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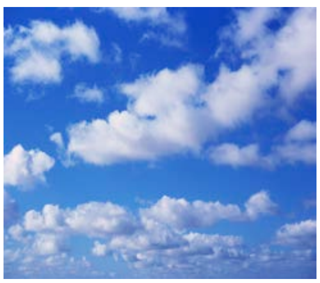

Evaluation of Air Toxics Monitoring in EPA Region 9

Final Report

Promoting Environmental Results

Through Evaluation

Acknowledgements

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Abbreviations

ADAM	California Air Resources Board's air quality database
ADEQ	Arizona Department of Environmental Quality
AMTAC	Air Monitoring Technical Advisory Committee
AMTIC	Ambient Monitoring Technology Information Center
APCD	Air Pollution Control District
AQS	Air Quality System
ASPEN	Assessment System for Population Exposure Nationwide
ATRA	Air Toxics Risk Assessment
BAAQMD	Bay Area Air Quality Management District
CAA	Clean Air Act
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
DAQEM	Department of Air Quality and Environmental Management
DEP	Division of Environmental Protection
DOH	Department of Health
DPR	Department of Pesticide Regulation
DVD	Digital Video Disk
EPA	Environmental Protection Agency
EPIC	Environmental Protection Indicators for California
ERG	Eastern Research Group
GIS	Geographic Information System
GPRA	Government Performance and Results Act
HAP	Hazardous Air Pollutant
IO	Inorganic
JATAP	Joint Air Toxics Assessment Project
MACT	Maximum Achievable Control Technology
MATES	Multiple Air Toxics Exposure Study
MDL	Method Detection Limit
MDN	Mercury Deposition Network
MIP	Measure Implementation Plan
NACAA	National Association of Clean Air Agencies
NATA	National Air Toxics Assessment
NATTS	National Air Toxics Trends Stations
NEI	National Emissions Inventory
NELAC	National Environmental Laboratory Accreditation Council
NESCAUM	Northeast States for Coordinated Air Use Management
NIST	National Institute of Standards and Technology
NDOT	Nevada Department of Transportation
OAQPS	Office of Air Quality Planning and Standards
OAR	Office of Air and Radiation
OEHHA	Office of Health Hazard Assessment

OMB	U.S. Office of Management and Budget
OPEI	Office of Policy Economics and Innovation
OPMO	Office of Program Management Operations
PAH	Polycyclic aromatic hydrocarbon
PAMS	Photochemical Assessment Monitoring Stations
PART	Program Assessment Rating Tool
POM	Polycyclic organic matter
PM_{10}	Particulate matter with a diameter less than or equal to 10 microns
$PM_{2.5}$	Particulate matter with a diameter less than or equal to 2.5 microns
PT	Proficiency Test
QA/QC	Quality assurance/ quality control
RATC	Regional Air Toxics Coordinators
SCAQMD	South Coast Air Quality Management District
SLT	State and Local Agencies and Tribes
STI	Sonoma Technology, Inc.
TAC	Toxic Air Contaminant
TAD	Technical Assistance Document
TSA	Technical System Audit
TO	Toxic organic
TSP	Total Suspended Particle
TTN	Technology Transfer Network
UATMP	Urban Air Toxics Monitoring Program
UP	Union Pacific
US	United States
VOC	Volatile organic compound
WASBAQS	Western Arizona/ Sonoma Border Air Quality Studies
WESTAR	Western States Air Resources Council

Evaluation of Air Toxics Monitoring in EPA Region 9

Introduction

Hazardous Air Pollutants (HAP), also known as air toxics, are pollutants that are known or suspected to cause cancer and other serious conditions including damage to respiratory, immune, and neurological systems, as well as having negative reproductive and developmental effects on those who are exposed at sufficient concentrations and durations. The Environmental Protection Agency (EPA) and a number of state and local agencies and tribes (SLT) across the United States (US) have air toxics monitoring experience extending back more than two decades. Building on this breadth of experience, EPA initiated the national air toxics monitoring program in 1998, which provided a consistent platform for continued air toxics monitoring activities across the nation.

EPA Region 9—comprised of SLTs in Arizona, California, Hawaii, and Nevada—has one of the largest and most well-developed sets of air toxics monitoring programs in the country. EPA Region 9 has also been cited as having areas with the highest level of risk from air toxics. This evaluation was launched to assess the design and implementation of locally- and nationally- funded air toxics monitoring activities across the region and identify ways in which program effectiveness can be improved based on the experiences of SLTs throughout EPA Region 9 and EPA Program Managers and staff. We conducted this review to pursue four key objectives:

1. Characterize air toxics monitoring programs across EPA Region 9, including identification of SLT objectives as well as those of EPA Region 9.
2. Assess the design of EPA Region 9's air toxics monitoring programs and the extent to which they meet stated objectives.
3. Distinguish ways in which EPA Region 9's monitoring programs contribute to the objectives of the national air toxics monitoring program and areas for improvement.
4. Identify potential performance metrics for evaluating air toxics monitoring programs at national and regional levels.

To conduct our work, we reviewed and analyzed key documents including various studies, reports, and strategic planning documents; interviewed officials from EPA headquarters and EPA Region 9; interviewed officials from nine Region 9 SLTs; and analyzed data from

EPA's Air Quality System (AQS) database. Appendix A provides the Quality Assurance Plan prepared for this evaluation and Appendix B contains the National Air Toxics Program Logic Model, which describes the relationships between air toxics resources, activities, outputs, customers, and outcomes, and is used by EPA to guide its management of the national air toxics program. Appendix C lists the EPA and SLT officials who contributed information for this evaluation; Appendix D lists the questions referenced during these interviews; and Appendix E lists the websites and documents analyzed for this evaluation.

The findings and recommendations presented in this report reflect the ideas and opinions of the EPA and SLT officials that contributed to the evaluation. In general, this report includes those ideas and opinions that were expressed by more than one party, rather than presenting a comprehensive description of all ideas provided by the contributing officials. This report is not intended to provide a full evaluation or audit of any SLT's air toxics monitoring program or of the national air toxics monitoring program. Rather, the report looks across the Region 9 agencies to identify and assess current air toxics monitoring activities and to identify potential areas for improvement.

Background

National Air Toxics Monitoring Program

EPA is charged with controlling federally listed HAPs. The current federal list is based on the HAPs defined in the 1990 amendments to the Clean Air Act (CAA), with several modifications (see Appendix F). The federal HAPs list is comprised of a variety of air toxics that fall into several categories: metals and inorganic compounds; volatile organic compounds (VOC); semi-volatile organic compounds (semi-VOC); aldehydes and carbonyls; and polycyclic organic matter (POM) and polycyclic aromatic hydrocarbons (PAH). The EPA Office of Air and Radiation (OAR) and the Office of Air Quality Planning and Standards (OAQPS) within OAR develop and manage the national air toxics program to control emissions of the federally listed HAPs. EPA regional offices, including EPA Region 9, support the execution of activities within their regions to meet the national air toxics program goals and objectives.

One component of the national air toxics program is the monitoring of ambient concentrations of air toxics. EPA outlined its goals and objectives for national air toxics monitoring in the Air Toxics Component of the 2004 National Monitoring Strategy and the 2005 National Ambient Air Monitoring Strategy.[1] The goal of national air toxics

[1] The 2005 National Ambient Air Monitoring Strategy largely summarizes the air toxics monitoring goals and objectives outlined in the Air Toxics Component of the 2004 National Monitoring Strategy. We reference the 2004 National

monitoring, as articulated in the 2004 National Monitoring Strategy, is "to support reduction of public exposure to HAPs." This goal is supported by three primary objectives and three sub-objectives (see Box 1).

Monitoring Strategy throughout this report because it provides more detailed descriptions of the objectives and sub-objectives for air toxics.

Box 1: Air Toxics Goals and Objectives from EPA's 2004 National Monitoring Strategy

Goal

To support reduction of public exposure to Hazardous Air Pollutants.

