2-ETHYLBENZENE	0.030
583482	3,4-DIMETHYLHEXANE	0.029

(continued)

Table D-2. (continued)

CAS	Specie	Weight % of TOG
2213232	2,4-DIMETHYLHEPTANE	0.028
105055	1,4-DIETHYLBENZENE	0.027
625650	2,4-DIMETHYL-2-PENTENE	0.026
111660	1-OCTENE	0.026
1839630	1,3,5-TRIMETHYLCYCLOHEXANE	0.024
2004708	TRANS-1,3-PENTADIENE	0.024
874419	1,3-DIMETHYL-4-ETHYLBENZENE	0.020
100425	STYRENE	0.020
562492	3,3-DIMETHYLPENTANE	0.019
1074175	1-METHYL-2-NPROPYLBENZENE	0.019
2051301	2,6-DIMETHYLOCTANE	0.018
1120214	N-UNDECANE (HENDECANE)	0.018
98828	(1-METHYLETHYL)BENZENE	0.018
15869871	2,2-DIMETHYLOCTANE	0.018
16747301	2,4,4-TRIMETHYLHEXANE	0.017
527537	1,2,3,5-TETRAMETHYLBENZENE	0.017
4032944	2,4-DIMETHYLOCTANE	0.017
4110445	3,3-DIMETHYLOCTANE	0.017
74997	1-PROPYNE	0.017
16747265	2,2,4-TRIMETHYLHEXANE	0.016
74862	ETHYNE	0.015
141935	1,3-DIETHYLBENZENE	0.015
14686136	TRANS-2-HEPTENE	0.014
95932	1,2,4,5-TETRAMETHYLBENZENE	0.014
14720742	2,2,4-TRIMETHYLHEPTANE	0.014
6443921	CIS-2-HEPTENE	0.014
2870044	1,3-DIMETHYL-2-ETHYLBENZENE	0.013
6236880	1-METHYL-4-ETHYLCYCLOHEXANE	0.013
2207014	CIS-1,2-DIMETHYLCYCLOHEXANE	0.012
7642048	CIS-2-OCTENE	0.012
1069530	2,3,5-TRIMETHYLHEXANE	0.011
824635	2-METHYLINDAN	0.011
464062	2,2,3-TRIMETHYLBUTANE	0.010
3899363	3-METHYLTRANS-3-HEXENE	0.010
692240	2-METHYLTRANS-3-HEXENE	0.009
15869893	2,5-DIMETHYLOCTANE	0.009
874351	5-METHYLINDAN	0.009
535773	1-METHYL-3-(1-METHYLETHYL)BENZENE	0.009
99876	1-METHYL-4-(1-METHYLETHYL)BENZENE	0.008
527844	1-METHYL-2-(1-METHYLETHYL)BENZENE	0.008
13389429	TRANS-2-OCTENE	0.008
124118	1-NONENE	0.007
106990	1,3-BUTADIENE	0.007
538932	(2-METHYLPROPYL)BENZENE	0.006
16021208	1-ETHYL-2-NPROPYLBENZENE	0.006
3221612	2-METHYLOCTANE	0.006
558372	3,3-DIMETHYL-1-BUTENE	0.005
1595115	1-METHYL-2-N-BUTYLBENZENE	0.005
7385786	3,4-DIMETHYL-1-PENTENE	0.005
91203	NAPHTHALENE	0.005
933982	1,2-DIMETHYL-3-ETHYLBENZENE	0.005

(continued)

