SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Enhanced Air Toxics Exposure Study for the South Coast Air Basin

Application to the U.S. Environmental Protection Agency's Solicitation: "National Air Toxics Monitoring Program – Community Assessments"

OAR-EMAD-03-08, Amendment 002

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ENHANCED AIR TOXICS EXPOSURE STUDY FOR THE SOUTH COAST AIR BASIN

PROPOSED WORK PLAN

Pursuant to the U.S. Environmental Protection Agency's (EPA) solicitation for pilot demonstration projects under the "National Air Toxics Monitoring Program – Community Assessments – Request for Applications" (OAR-EMAD-03-08, Amendment 002), the South Coast Air Quality Management District (SCAQMD) proposes to conduct a comprehensive community assessment program that would enhance an intensive regional air toxics exposure study currently underway in the South Coast Air Basin. The proposed project will consist of community studies to identify how emissions from industrial and transportation sources are dispersed into the surrounding community. These measurements will partially be used to address community exposure and risk issues within the South Coast Air Basin, assess model performance, and complement the regional exposure study.

This work plan is prepared for U.S. EPA's consideration and outlines how the project will meet the specific objectives of the solicitation. The following sections further describe the work plan, proposed budget and timeline for completion.

OBJECTIVE

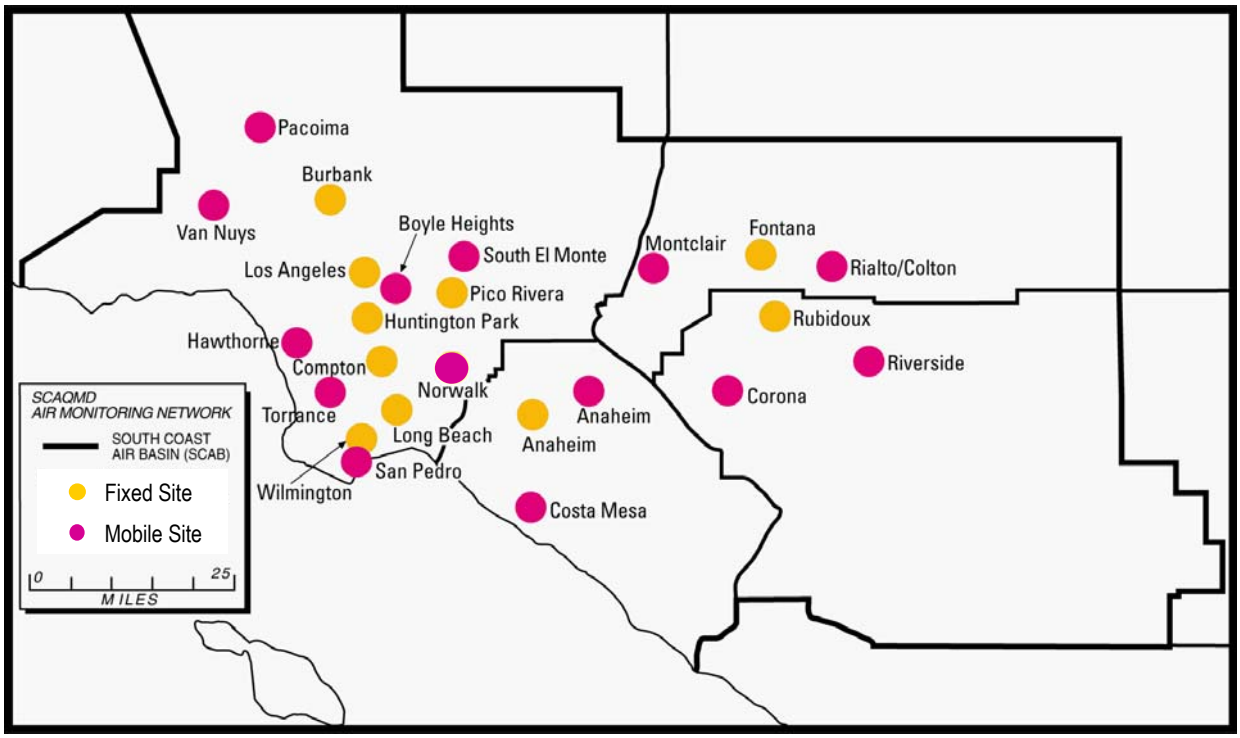
The objective of this proposed study is to enhance the regional air toxics exposure study currently underway in the South Coast Air Basin (Basin). The proposed study will focus on three areas of concerns: 1) the Basin's general aviation airports located adjacent to residential communities; 2) the effectiveness of hexavalent chromium regulations and characterizing current hexavalent chromium levels in the Basin; and 3) monitoring facilities in a sub-region of the Basin (specifically, the Sun Valley area located in the northwestern portion of the Basin). The proposed study will greatly enhance the Multiple Air Toxics Exposure Study (MATES-III) currently underway to measure ambient air toxic levels in the Basin. The objective of MATES-III is consistent with U.S. EPA's National Air Monitoring Strategy and Air Toxic Strategy goals and objectives "to provide greater spatial resolution that could capture important concentration gradients across communities; detect impact signatures from differences between areas subjected to stationary, area, or mobile sources, and address in-depth specific community exposure and risk issues."

