ENVIRONMENTAL JUSTICE ENHANCEMENTS FOR FY 2003-04

INITIATIVE I-5

MATES III STUDY

Draft Workplan

January, 2004

Table of Contents

1. Background and Objectives

Background

The South Coast Air Basin, a highly urbanized area, is home to about sixteen million people who own and operate about eleven million motor vehicles and contains some of the highest concentrations of industrial and commercial operations in the country. It also has the poorest air quality in the U.S. In 1986, SCAQMD conducted the first MATES study to determine the Basin-wide risks associated with major airborne carcinogens. At the time the state of technology was such that only ten known air toxic compounds could be analyzed. In 1998, a second MATES study (MATES-II) represented one of the most comprehensive air toxics measurement programs conducted in an urban environment. MATES-II included a monitoring program of 40 known air toxic compounds, an updated emissions inventory of toxic air contaminants, and a modeling effort to characterize health risks from hazardous air pollutants.

Since these studies were conducted, several emissions control programs have been implemented at the national, state, and local levels, and toxics emissions have been declining. However, at the community level, there is heightened awareness of toxic air contaminant exposures. There are also environmental justice concerns that programs designed to reduce emissions may not be effective in reducing risks from toxic air contaminants in certain areas, particularly in communities with lower income or multiple sources of air toxics.

In September, 2003 the SCAQMD Governing Board approved several enhancements to the District's Environmental Justice program. Initiative I-5 of these enhancements calls for a one-year sampling program for air toxics. To provide current data on air toxic levels and exposures, and to address environmental justice issues, staff proposes to establish an updated baseline of toxic emissions, exposures, and risk levels by conducting MATES-III.

Objective

The objective of MATES-III is to characterize the ambient air toxic concentrations and potential exposures in the South Coast Air Basin (Basin). This project includes one year of ambient monitoring for air toxics which will have a combination of Basin-wide measurements and localized studies. The project will develop an updated toxics emissions inventory and conduct air dispersion modeling to estimate ambient levels and the potential health risks of air toxics. The results of this effort will determine the spatial concentration pattern of important hazardous air pollutants in the Basin, will assess the effectiveness of current air toxic control measures, provide trend data of air toxic levels, and be used to update and develop appropriate control strategies for reducing exposures to toxics associated with significant public health risks.

MATES-III proposes to enhance the spatial resolution of previous studies by characterizing the ambient concentration of selected toxic air compounds in communities with varying land-type usage, such as residential, industrial, and commercial, as well as gradients from source areas downwind to receptor areas. There are four components to the study, as listed below.

- Air Toxics Monitoring and Analyses
- Emissions Inventory Enhancements
- Air Toxic Modeling and Risk Assessments
- Air Toxic Trend Analysis

2. Air Toxics Monitoring and Analyses

Substances to be Monitored

The chemical compounds (Table 1) to be monitored in MATES-III include the toxics posing the most significant contributors to health risks as found in previous studies in the Basin. Additional measurements include organic carbon, elemental carbon, and total carbon, as well as Particulate Matter (PM), including $PM_{2.5}$. Acrolein will only be included if there is a suitable method available. Other compounds may also be reported since they are additionally captured in both the sampling and analytical protocols proposed.

Table 1 Substances to be Monitored in MATES-III

Target Pollutants		
Benzene	Carbon Tetrachloride	Chloroform
1,3-Butadiene	Propylene Dichloride	Acrolein
Methylene Chloride	Tetrachloroethylene (Perchloroethylene)	Trichloroethylene, TCE
Vinyl Chloride	Arsenic	Beryllium
Cadmium	Hexavalent Chromium	Lead and Compounds
Manganese	Nickel	Acetaldehyde
Formaldehyde	Organic Carbon	Elemental Carbon
Total Carbon	PM_{10}	$PM_{2.5}$
PAHs	Naphthalene	

Naphthalene and other polycyclic aromatic hydrocarbons (PAHs), components of mobile source emissions, are also proposed to be measured, depending on availability of resources. Recent measurements have shown that annual averages of naphthalene are at levels hundreds to thousands of times higher that of other PAHs. The National Toxicology Program is reviewing naphthalene for potential listing as a carcinogen. Additionally, the California EPA's Office of Environmental Health Hazard Assessment is evaluating the health risk of ambient naphthalene under California's air toxics program. The International Agency for Research on Cancer considers naphthalene to be possibly carcinogenic to humans. Given the likely importance of naphthalene to public health, it would be of value to obtain additional information on ambient levels and emissions of this compound.

Siting of Monitoring Stations

The MATES-III project will conduct air toxics monitoring at ten locations over a one year period. In addition to the ten fixed sites, the SCAQMD will deploy mobile monitoring platforms that will focus on "microscale" studies near localized sources such as airports, marine ports, industrial facilities, busy roadways, and warehouse distribution centers.

The combination of fixed and microscale sites will ensure sufficient resolution to monitor representative concentrations of varying land use types and characterize spatial gradients in the Basin.