**Table D-2.** (concluded)

CAS	Specie	Weight % of TOG
112403	N-DODECANE	0.004
7146603	2,3-DIMETHYLOCTANE	0.004
816795	3-ETHYL-2-PENTENE	0.003
135013	1,2-DIETHYLBENZENE	0.003
1074926	1-(1,1-DIMETHYLETHYL)-2-METHYLBENZENE	0.003
2213323	2,4-DIMETHYL-1-PENTENE	0.003
563166	3,3-DIMETHYLHEXANE	0.003
17171721	1,3-DINPROPYLBENZENE	0.002
824226	4-METHYLINDAN	0.001
538681	N-PENTYLBENZENE	0.001
488233	1,2,3,4-TETRAMETHYLBENZENE	0.001
107404	2,4,4-TRIMETHYL-2-PENTENE	0.001
503173	2-BUTYNE	0.000
463490	1,2-PROPADIENE	0.000
590192	1,2-BUTADIENE	0.000
689974	1-BUTEN-3-YNE	0.000
107006	1-BUTYNE	0.000
542927	1,3-CYCLOPENTADIENE	0.000
460128	1,3-BUTADIYNE	0.000
691372	4-METHYL-1-PENTENE	0.000
563780	2,3-DIMETHYL-1-BUTENE	0.000
691383	4-METHYLCIS-2-PENTENE	0.000
7642093	CIS-3-HEXENE	0.000
616126	3-METHYLTRANS-2-PENTENE	0.000
922623	3-METHYLCIS-2-PENTENE	0.000
637923	1-ETHYL TERTBUTYLETHER	0.000
590352	2,2-DIMETHYLPENTANE	0.000
693890	1-METHYLCYCLOPENTENE	0.000
3404613	3-METHYL-1-HEXENE	0.000
592767	1-HEPTENE	0.000
107391	2,4,4-TRIMETHYL-1-PENTENE	0.000
10574375	2,3-DIMETHYL-2-PENTENE	0.000
560214	2,3,3-TRIMETHYLPENTANE	0.000
14850238	TRANS-4-OCTENE	0.000
3074713	2,3-DIMETHYLHEPTANE	0.000
135988	(1-METHYLPROPYL)BENZENE	0.000
1074551	1-METHYL-4-NPROPYLBENZENE	0.000
98191	1-(1,1-DIMETHYLETHYL)-3,5-DMBENZENE	0.000

**Table D-3.** Profile No. 442: Gasoline – catalyst – stabilized exhaust – ARB IUS summer 2004

CAS	Specie	Weight % of TOG
74828	METHANE	19.040
78784	ISOPENTANE	6.809
74851	ETHYLENE	6.473
108883	TOLUENE	5.857
107835	2-METHYLPENTANE	3.703
108383	M-XYLENE	3.626
115117	ISOBUTYLENE	3.328
74862	ACETYLENE	3.308
115071	PROPYLENE	3.116
109660	N-PENTANE	2.751
96377	METHYLCYCLOPENTANE	2.751
71432	BENZENE	2.626
96140	3-METHYLPENTANE	2.174
1634044	METHYL T-BUTYL ETHER (MTBE)	1.933
540841	2,2,4-TRIMETHYLPENTANE	1.712
50000	FORMALDEHYDE	1.693
110543	N-HEXANE	1.577
565593	2,3-DIMETHYLPENTANE	1.433
95476	O-XYLENE	1.260
100414	ETHYLBENZENE	1.068
74840	ETHANE	1.048
79298	2,3-DIMETHYLBUTANE	1.048
95636	1,2,4-TRIMETHYLBENZENE {1,3,4-TRIMETHYLBENZENE}	0.981
620144	1-METHYL-3-ETHYLBENZENE	0.808
106978	N-BUTANE	0.779
589344	3-METHYLHEXANE	0.760
75832	2,2-DIMETHYLBUTANE	0.635
110827	CYCLOHEXANE	0.606
108872	METHYLCYCLOHEXANE	0.606
565753	2,3,4-TRIMETHYLPENTANE	0.596
589811	3-METHYLHEPTANE	0.596
106990	1,3-BUTADIENE	0.548
142825	N-HEPTANE	0.500
108087	2,4-DIMETHYLPENTANE	0.433
106989	1-BUTENE	0.423
513359	2-METHYL-2-BUTENE	0.414
67561	METHYL ALCOHOL	0.404
108678	1,3,5-TRIMETHYLBENZENE	0.394
111659	N-OCTANE	0.385
287923	CYCLOPENTANE	0.356
592132	2,5-DIMETHYLHEXANE	0.337
622968	1-METHYL-4-ETHYLBENZENE	0.337
592278	2-METHYLHEPTANE	0.337
3522949	2,2,5-TRIMETHYLHEXANE	0.317
2216333	3-METHYLOCTANE	0.298
563462	2-METHYL-1-BUTENE	0.289
611143	1-METHYL-2-ETHYLBENZENE	0.279
589435	2,4-DIMETHYLHEXANE	0.269
617787	3-ETHYLPENTANE	0.260
1759586	TRANS-1,3-DIMETHYLCYCLOPENTANE	0.260
624646	TRANS-2-BUTENE	0.240