BACKGROUND

The Basin is a highly urbanized area, home to about 16 million people who own and operate about 11 million motor vehicles, and contains some of the highest concentrations of industrial operations in the country. The Basin is one of the worst areas for ozone and particulate matter air quality in the U.S. In 1986, the SCAQMD conducted the first Multiple Air Toxics Exposure Study (MATES) to determine Basinwide 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 study, MATES-II, (SCAQMD, 2000) was conducted representing one of the most comprehensive air toxics measurement programs conducted in an urban environment. MATES-II included a comprehensive monitoring program consisting of ten fixed sites sampling 40 known air toxic compounds, an updated emissions inventory of toxic air

contaminants, and a regional air toxics modeling effort to characterize health risks from toxic air pollutants. Additional sampling was also conducted during MATES-II at 14 various locations near source emissions utilizing two mobile sampling platforms. The locations of the 10 fixed and 14 mobile sites in MATES II are shown in Figure 1. Two of the ten sites are part of the U.S. EPA's Photochemical Assessment Monitoring Stations (PAMS) and seven of the ten sites are part of the National Ambient Monitoring Stations (NAMS) network. NAMS and PAMS ambient data are uploaded to the U.S. EPA Air Quality System (AQS).

Figure 1. MATES-II monitoring network.



A third MATES study (MATES-III) was initiated in February 2004 and is slated to be completed in about 18 months. This is the most comprehensive air toxics exposure study to-date with twice the amount of samples being collected compared to MATES-II. The same ten fixed sites used in MATES-II (Figure 1) are used for MATES-III. Trends and general risk levels in the Basin will be calculated as part of MATES-III based on an updated air toxic emissions inventory and the monitoring data.

The high population density within the Basin often results in little separation between source emitters and neighboring communities. In addition, there is heightened community awareness within the Basin of the potential air toxic impacts from nearby sources. These concerns are continually presented at townhall meetings the SCAQMD holds in communities within the Basin. Programs such as MATES are designed to monitor and characterize toxic emissions over the entire Basin. A limited number of communities located near industrial sources and large mobile sources (such as marine ports and commercial airports) will be studied under MATES-III. Given the significant number of industrial sources in the South Coast Air Basin, additional

funding assistance from the current U.S. EPA solicitation would enhance the MATES-III program.

STATEMENT OF WORK

The proposed work effort outlined above would be accomplished in eight tasks as follows:

Task 1. Prepare Technical Work Plan

A technical work plan will be prepared outlining the technical approach for selecting monitoring sites surrounding each emission source of interest, sampling methodologies, proposed analysis of the field samples, calculations of exposure and risk, and approaches to conduct the model-to-monitor relationships. The proposed sources include general aviation airports, industrial sources, and mobile-dominant sources such as freeways. The work plan will outline the use of historical wind roses to determine suitable upwind and downwind locations for each of the proposed source areas. In addition, the work plan will describe the activities underway in MATES-III since the proposed study will complement the MATES-III efforts and how the two studies complement each other. The work plan will provide more detailed descriptions of the sampling protocols and laboratory analysis methods to be used in analyzing the field samples and the computer modeling approaches proposed for this study. A Quality Assurance Plan, as required under the U.S. EPA solicitation, will be provided as part of the work plan. The detailed work plan will be prepared within one month from the start date of the project and submitted to U.S. EPA for review and comments. Comments from the U.S. EPA will be integrated into a final work plan.

