MATES III

Draft Protocol for the

Analysis of Trends in Toxic Air Contaminants

March 24, 2004

INTRODUCTION

From 1986 to 1987, the District conducted a Multiple Air Toxics Exposure Study (MATES) to determine the basin-wide risks associated with major airborne carcinogens.[1] One of the recommendations of the MATES study was to maintain an ambient monitoring network for selected gaseous organics and toxic metal compounds. The State of California Air Resources Board (ARB) has maintained such a network since 1990.

Six of the approximately 20 sites in ARB's statewide toxics monitoring network are in the South Coast Air Basin (Basin) and vicinity as shown in Figure 1. Simi Valley is included since it is just outside the western edge of the Basin and represents conditions on the west side of the San Fernando Valley. The measurements consist of 24-hour integrated samples collected once every 12 days. Table 1 lists the toxic air contaminants (TACs) sampled.

OBJECTIVE

Analyze seasonal and temporal trends in the historical data. This will illustrate the benefits of past regulatory efforts and will aid us in designing future control strategies.

Figure 1. ARB toxic monitoring sites in the South Coast Air Basin and vicinity.

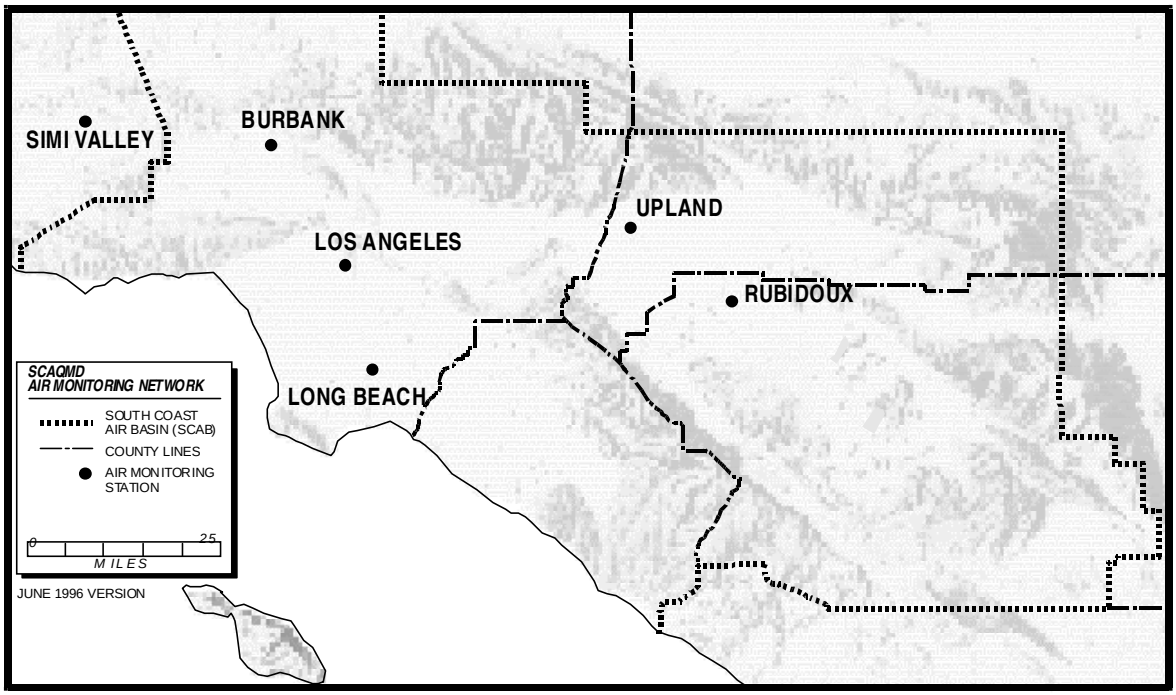


Table 1. Toxic Air Contaminants Measured by the Air Resources Board.