Objectives

Trends: Measurements of key HAPs in representative areas of the nation to provide a basic measure of air quality differences across cities and regions, and over time in specific areas. Trends measurements provide one basis for accounting program progress.

Exposure Assessments: Ambient measurements may serve as a surrogate for actual human exposure. However, understanding relationships between ambient concentrations and personal exposure and how human activities impact these relationships is critical for true exposure assessments. Therefore, ambient measurements support exposure assessments by providing ambient concentration levels for comparison with personal measurements. In addition, ambient measurements may also provide direct input into more detailed human exposure models that can be used to estimate actual human exposures.

Air Quality Model Evaluation: Measurements provide basic ground truthing of models which in turn are used for exposure assessment, development of emission control strategies, and related assessments of program effectiveness. In addition, measurements provide direct input into source-receptor models which provide relatively direct linkage between emission sources and receptor locations.

Sub-objectives

Program Accountability: Monitoring data provide perhaps the most acceptable measure of air program progress, i.e., observed changes in the atmosphere consistent with expectations of emissions strategies. Accountability is the closest direct match to measurement in addressing agency goals as outlined in the Government Performance and Results Act of 1993 (GPRA), and applies for all program (MACT, residual risk, area source, mobile source rules, local-scale projects).

Problem Identification: Measurements are used to uncover suspected air quality issues associated with a specific source or source groups, or confirm that a problem does not exist. Given the numerous HAPs and variation in issues across the nation, this particular objective is probably attributed to much of the historical toxics monitoring as well as the emerging local-scale projects studies.

Science Support: Routine network measurements often provide a backbone of basis measurements from which more expensive research studies can utilize in the areas of model process development, exposure studies, and health effects. By themselves, data studies associate adverse health impacts with observations, particularly where toxics measurements are grouped with multiple pollutants. In addition, given the current limited research efforts on methods development, the national air toxics program can also provide opportunities to test and advance measurement methodologies for air toxics.

EPA conducted National Air Toxics Assessments (NATA) in 1996 and 1999 to evaluate the distribution of air toxics across the United States. The NATA data were used to compile national emissions inventories on air toxics, estimate air toxics levels across the nation, estimate population exposures, and characterize public health risks. The 1999 NATA focused on 177 pollutants, which included 176 of the federally listed HAPs and diesel particulate matter.

EPA also seeks to estimate the national levels of air toxics through its National Emissions Inventory (NEI). NEI includes estimates of HAP emissions from major sources, area sources, and non-point sources. EPA has developed compilations of NEI data for 1996, 1999, and 2002.

To supplement the information produced through the NATA and the NEI, EPA launched a national air toxics data monitoring effort in 2004, which is referred to as the National Air Toxics Trends Station (NATTS) program. The NATTS program is currently comprised of 25 monitoring sites across the country that monitor for 21 air toxics (see Appendix G), and three SLTs in EPA Region 9 currently maintain NATTS sites (see Table 1). The Eastern Research Group, Inc. (ERG) and Sonoma Technology, Inc. (STI), under contract to EPA, are currently analyzing data collected through the NATTS program and the Urban Air Toxics Monitoring Program (UATMP). The UATMP, currently comprised of 59 air toxics sampling sites in US urban areas, is an EPA contract vehicle allowing SLTs to access EPA contractors to conduct some of their air toxics monitoring efforts. Some of the monitoring sites for the UATMP and the NATTS program overlap, although the UATMP includes only one site in EPA Region 9 (in Phoenix, Arizona) while the NATTS program has four sites in the region. The preliminary results of recent NATTS and UATMP data analyses were presented at the 2007 Air Toxics Data Analysis Work Shop and are available through EPA's Technology Transfer Network (TTN) Ambient Monitoring Technology Information Center (AMTIC).[2]

Table 1: NATTS Sites in EPA Region 9

Location of NATTS Site	Agency Maintaining NATTS Site
Los Angeles, California (downtown)	South Coast Air Quality Management District
Los Angeles Area, California (Rubidoux)	South Coast Air Quality Management District
Phoenix, Arizona	Arizona Department of Environmental Quality
San Jose, California	Bay Area Air Quality Management District

[2] The presentations from the 2007 Air Toxics Data Analysis Work Shop are located at http://www.epa.gov/ttn/amtic/airtox-daw-2007.html.

Air Toxics Monitoring in EPA Region 9

In addition to the NATTS monitoring program, many SLTs in EPA Region 9 manage local air toxics monitoring programs and participate in related national monitoring programs. Some SLTs maintain long-term[3] state- or local-scale air toxics trends networks which collect data on air toxics prevalent in their area. In addition, many SLTs regularly conduct short-term and community-scale studies which focus on specific air toxics or neighborhoods. These short-term and community-scale studies are often collaborative projects that involve many stakeholders, including representatives from EPA, state and local government, tribes, industry, academia, and the public, working together to address concerns around potential sources of air toxics and to develop mitigation strategies. Some SLTs in the region also participate in EPA's Photochemical Assessment Monitoring Stations (PAMS) program, which involves monitoring for ozone and its precursors. The target list of PAMS program compounds includes 58 VOCs (55 hydrocarbons and 3 carbonyls), nine of which are federally listed HAPs (see Appendix H).

SLTs in EPA Region 9 fund their air toxics monitoring activities through a number of mechanisms. EPA provides many SLTs with funding through CAA Section 103 and 105 grants. Under Section 105, EPA is authorized to provide grants to cover up to three-fifths of the of planning, developing, establishing, carrying out, improving, or maintaining of programs that address the prevention and control of air pollution, and the grant recipient is required to match a portion of the funds. Section 103 grants are provided to fund specific air pollution projects including research, investigations, experiments, demonstrations, surveys, studies, and training efforts. These grants do not include requirements for the SLTs to match the funds received. NATTS program monitoring sites are funded through Section 103 grants and some SLTs also receive Section 105 grants for PAMS sites and other air toxics monitoring projects. In addition, since 2004 EPA has invited eligible SLTs to apply for Section 103 community-scale monitoring grants that address current priorities of the national air toxics monitoring program. Table 2 lists community-scale monitoring grants awarded to SLTs in EPA Region 9 during the 2004 and 2005 grant cycles. SLTs in EPA Region 9 supplement the grant funds received from EPA through a variety of state and local funding mechanisms including taxes, permit fees, penalty fees, settlement funds, and vehicle fees. State and local trends networks are typically funded through these state and local funding sources, and SLTs fund short-term and community-scale air toxics monitoring projects through one of three funding models: state and local funding mechanisms, EPA community-scale monitoring grants, or a combination of EPA community-scale grant dollars and state and local funding mechanisms.

[3] For the purpose of this evaluation, long-term studies are defined as lasting longer than one year and short-term studies are defined as lasting approximately one year or less.

Table 2: EPA Region 9 Community-Scale Air Toxics Monitoring Grants, 2004-2005

Applicant and Grant Title	Year	Funding	Project Period
Placer County APCD: Roseville Rail Yard Air Monitoring Project	2005	$218,101	5/1/06 - 10/31/07
Nevada DEP: Development of Broadly Deployable Methods for Quantifying Atmospheric Hg Speciation in Urban and Rural Settings in NV	2005	$363,890	6/1/06 - 8/31/07
San Diego APCD: Untitled	2005	$457,000	6/1/06 - 6/30/08
City of Los Angeles, Harbor Dept, EMD: Port of Los Angeles Community-Based Air Toxics Exposure Study	2005	$250,000	7/1/06 - 1/31/08
South Coast AQMD	2004	$495,242	Through 10/31/07
Gila River Indian Community	2004	$122,914	Through 3/31/07
Salt River Indian Community	2004	$141,540	Through 1/31/08
Arizona DEQ	2004	$230,788	Through 9/30/06

Air Toxics Monitoring Methods and Quality Control

Air toxics monitoring programs can be generalized as having four components: sampling, laboratory analysis (processing of samples), data analysis, and data reporting and communication. Typically, air toxics samples are either collected using particulate matter filters, known as $PM_{2.5}$ or PM_{10} filters, or using canisters or cartridges that collect samples of gaseous toxics. The equipment and equipment settings used for sampling and laboratory analysis varies between SLTs in EPA Region 9 and nationwide.