(continued)

Table D-3. (continued)

CAS	Specie	Weight % of TOG
584941	2,3-DIMETHYLHEXANE	0.240
75070	ACETALDEHYDE	0.240
74997	1-PROPYNE	0.231
563451	3-METHYL-1-BUTENE	0.231
103651	N-PROPYLBENZENE	0.231
2216344	4-METHYLOCTANE	0.231
2532583	CIS-1,3-DIMETHYLCYCLOPENTANE	0.231
620235	TOLUALDEHYDE	0.221
646048	TRANS-2-PENTENE	0.212
142290	CYCLOPENTENE	0.192
590181	CIS-2-BUTENE	0.173
526738	1,2,3-TRIMETHYLBENZENE	0.173
1072055	2,6-DIMETHYLHEPTANE	0.173
111842	N-NONANE	0.173
67641	ACETONE	0.163
100527	BENZALDEHYDE	0.163
124185	N-DECANE	0.154
589537	4-METHYLHEPTANE	0.154
1074437	1-METHYL-3N-PROPYLBENZENE	0.154
463490	1,2-PROPADIENE	0.144
1640897	ETHYLCYCLOPENTANE	0.144
926829	3,5-DIMETHYLHEPTANE	0.144
78795	ISOPRENE	0.144
109671	1-PENTENE	0.135
107028	ACROLEIN (2-PROPENAL)	0.135
2815589	1,2,4-TRIMETHYLCYCLOPENTENE	0.125
4050457	TRANS-2-HEXENE	0.125
100425	STYRENE	0.125
627203	CIS-2-PENTENE	0.115
934747	1,3-DIMETHYL-5-ETHYLBENZENE	0.115
760203	3-METHYL-1-PENTENE	0.106
2613652	TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.106
934805	1,2-DIMETHYL-4-ETHYLBENZENE	0.106
110838	CYCLOHEXENE	0.087
496117	INDAN	0.087
871830	2-METHYLNONANE	0.087
78853	2-METHYL-2-PROPENAL	0.087
16747265	2,2,4-TRIMETHYLHEXANE	0.077
638040	CIS-1,3-DIMETHYLCYCLOHEXANE	0.077
625274	2-METHYL-2-PENTENE	0.077
1120623	3-METHYLCYCLOPENTENE	0.067
1839630	1,3,5-TRIMETHYLCYCLOHEXANE	0.067
590738	2,2-DIMETHYLHEXANE	0.067
689974	VINYLACETYLENE	0.067
2213232	2,4-DIMETHYLHEPTANE	0.067
763291	2-METHYL-1-PENTENE	0.067
2613663	CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.067
64175	ETHYL ALCOHOL	0.067
105055	1,4-DIETHYLBENZENE (PARA)	0.067
74986	PROPANE	0.058
674760	4-METHYL-TRANS-2-PENTENE	0.058

(continued)

Table D-3. (continued)