Volatile Organic Compounds		
Acetaldehyde	cis-1,3-Dichloropropene	Methylene Chloride
Benzene	trans-1,3-Dichloropropene	Perchloroethylene
1,3-Butadiene	Ethyl Benzene	Styrene
Carbon Disulfide	Ethylene Dibromide	Toluene
Carbon Tetrachloride	Ethylene Dichloride	Trichloroethylene
Chlorobenzene	Formaldehyde	meta-Xylene
Chloroform	Methyl Bromide	meta/para-Xylene
meta-Dichlorobenzene	Methyl Chloroform	ortho-Xylene
ortho-Dichlorobenzene	Methyl Ethyl Ketone	para-Xylene
para-Dochlorobenzene	Methyl tertiary-Butyl Ether	
Polycyclic Aromatic Hydrocarbons		
Benzo(a)pyrene	Benzo(g,h,i)perylene	Dibenz(a,h)anthracene
Benzo(b)fluoranthene	Benzo(k)fluoranthene	Indeno(1,2,3-cd)pyrene
Metals		
Aluminum	Copper	Selenium
Antimony	Hexavalent Chromium	Silicon
Arsenic	Iron	Strontium
Barium	Lead	Sulfur
Beryllium	Manganese	Tin
Bromine	Mercury	Titanium
Cadmium	Molybdenum	Uranium
Calcium	Nickel	Vanadium
Chlorine	Phosphorous	Yttrium
Chromium	Potassium	Zinc
Cobalt	Rubidium	Zirconium

APPROACH

Using available statistical software packages, analyze the measured concentrations for temporal trends, seasonal trends, and extreme values. Compare extreme and average concentrations to acute and chronic reference exposure levels from the State of California Office of Environmental Health Hazard Assessment (OEHHA). Using available unit risk factors (URFs) developed by OEHHA, show temporal trends in inhalation cancer risks.

REPORT STRUCTURE

The report will have four major sections, in addition to appendices, as follows:

- Temporal trends,
- Seasonal trends,
- Extreme values, and
- Source apportionment.

Temporal Trends

The purpose of this section is to demonstrate regulatory progress. The temporal variation of pollutant concentrations will be illustrated using data from each of the six stations shown in Figure 1 for each year from 1990 to 2002. There will be a series of graphs showing the trends in concentration over time; an example is shown in Figure 2. Statistically significant upward or downward trends will be noted.

Temporal variation of inhalation cancer risks will be illustrated and discussed through a series of stacked histograms, showing the variation in cancer risk due to each component. An example of this plot is shown in Figure 3. In an appendix, there will be tables showing statistical summaries by year for each station and for the whole network (i.e., six stations shown in Figure 1). A template for these tables is shown in Table 2.

Seasonal Trends

The remainder of the report will focus on current conditions as represented by the three-year period, 2000 to 2002. The most recent three-year period is chosen for analysis since single year could be a meteorological anomaly, whereas a three-year period captures a wider range of climatic conditions. A three-year sampling period increases the sampling size for determining statistical significance. Also a three-year sampling period has a regulatory tradition for representing current conditions. For example, the SCAQMD considers the most recent three-year period for establishing background conditions per Regulation XIII. And, the U.S. EPA determines attainment status for many standards by looking at the most recent three-year period.

Seasonal trends in pollutant concentrations will be illustrated and discussed through a series of plots, showing the monthly means by pollutant, and their confidence intervals. An example is shown in Figure 4. An appendix will contain tables by pollutant summarizing the monthly statistics for each station and for the network as a whole. A template for this table is shown in Table 3.

Extreme Values

Measured extreme chronic and acute concentrations over the most recent three-year period will be compared to their respective OEHHA-approved chronic and acute reference exposure levels (RELs).[3] A table template for this comparison is shown in Table 4. Since the data consists of 24-hour integrated samples, a relationship must be developed to convert 24-hour average concentrations to acute concentrations. A preliminary analysis of local NO_X concentration data indicates that appropriate one-hour to 24-hour ratio ranges from five to eight, depending on the location. The development of acute to chronic ratios will be documented in an appendix to the report.

Source Apportionment

Apportionment of the measured pollutant concentrations to source category (i.e., stationary, on-road, and off-road) will be estimated using the 2002 toxics inventory developed for the update of the Air Toxics Control Plan. This will allow us to estimate source apportionment of the cancer risks. Figure 5 illustrates how the results would be presented. A copy of the 2002 toxics inventory by major source category will be included in an appendix.