One key aspect of air toxics monitoring is the methods used. A methods document typically provides a set of procedures and settings for using specified types of equipment to collect and process samples for a category of air toxics compounds (e.g., VOCs), and recommends quality assurance/ quality control (QA/QC) procedures. EPA promotes the standardization of methods for air toxics through the guidance provided in the air toxics technical assistance document[4] (air toxics TAD). The air toxics TAD provides detailed guidance on the use of EPA-recommended methods for NATTS program toxics, QA/QC procedures, and reporting to the national Air Quality System (AQS) database. The sets of methods recommended by EPA for use in the NATTS and other air toxics monitoring programs are known as the toxic organic (TO) compendium methods and the inorganic (IO) compendium methods. In addition to the QA/QC procedures specified in the TO- and IO-compendium methods, EPA manages a Proficiency Test (PT testing) program which allows

[4] The air toxics TAD is located at http://www.epa.gov/ttnamti1/files/ambient/airtox/toctad04.pdf.

laboratories to analyze NATTS program audit samples and compare their results with the actual quantities within the sample. SLTs conducting air toxics monitoring outside of the NATTS program sometimes use these TO- and IO- compendium methods and participate in the PT testing program, but alternatively may use other methods developed in-house or by external agencies or organizations and may follow QA/QC procedures different from those outlined in the air toxics TAD and the TO- and IO- compendium methods.

EPA also promotes standardization of air toxics monitoring through the identification of limits at which SLTs should be able to detect specific air toxics compounds. In the September 2007 version of the air toxics TAD, EPA defined the following related terms:

- Quantitation Limits: The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte.
- Detection Limits: Minimum concentration of an analyte that can be measured above instrument background.
- Sample Quantitation Limit (also known as a Practical Quantitation Limit): the lowest concentration of an analyte that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions.
- Method Detection Limits (MDL): the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.

EPA has set MDLs for many of the air toxics compounds monitored through the NATTS program, which are based on the use of the recommended TO- and IO- compendium methods.

Storing, Sharing, and Using Air Toxics Data

EPA maintains the AQS database as a repository for national air quality data, including air toxics datasets, and specifies procedures in the air toxics TAD for flagging data points in regards to how they compare with quantitation and detection limits. The AQS database has a data entry and retrieval interface that can be accessed by anyone approved to hold an AQS user account, typically EPA and SLT officials and their contractors. In addition to submitting data to AQS, some SLTs in EPA Region 9 maintain other air toxics databases. For example, the California Air Resources Board (CARB) maintains an air quality database called ADAM that provides public access to California air quality data. The ADAM database includes over twenty years of air toxics measurements.

In addition to collecting and sharing air toxics data, EPA is continuously seeking improvement on ways in which air toxics data is analyzed and used for evaluating program performance. EPA's air toxics program was evaluated through the Office of Management and Budget's (OMB) Program Assessment Rating Tool (PART) in 2004. In response to the PART evaluation, EPA developed Measure Implementation Plans (MIP) for ambient air toxics data and toxicity-weighted emissions. The ambient air toxics data MIP focused on the role of NATTS data in evaluating the performance of the national air toxics program and identified process steps for the annual development of public health risk metrics for air toxics based on data from the NATTS program sites. The metrics detailed in the MIP rely on two key computations: a weighting of the portion of the US population each NATTS site represents and cancer and non-cancer risk factors determined using ambient monitoring data and estimated unit risk factors. EPA also notes progress towards compiling NATTS data for use in developing performance measures on the information webpage for the air toxics PART evaluation.[5]

In addition, the 2006-2011 EPA Strategic Plan[6] identified "healthier outdoor air" as an objective, and for an air toxics sub-objective stated "by 2011, reduce the risk to public health and the environment from toxic air pollutants by working with partners to reduce air toxics emissions and implement area-specific approaches." The plan also identified two strategic targets for the national air toxics program:

- By 2010, reduce toxicity-weighted (for cancer risk) emissions of air toxics to a cumulative reduction of 19 percent from the 1993 non-weighted baseline of 7.24 million tons.
- By 2010, reduce toxicity-weighted (for non-cancer risk) emissions of air toxics to a cumulative reduction of 55 percent from the 1993 non-weighted baseline of 7.24 million tons.

Following the development of the 2006-2011 EPA Strategic Plan, the EPA Office of Program Management Operations (OPMO) developed a matrix which identifies national air toxics performance measures, indicators, and data currently available to measure progress towards the air toxics strategic targets (see Appendix I). Developed in January 2007, the matrix will be used as a basis for further development of performance measures for the national air toxics program.

[5] The results of the 2004 air toxics program PART evaluation and subsequent improvement efforts are located at http://www.whitehouse.gov/omb/expectmore/detail/10000226.2004.html#improvementPlans.

[6] The 2006-2011EPA Strategic Plan is located at http://www.epa.gov/cfo/plan/plan.htm.

Overview of Air Toxics Monitoring Activities in EPA Region 9

This section provides an overview of the air toxics monitoring activities of each of the nine SLTs in EPA Region 9 that participated in this evaluation. Further details on the specific air toxics monitored by these agencies are provided in Appendix J.

Arizona Department of Environmental Quality

The Arizona Department of Environmental Quality (ADEQ) is currently involved in a number of air toxics monitoring efforts. ADEQ maintains several toxics and PAMS program sites, one of which—the Phoenix Supersite—has also been designated a monitoring site for the NATTS program since 2004. At the Phoenix Supersite, ADEQ currently monitors for VOCs, carbonyls, PAHs, hexavalent chromium, speciated $PM_{2.5}$, and PM_{10} metals. ADEQ has also led three short-term studies in the U.S.-Mexico border region. The most recent study was the Western Arizona/Sonora Border Air Quality Study (WASBAQS) in 2006-2007. WASBAQS included Supersites in Yuma, Arizona and Mexico where the agency monitored for a variety of VOCs, semi-VOCs, carbonyls, metals, and chlorinated pesticides.

ADEQ also participated in the monitoring studies conducted by the Joint Air Toxics Assessment Project (JATAP) and has contributed data from several of their monitoring sites, including the Phoenix Supersite, to the JATAP study. A description of current JATAP activities is summarized below. ADEQ sends its air toxics samples to outside laboratories for processing and analysis.

ADEQ also maintains a list of HAPs for the state (see appendix K).

Bay Area Air Quality Management District

The Bay Area Air Quality Management District (BAAQMD) maintains an ambient monitoring network with twenty air toxics monitoring sites. BAAQMD primarily collects VOC samples from these monitoring sites and processes the VOC canisters at an in-house laboratory. BAAQMD also coordinates with CARB in its monitoring efforts: several of BAAQMD's air toxics monitoring sites are used to collect samples that are processed in CARB laboratories and included in CARB trends analyses.

The BAAQMD trends network monitoring site located in San Jose is also part of the NATTS network. Sampling at this site includes a broader range of compounds than what is collected at the other BAAQMD air toxics monitoring sites, including several carbonyls.

BAAQMD also leads short-term monitoring studies which supplement the data from their trends network. For example, BAAQMD has studied diesel particulate matter emissions through analysis of elemental carbon data collected with PM_{10} filters. In addition, BAAQMD is planning to initiate a study of air toxics at the Port of Oakland in the next year.

California Air Resources Board

CARB has engaged in long-term air toxics trends monitoring for over twenty years. CARB established its air monitoring trends network—which currently includes monitoring for over fifty air toxics including VOCs, metals, and carbonyls—in 1985 and currently samples for air toxics at twenty sites in California and two sites in Mexico.

The California Office of Environmental Health Hazard Assessment (California OEHHA) maintains a list of Toxic Air Contaminants (TAC) for the state (see Appendix L) that is more extensive than EPA's HAPs list, and regularly performs risk assessments on potential new TACs. The air toxics measured through CARB's monitoring network are drawn from this TACs list, and CARB routinely evaluates and updates the list of air toxics monitored through its trends network based on revisions to the TACs list. Several other California agencies refer to CARB's TACs list when prioritizing compounds for air toxics monitoring studies.