Ambient Sampling Schedule

Current data from the SCAQMD air monitoring network stations include criteria pollutants and special study data from MATES-I and II. These data, along with data from the Photochemical Assessment Monitoring Stations (PAMS), $PM_{2.5}$ monitoring stations, and the California Air Resources Board (CARB) toxics network will be reviewed for trend information. Further, these data will serve as a guide for comparative data generated from MATES-III. Sampling for MATES-III is proposed to follow a one in three day 24 hour-integrated sampling schedule which is double the current schedule utilized at the monitoring stations. In the microscale and gradient studies, a 24 hour-integrated sampling schedule will be maintained for carbonyls, PM, and volatile organic compound (VOC) measurements, but in addition, three 8-hour integrated canister samples for VOCs will be collected for higher temporal resolution over a single day. All data will be submitted to Air Quality System (AQS) after review and validation. Monitoring will be conducted with other planned studies in the Basin, including the Port of Los Angeles proposed particulate monitoring near the port area.

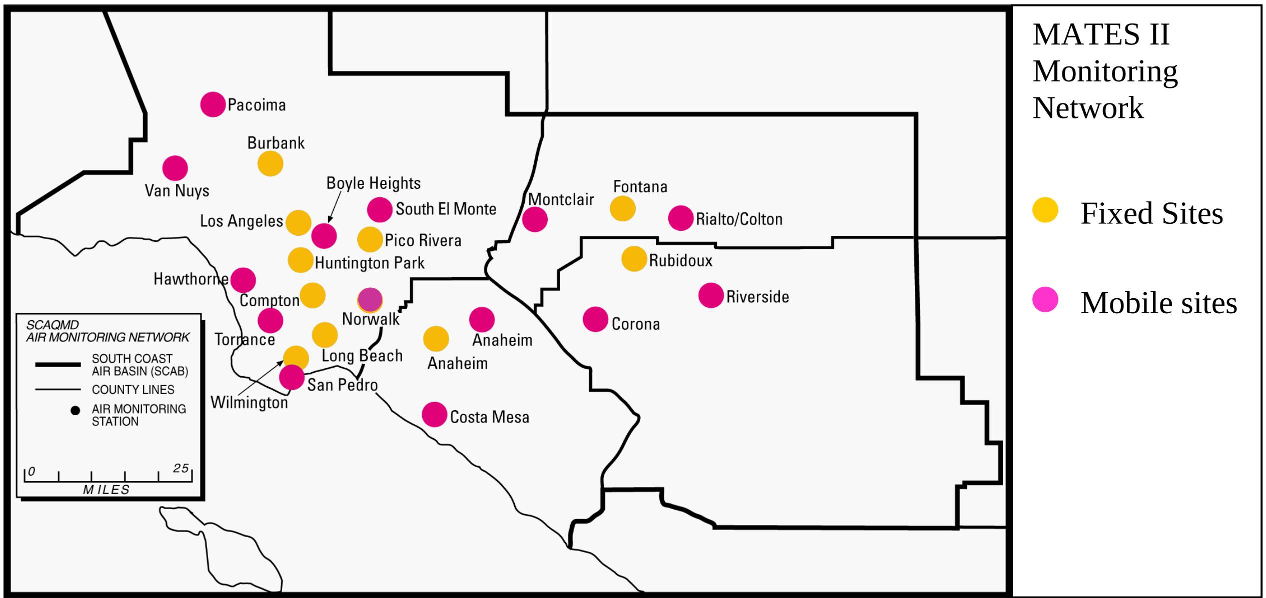
Proposed Monitoring Sites

Fixed Sites

The proposed fixed monitoring sites are those used in the MATES II study. These sites were selected to measure numerous air toxic compounds at different locations in the Basin in order to establish a baseline of existing air toxic ambient concentrations, as well as risk level data, and to assist in the assessment of modeling performance accuracy. Ten sites were selected and air samples were collected for up to one year.

The locations for the ten fixed sites reflect key locations within the Basin and are geographically dispersed. Fixed site locations include areas varying in land-use types to obtain a good spatial representation of the Basin which include expected areas of possible elevated toxics levels (e.g. industrial and commercial) and those areas that are not directly near source emissions (neighborhoods). The sites also reflect resource constraints and the leveraging of existing specialized equipment. In addition, using these sites utilized in MATES-I and MATES-II will allow for trend analysis. The sites used in MATES II are shown below.

Figure 1 MATES II Sampling Locations



The ten sites were selected with the input from the MATES II Technical Review Group and the Environmental Justice Task Force, and locations are listed below. Five were selected to provide continuity with the ARB long-term trend sites (Los Angeles, Burbank, Long Beach, Rubidoux and Upland/Fontana). The Pico Rivera site was selected because monitoring equipment was available from the EPA-sponsored PAMS program. Anaheim was chosen for geographic equity, such that at least one site existed in each of the four counties. Wilmington, Compton, and Huntington Park were new sites selected to examine environmental justice concerns. Because the fixed site locations are based on EPA guidelines for "neighborhood scale" monitoring, each of these sites may also be representative of adjacent communities.

Table 2   Mates II Fixed Site Locations

Site	**Address**
Anaheim	1010 S. Harbor Blvd.
Burbank	228 W. Palm Ave.
Compton	720 N. Bullis Rd.
Fontana	14360 Arrow Highway
Huntington Park	6301 S. Santa Fe Ave.
Long Beach	3648 N. Long Beach Blvd.
Los Angeles	1630 N. Main St.
Pico Rivera	3713 B-San Gabriel River Parkway
Rubidoux	5888 Mission Blvd.
Wilmington	900 E. Lomita Blvd.