TASKS AND SCHEDULE

Task	Description	Schedule
1	Acquire air quality data from ARB	March 2004
2	Analyze air quality data	April to June 2004
3	Prepare report outline	July 2004
4	Present preliminary results	July 2004
5	Draft report	August 2004
6	Final report	October 2004

REFERENCES

1. SCAQMD. "The Magnitude of Ambient Air Toxics Impacts from Existing Sources Sources in the South Coast Air Basin." South Coast Air Quality Management District, El Monte, CA. 1987.
2. Ambient air quality data can be ordered at the following ARB link: http://www.arb.ca.gov/aqd/aqdcd/aqdcd.htm
3. OEHHA-approved unit risk factors and acute and chronic RELs are available at the following link: http://www.arb.ca.gov/toxics/healthval/healthval.htm

Figure 2. Sample of a plot illustrating temporal trends in benzene. The tick mark represents the mean and the bars represent the 90 percent confidence interval about the mean.

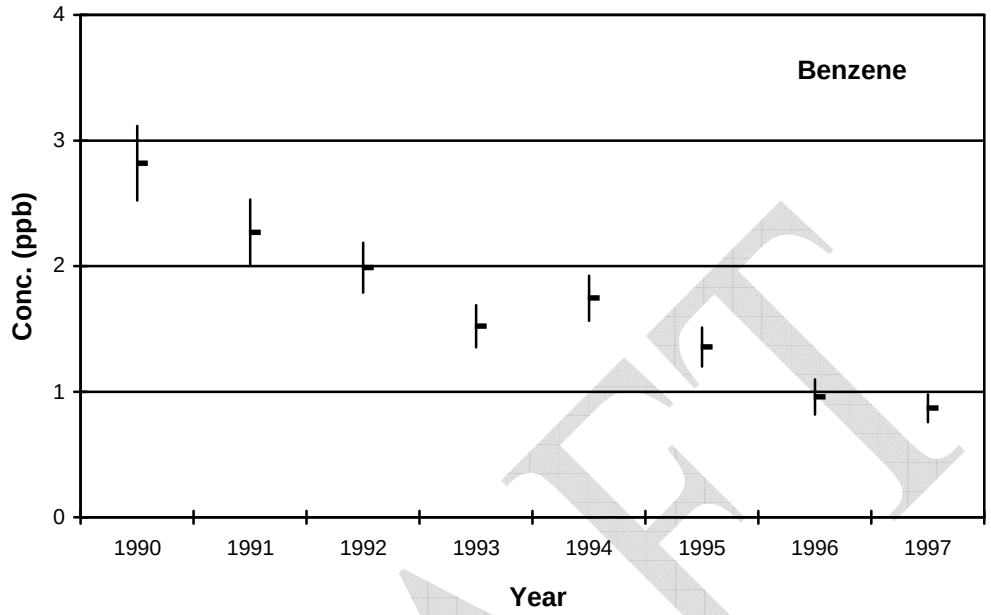


Figure 3. Sample plot illustrating trends in inhalation cancer risks.