In addition to monitoring through its trends network, CARB has conducted numerous special studies focused on a variety of air toxics thought to be prevalent in California. CARB recently conducted special studies on acrolein, compounds found in wood smoke, asbestos, diesel particulate matter, and hexavalent chromium and is currently leading a special study on near-roadway effects to characterize concentrations of PAHs and black carbon near Interstate-5. CARB also collaborates with California OEHHA, EPA, and local air districts on an inter-agency working group focused on acrylonitrile monitoring. The activities of this group have included significant monitoring for acrylonitrile and efforts to use the monitoring data to validate models. CARB also conducts regular ambient monitoring for dioxins and polybrominated diphenylethers (PBDE), and has performed near-source PBDE monitoring in the past.

In 1999, the California legislature passed the Children's Environmental Health Protection Act (Senate Bill 25), which required CARB and California OEHHA to review the effectiveness of California's ambient air quality standards and to assess the degree to which the CARB air toxics monitoring network effectively represents the pollutants present within the state. As part of its activities to address Senate Bill 25, California OEHHA published a report in 2001 that provided an assessment of TACs in the state that disproportionately affect infants and children.[7] CARB is also leading a number of children's health and exposure studies which respond to the bill.

CARB has conducted pesticide monitoring in rural areas in California since the mid-1980s on behalf of California's Department of Pesticide Regulation (DPR). CARB conducts ambient monitoring for pesticides and also performs short-term application site monitoring during pesticide application periods. DPR uses data collected by CARB, in conjunction with toxicity data, to determine whether pesticides should be listed as TACs. Since 1986, CARB has conducted ambient and/or site application monitoring for 45 pesticides, some of which have been listed as TACs in California.

CARB laboratories process all of the air toxics and pesticides samples collected through these monitoring networks and through other special monitoring studies. CARB has also been a leader in developing sampling and analysis methods for air toxics.

Hawaii Department of Health

The Hawaii Department of Health (Hawaii DOH) maintains a statewide air monitoring network that is largely devoted to the monitoring of criteria air pollutants. On the island of Hawaii, specialty monitoring is conducted to assess the impact that volcanic emissions are having on the air quality through the signature pollutants of sulfur dioxide and particulate matter. Hawaii DOH also monitors for seventeen carbonyls, VOCs, and metals at their monitoring site in Pearl City, Oahu. Hawaii DOH laboratories process all of the air toxics samples collected at the Pearl City site.

Joint Air Toxics Assessment Project (Arizona)

JATAP is a collaborative air toxics evaluation effort between state, county, and tribal representatives in the Phoenix, Arizona area. JATAP is comprised of the following entities: ADEQ, Maricopa County, Pinal County, the Gila River Indian Community, the Ft. McDowell Yavapai-Apache Tribe, the Salt River Pima-Maricopa Indian Community, and the Institute for Tribal Environmental Professionals. EPA also participates on the JATAP Steering Committee.

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[7] The TACs assessment report is located at http://www.oehha.ca.gov/air/toxic_contaminants/SB25finalreport.htm.

ADEQ and the Gila River Indian Community conducted pilot studies in 2003-2004 which provided background information and preliminary data for a larger air toxics monitoring study in 2005. The 2005 study was comprised of nine air toxics monitoring sites in Phoenix and the surrounding tribal communities and collected data on a variety of VOCs and compounds associated with $PM_{2.5}$. JATAP used consultants to process the air toxics samples from their 2003-2005 studies.

JATAP recently received an additional $200,000 to support analysis of the results of their 2005 monitoring study. The results of this analysis will be used to assess the health impacts of air toxics in the Phoenix area.

Nevada Division of Environmental Protection

The Nevada Division of Environmental Protection (Nevada DEP) conducts air toxics monitoring activities focused on mercury emissions. Nevada DEP monitors for mercury at three Mercury Deposition Network (MDN) sites across the state, two of which were established by EPA. Comprised of over 85 monitoring sites nationwide, the MDN collects weekly data on the mercury concentrations in precipitation and wet depositions. Nevada DEP also received funding from EPA in 2006 to develop a sampling system that detects mercury in the air.

Nevada DEP is currently teaming with researchers at the University of Nevada to study mercury emissions from mining operations in the State of Nevada. This study is focusing on monitoring for elemental mercury and reactive gaseous mercury at several monitoring sites. One goal of this study is to develop a framework for comparing mercury emissions from mining areas to non-disturbed, naturally-enriched areas.

Placer County Air Pollution Control District

The Placer County Air Pollution Control District (Placer County APCD) is currently engaged in an effort to monitor and mitigate diesel particulate matter emissions from the Union Pacific J.R. Davis Yard in Roseville, California (Roseville Rail Yard). In 2000-2004, CARB conducted a risk assessment analysis of the Roseville Rail Yard that provided a baseline for the emissions and associated cancer risks from the yard. After CARB's final report was released in 2004, Placer County APCD concluded that further monitoring of the rail yard was warranted to address public concerns.

In late 2004, Placer County APCD and the Union Pacific Rail Road (UP) signed an agreement in which UP consented to voluntarily cut emissions from the Roseville Rail Yard, fund an incentive program, and fund continued monitoring at the yard by Placer

County APCD. Using the funds provided through the agreement, Placer County APCD conducted monitoring at four sites during the summers of 2005-2007. The agency monitored for a variety of compounds associated with the combustion of diesel including nitrogen oxides, elemental and organic carbon (using $PM_{2.5}$ and PM_{10} filters), continuous $PM_{2.5}$, and black carbon.

Several agencies helped support Placer County APCD in their monitoring effort. CARB and the South Coast Air Quality Management District (SCAQMD) provided a variety of in-kind services, including modeling, participation on the project advisory board, lab and auditing services, in addition to loaning Placer County APCD much of the sampling equipment for the project. EPA awarded Placer County APCD a community-scale monitoring grant for the project and participated in the project advisory board. Sacramento Metro Air Quality Management District also provided limited funding for the project because the rail yard crosses into Sacramento County.

Placer County APCD is interested in continuing the Roseville Rail Yard monitoring study to further assess the effects of UP's mitigation strategies. The agency is currently looking into funding options for continued monitoring and data analysis.

San Diego Air Pollution Control District

The San Diego Air Pollution Control District (San Diego APCD) maintains nine monitoring sites where air toxics VOC samples are collected. Four of these sites are part of the PAMS network, two are part of CARB's trends network, and three are community-scale monitoring sites that opened in January 2007. San Diego APCD currently samples for 44 toxic VOCs at the three community-scale monitoring sites and will report the data to the AQS database. The agency plans to add acrolein and acrylonitrile to the target compound list in 2008. San Diego APCD monitors for PAMS hydrocarbons at all four of their PAMS network sites and, at two of these sites, also monitors for carbonyls. Four 3-hour samples are collected at each site during the PAMS season, and one 24-hour sample is collected at each site during the non-PAMS season. These samples are collected according to the PAMS methodology and the data are submitted to the AQS database as part of the PAMS dataset. The two CARB trends network sites opened in 1988-1989 and San Diego APCD samples for carbonyls, toxic VOCs, and toxic metals at these sites. The data from the CARB sites is available through the ADAM database.

San Diego APCD maintains six monitoring sites where air toxics metals samples are collected. Two are part of the $PM_{2.5}$ Speciation Trends Network, two are the CARB trends network sites described above, and two are community-scale monitoring sites that opened in 1994. An EPA community-scale monitoring grant allowed the purchase of an inductively coupled plasma mass spectrometer that will replace the previous analytical methodology and allow for the speciation of hexavalent chromium and the addition of several more toxic metals to the target compound list. San Diego APCD will begin the hexavalent chromium speciation in 2008.