CAS	Specie	Weight % of TOG
2091956	2,2,5-TRIETHYLHEPTANE	0.058
15890401	CIS-1,TRANS-2,3-TRIMETHYLCYCLOPENTANE	0.058
592416	1-HEXENE	0.048
874419	1,3-DIMETHYL-4-ETHYLBENZENE	0.048
14686147	TRANS-3-HEPTENE	0.048
91203	NAPHTHALENE	0.048
13269528	TRANS-3-HEXENE	0.048
527844	1-METHYL-2-ISOPROPYLBENZENE	0.048
1758889	1,4-DIMETHYL-2-ETHYLBENZENE	0.048
123386	PROPIONALDEHYDE	0.038
7688213	CIS-2-HEXENE	0.038
922281	3,4-DIMETHYLHEPTANE	0.038
4110445	3,3-DIMETHYLOCTANE	0.038
2207047	TRANS-1,4-DIMETHYLCYCLOHEXANE	0.038
15869893	2,5-DIMETHYLOCTANE	0.038
4032944	2,4-DIMETHYLOCTANE	0.038
2207036	TRANS-1,3-DIMETHYLCYCLOHEXANE	0.038
590863	ISOVALERALDEHYDE	0.038
692240	2-METHYL-TRANS-3-HEXENE	0.038
141935	1,3-DIETHYLBENZENE (META)	0.029
4170303	CROTONALDEHYDE	0.029
535773	1-METHYL-3-ISOPROPYLBENZENE	0.029
2207014	CIS-1,2-DIMETHYLCYCLOHEXANE	0.029
527537	1,2,3,5-TETRAMETHYLBENZENE	0.029
75285	ISOBUTANE	0.019
123728	BUTYRALDEHYDE	0.019
78933	METHYL ETHYL KETONE (MEK) (2-BUTANONE)	0.019
14720742	2,2,4-TRIMETHYLHEPTANE	0.019
1069530	2,3,5-TRIMETHYLHEXANE	0.019
98095	C6 ALDEHYDES	0.019
488233	1,2,3,4-TETRAMETHYLBENZENE	0.019
824635	2-METHYLINDAN	0.019
874351	5-METHYLINDAN	0.019
95932	1,2,4,5-TETRAMETHYLBENZENE	0.019
625650	2,4-DIMETHYL-2-PENTENE	0.019
464062	2,2,3-TRIMETHYLBUTANE	0.010
590192	1,2-BUTADIENE {METHYLLALLENE}	0.010
112403	N-DODECANE	0.010
17171721	1,3-DIPROPYLBENZENE	0.010
538681	N-PENTYLBENZENE	0.010
10574364	3-METHYL-CIS-2-HEXENE	0.010
6443921	CIS-2-HEPTENE	0.010
14686136	TRANS-2-HEPTENE	0.010
7146603	2,3-DIMETHYLOCTANE	0.010
1074175	1-METHYL-2N-PROPYLBENZENE	0.010
2051301	2,6-DIMETHYLOCTANE	0.010
15869871	2,2-DIMETHYLOCTANE	0.010
3221612	2-METHYLOCTANE	0.010
691372	4-METHYL-1-PENTENE	0.010
98828	ISOPROPYLBENZENE (CUMENE)	0.010
6236880	1-METHYL-4-ETHYLCYCLOHEXANE	0.010

(continued)

**Table D-3.** (concluded)

<b>CAS</b>	<b>Specie</b>	<b>Weight % of TOG</b>
824226	4-METHYLINDAN	0.010
562492	3,3-DIMETHYLPENTANE	0.010
98191	1-(1,1-DIMETHYLETHYL)-3,5-DIMETHYLBENZENE	0.010
933982	1,2-DIMETHYL-3-ETHYLBENZENE	0.010
1595681	1-METHYL-2-N-BUTYLBENZENE	0.010
1120214	N-UNDECANE	0.010
563780	2,3-DIMETHYL-1-BUTENE	0.010

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**Appendix E**  
**Facility Survey Form for Perchloroethylene Dry Cleaners**

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**Dry Cleaning Operation Initial Report**

**Due: July 1, 2003**

**RETURN TO: Gary Quinn SCAQMD; 21865 Copley Dr, Diamond Bar, CA 91765-4178**

**Facility Information**

1. Facility Name: \_\_\_\_\_ 2. Facility ID Number: \_\_\_\_\_  
3. Facility Address: \_\_\_\_\_  
4. Contact Person: \_\_\_\_\_ 5. Telephone Number: \_\_\_\_\_

**Location Information** (Provide the distance from perc machine to nearest appropriate receptor.)

6. Nearest Business: \_\_\_\_\_ feet 7. Nearest Residence: \_\_\_\_\_ feet  
8. Nearest Sensitive Receptor (if within one-fourth of a mile or 1,320 feet)  
8a. School (K-12): \_\_\_\_\_ ft 8b. Day Care: \_\_\_\_\_ ft 8c. Hospital: \_\_\_\_\_ ft 8d. Nursing Home: \_\_\_\_\_ ft

**Perc Machine Information** (Attach another form and complete this section for each additional machine.)

9. Permit Number: \_\_\_\_\_  
10. Manufacturer: \_\_\_\_\_ 11. Model Number: \_\_\_\_\_  
12. Rated Capacity: \_\_\_\_\_ pounds 13. Date of Purchase: \_\_\_\_\_

**14. Type of Machine**

- Converted Closed-Loop (former vented dry-to-dry with retrofitted refrigerated condenser)**  
 **Dry-to-Dry, Closed-Loop with primary control system (has an integral refrigerated condenser)**  
 **Dry-to-Dry, Closed-Loop with both primary and secondary control systems (has both an integral refrigerated condenser and a carbon adsorber)**