At each site, sampling equipment will include particulate samplers, canisters, and carbonyl samplers, as well as equipment to measure key meteorological parameters.

Key Tasks

1. Site Set-up

Acquire necessary additional equipment for sampling and analyses.

For non-SCAQMD sites, locate and secure acceptable locations.

Install equipment at sites

2. Monitoring and Reporting

Develop monitoring and analyses protocols.

Conduct monitoring and analyze samples.

Report data on a monthly basis

Deliverables and schedule: A draft monitoring and analysis protocol will be developed by in January, 2004 for review by the Technical Advisory Group, and will be finalized by the start of sampling. Sampling and laboratory analyses will be conducted for one year, starting in February, 2004.

Microscale Sites

The purpose of the microscale sites is to monitor air contaminants on a neighborhood level at locations of concern within the SCAB. This information will be used to determine if communities may be experiencing localized air toxics hot-spots not otherwise determined by modeling as related to issues of environmental justice.

The microscale sites will utilize the SCAQMD's mobile monitoring platforms and be situated near air toxic emission sources. As in MATES II, each microscale site will be paired with a fixed site for comparison to determine if toxic air emissions at these microscale sites statistically exceed a neighboring fixed site. Due to the limited number of mobile monitoring platforms, each microscale site study will last approximately two months. Other considerations include the following: 1) power availability, 2) security, 3) accessibility to SCAQMD staff and 4) availability of the premises for a 6 to10 week period. Some proposed locations for microscale monitoring might include Wilmington, a community near refineries and the Port of Los Angeles, the Santa Monica Regional Airport, and education centers measured under the SCAQMD's Children's Health Agenda.

Since the sampling periods for the microscale sites will be limited, annual averages for measured substances can not be calculated. However, by comparing the levels from the microscale sites to those from the nearest fixed site during the timeframe that the microscale site was operating can yield insights on potential community gradients.

Proposed Approach

Microscale sites will be selected using the following criteria, in consultation with the MATES III Technical Advisory Group.

- Proximity to emissions source(s)
- Areas identified with environmental justice issues
- Potential for neighborhood gradients
- Elevated risks from MATES II modeling analysis
- Community concerns
- Geographic equity

Input on potential types of sites has come from several sources, including the following.

- Community concerns from public outreach and Town Hall meetings
- Public Complaints
- MATES II modeling data
- Data from existing studies
- MATES Technical Advisory Group

A list of potential sites for microscale monitoring is in Table 3. The actual site location will also depend on availability of power, security, and accessibility for SCAQMD staff.

Key Tasks

Set up monitoring platforms

Develop a list of potential microscale sites

Prioritize candidate sites and establish sampling schedules

Locate and procure access to sites.

Conduct monitoring and analyses, and report results.

Deliverable and schedule: A prioritized listing of potential sites and monitoring schedules will be developed by February, 2004. For each microscale site, conduct monitoring and prepare a report of findings. Assemble a database of the microscale measurements.

Table 3 Potential categories of microscale sites for MATES III

Description	
Airport operations	
Transfer station	
Mobile on-road	
Rail yard	
Battery recycling operation	
Port operations	
Warehouse/distribution operations	
Refinery operations	
Multiple source area	
Heavy duty vehicle traffic	
Landfill	
Agricultural operations	

Monitoring and Laboratory Analysis

For MATES-III, the SCAQMD will leverage meteorological equipment and sampling equipment for canisters, PM_{10} and $PM_{2.5}$ filters, and carbonyl cartridges from the existing air monitoring network. The SCAQMD laboratory will provide the analytical equipment for all analysis. The SCAQMD will utilize a variety of analytical methods to measure the ambient species as briefly described in Table 4. Detailed protocols are described in the "MATES III Protocol for Monitoring and Laboratory Analyses."

Table 4 Sampling and Analysis Methods for MATES-III

Ambient Species	Sampling Method	Laboratory Analysis
Volatile Organic Compounds (VOCs)	Summa Polished/ Silca-Lined Canisters	Gas chromatograph – Mass spectrometer (GC-MS) with automated pre-concentration and cryo-focusing
Carbonyls	DNPH Cartridge	Solvent recovery and subsequent analysis via high performance liquid chromatography (HPLC)
Hexavalent Chromium	Cellulose Fiber Filters	Treatment with buffer solution to maintain proper pH for unwanted conversions and then subsequent analysis via ion chromatograph(IC)
Elemental and Organic Carbon (EC/OC)	PM Filters	Section of PM filter removed and analyzed on a laser corrected carbon analyzer
PM_{10}	Hi-Volume Quartz Filters	Mass determined by analytical balance; metals determined by X-Ray diffraction and/or subsequent analysis on inductively coupled plasma mass spectrometry (ICP MS); Ions extracted with water from filter and then subsequently analyzed on IC
$PM_{2.5}$	Medium-Volume Teflon Filters	Mass determined by Micro-balance; metals determined by X-Ray diffraction and/or subsequent analysis on inductively coupled plasma mass spectrometry (ICP MS); Ions extracted with water from filter and then subsequently analyzed on IC
Diesel PM		Methodology to be selected

Volatile organic compounds (VOCs) will be measured from air samples collected in either summa polished or silica-lined 6-liter canisters using an automated canister sampler to fill at a constant rate over a 24-hour or 8-hour time period depending upon the site. The filled canisters will be brought back to the laboratory for analysis within 48 hours of the sample being collected. VOCs will be identified and measured using gas chromatograph mass spectrometry (GC-MS). The SCAQMD currently has two GC-MS instruments that are based upon the U.S. EPA's TO-14 and TO-15 methods. These instruments are equipped with automated canister preconcentrators attached to the GC to enable continuous analysis.