In addition to collecting the samples at all of the sites described above, San Diego APCD performs the analyses for the VOC and metals samples collected at the agency's community-scale and PAMS program monitoring sites at their in-house laboratory. San Diego APCD ships the samples from the CARB trends network sites to a CARB laboratory for processing. At the two $PM_{2.5}$ Speciation Network sites, San Diego APCD personnel maintain the instruments and collect samples. Samples from one site are shipped to a CARB laboratory in Sacramento and samples from the other site are shipped to an EPA contract laboratory in North Carolina.

Another result of the agency's community-scale monitoring grant was the purchase of a Desert Research Institute Thermal/Optical Carbon Analyzer. San Diego APCD will use this analyzer to collect organic and elemental carbon samples at three monitoring sites starting in 2008, and will analyze the data at their in-house laboratory. Organic and elemental carbon data for the agency's two $PM_{2.5}$ Speciation Trends Network sites is also available through the AQS database.

San Diego APCD also collaborates with CARB on some community-scale monitoring efforts, including a recent environmental justice monitoring project in the Barrio Logan neighborhood that measured hexavalent chromium emissions from a nearby decorative chrome plater.

South Coast Air Quality Management District

SCAQMD is involved in numerous air toxics monitoring efforts. SCAQMD conducted the first Multiple Air Toxics Exposure Study, MATES I, in 1986-1987, providing the agency with a baseline of air toxics concentrations in the South Coast air basin. SCAQMD built on the results of this study in 1998-1999 by completing a second, more comprehensive study (MATES II), that monitored for over 30 VOCs, carbonyls, PAHs, and metals, and collected elemental carbon data as a surrogate for diesel particulate matter. The agency monitored at 10 fixed sites and conducted micro-scale studies using three mobile platforms to sample at 14 communities. MATES II also included significant data analysis, modeling, and development of an emissions inventory. Laboratory analysis for the data collected through MATES II was jointly conducted by SCAQMD and CARB.

With partial funding from EPA, SCAQMD recently completed monitoring for a MATES III study and released a draft report. This study consisted of 10 fixed sites that monitored for many of the compounds that were found to be prevalent in the air basin during MATES II, and additional compounds of interest such as naphthalene. SCAQMD will use the data from MATES III to perform a variety of trends analyses and modeling projects, which will build on the analyses performed on the MATES II data. The agency also hopes to use the data from the study to complete source apportionment analyses. SCAQMD's laboratory will analyze all of the samples from the MATES III study with the exception of the semi-volatile hydrocarbons.

Since 2007, SCAQMD has maintained two NATTS sites. At these sites, the agency monitors for additional compounds not measured through MATES III, such as acrolein and PAHs. SCAQMD's laboratory processes much of the NATTS data, although the agency sends the PAH samples to outside laboratories for processing.

SCAQMD was also recently awarded a community-scale monitoring grant to conduct an air toxics monitoring project at Los Angeles International Airport.

Other Air Toxics Monitoring Efforts in EPA Region 9

In addition to the nine SLTs listed above, there are several other entities in EPA Region 9 that manage air toxics monitoring programs. Several of the projects being conducted by these entities were mentioned by participants in this evaluation, including:

- The Nevada Department of Transportation (NDOT), with oversight from the Clark County Department of Air Quality and Environmental Management (DAQEM), is monitoring near-roadway exposures of air toxics on a segment of US-95. This study is part of a larger national mobile source air toxics study being conducted by the Federal Highway Administration.
- NDOT and the Federal Highway Administration, with oversight from the Clark County DAQEM, will soon begin monitoring for mobile source emissions, potentially including emissions from the local McCarran International Airport, on a segment of Interstate-15.
- In 2006, the City of Los Angeles was awarded a community-scale monitoring grant to conduct an air toxics monitoring study at the Port of Los Angeles.

Findings

The following six findings summarize the opinions and ideas expressed by EPA and SLT officials during development of this report. These findings are not presented to indicate critical issues with the national air toxics monitoring program or SLT air toxics monitoring efforts. Rather, these findings are presented to indicate common air toxics monitoring challenges experienced by EPA and SLT officials, and are intended to be used as a basis for continued discussions on how to improve coordination and communication around air toxics monitoring in EPA Region 9 and nationally.

Finding 1: There Is a Significant Amount of Consistency in Air Toxics Monitoring Objectives across Agencies in EPA Region 9 with the National Objectives, although Differences in Program Design and Implementation Reflect Variation in Priorities across These Objectives.

Officials from EPA headquarters, EPA Region 9, and SLTs in EPA Region 9 agree that the overarching goal of current national, state, tribal, and local air toxics monitoring programs is to reduce human health risks caused by exposure to air toxics. The objectives in EPA's 2004 National Monitoring Strategy achieve this goal through a dual emphasis on NATTS program sites and community-scale monitoring efforts. Objectives set by SLTs within EPA Region 9 are highly consistent with EPA's air toxics monitoring objectives: three SLTs in the region maintain NATTS program sites and all of the SLTs in EPA Region 9 that have received community-scale monitoring grants manage these efforts consistent with the objectives detailed in the 2004 National Monitoring Strategy. The data resulting from these NATTS program sites and community-scale monitoring efforts provides a picture of the distribution of air toxics concentrations at and between NATTS program sites in the region. In addition, some SLTs in EPA Region 9 are working towards objectives which complement and expand on the current scope of objectives listed in the EPA strategy.

However, SLTs in the region vary in the relative emphasis they place on the NATTS program, their own trends networks, and various local-scale monitoring efforts, reflecting a balance between nationally- and locally- funded air toxics monitoring efforts. The patchwork of SLT air toxics monitoring activities across EPA Region 9 largely reflects the varying emphasis on specific program objectives, as well as the relative priority of air toxics compared with other air quality and environmental issues at each agency.

There Is Relative Consistency in the Stated and Implied Air Toxics Monitoring Program Objectives across Air Districts in EPA Region 9, and Potential Interest in Expanding Current Program Objectives in the Future.

EPA headquarters, EPA Region 9, and SLTs in EPA Region 9 have highly consistent objectives for achieving a reduction in human health risk due to air toxics exposure. EPA Region 9 and SLT officials that participated in this evaluation verbally articulated air toxics monitoring objectives consistent with those in EPA's 2004 National Monitoring Strategy. These objectives include: trends measurements, exposure assessments, problem identification, program accountability, air quality model evaluation, and science support. Some SLTs in the region also maintain written sets of air toxics objectives. For example, San Diego APCD includes air toxics monitoring program objectives in its *County of San Diego Adopted Operational Plan.* The operational plan for fiscal years 2007-2008 and 2008-2009[8] lists specific objectives under two categories: the environment and safe and livable communities. These objectives include community outreach, rulemaking, and process development needs, and also describe plans for additional air toxics monitoring studies and risk assessments.

Some SLTs within the region also expand upon the objectives set by EPA in the 2004 National Monitoring Strategy. First, some agencies indicated that they are focusing on airborne substances beyond those listed by EPA as HAPs. For example, CARB has adopted a broader list of air toxics, known as TACs, which currently includes 244 substances, including all HAPs currently listed by EPA.[9] CARB, in consultation with California OEHHA, regularly performs risk assessments on potential TACs and updates the register of TACs accordingly. This continuous update process allows CARB to expand its air toxics monitoring program to include new compounds on a regular basis and provides a means for prioritizing continued monitoring of compounds that are prevalent in the region but are not as prevalent on the national scale, and therefore are not monitored through the NATTS program. Several of the local agencies in California also use the CARB TACs list when prioritizing compounds for studies within their air districts.

Second, some agencies have found that ambient air toxics monitoring data is not only useful for addressing problem identification objectives, but also for leveraging voluntary air toxics emissions reductions from sources. For example, some community-scale monitoring programs, such as Placer County APCD's Roseville Rail Yard project, have used ambient monitoring data to leverage actual, voluntary emissions reductions from a source and to measure the effectiveness of emissions reduction and mitigation efforts.

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[8] The *County of San Diego Adopted Operation Plan Fiscal Years 2007-2008 & 2008-2009* is located at http://www.sdcounty.ca.gov/auditor/pdf/adoptedplan_07-09.pdf.