**Facility Annual Operating Information** (Provide information corresponding to a full calendar year.)

15. Amount of Clothes Cleaned: \_\_\_\_\_ pounds per year  
16. Business Operating Hours: \_\_\_\_\_ hours per day \_\_\_\_\_ days per week \_\_\_\_\_ weeks per year  
17. Machine Operating Hours: \_\_\_\_\_ hours per day \_\_\_\_\_ days per week \_\_\_\_\_ weeks per year  
**18. Perc Purchased (by Vendor):**  
18a. \_\_\_\_\_ gallons per year Vendor's name: 18b. \_\_\_\_\_  
18c. \_\_\_\_\_ gallons per year Vendor's name: 18d. \_\_\_\_\_  
18e. \_\_\_\_\_ gallons per year Vendor's name: 18f. \_\_\_\_\_  
**19. Initial Perc Inventory:** \_\_\_\_\_ gallons (amount of perc at the beginning of the year)  
**20. Final Perc Inventory:** \_\_\_\_\_ gallons (amount of perc at the end of the year)  
**21. Still Oil Waste (Sludge):** \_\_\_\_\_ gallons per year (Still residue only. Do not include wastewater.)  
**22. Filter Cartridges (by Brand Name, Model Number, and Type):**  
22a. \_\_\_\_\_ number per year Brand Name & Number: 22b. \_\_\_\_\_ Type: 22c. Spin or Cartridge  
22d. \_\_\_\_\_ number per year Brand Name & Number: 22e. \_\_\_\_\_ Type: 22f. Spin or Cartridge  
22g. \_\_\_\_\_ number per year Brand Name & Number: 22h. \_\_\_\_\_ Type: 22i. Spin or Cartridge  
23. Attach Copy of Waste Manifest(s)

**Signature of Responsible Company Official**

**I SWEAR UNDER PENALTY OF PERJURY THAT THE INFORMATION PROVIDED IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND CONFORMS WITH THE INFORMATION REQUESTED BY THE SCAQMD.**

24. Signature : \_\_\_\_\_ 25. Date: \_\_\_\_\_  
Print Name: \_\_\_\_\_ 26. Title: \_\_\_\_\_

**Dry Cleaning Operation Initial Report**  
**Instructions**

**Facility Information**

1-3. Facility Name, Identification (ID) Number, and Address: Use the information contained in the SCAQMD permit. The permit should be posted somewhere on or near the perchloroethylene (perc) machine.

4-5. Contact Person and Telephone Number: Identify someone who can be reached during the day and who can answer questions regarding the information requested on this form.

**Location Information**

6-7. Nearest Business or Residence: Report the distance (in feet) from the perc machine to the property line of the nearest business or residence.

8. Nearest Sensitive Receptor: If the nearest sensitive receptor (such as a school, day care, hospital, or nursing home) is within one-fourth of a mile (or 1,320 feet) of the facility, report the distance (in feet) from the perc machine to the property line of the nearest sensitive receptor. Please consult a map. One-fourth of a mile is equivalent to one-fourth of one red grid on a Thomas Bros. map.

**Perc Machine Information** (Attach another form and complete this section for each additional machine.)

9. Permit Number: Use the information contained in the SCAQMD permit.

10-12. Manufacturer Name, Model Number, Rated Capacity: Use the information mounted on the perc machine or contained in the purchase order, invoice, or instruction manual.

13. Date of Purchase: Use the information contained in the purchase order or invoice. If not available, use the date on the plate on the machine.

**14. Type of Machine. Choose one description.**

- Converted Closed-Loop.** A “converted” perc machine is any former vented dry-to-dry machine that now uses a retrofitted refrigerated condenser.
- Closed-Loop with primary control system only.** A perc machine “with [a] primary control system only” is any non-vented dry-to-dry machine that uses a refrigerated condenser only.
- Closed-Loop with both primary and secondary control systems.** A perc machine “with both primary and secondary control[s]” is any non-vented dry-to-dry machine that uses both a refrigerated condenser and a carbon adsorber.

**Facility Annual Operating Information** (A calendar year begins on January 1 and ends on December 31.)

15. Amount of Clothes Cleaned: Use the annual total contained in the recordkeeping forms.

16. Business Operating Hours: Report the store operating hours.

17. Machine Operating Hours: Report the machine operating hours. Attach additional forms if you have more than one perc machine.