Task 2: Conduct Field Monitoring at Airports and Surrounding Communities

The proposed 12-month monitoring will be conducted at a minimum of two locations surrounding general aviation airports and industrial sources. It is envisioned that the two locations would complement the 12-month MATES-III monitoring. As such, the two locations will be in areas where MATES-III monitoring has not been conducted. At this time, it is proposed that monitoring be conducted in communities surrounding the two largest general aviation airports in the South Coast Air Basin (Van Nuys and Santa Monica). The area surrounding Van Nuys Airport consists of various industrial sources and motor vehicle sources as well. The communities surrounding Santa Monica Airport provide a different air quality perspective in that they are mostly suburban and are mainly influenced by mobile sources and the airport activities. This task includes laboratory analysis of the field samples and preparation of preliminary data reports for the final report. All data will be uploaded to the U.S. EPA AQS on a quarterly basis.

Task 3: Assess Rule-Effectiveness of SCAQMD Hexavalent Chromium Regulations and Characterize Current Hexavalent Chromium Levels in the South Coast Air Basin

It is proposed that under this task, an assessment of the effectiveness of SCAQMD Rule 1469 - Hexavalent Chromium Emissions from Chrome Plating and Chromic Acid Anodizing Operations be conducted. Historical hexavalent chromium data collected through special ambient monitoring of the top ten facilities that use chromium will be assessed and documented. In addition, under MATES-III chromium sampling and analysis will be evaluated and assessed.

This information will be used to assess the effectiveness of Rule 1469. This task will be completed within the 12-month monitoring period described in Task 2.

Task 4. Conduct Sub-Regional Air Toxics Monitoring in the Sun Valley Region
Under this task, SCAQMD staff is proposing to complement the MATES-III microscale element with additional air toxics monitoring near various industrial sources in the Sun Valley region of the Basin. The Sun Valley region (located in the northwestern portion of the Basin) contains several sources of potential air toxic emissions including a landfill, recycling facilities, industrial facilities, and is located downwind from a commercial airport. The proposed monitoring will be conducted at a minimum of two locations in the target area over a three to four month period of the project. The monitoring locations will be selected to determine the air toxic impacts on the residents and schools within the Sun Valley area and will complement the regional monitoring done for the MATES-III. Specifically, VOC canisters and samplers for chromium and other potential toxic air contaminants will be collected at the additional sampling sites. A full complement of sampling equipment will be provided under MATES-III to characterize the region.

Task 5. Develop Air Toxics Emissions Inventories
A 2004-05 base-year emissions inventory of toxic air contaminants will be developed as part of the overall MATES-III. The base-year inventory will be used in the computer modeling outlined in Task 6. In addition to the base-year emissions inventory, emissions inventories for 2002, 2005, and 2008 will be developed and submitted to U.S. EPA as part of the National Toxics Inventory as required under the U.S. EPA solicitation.

Task 6. Conduct Computer Simulation Modeling
Appropriate computer modeling will be conducted under this task and the computer model results will be compared to the ambient measurements collected under Tasks 2, 3, and 4. The results of the computer simulation modeling will be compared to computer model results from MATES-III. The description of the computer simulation models will be provided in the detailed work plan prepared under Task 1. This task will be completed within five months after completion of the 12-month monitoring.

Task 7. Estimate Exposure and Risk Values
This task entails the calculation of exposure and risk resulting from the detailed analysis of the monitoring data collected under Tasks 2, 3, and 4 and the modeling analysis conducted under Task 6. The California Office of Environmental Health Hazard Assessment (OEHHA) or U.S. EPA approved unit risk factors (URF) will be used to estimate potential cancer risk. The estimated risk values will be compared to the estimated potential risk calculated under MATES-III. Risk estimates will be reported by location and compared spatially surrounding the subject emission source. In addition, the risk estimates will be compared spatially with the MATES-III risk estimates. This task will be completed within three months after completion of the 12-month monitoring period, as outlined in Task 2.