[9] Information collected on November 15, 2007 from the CARB air toxics website (http://www.arb.ca.gov/toxics/toxics.htm).

Third, several EPA and SLT officials noted that there may be pressure in the future from federal agencies, SLTs, and non-profit groups to expand the scope of air toxics monitoring activities and objectives to include attention to ecosystem health. Currently, EPA and SLTs in EPA Region 9 define public exposure to air toxics, and the associated human health risks, as the primary driver for investment in air toxics monitoring activities. A few agency officials noted, however, that attention to the ecosystem health effects of air toxics will likely increase in the coming years, and SLTs in EPA Region 9 may pioneer air toxics monitoring objectives to assess these effects. For example, there is evidence of growing attention to the effects of deposition of mercury and other air toxics in terrestrial and aquatic ecosystems in National Parks and in other sensitive ecosystems, which may catalyze SLT interest in ecosystem effects.

Agencies' Prioritization of Objectives Illustrates a Balance Between Nationally- and Locally-Funded Monitoring Efforts.

Since the early stages of developing national air toxics monitoring program capacity, EPA has recognized the need to balance national-scale, standardized approaches to air toxics measurements with community-scale, custom approaches. EPA has integrated these two guiding approaches under the framework of the 2004 National Monitoring Strategy. The balance between the NATTS program, regional trends monitoring, and community-scale monitoring projects in EPA Region 9 reflects adherence to this principle.

All the air toxics monitoring efforts managed by SLTs in EPA Region 9 address the objectives framed in the 2004 National Monitoring Strategy; however we found that each SLT uses a different set of activities to fulfill the objectives, resulting in a patchwork of air toxics monitoring activities across the region. The set of air toxics monitoring activities managed by each SLT in the region depends on a variety of factors including the relative priority of air toxics issues compared with other air quality and environmental issues (e.g., criteria pollutant issues), the local funding mechanisms available, the national monitoring programs (e.g., NATTS or PAMS) in which the agency participates, and other available federal funding mechanisms (e.g., community-scale monitoring grants and Section 105 grants). For those agencies with relatively smaller local funding mechanisms, the primary focus of air toxics monitoring efforts is on projects that can be federally funded. For example, ADEQ focuses its air toxics monitoring efforts around a NATTS site and several PAMS sites and has received community-scale monitoring grants to support some of the agency's additional air toxics monitoring activities, such as the JATAP monitoring efforts. SLTs with more consistent local funding mechanisms tend to focus more extensively on local-scale projects, and participation in the NATTS program is an added element in the agency's suite of air toxics monitoring activities. For example, SCAQMD focuses much of its air toxics monitoring efforts on the local-scale MATES studies, which are funded through a combination of local and federal mechanisms, and also maintains two NATTS sites.

Officials in EPA headquarters, EPA Region 9, and SLTs within the region all cited challenges associated with air toxics monitoring as a restriction to expanding air toxics monitoring capacity in the region. Compared with criteria pollutants, the methods for collecting and analyzing air toxics samples are relatively new. Agency officials noted that even if time-tested air toxics methods were available for all HAPs, laboratory analyses of these compounds would still take considerably more effort than analyses of criteria pollutants, as air toxics are by nature more difficult to isolate and measure. Therefore, each new air toxics activity represents a significant investment of resources and staff time for EPA and SLTs.

Due to the complexity of air toxics monitoring, EPA and SLTs tend to prioritize monitoring efforts which provide the most benefit. However, perspectives on the relative benefits of air toxics activities can differ between EPA headquarters and SLTs. While SLTs understand the importance of the NATTS program and always seek to fulfill the requirements of their NATTS grants, many SLTs in EPA Region 9 prefer to focus on trends monitoring for compounds thought to be prevalent in their region in order to address local community concerns, rather than prioritizing further national trends monitoring efforts. In addition, other EPA objectives such as program accountability and science support tend to be less salient to SLTs except in cases where there are direct implications for the understanding or control of local risks from public exposure to air toxics. This preference to address local needs has created a patchwork of air toxics monitoring activity across EPA Region 9, where each air district is attempting to focus on compounds most important to its area while at the same time balancing the objectives of the NATTS program. SLT officials noted that explicitly understanding NATTS and community-scale monitoring program objectives would help them meet the objectives for these programs in addition to the objectives of other local-scale monitoring efforts.

In addition, both EPA and SLT officials noted that the best tactic for addressing the 2004 National Monitoring Strategy air toxics objectives is not always clearly defined. For example, the objective for air quality model evaluation envisions the use of air toxics monitoring data to ground-truth national models and to develop a variety of air toxics assessments and control strategies, as was done through the 1996 and 1999 NATA assessments.[10] Both EPA and SLT officials recognized that data beyond that available through the 25 current NATTS sites will be needed to effectively ground-truth national

[10] EPA compared the Assessment System Population Exposure Nationwide (ASPEN) modeling system results from the 1996 and 1999 NATA Assessments with monitored concentration data to evaluate the accuracy of NATA results (http://www.epa.gov/ttn/atw/nata/mtom_pre.html and http://www.epa.gov/ttn/atw/nata1999/nsata99.html).

models, although these officials noted that further research is needed to understand the extent of data needed to evaluate the models. These agency officials cited the effectiveness of past SLT efforts using local monitoring data for local trends assessments, control strategies, and modeling efforts and previous UATMP and NATA analyses as examples of how monitoring data can be used for significant data analyses.

Some SLTs in EPA Region 9 are also beginning to use monitoring data for model verification efforts at a regional scale. For example, as part of SCAQMD's MATES III study, regional modeling results will be compared to air toxics monitoring data. However, EPA officials noted that verification of community-scale models has been an allowable activity under recent community-scale grant competitions, but that they have received few applications for this type of activity in the past.

Finding 2: National and SLT Trends Monitoring Networks Are Complementary Efforts, although SLTs Have Experienced Challenges with Participation in the NATTS Program that Differ from Challenges They Face in Their Own Air Toxics Monitoring Efforts.

National ambient monitoring networks and SLT trends monitoring networks are complementary efforts that jointly provide data on the prevalence of air toxics in EPA Region 9 and across the nation. Most of the air toxics monitoring in Region 9 is not part of the national monitoring network, rather, these monitoring activities are independent efforts managed by SLTs. The SLTs in EPA Region 9 participating in the NATTS program have received substantial benefits from the program, but have also encountered unanticipated set-up and analytical challenges that in some cases exceeded the resource needs covered by EPA funding. Most of the NATTS sites in EPA Region 9 were established at sites where air toxics monitoring was already being conducted by experienced districts with well-developed methods. These methods differed from EPA's methods, setting up a challenge for the SLTs in conforming to the national methods. Joining the NATTS program necessitated redesign of the SLTs' methods and retraining of agency personnel. In addition, these SLTs were faced with the decision of whether to switch all their air toxics sites or just the NATTS program sites to the EPA methods. In addition, both EPA and SLT officials noted that many of the challenges associated with past participation in the NATTS program are direct results of the program being relatively new, and are similar to challenges encountered at the infancy of other large-scale monitoring programs. These officials cited a need to learn from the experiences of the early implementers of the NATTS program.

National and SLT Air Toxics Trends Networks Are Complementary and Jointly Contribute to What Is Known about the Prevalence of Air Toxics in EPA Region 9.

The NATTS national ambient monitoring program, which includes four sites in EPA Region 9, gives a broad picture of air toxics trends on a national scale. EPA and SLTs in the region agree that the NATTS program successfully facilitates the collection of a consistent national dataset that provides a benchmark of air toxics concentrations across the United States. Some SLT officials noted that it would be useful to compare data from SLT monitoring efforts against these national benchmarks to better understand how EPA Region 9 air basins compare to other air basins across the country, although this would require an assessment of possible differences in sampling and laboratory methods.