**18. Perc Purchased: Use the annual total contained in purchase orders or invoices. Extra lines are provided in case you have more than one supplier. Attach a second form if you need more lines.**

**19-20. Initial and Final Perc Inventory: For the INITIAL inventory, report (or estimate) the entire perc inventory (in gallons) at the facility on JANUARY 1. For the FINAL inventory, report (or estimate) the entire perc inventory (in gallons) at the facility on DECEMBER 31. Include all useable perc: in the machine (storage tank or reservoir), in the filter and treatment systems, and in cans or drums as fresh solvent. Do not include the perc contained in waste (still residue or spent filters).**

**21. Still Oil Waste (Sludge): Report the still oil (or sludge) waste (or residue) in gallons. Do not include wastewater.**

**22. Filters Purchased: Use the information contained in purchase orders or invoices. Extra lines are provided in case you use different types of filters or have more than one supplier. Attach a second form if you need more lines.**

22c, 22f, & 22i. Type: Spin or Cartridge Filter. Circle the appropriate filter type.

**Signature of Responsible Company Official**

24. A Responsible Company Official is any one of the following persons:

- a. for a corporation: a corporate officer in charge of a principal business function, or a duly authorized representative who performs similar policy making functions or is responsible for the overall operation;
- b. for a partnership: a general partner;
- c. for a sole proprietorship: the owner; or
- d. for a municipal, state, federal, or other public agency: a principal executive officer or ranking official.

**Appendix F**

**Example of Initial Compliance Status Report for Rule 1469**

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# INITIAL COMPLIANCE STATUS REPORT FOR RULE 1469

(Hexavalent Chromium Emissions from Chrome Plating and  
Chromic Acid Anodizing Operations)

1. Print or type the following for each plant in which chromium electroplating and/or chromium anodizing operations are performed.

Facility Name: \_\_\_\_\_ AQMD ID#: \_\_\_\_\_

Street Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

Facility Contact/Title: \_\_\_\_\_ Phone#: \_\_\_\_\_

Mailing Address (if different from facility address)

Street Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

2. Check the box to indicate the receptor type and enter the distances in feet measured from the center of the facility to the property lines of the nearest receptors located within one-quarter of a mile from the center of the facility.

Residence \_\_\_\_\_  Commercial \_\_\_\_\_  Industrial \_\_\_\_\_  Hospital \_\_\_\_\_  
 Daycare Center \_\_\_\_\_  School (K-12) \_\_\_\_\_  Convalescent Home \_\_\_\_\_

3. Check the box to indicate the source type and provide the building parameters.

Point Source Stack Height in feet \_\_\_\_\_  
 Volume Source Building Area in square feet \_\_\_\_\_

4. Check the boxes to indicate the operating scenario, annual facility-wide emissions of hexavalent chromium per Rule 1469(d)(4) and the facility maximum operating schedule.

Vented to Air Pollution Control Equipment  
 Operating MORE than 12 hours per day  Emissions are 0.04 lbs/yr or less  
 Operating 12 hours per day or LESS  Emissions are 0.036 lbs/day or less

NOT Vented to Air Pollution Control equipment  
 Provide Operating Schedule? \_\_\_\_\_  Emissions are 0.025 lbs/yr or less

5. Complete the following table. If additional lines are needed, make copies of this page.

Permit#	Type of Tank	Applicable emission limit	Type of control technique	Control system Permit#	Method to determine compliance <sup>1</sup>	Test method followed	Type and quantity of HAP emitted <sup>2,3</sup>

<sup>1</sup>If a performance test was conducted, submit the test report containing the elements required by Appendix 1.

<sup>2</sup>If the compliance procedures of alternative requirements for decorative and anodizing operations are being followed, attach the calculations needed to support the emission limit (expressed in mg/hr).

<sup>3</sup>If different values from previously submitted emission estimates are reported, the owner or operator shall state this report corrects and verifies the previous estimate in a separate sheet and attach with this report.

