

**Multiple Air Toxics Exposure Study
in the South Coast Air Basin**

MATES III

-- DRAFT--

January 2008

**South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765**

**SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
GOVERNING BOARD**

Chairman:

WILLIAM A. BURKE, Ed. D.
Speaker of the Assembly Appointee

Vice-Chairman:

S. ROY WILSON, Ed. D.
Supervisor, Fourth District
Riverside County Representative

MEMBERS:

MICHAEL D. ANTONOVICH
Supervisor, Fifth District,
Los Angeles County Representative

BILL CAMPBELL
Supervisor, Third District
Orange County Representative

JANE W. CARNEY
Senate Rules Committee Appointee

RONALD O. LOVERIDGE
Mayor, City of Riverside
Cities Representative, Riverside County

JOSEPH K. LYOU, PH.D.
Governor's Appointee

GARY OVITT
Supervisor, Fourth District
San Bernardino County Representative

JAN PERRY
Councilmember
City of Los Angeles Representative

MIGUEL PULIDO
Mayor, City of Santa Ana
Cities Representative, Orange County

TONIA REYES URANGA
Councilmember, City of Long Beach
Cities Representative, Los Angeles County,
Western Region

DENNIS YATES
Mayor, City of Chino
Cities Representative, San Bernardino County

VACANT
Cities Representative, Los Angeles County
Eastern Region

EXECUTIVE OFFICER:

BARRY R. WALLERSTEIN, D.Env

AUTHORS AND CONTRIBUTORS

The following individuals contributed to the development, implementation, and reporting of this project.

South Coast Air Quality Management District

Executive Officer

Barry R. Wallerstein, D.Env.

Deputy Executive Officers

Elaine Chang, Dr. PH
Planning, Rule Development & Area Sources

Chung Liu, D. Env.
Science and Technology Advancement

Assistant Deputy Executive Officers

Laki Tisopulos, Ph.D., P.E.
Planning, Rule Development & Area Sources

Henry Hogo
Mobile Source Division, Science and
Technology Advancement

AUTHORS

Jean Ospital, Dr. PH Health Effects Officer
Joe Cassmassi Planning and Rules Manager
Tom Chico Program Supervisor

CONTRIBUTORS

Libby Ayers	Meteorological Technician
Dale Barber	Temporary Air Quality Instrument Specialist I
Steven Barbosa	Principal Air Quality Chemist
Tracy Basler	Temporary Laboratory Technician
Rene Bermudez	Principal Air Quality Instrument Specialist
Roger Bond	Air Quality Chemist
Malou Cartwright	Laboratory Technician
Wimol Chanjamsri	Chemist
Paul Chavez	Senior Air Quality Instrument Specialist
Tom Chico	Program Supervisor
Alice Chen	Temporary Chemist
Corie Choa	Principal Air Quality Chemist
Amy Chun	Temporary Laboratory Technician
Kris Collins	Temporary Laboratory Technician
Monique Davis	Temporary Chemist
Alicia Diaz	Laboratory Technician
Jorge Diez	Laboratory Technician
Rudy Eden	Senior Enforcement Manager, Laboratory Services
Lila Enriquez	Air Quality Instrument Specialist I
Philip Fine	Atmospheric Measurements Manager
Jeremy Graham	Temporary Laboratory Technician
Tracy Goss	Program Supervisor
Sam Guo	Air Quality Chemist

Refaat Hanna	Air Quality Instrument Specialist II
Sheri Hanizavareh	Student Intern
Sandra Hom	Senior Air Quality Chemist
Dan Houghton	Air Quality Chemist
Tai-Ching Hu	Senior Air Quality Chemist
Judy Hwa	Air Quality Chemist
Eddie Hwang	Temporary Laboratory Technician
Laura Julius	Temporary Chemist
Aaron Katzenstein	Senior Air Quality Chemist
Bong-Mann Kim	Air Quality Specialist
Cindy Kirkpatrick	Temporary Laboratory Technician
Mike Koch	Air Quality Instrument Specialist I
Sally Kou	Air Quality Chemist
Jong Hoon Lee	Air Quality Specialist
Kay Liu	Air Quality Chemist
Eddie Lui	Temporary Laboratory Technician
Jason Low	Quality Assurance Manager
Joe Macias	Temporary Air Quality Instrument Specialist I
Ricardo Morales	Air Quality Instrument Specialist I
Richard Parent	Air Quality Instrument Specialist II
Tom Parsons	Atmospheric Measurements Manager (retired)
Tuyet-le Pham	Air Quality Specialist
Ed Ruffino	Air Quality Instrument Specialist II
Ken Sanchez	Air Quality Chemist
David Sawyer	Principal Air Quality Instrument Specialist
Mike Shu	Air Quality Chemist (retired)
Steve Taw	Laboratory Technician
Solomon Teffera	Principal Air Quality Chemist
Lyovit Usares	Temporary Laboratory Technician
Brian Vlasich	Air Quality Instrument Specialist II
Thy Vo	Temporary Chemist
Jill Whynot	Director of Strategic Initiatives
Paul Williamson	Air Quality Chemist
Sumner Wilson	Principal Air Quality Instrument Specialist
Robert Yi	Air Quality Chemist
Xinqiu Zhang	Air Quality Specialist