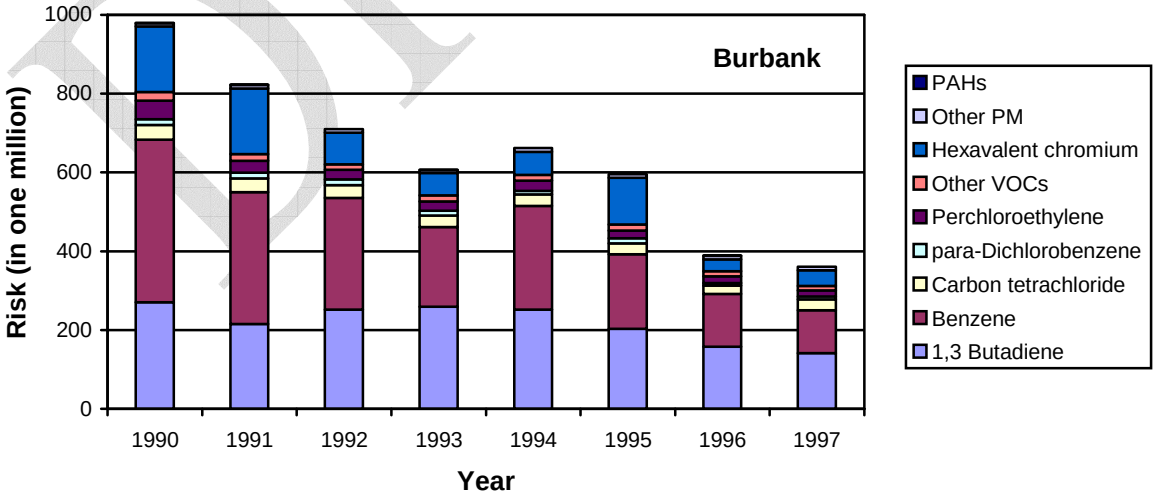


Figure 4. Sample of a plot illustrating seasonal trends in benzene. The tick mark represents the mean and the bars represent the 90 percent confidence interval about the mean.

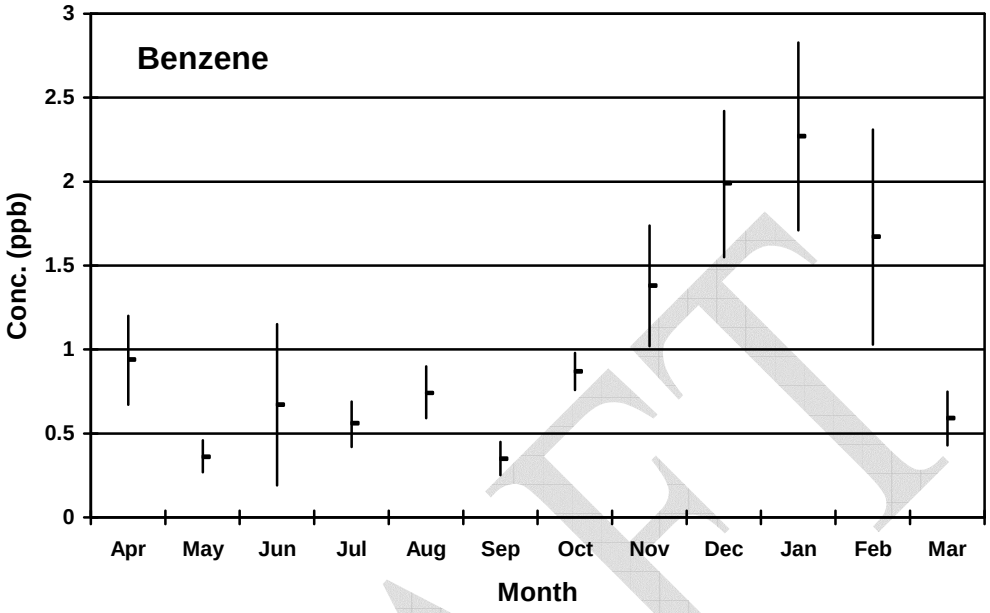
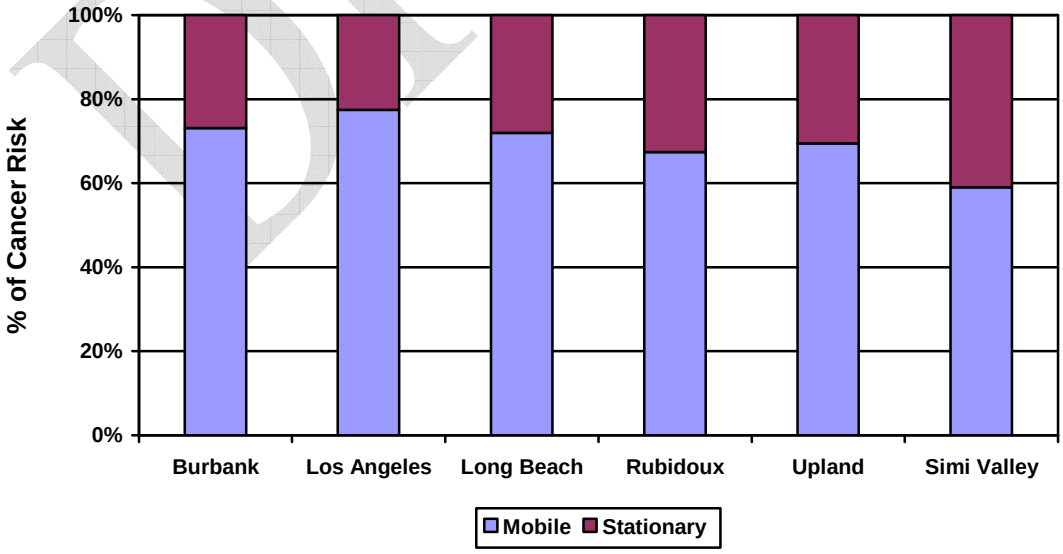