Task 8. Prepare Draft and Final Technical Report
A technical report will be prepared describing the field monitoring program, the results of the computer simulation modeling, estimated exposure and risk values, and comparisons with

MATES-III and previous air toxic studies. A summary of results and findings will be provided. In addition, the technical report will provide a summary of the results from MATES-III. A draft technical report will be prepared within five months after completion of the 12-month monitoring period for review by U.S. EPA. Comments from U.S. EPA will be incorporated into a final technical report.

REQUIRED ELEMENTS OF PROPOSED STUDY

The following sections describe various aspects of the proposed study that meet the requirements of the U.S. EPA solicitation.

Air Toxics Monitoring

Up to three movable sampling platforms will be deployed in communities nearby each airport or facility of interest. Placement of the sampling platforms will partially be based upon historical wind patterns collected from the SCAQMD meteorological network. The SCAQMD is providing existing meteorological and sampling equipment to conduct the air toxics monitoring as part of MATES-III. Additional meteorological and sampling equipment is needed for the enhanced study proposed in this request. The request to U.S. EPA includes the acquisition of two containers to house the monitoring equipment in the event that suitable shelter space could not be secured.

Table 1 shows the chemical compounds to be monitored in this project including the chemical compounds required in the U.S. EPA solicitation and the most significant contributors to health risks found in previous studies in the Basin. Additional measurements that SCAQMD will be conducting are organic carbon, elemental carbon, and total carbon, as well as particulate matter (PM). Other compounds may also be reported since they are additionally captured in both the sampling and analytical protocols proposed to be used. Acrolein will not be included until U.S. EPA has formalized an appropriate method.

Table 1. Selected substances to be monitored.

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

Sampling Schedule and Ambient Data Review

Twenty-four hour integrated samples will be collected on a one in three day period. This schedule is identical to that being used in MATES-III and the U.S. EPA schedule for ambient PM sampling.

Current data from the SCAQMD air monitoring network stations include criteria pollutants and special study data from MATES-II and III will be compared to the data collected under this study. These data, along with data from the Photochemical Assessment Monitoring Stations (PAMS), $PM_{2.5}$ monitoring stations, and the California Air Resources Board (CARB) air toxics network will be reviewed for trend information and used as references for this proposed study.

Laboratory Analysis

Laboratory analysis of the samples collected will be conducted by SCAQMD staff. A variety of analytical methods to measure ambient chemical compounds (as provided in Table 2) will be utilized. All measurements conducted for this project and MATES-III follow protocols outlined for the National Air Toxics Trends System (NATTS) sites. All data analyzed will be reported to the U.S. EPA AQS on a quarterly basis (within 90 days after the end of each quarter).

Table 2. Proposed sampling and analysis methods.

Ambient Species	Sampling Method	Laboratory Analysis
Volatile Organic Compounds (VOCs)	Silica-Lined Canisters	Gas chromatograph (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)
PM_{10} and $PM_{2.5}$	High-Volume and Medium-Volume Quartz and Teflon 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
Elemental and Organic Carbon	PM_{10} and $PM_{2.5}$ Filters	Section of PM filter removed and analyzed on a laser based carbon thermal analyzer

Volatile organic compounds (VOCs) will be measured from air samples collected in silica-lined 6-liter canisters using a critical orifice to fill at a constant rate over a 3-hour time period. VOCs will be identified and measured using a gas chromatograph mass spectrometer (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 pre-concentrators attached to the gas chromatograph to enable continuous analysis.

Carbonyl compounds will be sampled by drawing air through a DNPH (2,4-Dinitrophenylhedrazine) cartridge. The carbonyl compounds undergo derivatization with DNPH, the derivatives are extracted using acetonitrile and 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 (PM) 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 in accordance with the U.S. EPA's Federal Reference Method (FRM). All PM samples will be collected upon quartz, cellulose, and teflon 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 energy dispersive x-ray fluorescence, inductively coupled plasma mass spectrometry (ICP-MS), and ion chromatography. Identification of ions within the PM samples will also be performed 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 a method and procedure known as thermal optical reflectance (TOR) to measure the OC and EC content of the filter.