MATES III Technical Advisory Group

<u>Member Name:</u>	<u>Affiliation:</u>
Greg Adams	L.A. County Sanitation Districts
Robert Blaisdell	Cal EPA Office of Environmental Health Hazard Assessment
Steven Cadle	General Motors
Judith Chow	Desert Research Institute
Steve Colome	Integrated Environmental Sciences
Bob Devlin	U.S. Environmental Protection Agency
Rob Farber	Southern California Edison
Dennis Fitz	Center for Environmental Research and Technology
John Froines	University of California, Los Angeles
Dan Greenbaum	Health Effects Institute
Debra Kaden	Health Effects Institute
Dean High	Consultant
Mike Lakin	Engine Manufacturers Association
Bill LaMarr	California Small Business Alliance
Angelo Logan	East Yard Communities for Environmental Justice
Fred Lurmann	Sonoma Technology
Melanie Marty	Cal EPA Office of Environmental Health Hazard Assessment
Rod Merl	City of Santa Monica
Dale Shimp	California Air Resources Board
Shankar Prasad	California Air Resources Board
Bill Quinn	California Council for Environmental and Economic Balance
Constantino Sioutas	University of Southern California
Samuel Soret	Loma Linda University
Mel Zeldin	Consultant

Table of Contents

EXECUTIVE SUMMARY	ES-1
1. INTRODUCTION	
Background.....	1-1
Objective.....	1-1
2. MATES III MONITORING PROGRAM	
Substances Monitored.....	2-1
Siting of Monitoring Stations.....	2-2
Ambient Sampling Schedule.....	2-2
Monitoring Sites.....	2-2
Monitoring and Laboratory Analysis.....	2-4
Findings.....	2-6
Cancer Risk Estimates	2-9
3. EMISSIONS INVENTORY DEVELOPMENT	
Introduction.....	3-1
Overview.....	3-1
Point Sources	3-2
Area Sources	3-2
On-Road Mobile Sources.....	3-3
Off-Road Mobile Sources.....	3-4
Summary of Toxic Emissions.....	3-4
Selected Emissions and Air Quality Changes Since MATES II.....	3-5
References.....	3-5
4. REGIONAL MODEL EVALUATION	
Introduction.....	4-1
Background.....	4-1
MATES III vs. MATES II: Key Modeling Assumptions	4-3
Modeling Results	4-3
Estimation of Risk.....	4-6
Evaluation	4-12
Reference	4-13
5. MICROSCALE STUDY	
Introduction.....	5-1
Site Selection	5-1
Microscale Sites and Sampling Periods.....	5-2

6. SUMMARY FINDINGS AND CONCLUSIONS	
Improvements to Ambient Monitoring	6-1
Improvements to Air Toxics Modeling.....	6-1
Key Findings.....	6-1
Discussion.....	6-2