Figure 5. Sample chart illustrating source apportionment of cancer risks.



Toxic Air Contaminant CAS No: Units:

Site	Statistic	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Burbank	Minimum													
	Mean													
	Median													
	Maximum													
	Std. Dev													
	N													
	N < MDL													
Los Angeles	Minimum													
	Mean													
	Median													
	Maximum													
	Std. Dev													
	N													
	N < MDL													
Long Beach	Minimum													
	Mean													
	Median													
	Maximum													
	Std. Dev													
	N													
	N < MDL													
Rubidoux	Minimum													
	Mean													
	Median													
	Maximum													
	Std. Dev													
	N													
	N < MDL													

MDL = minimum detection level
Mol. Wt. =

URF =
Chronic REL =
Acute REL =

Table 2. Sample table summarizing the statistical trends. There will be a table for each pollutant analyzed.

Toxic Air Contaminant CAS No: Units:

Site	Statistic	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Simi Valley	Minimum													
	Mean													
	Median													
	Maximum													
	Std. Dev													
	N													
	N < MDL													
Upland	Minimum													
	Mean													
	Median													
	Maximum													
	Std. Dev													
	N													
	N < MDL													
Network	Minimum													
	Mean													
	Median													
	Maximum													
	Std. Dev													
	90% CI													
	95% CI													
	N													
	N < MDL													

MDL = minimum detection level
Mol. Wt. =

URF =
Chronic REL =
Acute REL =

Table 2. (Concluded)

Toxic Air Contaminant CAS No: Units: Period of Record: 2000 to 2002

Site	Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Burbank	Minimum												
	Mean												
	Median												
	Maximum												
	Std. Dev												
	N												
	N < MDL												
Los Angeles	Minimum												
	Mean												
	Median												
	Maximum												
	Std. Dev												
	N												
	N < MDL												
Long Beach	Minimum												
	Mean												
	Median												
	Maximum												
	Std. Dev												
	N												
	N < MDL												
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	Mean												
	Median												
	Maximum												
	Std. Dev												
	N												
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Table 3. Sample table summarizing the seasonal statistics. There will be a table for each pollutant analyzed.

Toxic Air Contaminant CAS No: Units: Period of Record: 2000 to 2002

Site	Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Simi Valley	Minimum												
	Mean												
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	Maximum												
	Std. Dev												
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	Median												
	Maximum												
	Std. Dev												
	N												
	N < MDL												
Network	Minimum												
	Mean												
	Median												
	Maximum												
	Std. Dev												
	90% CI												
	95% CI												
	N												
	N < MDL												

MDL = minimum detection level
Mol. Wt. =

URF =
Chronic REL =
Acute REL =

Table 3. (Concluded)

Site: Period of Record: 2000 to 2002

Pollutant	Maximum Concentrations (µg/m^3)			Toxicity Values			Health Risks		
	Annual (µg/m^3)	24-hour (µg/m^3)	1-hour (µg/m^3)	URF (µg/m^3)$^{-1}$	Chronic REL (µg/m^3)	Acute REL (µg/m^3)	Cancer (in a million)	Chronic HI (unitless)	Acute HI (unitless)

Table 4. Sample table comparing maximum pollutant concentrations to relevant health effects thresholds. There will be a table for each of the stations analyzed.