Carbonyl compounds will be sampled by drawing a continuous amount of air through a DNPH (2,4-Dinitrophenylhedrazine) cartridge. The carbonyl compounds undergo derivatization with DNPH, the derivatives are analyzed using High Performance Liquid Chromatography (HPLC) in conjunction with U.S. EPA method TO-11.

Hexavalent Chromium (Chrome VI) will be analyzed using ion chromatography (IC). Sample collection involves drawing air at a prescribed rate for 24-hours through a cellulose fiber filter. The filter is treated with sodium bicarbonate to prevent conversion of chrome-VI to chrome-III. Chrome VI is extracted from the filter by sonication and subsequently analyzed using IC.

Particulate matter less than 10 microns (**PM_{10}**) and less than 2.5 microns (**$PM_{2.5}$**) will be collected separately over a 24-hour period using size selective inlet (SSI) samplers according to the method based on U.S. EPA's Federal Reference Method 40CFR50. All PM_{10} and $PM_{2.5}$ samples will be collected upon quartz filters and will be analyzed for total PM mass, metals, ions, organic carbon (OC) and elemental carbon (EC). Metal analysis upon particulate samples will be determined using methodology based on IO-3 (Compendium of Methods for Inorganic Air Pollutants) implementing a combination of x-ray diffraction, inductively coupled plasma mass spectrometry (ICP-MS), and ion chromatography. Identification of ions within the PM samples will also be done by IC. Carbon analysis is conducted by taking a small circular disk from sampled PM_{10} or $PM_{2.5}$ filters. The small circular disk is placed into a carbon analyzer which utilizes either a thermal optical reflectance or thermal optical transmittance method (IMPROVE or NIOSH method) to measure the OC and EC content of the filter. As part of this effort, speciation air sampling system (SASS) samplers are proposed to be deployed to characterize specific PM species.

Diesel PM. For MATES II, diesel PM was estimated using ambient measurements of EC, and using EC emissions inventories to determine the contribution of diesel emissions to ambient PM levels. For MATES III, a review of methodologies to assess the levels of diesel PM will be conducted, and a proposed method will be presented to the Technical Advisory Group for review. The method chosen will need to take into consideration the availability of resources and monitoring methods that can be deployed on a routine basis.

Quality Assurance and Quality Control (QA/QC)

The SCAQMD is committed to achieving the highest possible data quality level in the MATES-III program. To achieve this data quality level, the SCAQMD has an implemented QA/QC plan which follows U.S. EPA *Quality Assurance Project Plan for the Air Toxics Monitoring Network* (EPA-454/R-01-007). The SCAQMD objectives, procedures, documentation, and data review techniques assures the MATES-III program will produce accurate and precise data. The technical procedures for QA/QC include annual system audits on all equipment in the laboratory and at the MATES-III sampling sites. Quality control procedures will include proper record keeping, standard checks, and routine calibrations of the sampling and analytical equipment. These procedures include operating collocated samples greater than 10 percent of samples collected. For example, the SCAQMD is currently conducting a collocated sampling of its Rubidioux station using multiple samplers. This plan will be updated as appropriate to reflect the specific monitoring and analysis of the targeted pollutants in MATES-III.

3. Air Toxic Emission Inventory

The objective of this component is to develop a spatially and temporally resolved toxic emissions inventory for point, area, on- and off-road mobile sources. The toxic emissions inventory will be used to conduct regional and micro-scale modeling under MATES III.

The toxic emission inventory for MATES-III will consist 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, recreational vehicles, construction equipment, etc. Currently, the SCAQMD has a variety of databases and data sources that contain emissions data. Table 5 provides a general summary of the four existing toxic emissions inventory data sources maintained at the SCAQMD.

Table 5 SCAQMD Sources of Toxic Emissions Data

Data Source	Source Categories	Pollutants	Comments
Assembly Bill 2588	Point sources (-1200 facilities)	• 170+ carcinogenic and non-carcinogenic compounds • Reported once every 4 years	• Emissions updates since the year 2000. • Emissions based on material usage.
Annual Emissions Reporting (AER)	Point sources ≥ 4 tpy of VOC, NOx, SOx, or PM (-3000 Facilities)	• 6 criteria pollutants and 24 toxics • Reported annually	Emissions based on material usage only.
2003 AQMP inventory	• All source categories • Point source emissions developed from AER.	Carcinogens and non-carcinogens speciated from PM and V OC emissions	• ARB continually updates speciation profiles as data become available.
Rule development efforts and rule reporting requirements	• Select point sources • Select area sources	Carcinogens and non-carcinogens based on industry and source category.	• Development efforts for Rule 1468 and Proposed Rule 1469 • Reporting requirements for rules 461, 1421, 1469.