Stakeholders at all levels recognize that SLT ambient monitoring networks supplement national efforts by providing more detailed information on the extent and effects of air toxics at local and regional scales. These SLT networks collect detailed, long-term data on air toxics within an air district and provide SLTs the opportunity to identify significant changes in local air toxics over time. For example, BAAQMD maintains a trends network which includes 20 air toxics monitoring sites in the San Francisco Bay Area. The density of sites within the Bay Area provides a rich dataset, which can supplement broader national-scale monitoring efforts like NATTS. This level of information can contribute to the development of national air toxics models and trends analyses, although the SLTs would need to assess how their methods compare to the NATTS methods to conduct such a comparison.

Difficulties with NATTS Program Start-Up Have Forced Trade-offs across SLT Program Objectives in the Past, although Future NATTS Implementers Are Likely to Benefit from Lessons Learned through These Initial Implementations.

The three state and local agencies in EPA Region 9 currently participating in the NATTS program (ADEQ, BAAQMD, and SCAQMD) noted a number of benefits of participation, including the ability to use the CAA Section 103 grant funds provided by EPA to purchase new laboratory equipment, which can also be used for analyzing data from other air toxics monitoring programs. Moreover, NATTS participation allows agencies to discuss methods and other technical issues through regularly held conference calls, enhancing agencies' abilities to share information across air districts. The benefit of NATTS participation is likely greatest for those SLTs that otherwise would not have been able to monitor for air toxics but had a strong interest in doing so. SLTs that already had robust air toxics monitoring programs before joining the NATTS program received the benefit of funding and communication, but these benefits may not have outweighed the significant difficulties in having to redesign their systems to conform to national standards.

Regardless of whether a SLT had an air toxics monitoring program in place or not, a common challenge for NATTS participants was allocating sufficient budget to meet the objectives of the program. EPA provided a specific funding amount intended to cover the costs of the sampling and use the national contract for processing, analysis, validation, and reporting of air toxics samples. The funding for each NATTS grant recipient also included approximately $50K in additional funds that could be used at the SLT's discretion. But SLT officials noted that funding levels were insufficient to support the more intangible aspects of participating in the NATTS program. For example, there is an array of start-up costs associated with NATTS participation—such as learning or redesigning laboratory methods, setting up new equipment, and in some cases, identifying and coordinating with an external laboratory—which required funding beyond that provided through EPA grants. Agency officials also reported that certain aspects of the NATTS program design, such as the use of a 1:6 sampling frequency instead of the 1:12 sampling schedule used by many SLTs, increased demands on staff time. In addition, agencies participating in the NATTS program are currently required to monitor for some compounds, such as hexavalent chromium, that use relatively new laboratory methods. According to agency officials, newer methods are likely to need small changes in the sampling or laboratory procedures as they are implemented and further tested, and these changes can demand re-work and extra cost for the agencies responsible for those procedures. Addressing these challenges required extra staff time and budget for the participating SLTs in EPA Region 9 resulting in trade-offs as agencies sought to fulfill national, state, and local objectives in the face of limited resources.

However, many EPA and SLT officials noted that many of challenges encountered with the NATTS program are similar to those experienced during implementation of other air quality programs, and that learning from the current NATTS program participants' efforts to address these challenges may eliminate or mitigate issues encountered by future program participants. For example, BAAQMD experienced significant challenges associated with attaining the MDLs for the TO-15 air toxics method. EPA recently provided BAAQMD with a gas chromatographer/mass spectrometer that is expected to resolve many of these challenges. Future NATTS program participants can build on this knowledge by purchasing this piece of equipment at the onset of NATTS participation or choosing to use the national contract for laboratory analyses. Also, future NATTS program implementers are likely to benefit from more stable air toxics methods, as further testing and experience will improve the stability of these methods. More stable and accepted methods will make NATTS program implementation easier for agencies that have only NATTS sites and for those SLTs that have larger air toxics monitoring networks.

EPA and SLT officials also noted that many of the difficulties experienced by EPA Region 9 SLTs during implementation of the NATTS program resulted from challenges associated with the laboratory analysis of the samples. As new compounds to monitor are added to the

NATTS program, EPA selects the national monitoring methods for these compounds based on analysis of existing methods and further research conducted on the air toxics compounds. SLTs in EPA Region 9 reported that the methods selected by EPA sometimes differ from those used for their existing monitoring efforts. For example, many SLTs in the region were using the 'scan' mode on their mass spectrometers, while the national method called for the use of the 'SIM' mode. While SLT officials agree that data comparability is affected by the use of different methods or equipment for processing air toxics samples, there can be substantial costs for SLTs associated with making changes in monitoring methods to align with new national standards. For agencies that have been tracking ambient air toxics trends for some time, there is a reluctance to change methods—even if such changes are improvements—because such a shift can disrupt the temporal comparability of trends data at the local or state level. In addition, it is generally not possible to switch a method for one site (i.e., the NATTS site) in a larger network; therefore, SLTs that have many air toxics monitoring sites are more significantly impacted by changes in methods. However, EPA officials noted that the difficulties encountered by some SLTs are due to their choice to build their internal laboratory capacity as part of participation in the NATTS program, rather than using the national contract for laboratory analyses, which would eliminate the need to change methods. But, SLT officials noted that while this may be the case for agencies that manage only NATTS sites, SLTs that have a larger network of air toxics monitoring sites could sacrifice site comparability if they use the national contract laboratory for one site and their own laboratory for all their other sites. In general, it can be seen that SLTs with previous air toxics monitoring programs, a group that includes all but one Region 9 NATTS participant, bring a wealth of experience to the NATTS program but also have special implementation challenges.

Several SLT officials indicated that they were not aware of any efforts to analyze or make use of the NATTS data that has been collected; however EPA officials noted that a portion of the NATTS budget is devoted to data analysis each year and that there have actually been significant efforts to analyze national air toxics data. These EPA officials stated that because the NATTS data is only a portion of the dataset that has been analyzed, sometimes it may not be clear that the NATTS data is being used for analyses. Four phases of ambient air toxics data analysis were conducted starting in 1999, and the results of these studies are available through the EPA AMTIC and Lake Michigan Air Directors Consortium websites.[11] In addition, preliminary results from recent analyses of the UATMP data were reported at the September 2007 EPA-sponsored Air Toxics Data Analysis Workshop in Chicago.[12] Final results and reports from these analyses are anticipated to be publicly available in 2008. EPA officials stated that further communication of these and future air

[11] The EPA AMTIC website is located at http://www.epa.gov/ttn/amtic/airtoxpg.html and the Lake Michigan Air Directors Consortium website is located at http://www.ladco.org/toxics.html.
[12] Presentations from this workshop are located at http://www.epa.gov/ttn/amtic/airtox-daw-2007.html.

toxics data analyses are warranted to ensure that all SLTs are aware of ongoing national data analysis efforts.

Finding 3: Short-Term and Community-Scale Air Toxics Monitoring Projects Play an Important Role in Characterizing Air Toxics and Their Health Effects in EPA Region 9, while Presenting Unique Resource and Management Challenges for SLTs.

SLTs in EPA Region 9 have undertaken a variety of short-term and community-scale air toxics monitoring projects in addition to participation in broader local, state, tribal, and national trends monitoring networks. Short-term and community-scale air toxics monitoring projects greatly contribute to the characterization of air toxics at the local level and provide a means for performing risk assessments, identifying source "fingerprints",[13] and evaluating new monitoring methods. These air toxics monitoring projects provide unique opportunities for SLTs to collaborate with a variety of community stakeholders and educate the public on air toxics issues, but can also prompt public scrutiny of agencies' abilities to diminish air toxics concentrations. Some SLTs fund short-term and community-scale air toxics monitoring projects through a variety of state, local, and tribal funding mechanisms, while others receive community-scale air toxics monitoring grants from EPA. Agencies that have received EPA grants welcome the opportunity they provide to collect and analyze air toxics data and acknowledge the benefits of the grant program, such as informing and motivating mitigation strategies. SLTs expressed a desire to use grant funds to perform further analyses and public communication than has been conducted in previous grant cycles. These agencies also noted aspects of the community-scale and other short-term funding structures that can hinder their ability to effectively use the grant funds to their full benefit.