Table No.	List of Tables Description	Page No.
ES-1	Substances Measures in MATES III	ES-2
ES-2	CMB Estimate of Diesel Particulate Compared to Emissions Inventory Ratio Methods	ES-4
ES-3	Modeled Risk Comparisons	ES-5
2-1	Substances Monitored in MATES III	2-1
2-2	MATES II Fixed Site Locations	2-3
2-3	Sampling and Analysis Methods for MATES III	2-5
2-4	2005 Emissions of Diesel PM and EC, tons/yr	2-9
2-5	Estimates of Average Diesel PM, ug/m ³	2-9
3-1	Commonly Used Spatial Surrogates	3-6
3-2	Broad Vehicle Classes Considered by EMFAC	3-6
3-3	Vehicle Activity Information for the Counties of the Basin	3-6
3-4	2005 Annual Average Day Toxic Emissions for the South Coast Air Basin	3-7
3-5	Cancer Potency Weighted Species Apportionment for 2005	3-8
3-6	Selected Emissions and Air Quality Changes Since MATES II	3-8
4-1	Summary Comparison of Key Modeling Considerations Between MATES III and MATES II	4-4
4-2	Toxic Compounds Simulated and Measured: 2005 Eight-Station Annual Average	4-5
4-3	County-Wide Risk	4-10
4-4	Risk from Individual Toxic Compounds	4-11
4-5	Comparison of the 2005 Network Averaged Modeled Risk to Measured Risk at the eight MATES III sites	4-12

5-1	Comparison of Observed Concentrations for the Microscale and Fixed Site Pair of Commerce and Huntington Park	5-4
5-2	Comparison of Observed Concentrations for the Microscale and Fixed Site Pair of Indio and Rubidoux	5-5
5-3	Comparison of Observed Concentrations of the Microscale and Fixed Site Pair of San Bernardino and Fontana	5-6
5-4	Comparison of Observed Concentrations for the Microscale and Fixed Site Pair of Sun Valley and Burbank	5-7
5-5	Comparison of Observed Concentrations for the Microscale and Fixed Site Pair of Santa Ana and Anaheim	5-8

List of Figures

Figure No.	Description	Page No.
ES-1	Map of MATES III Monitoring Sites	ES-7
ES-2	MATES III Air Toxics Risk	ES-8
ES-3	MATES III Air Toxics Risk	ES-8
ES-4	MATES III Model Estimated Risk	ES-9
2-1	MATES III Monitoring Locations	2-3
2-2	Average Concentrations of 1,3-Butadiene	2-11
2-3	Average Concentrations of Benzene	2-11
2-4	Average Concentrations of Perchloroethylene	2-12
2-5	Average Concentrations of Methylene Chloride	2-12
2-6	Average Concentrations of Formaldehyde	2-13
2-7	Average Concentrations of Acetaldehyde	2-13
2-8	Average Concentrations of Arsenic in TSP	2-14
2-9	Average Concentrations of Cadmium in TSP	2-14
2-10	Average Concentrations of Lead in TSP	2-15
2-11	Average Concentrations of Nickel in TSP	2-15
2-12	Average Concentrations of Hexavalent Chromium	2-16
2-13	Average Concentrations of PM ₁₀ Elemental Carbon	2-16
2-14	Average Concentrations of PM _{2.5} Elemental Carbon	2-17
2-15	Average Monitored Naphthalene Concentrations for MATES III Year 2	2-17
2-16	Average Concentration of PAHs for MATES III Year 2	2-18
2-17	Estimated 70-Year Risk from MATES III Year 1 Monitoring Data	2-18

2-18	Estimated 70-Year Risk from MATES III Year 2 Monitoring Data	2-19
3-1	Flow Diagram for On-Road Emissions Processing	3-9
3-2	Cancer Potency Weighted Source Apportionment for 2005	3-9
3-3	Cancer Potency Weighted Emission Comparison of MATES II and MATES III	3-10
4-1	MATES III Modeling Domain	4-2
4-2a	Annual Average Concentration Pattern for Diesel PM _{2.5}	4-7
4-2b	Annual Average Concentration Pattern for Benzene	4-7
4-2c	Annual Average Concentration Pattern for 1,3 Butadiene	4-8
4-2d	Annual Average Concentration Pattern for Total Formaldehyde	4-8
4-3	MATES III Simulated Cumulative Risk	4-9

**List of Appendices
(Separate Document)**

Appendix	Title
I	List of Substances and Their Associated Risk Factor
II	List of MATES III Technical Advisory Group Members
III	Monitoring and Laboratory Analysis Protocols
IV	Measurements of Ambient Naphthalene and Other PAHs
V	PM _{2.5} Particulate Bound Organic Compound Analysis
VI	Summary of Fixed Monitoring Site Data
VII	PM _{2.5} Source Apportionment Methodology
VIII	2005 Emissions by Major Source Category
IX	Air Toxic Regional Modeling