Proposed Approach

Point Sources – The AB2588 and AER databases listed in Table 2 will be used to develop the point source toxic inventory for MATES-III. The data collected in fiscal year (FY) 2002-03 (i.e., 7/1/2002 to 6/30/2003) will be used to estimate calendar year 2004 emissions. This database includes facilities emitting 4 or more tons per year of VOC, NO_X, SO_X, 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). There are approximately 3000 facilities in the program. Toxic emissions will be calculated by applying the latest ARB speciation profiles[1] to the hydrocarbon and particulate matter emissions.

Facilities in the AB2588 Program 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 as shown in Table 6. The reported toxics will be used directly in MATES-III emission inventory. The 2004 inventory for MATES-III will be developed from toxic emissions reported over the following FYs: 2000-01, 2001-02, 2002-03, and 2003-04.

Table 6 . Reported Toxic Emissions under the AB2588 Program

Acetaldehyde	1,2-Dichloropropane	Isocyanites & diisocyanates	POMs & PAH derivatives
Acrolein	1,3-Dichloropropene	Lead	Propylene oxide
Acrylonitrile	Diesel PM	Manganese	Quinoline
Ammonia	Dimethyl phthalate	Mercury	Selenium
Arsenic	1,4-Dioxane	Methanol	Sodium hydroxide
Asbestos	Ethyl benzene	Methyl chloride	Styrene
Benzene	Ethylene dibromide	Methyl chloroform	1,1,2,2-Tetrachloroethane
Beryllium	Ethylene dichloride	Methyl ethyl ketone	Sulfuric acid & oleum
1,3-Butadiene	Ethylene oxide	Methyl isobutyl ketone	Toluene
Cadmium	Fluorocarbons	MTBE	1,1,2-Trichloroethane
Carbon tetrachloride	Formaldehyde	Methylene chloride	Trichloroethylene
Carbonyl sulfide	Glycol ethers	Nickel	1,2,4-Trimethylbenzene
Chlorine	Hexachlorobenzene	p-Dichlorobenzene	Urethane
Chloroform	Hexachlorocyclohexanes	PAHs	Vinyl chloride
Chromium (hexavalent)	Hexane	PCBs	Xylenes
Copper	Hydrazine	Pentachlorophenol	Chlorodifluoromethane
Crystalline silica	Hydrochloric acid	Perchloroethylene	
Di(2-ethylhexyl)phthalate	Hydrogen fluoride	Phosphorous	
Dioxins & furans	Hydrogen sulfide	Phosphorous compounds	

In order to prepare the point source inventory, emissions data for each facility will be 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 will be used in conjunction with the reported data to assign the appropriate SCC codes and develop the inventory at the SCC level.

Area Sources – The area source emissions developed for the 2003 AQMP[2] and extrapolated to the year of interest will be used for MATES-III. Emissions will be spatially allocated to 2 km by 2 km grids using spatial surrogates. Toxic emissions will be calculated by applying the latest ARB speciation profiles[1] to the hydrocarbon and particulate matter emissions.

Per 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, we will develop "bottom-up" inventories using reported emissions or activity. A bottom-up inventory will also be developed for auto body shops.

On-road Mobile Sources – On-road emissions are the product of emission factors and vehicular activity. The emissions developed for the 2003 AQMP[2] and extrapolated to the calendar year 2004 will be used for MATES-III. For the 2003 AQMP, ARB's EMFAC2002 emission factors[3] were used and link-based traffic volumes and speeds were obtained from the Southern California Association of Government (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_X, PM, CO, and SO_X). Toxic emissions will be calculated by applying the latest ARB speciation profiles[1] for mobile sources to the hydrocarbon and particulate matter emissions.

Off-road Mobile Sources –The off-road emissions developed for the 2003 AQMP[2] will be 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-sponsored studies. Emissions will be spatially allocated to 2 km by 2 km grids using spatial surrogates. Toxic emissions will be calculated by applying the latest ARB speciation profiles[1] for off-road mobile sources to the hydrocarbon and particulate matter emissions.

Key Tasks

Protocol for Inventory Development – Develop a detailed emission inventory protocol for review by the technical committee. The protocol will include the list of pollutants to be inventoried; the proposed inventory methods; samples of the tables, charts, and maps to be used to summarize the emissions; and an outline for the technical report.

Basin-wide Toxics Inventory – Develop a county-wide toxic inventory by major source category grouping.

Gridded Toxics Inventory – Develop maps of gridded toxic emissions.

Emissions Inventory Technical Report – A complete report documenting the inventory methods and summarizing the results will be prepared.

Schedule and Deliverable

Efforts to develop the inventory protocol will begin January 2004 and the protocol will be available for review by March 2004. The basin-wide toxic inventory will be completed by October 2004 and the gridded toxics inventory will be completed by January 2005. This component of the study should be completed by March 2005 with a report summarizing the findings.