**EXAMPLE RESPONSE**

Permit#	Type of Tank	Applicable emission limit	Type of control technique	Control system Permit#	Method to determine compliance <sup>1</sup>	Test method followed	Type and quantity of HAP emitted <sup>2,3</sup>
D99999	Hard chrome plating	0.015 mg/dscm	Composite meshpad system	D88888	Performance test	EPA Method 306	Cr 0.009 mg/dscm
D77777	Chrome anodizing	45 dynes/cm	Wetting agent fume suppressant	N/A	Surface tension measurement	EPA Method 306B	Cr 40 dynes/cm
E55555	Decorative chrome plating	0.01 mg/dscm	Foam blanket	N/A	Performance test	EPA Method 306A	Cr 0.005 mg/dscm

6. Complete the following table for each control technique used. If additional lines are needed, make copies of this page.

Control System Permit#	Tank Permit#	Range of site-specific operating parameter values <sup>1</sup>				
		Pressure drop	Velocity pressure	Surface tension	Foam blanket thickness	Maximum potential rectifier capacity per tank

<sup>1</sup>If the applicable monitoring and reporting requirements to demonstrate continuous compliance through alternative requirements are used, attach a description. Parameter value ranges are established through initial performance testing.

**EXAMPLE RESPONSE**

Control System Permit#	Tank Permit#	Range of site-specific operating parameter values <sup>1</sup>				
		Pressure drop	Velocity pressure	Surface tension	Foam blanket thickness	Maximum potential rectifier capacity per tank
D88888	D99999	7 IN. W.C. ± 1 in.	N/A	N/A	N/A	3000 amps
N/A	D77777	N/A	N/A	≤ 45 dynes/cm	N/A	6000 amps
N/A	E55555	N/A	N/A	N/A	≥ in.	1000 amps

7. Check the boxes if operating hard chromium electroplating tanks to indicate the maximum cumulative potential rectifier capacity used in these tanks, how this capacity was determined and include the records or a description.

- Greater than or equal to 60 million amp-hr/yr
- LESS than 60 million amp-hr/yr
- Determined by taking the sum of the total installed rectifier capacity (amperes) multiplied by 8,400 hrs/yr and by 0.7 for each tank
- New source, the capacity was projected for the first 12 months of tank operation
- Determined from records that show the facility's previous annual rectifier capacity
- Attach the records used to determine the rectifier capacity
- Describe how the operations will change to meet less than 60 million amp-hr
- The facility has accepted or will accept a federally enforceable limit of 60 million amp-hr/yr

8. Check one of the following boxes that describe the facility's compliance status:

- The facility is in compliance with the provisions of Rule 1469.
- The facility is not in compliance with the provisions of Rule 1469.

9. Responsible Official Certification Statement

I certify that an Operation and Maintenance Plan for the add-on control equipment has been completed (if applicable) and the plan and other work practice standards of 1469(g) are being followed.

I also certify that the information contained in this report to be accurate and true to the best of my knowledge.

Print or type the name of the title of the Responsible Official for the plant:

\_\_\_\_\_  
(Name)

\_\_\_\_\_  
(Title)

\_\_\_\_\_  
(Signature of Responsible Official)

\_\_\_\_\_  
(Date)

A Responsible Official can be:

- The president, vice-president, secretary, or treasure of the company that owns the plant;
- The owner of the plant or the plant engineer or supervisor;
- A government official if the plant is owned by the Federal, State, City or County government; or
- A ranking military officer if the plant is located on a military base.

## **Appendix G**

### **Selected PM Speciation Profiles**

Particulate Matter (PM) Speciation profiles contains the weight fraction data (expressed as percent for ease of display) of each chemical in the profile, within each of the specified size fractions (i.e., TSP, PM<sub>10</sub>, and PM<sub>2.5</sub>). The following PM speciation profiles are included here:

- Profile No. 400: Gasoline vehicles - catalyst
- Profile No. 472: Tire Wear
- Profile No. 473: Brake Wear

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**Table G-1.** PM Profile No. 400: Gasoline Vehicles - Catalyst

CAS	Specie	Wt. % of TSP	Wt. % of PM <sub>10</sub>	Wt. % of PM <sub>2.5</sub>
7726956	BROMINE	0.05	0.05	0.05
7440702	CALCIUM	0.55	0.55	0.55
7782505	CHLORINE	7	7	7
7440473	CHROMIUM	0.05	0.05	0.05
7440484	COBALT	0.05	0.05	0.05
7440508	COPPER	0.05	0.05	0.05
7440440	ELEM CARBON	20	20	20
7439896	IRON	0.05	0.05	0.05
7439965	MANGANESE	0.05	0.05	0.05
7440020	NICKEL	0.05	0.05	0.05
14797558	NITRATES	0.55	0.55	0.55
7440097	POTASSIUM	0.55	0.55	0.55
14808798	SULFATES	45	45	45
7440666	ZINC	0.05	0.05	0.05
99999	OTHER	25.95	25.95	25.95