All data collected in this study along with all MATES-III data will be submitted to the U.S. EPA Air Quality System (AQS) after review and validation.

Advanced Technologies

Optical based techniques such as aethelometers for particulates may be utilized. In addition, the SCAQMD recently acquired portable mass spectrometers that may be utilized in this study for continuous monitoring of certain toxic compounds. As part of MATES-III, sampling and analysis for polycyclic aromatic hydrocarbons (PAHs) such as naphthalene will be conducted on a limited basis. The analyses of atmospheric PAHs have been limited to specific special studies and have not been performed under a larger regional scale study. The results of this element of MATES-III will provide valuable information to U.S. EPA in planning future air toxics exposure studies.

Specific advanced technology sampling equipment will be further identified in the detailed Technical Work Plan as outlined in Task 1 of the Statement of Work.

Quality Assurance and Quality Control (QA/QC)

The SCAQMD is committed to achieving the highest possible data quality. 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 this 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 monitoring 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. The SCAQMD QA/QC plan will be updated as appropriate to reflect the specific monitoring and analysis of the targeted pollutants in the

proposed project. **This detailed quality assurance plan will be prepared and submitted to U.S. EPA prior to monitoring as outlined in Task 1 of the Statement of Work.**

Air Toxics Modeling

Point source dispersion modeling will be conducted as part of this proposed project and correlation with the MATES-III modeling and monitoring data will be used to assess annual average risk throughout the Basin and localized impacts at the neighborhood scale. Regional modeling is conducted under MATES-III to determine annual average concentrations of the toxic compounds and associated health risks. The analysis will use the flexible chemistry version of the Urban Airshed Model (UAM) with the UAM-TOX chemistry module to simulate the advection, dispersion and chemical reactions for each hour, for a 1-year period. The UAM-TOX modeling will use updated meteorological data acquired as part of the ambient monitoring and neighboring air district monitoring networks, PAMS upper-air wind and temperature profiling sites, National Weather Service (NWS) and other meteorological observation networks. The meteorological data will be processed using the CALMET meteorological model. The emissions data will reflect updates to all point and area sources including facility source profiles from the SCAQMD air toxics database and will also rely upon the latest CARB mobile emissions factors (EMFAC2002 Version 2.01 and the Off-Road Model). The regional emissions will be defined at a two kilometer grid resolution and the regional modeling will be conducted at a maximum grid resolution of 5 kilometers.

An example of the regional modeling results from MATES-II is shown in Figure 2. Figure 2 shows the spatial concentration pattern for hexavalent chromium estimated using the UAM-TOX model. Higher levels of hexavalent chromium are found closest to facilities using hexavalent chromium, and the concentrations drop off further away from these facilities.

Figure 2. Annual average hexavalent chromium concentrations for the South Coast Air Basin.