References

1. ARB speciation profiles can be viewed or downloaded from the following ARB link: http://www.arb.ca.gov/emisinv/speciate/speciate.htm.
2. A copy of the 2003 AQMP can viewed or downloaded at the following SCAQMD link: http://www.aqmd.gov/aqmp/AQMD03AQMP.htm.
3. EMFAC2002 can be obtained at the following ARB link: http://www.arb.ca.gov/msei/on-road/latest_version.htm.

4. Dispersion Modeling

The objective of this portion of the study is to develop air dispersion modeling tools to estimate cumulative air toxic impacts in the South Coast Air Basin. The modeling tools will be used in the risk assessment portion of the study described in the next section.

For many years, the SCAQMD utilized Gaussian dispersion models recommended by the - U.S. EPA to perform, facility toxic risk assessments. These dispersion models simulate pollutants emitted from a stack and track their impacts at various specified downwind receptors. While the Gaussian models are recognized tools for estimating air toxic . impacts from individual facilities, they do not readily provide an analysis of impacts from regional sources such as motor vehicles. In order to estimate cumulative air toxic impacts from all sources a regional dispersion model is needed. The regional dispersion model, by itself, would not be able to address localized impacts. However, a combination of a regional dispersion model with a model that can handle localized impacts would appropriately address cumulative air toxic impacts.

This section describes air dispersion models.

Proposed Approach

It is important to maintain consistency in the modeling methodology and evaluation of toxic risk. In the MATES II study, the Flexible Chemistry version of the Urban Airshed Model (UAM) with the TOX chemistry module was used to estimate concentrations of toxic air contaminants (TACs) in the South Coast Air Basin (Basin). To maintain consistency between MATES II and MATES III, the UAM-TOX model will serve as the primary tool to determine regional dispersion of toxic emissions. The UAM dispersion platform is however one of several regional dispersion models that are available for use in this analysis.

In response to critical assessments of the regional modeling conducted for the 2003 AQMP, the District has committed to move towards the use of the newer modeling platforms. CAMx and CMAQ (the U.S. EPA's MODELS3 framework) will be evaluated in the development of the modeling protocol to determine the added benefit of including these algorithms in the risk assessment phase of the analysis. The dispersion formulation used in both CAMx and CMAQ is designed to integrate with the current state-of-the-art numerical prognostic meteorological models to enhance mass consistency in model performance. Differences in the layer structuring between the UAM and the newer models will need to be carefully evaluated to determine the impact to modeled ground level concentrations.

The UAM will be exercised for a full year of meteorological data. Staff will develop meteorological data for the months in which the MATES-III monitoring program is conducted. A significant effort will be undertaken to develop modeling data that is portable and can be used by several dispersion platforms. To meet this need, meteorological observational data and modeling simulations using three dimensional numerical and diagnostic model simulations will archived on a daily basis. The available meteorological modeling platforms that are currently being considered for this project include the NWS ETA-12 km, the Mesoscale Meteorological Model (MM5) and CALMET. Prior to the start of the program, an effort will be undertaken to convene of the SCOS97 Meteorological Working Group (MWG) to solicit recommendations on the choice of modeling platforms and the availability of alternate model output.

The meteorological modeling data sets are proposed to satisfy the input requirements of the UAM modeling system as well as those of CAMx and CMAQ. The data will be evaluated in a near real-time mode to avoid both the development of a significant backlog and to utilize current weather discussions and analysis data to adjust model performance in light of the ongoing situation. This activity is expected to reduce the need for extensive post event evaluation that is often characteristic of modeling analyses of historical events.

For permitted facilities and other facilities such as gasoline service stations where specific addresses are available, ISCST3 or AIRMOD may be used in conjunction with the regional model to provide a sub-grid impact of TACs to a specific community. The meteorological data used for these prospective analyses would be extracted directly from the meteorological data set used for the annual impact assessment. The outputs from the point source model will be combined with the results of the UAM to provide cumulative air toxic impacts on a grid basis or by receptor. (The assumption is that the regional modeling results are fairly similar-over a two to five kilometer basis.) Staff will assess whether this assumption is appropriate when calculating TAC impacts on an annual basis.

There are currently other regional dispersion models (CALPUFF) which treat point source releases as plumes until the plumes disperse horizontally to the size of the regional grid model resolution. The "plume-in-grid" treatment is included in such models as the UAM-V and CAMx. Staff will examine these models to determine the viability of these models for the current study.

The estimated TAC concentration fields will be used quantify exposure.

Key Tasks

1. Evaluate Modeling Tools for Point Sources Other Regional Sources-

Examine current regional models and chemistry modules to determine how such models can be adapted for the current study.

Examine current meteorological modeling platforms and determine how the models can be adapted for the current study.

Examine the applicability and data requirements of the point source and plume in grid model to treat point source releases explicitly on a sub-grid scale level.

Prepare a modeling protocol describing the models evaluated and the model to be used for the study. The protocol will also discuss the approaches to be used in modeling facilities of interest (i.e., receptor location and spacing, number of TACs to evaluate, and stack parameters needed for the study).

Deliverable and Schedule: Modeling Protocol within six months from start of study. The Modeling Protocol will be provided to the MATES-III Technical Advisory Committee for review and comments.

2. Prepare Meteorological Inputs for the Modeling Analysis

Gather all relevant meteorological data during the period the air toxic monitoring is conducted.