**Table G-2. PM Profile No. 472: Tire Wear**

CAS	Specie	Wt. % of TSP	Wt. % of PM <sub>10</sub>	Wt. % of PM <sub>2.5</sub>
7429905	ALUMINUM	0.061	0.061	0.061
7664417	AMMONIA	0.019	0.019	0.019
7440382	ARSENIC	0.000	0.000	0.000
7440393	BARIUM	0.020	0.020	0.020
7726956	BROMINE	0.002	0.002	0.002
7440702	CALCIUM	0.112	0.112	0.112
7782505	CHLORINE	0.780	0.780	0.780
7440473	CHROMIUM	0.003	0.003	0.003
7440508	COPPER	0.049	0.049	0.049
7440440	ELEM CARBON	22.000	22.000	22.000
7439896	IRON	0.460	0.460	0.460
7439921	LEAD	0.016	0.016	0.016
7439954	MAGNESIUM	0.038	0.038	0.038
7439965	MANGANESE	0.010	0.010	0.010
7440020	NICKEL	0.005	0.005	0.005
14797558	NITRATES	0.150	0.150	0.150
	ORGANIC CARBON	47.150	47.150	47.150
7723140	PHOSPHOROUS	0.125	0.125	0.125
7440097	POTASSIUM	0.038	0.038	0.038
7440177	RUBIDIUM	0.000	0.000	0.000
7782492	SELENIUM	0.002	0.002	0.002
7440213	SILICON	0.115	0.115	0.115
7440235	SODIUM	0.061	0.061	0.061
7440246	STRONTIUM	0.007	0.007	0.007
14808798	SULFATES	0.250	0.250	0.250
7704349	SULFUR	1.989	1.989	1.989
7440326	TITANIUM	0.036	0.036	0.036
	UNKNOWN	25.974	25.974	25.974
7440622	VANADIUM	0.000	0.000	0.000
7440666	ZINC	0.531	0.531	0.531

**Table G-3. PM Profile No. 473: Brake Wear**

CAS	Specie	Wt. % of TSP	Wt. % of PM <sub>10</sub>	Wt. % of PM <sub>2.5</sub>
7429905	ALUMINUM	0.033	0.033	0.033
7664417	AMMONIA	0.003	0.003	0.003
7440382	ARSENIC	0.001	0.001	0.001
7440393	BARIUM	5.445	5.445	5.445
7726956	BROMINE	0.004	0.004	0.004
7440702	CALCIUM	0.110	0.110	0.110
7782505	CHLORINE	0.150	0.150	0.150
7440473	CHROMIUM	0.120	0.120	0.120
7440508	COPPER	1.149	1.149	1.149
7440440	ELEM CARBON	2.610	2.610	2.610
7439896	IRON	28.700	28.700	28.700
7439921	LEAD	0.005	0.005	0.005
7439954	MAGNESIUM	8.300	8.300	8.300
7439965	MANGANESE	0.170	0.170	0.170
7439987	MOLYBDENUM	0.370	0.370	0.370
7440020	NICKEL	0.066	0.066	0.066
14797558	NITRATES	0.160	0.160	0.160
	ORGANIC CARBON	10.700	10.700	10.700
7723140	PHOSPHOROUS	0.000	0.000	0.000
7440097	POTASSIUM	0.019	0.019	0.019
7440177	RUBIDIUM	0.005	0.005	0.005
7782492	SELENIUM	0.002	0.002	0.002
7440213	SILICON	6.790	6.790	6.790
7440235	SODIUM	0.000	0.000	0.000
7440246	STRONTIUM	0.074	0.074	0.074
7704349	SULFUR	1.280	1.280	1.280
7440315	TIN	0.660	0.660	0.660
7440326	TITANIUM	0.360	0.360	0.360
	UNKNOWN	32.622	32.622	32.622
7440622	VANADIUM	0.066	0.066	0.066
7440666	ZINC	0.027	0.027	0.027