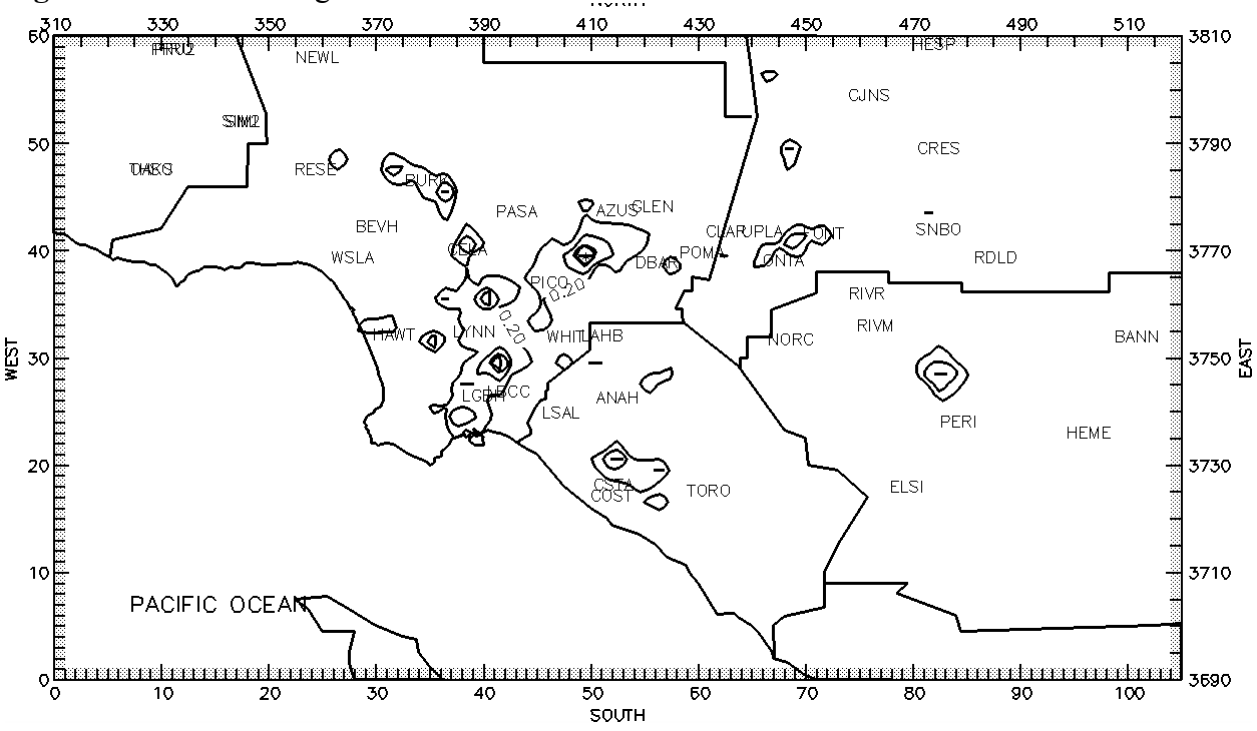
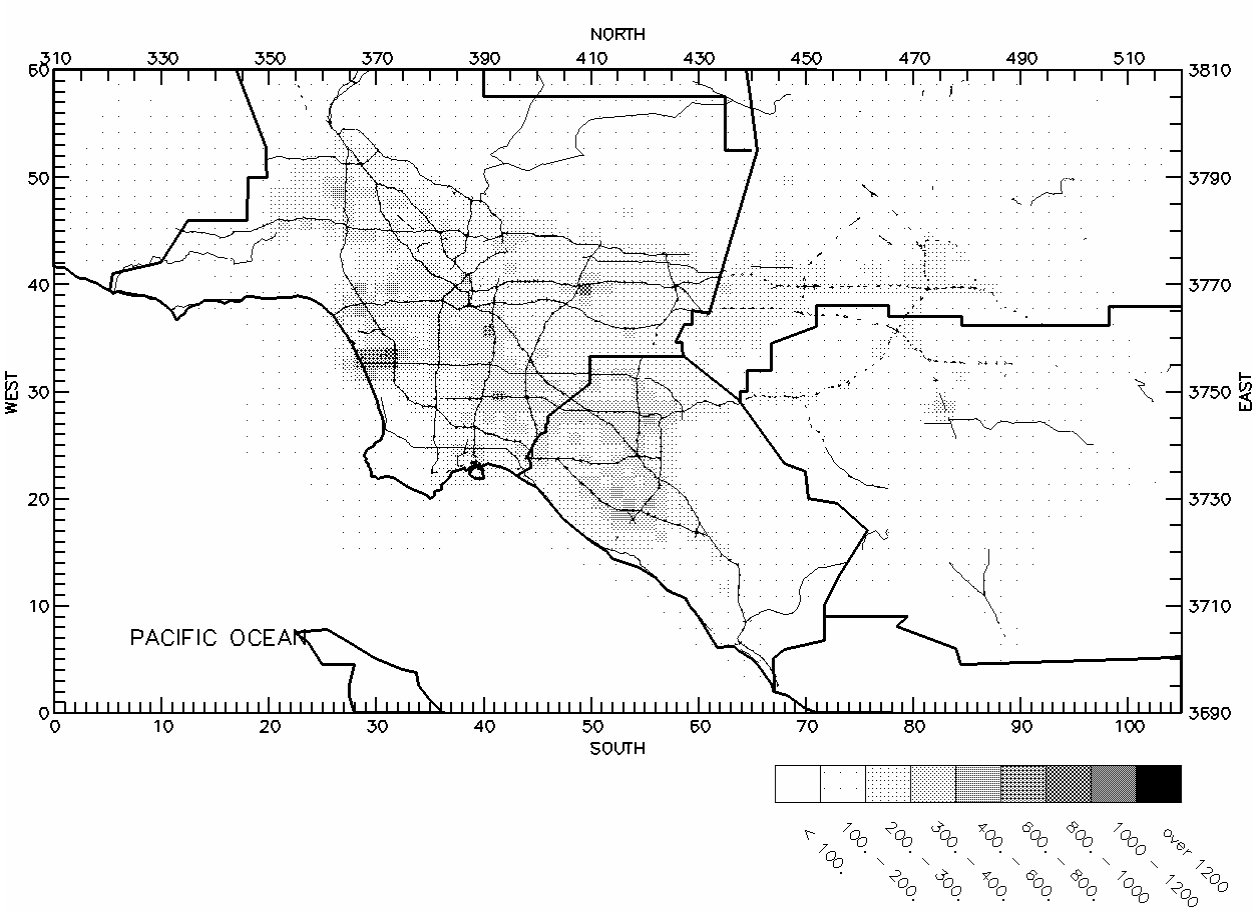