Prepare meteorological inputs for the regional and point source models. This includes 3-dimensional wind fields and mixing heights for the UAM and stability parameters for the point source model.

Review and incorporate the available emissions data and develop emission inputs needed by the UAM and point source model.

Deliverable and Schedule: On-going from start of study. Summary of the meteorological and emissions data will be provided to the MATES-III Technical Advisory Committee for review and comments.

3. Model Evaluation and Application

Evaluate the model performance using the TAC monitoring data collected during the study.

Based on the concentrations simulated, calculate cumulative risk using available unit health risk factors and Reference Exposure Levels.

Calculate other air toxic indicators identified by the MATES-III Technical Advisory Committee.

Deliverable and Schedule: To be completed six months from the final quality assurance of the TAC monitor data. Results will be summarized and documented in a working paper. The working paper will be provided to the MATES-III Technical Advisory Committee for review and comments.

5. Risk Assessment

The overall objective of this part of the study is to assess the health risks of the Basin's population to all pollutant sources in the study domain. To maintain consistency between the MATES-II and MATES-III analyses, the estimation of risk will follow the methodology employed in the MATES-II study. This will be performed at two different scales, a region-wide assessment assuming spatial resolution of two kilometers and neighborhood or sub-grid scale assessment for those areas experiencing relatively high levels of risk or exposure. In accomplishing this objective the latest available information and techniques will be utilized.

There are four basic steps in identifying health risks from toxic air contaminants (TA Cs):

Hazard identification, dose-response assessment, exposure assessment, and risk characterization.

Hazard identification involves identifying pollutants and qualitatively determining their potential adverse health effects. Dose response is the process of quantitatively determining the relationship between exposure to a pollutant and the resultant health effect. Exposure assessment estimates the public's exposure to emitted pollutants. Exposure has numerous pathways including inhalation, ingestion, and dermal absorption. Risk characterization, the last step in the risk assessment process, is the integration of the quantified health effects of the emitted pollutants and the public's exposure to those pollutants.

Proposed Approach

The proposed approach for the risk assessment portion of the study involves several tasks. These tasks are outlined below.

Establish Dose Response Levels

A review will be made of the dose-response levels used in MATES-II and OEHHA will be consulted for applicability and updates.

A table will be provided to the MATES-III Technical Advisory Committee, for their consideration, listing each TAC and its Chemical Abstract Service (CAS) number, unit risk factor (where available), and acute and chronic Reference Exposure Levels (where available).

Assess Exposure

The reader is referred to the dispersion modeling component of this work plan for a discussion of the exposure assessment.

Characterize Risk

A point estimate approach to exposure and risk modeling has traditionally been employed by the SCAQMD. Point estimate models provide single estimates of either cancer risk or hazard index which can then be compared to acceptable risk or exposure levels.

As in MATES II, annual average values for air toxics will be computed for each modeling cell and will be used to estimate exposures. Risks from carcinogenic substances will be estimated using OEHHA unit risk values and an assumed 70 year lifetime exposure to the annual averages.

A hazard index for each substance with a chronic REL will also be calculated based on annual average levels. A Hazard Index for substances with an acute REL will be calculated based on peak short term levels (generally one-hour levels).

Presentation of Results

The exposure and risk results will be incorporated and displayed on the SCAQMD's GIS system, which contains ARCINFO, ArcView, and all the necessary physical and socioeconomic databases for southern California. The use of GIS will facilitate the presentation of results on varying scales ranging from a Basin-wide view down to individual neighborhoods.

Key Tasks

1. Establish Dose Response Levels

Prepare table of MATES III TACs listing each TAC, its Chemical Abstract Service (CAS) number, unit risk factor (if available), and acute and chronic reference exposure levels (if available).

Deliverable and Schedule. Table to be completed within six months from the start of the study. The table will be provided to the MATES-III Technical Advisory Committee for review and comments.

2. Assess Exposure

Task to be completed per discussion on Dispersion Modeling Analysis (see previous section).

Deliverable and Schedule: Task to be completed six months from the final quality assurance of the TAC monitor data. Results will be summarized and documented in a working paper. The working paper will be provided to the MATES-III Technical Advisory Committee for review and comments.

3. Characterize Risk

Estimate lifetime cancer risks.

Estimate Hazard Index for chronic exposures.

Estimate Hazard Index for acute exposures.

Deliverable and Schedule: Results will be summarized and documented in a working paper. The working paper will be provided to the MATES-III Technical Advisory Committee for review and comments.

4. Presentation of Results

Develop sample display of results through the use of visualization tools such as ARCINFO and ARCVIEW.

Prepare results for presentation.

Deliverable and Schedule: Sample presentation formats will be prepared and presented to the MATES-III Technical Advisory Committee for comments. Task to be completed with the completion of the modeling analysis. Results will be presented in a working paper of the modeling analysis. The working paper will be provided to the MATES-III Technical Advisory Committee for review and comments.

6. Historical Trends in Toxic Air Contaminants and Associated Cancer Risks

The objective of this portion of the study is to 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.

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 2. 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 7 lists the toxic air contaminants (TACs) sampled; carcinogens are identified with an asterisk.