Figure 3 provides an example of the spatial pattern of estimated risk in the South Coast Air Basin based on the regional modeling conducted in MATES-II. As seen in Figure 3, estimated risk values (excluding risk from diesel combustion sources) are highest in areas with freeway interchanges and at commercial airports and marine ports.

Figure 3. Model estimated risk for the South Coast Air Basin from MATES-II (excluding diesel combustion sources).



Point source modeling to be conducted under MATES-III and this study will assess the impacts of the local sources on nearby neighborhood communities. The modeling will rely upon one of U.S. EPA's current stable of Gaussian dispersion models: ISCST3, ISCST-PRIME or AIRMOD. The analysis will also incorporate the use of GIS-based mapping. The model analyses will utilize the meteorological data analyzed for the regional simulation for the time period that is consistent with the ambient intensive toxic monitoring. The point source modeling results will be compared to the monitoring data collected. An analysis will be conducted to determine the feasibility of using point source modeling in assessing localized impacts.

SUMMARY

The SCAQMD staff believes that additional funding from U.S. EPA for MATES-III will provide valuable information regarding regional general aviation airport impacts in the South Coast Air

Basin and greater understanding of air toxic regulations in reducing air toxics exposure levels. The SCAQMD staff believes that this proposed study which enhances the MATES-III meet the five criteria outlined in the U.S. EPA solicitation.

Specifically, the MATES-III and the proposed study will characterize the current air toxics exposure levels in the South Coast Air Basin. With the ten regional air toxics monitoring sites in MATES-III, spatial differences in air toxic levels can be discerned. In addition, regional ambient air toxics modeling will provide a spatial picture of air toxic concentrations. The proposed study will provide a spatial characterization of air toxic levels around the general aviation airports and the chromium facilities.

As described in this work plan, the second and third criteria are addressed relative to characterizing community risk (study around general aviation airports and the Sun Valley region) and model to monitor relationships. Combining information from the proposed study with MATES-III as described in this work plan will provide a picture of urban gradients for the major air toxics. The measured and modeled concentration levels will be used to assess health risks.

Demonstrating advanced measurement and analysis technologies as described in the fourth criterion is addressed with the use of state-of-technology instruments to trace the source of certain air toxic contaminants. In addition, as part of MATES-III, polycyclic aromatic hydrocarbons (PAHs) will be sampled and analyzed. The additional information collected through these efforts will provide U.S. EPA a basis to craft future toxics monitoring programs.

Lastly, given the timing of the U.S. EPA solicitation and the need for the SCAQMD to conduct the MATES-III, the two will complement each other. The proposed study will enhance the understanding of air toxics exposure in the South Coast Air Basin from sources that the MATES-III could not study due to resource limitations. However, the requested funding from U.S. EPA represents about 20 percent of the total cost to conduct MATES-III and the proposed study.

REFERENCES

SCAQMD. "Multiple Air Toxics Exposures Study in the South Coast Air Basin (MATES II)." South Coast Air Quality Management District. March, 2000.

COST PROPOSAL AND DETAILED BUDGET