Figure 2 ARB toxic monitoring sites in the South Coast Air Basin and vicinity

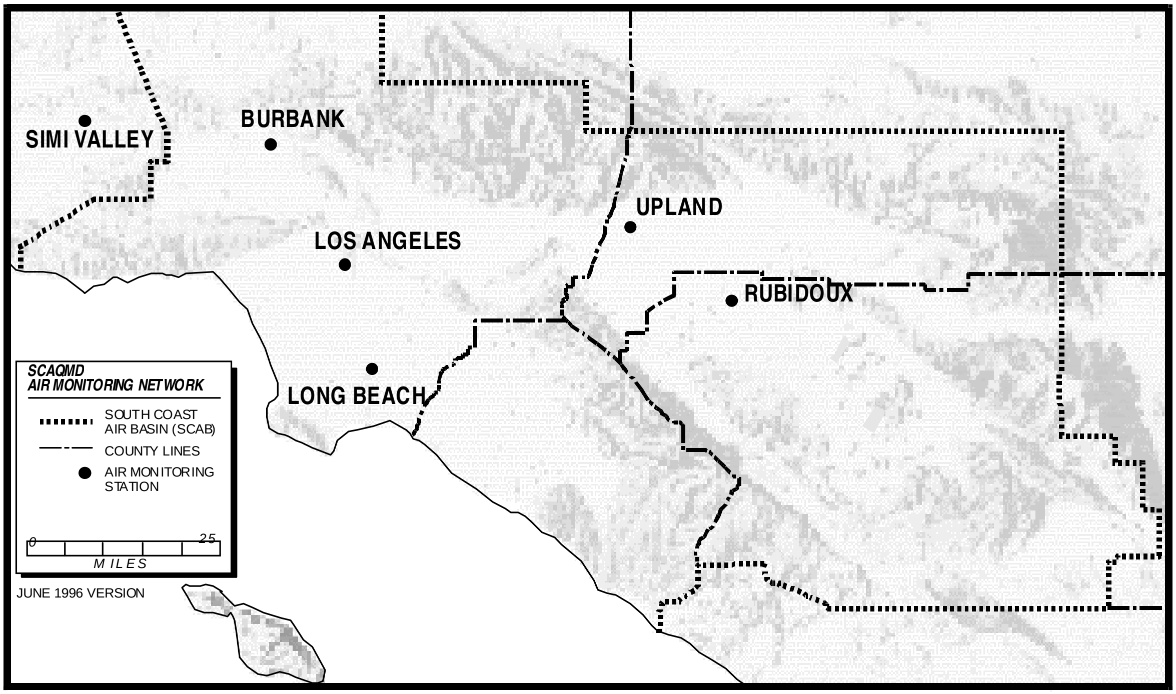


Table 7 Toxic Air Contaminants Measured by the Air Resources Board.

Toxic VOCs		Toxic PM	
Acetaldehyde*	Methyl Chloroform	Aluminum (Al)	Molybdenum (Mo)
Benzene*	Methyl Ethyl Ketone	Antimony (Sb)	Nickel (Ni)*
1,3-Butadiene*	MTBE*	Arsenic (As)*	Phosphorous (P)
Carbon Disulfide	Methylene Chloride*	Barium (Ba)	Potassium (K)
Carbon Tetrachloride*	Perchloroethylene*	Beryllium (Be)*	Rubidium (Rb)
Chlorobenzene	Styrene	Bromine (Br)	Selenium (Se)
Chloroform*	Toluene	Cadmium (Cd)*	Silicon (Si)
meta-Dichlorobenzene	Trichloroethylene*	Calcium (Ca)	Strontium (Sr)
ortho-Dichlorobenzene	meta-Xylene	Chlorine (Cl)	Sulfur (S)
para-Dichlorobenzene*	meta/para-Xylene	Chromium (Cr)	Tin (Sn)
cis-1,3-Dichloropropene	ortho-Xylene	Cobalt (Co)	Titanium (Ti)
trans-1,3-Dichloropropene	para-Xylene	Hexavalent Chromium*	Uranium (U)
Ethyl Benzene		Copper (Cu)	Vanadium (V)
Ethylene Dibromide*		Iron (Fe)	Yttrium (Y)
Ethylene Dichloride*		Lead (Pb)*	Zinc (Zn)
Formaldehyde*		Mercury (Hg)	Zirconium (Zr)
Methyl Bromide		Manganese (Mn)	

* carcinogen

Proposed Approach

Using available data from the ARB network, as well as from the MATES Studies and other sources, 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. Using available unit risk factors developed by OEHHA, show temporal trends in inhalation cancer risks.

Key Tasks

Order Data from the ARB – Data, through 2001, are currently available from the ARB. The 2002 data will become available in January 2004.

Data Analysis Plan – Develop a data analysis plan for review by the technical committee. The plan will include stations to be analyzed and their period of records, the statistical tests to be performed, samples of the tables and charts to be developed, and an outline for the technical report.

Analyze Ambient Air Quality Data – Data analysis will begin as soon as 2002 data are available from the ARB. Prepare tabular and graphical summaries to illustrate the results.

Report Preparation

Schedule and Deliverable

Efforts will begin as soon as the 2002 data becomes available from the ARB. The data analysis plan will available for review by February 2004. This component of the study should be completed by May 2004 with a report summarizing the findings.