Short-Term Ambient Monitoring Projects and Community-Scale Monitoring Projects Contribute to What Is Known about Air Toxics Prevalence, Their Associated Health Effects, and Effective Methods for Analyzing These Air Toxics.

In addition to monitoring air toxics through long-term national and SLT ambient air trends networks, a number of EPA Region 9 SLTs have also undertaken short-term ambient monitoring projects and community-scale projects in order to further characterize air toxics in areas where long-term ambient monitoring for air toxics is not currently or consistently conducted. These projects provide a cross-section of toxics occurring in the community, which may be extrapolated to areas with similar characteristics. For example, Hawaii DOH established a neighborhood air toxics monitoring site to sample for one year. The results of this project have provided Hawaii DOH with an indication of air toxics levels in the Pearl

[13] For the purpose of this evaluation, a "fingerprint" is defined as the unique combination of elements and compounds emitted from a source type.

City neighborhood on Oahu, which, according to agency officials, may also be representative of other similar neighborhoods on Oahu.

Some SLTs in EPA Region 9 also use the data from short-term ambient monitoring projects or community-scale projects to perform analyses to support local exposure risk assessments. For example, SCAQMD completed two successive air toxics exposure studies in the South Coast Air Basin—MATES and MATES II—and has produced a draft report of the third iteration of this study, MATES III. SCAQMD measured many of the same compounds across the MATES studies, which is allowing the agency an opportunity to develop detailed analyses on the long-term air toxics trends in the basin and to assess the carcinogenic risks associated with the air quality trends.

In addition, SLTs have successfully used short-term ambient monitoring and community-scale monitoring projects to attribute emissions to specific sources and identify source "fingerprints." While source attribution can be difficult in urban areas due to the number of potential sources present, SLTs are often successful in attributing emissions to specific sources. For example, ADEQ found that high levels of hydrofluoric acid in the San Luis area were due to emissions from local brick kilns. This source attribution led to moving the brick kilns out of town and away from local schools. Source attribution monitoring can also lead to identification of the "fingerprint" for a specified source type. As a result of such community-scale monitoring projects in EPA Region 9, agencies are improving understanding of the air toxics "fingerprints" of source types such as micro-scale chrome plating businesses, ports, rail yards, and roadways. Source "fingerprint" information could be used to assist agencies in other air districts to better interpret monitoring data or to better characterize potential air toxics risks of certain source types without necessitating costly ambient monitoring.

For several reasons, short-term or community-scale projects are an effective means of piloting monitoring for specific air toxics compounds or piloting new methods before monitoring on a broader scale. Pilot monitoring for a compound at a small scale or for a short period of time is a resource efficient means of developing and testing sampling and laboratory methods. For example, Nevada DEP received an air toxics grant to support the development of a process for measuring the deposition of mercury in urban and rural settings. The results of Nevada DEP's work could be used for future mercury studies within the state and could also assist other air districts interested in monitoring for mercury. Another reason to conduct pilot monitoring for a specific air toxics compound is to identify a baseline for the prevalence of that compound across a region and identify whether long-term monitoring is useful. For example, CARB conducted pilot monitoring for several PAHs, but eventually decided to end monitoring for these compounds because the baseline did not show significant levels of the toxics. A third reason to conduct pilot monitoring is to identify whether a pollutant should be classified as an air toxic. For example, CARB is currently using a network of monitors in agricultural regions to identify the prevalence of pesticides compounds in those areas. This data will assist the California DPR in evaluating whether these pesticides should be considered TACs in California. Table 3 provides a list of some of the air toxics recently piloted by SLTs in EPA Region 9.

Table 3: Example Air Toxics Recently Piloted by One or More Agencies in EPA Region 9

ADEQ	CARB	Nevada DEP	Placer County APCD	San Diego APCD
1,3-Butadiene	1,3- Butadiene	Mercury	Diesel particulate matter (black carbon and elemental carbon)	Hexavalent chromium
Cadmium	Acrolein			
	Acrylonitrile			
	Naturally-occurring asbestos			
	Diesel particulate matter (black carbon and elemental carbon)			
	Dioxins			
	Hexavalent chromium			
	PAHs			
	Saccharides (in wood smoke)			

Short-Term and Community-scale Monitoring Projects Provide Unique Opportunities for Collaboration within Local Communities, and These Interactions Can Also Present Challenges for SLTs.

SLT officials in EPA Region 9 reported that the narrow scope of many short-term and community-scale monitoring efforts provides an opportunity for agencies to work closely with the public and local emission sources. This collaboration can often encourage stakeholder commitment and lead to voluntary emissions reductions. For example, Placer County APCD worked with Union Pacific and a group of additional stakeholders to monitor emissions at the Roseville Rail Yard after receiving a series of public complaints about pollution from the yard. As a result of the monitoring project, Union Pacific voluntarily agreed to a mitigation plan that included a 10% reduction in emissions and provided funds for Placer County APCD to monitor the effects of the mitigation plan. Although the primary objective of the Roseville Rail Yard monitoring study is to identify the potential impacts resulting from the yard, the monitoring results will also provide the way to verify the performance of the rail yard mitigation plan. After the three-year monitoring period, if the monitoring results show the original mitigation plan is not as effective as anticipated, the rail yard has agreed to implement further mitigation measures to address public concerns. Agency officials reported that community members often view monitoring results as more accurate than modeled concentration values, and monitoring efforts like the Roseville Rail Yard project can help allay community concerns about nearby emission sources.

SLTs noted that it is important to identify at the outset of a project who will use the data and who will be affected by the actions associated with various monitoring outcomes. This information can be used to engage various stakeholders to gain a common understanding of possible outcomes to the monitoring. One benefit of this type of project planning is that it could provide an exit strategy for SLTs by defining some level of risk that would require no additional monitoring. In addition, it could prevent monitoring that would result in no mitigation benefits. Monitoring efforts that do not lead to emissions reductions or facility closures can lead to frustration and may have the potential to damage an agency's credibility. For example, CARB and San Diego APCD led an environmental justice monitoring study on hexavalent chromium emissions from a decorative chrome plater located near homes in the Barrio Logan neighborhood that showed there were significant emissions from the facility. Officials from CARB noted that area residents expected the facility to be shut down due to monitoring outcomes, but because it was not technically violating emissions regulations, no action could be enforced. The facility eventually shut down due to an unrelated violation, but, according to San Diego APCD officials, would otherwise still be operational. In other cases, the regulator agency for a particular source is the federal government, but the appropriate entities may not be engaged in the monitoring process or may not be in a position to act on the results of a particular study. Pre-defining who will use air toxics monitoring data and to what end could help promote positive study outcomes.

Short-Term and Community-Scale Projects Have Largely Been Successful in Supporting National and Local Air Toxics Monitoring Objectives, yet SLTs Cite Difficulties in Coordinating Funding Sources for These Projects.

Many of the SLTs in EPA Region 9 have received community-scale monitoring grants for air toxics projects, and officials at these agencies report that funds received through the grant program significantly enhanced their ability to perform short-term, local-scale air toxics monitoring projects. In addition agencies within Region 9 have undertaken many independent efforts to characterize local-scale air toxics. However, officials at some SLTs discussed certain aspects of short-term grant programs that can affect the successful outcome of a well-designed project. For example, SLT officials noted that some local-scale projects require a longer period of performance to carry out all phases of the project than can be funded through short-term grant programs. For example, JATAP's overall project plan for their current multi-year air toxics risk assessment effort in the Phoenix metropolitan area included data collection, laboratory analysis, and extensive data analysis, modeling, and risk assessment, but their initial community-scale monitoring grant only covered the air toxics data collection and laboratory analysis and portions of the remaining phases of the project. While SLTs in EPA Region 9 understand that the community-scale grant program only allows for short-term grants, they cite difficulties with identifying how to consolidate larger proposals to fit within the allotted timeframe or in identifying additional funding mechanisms to cover the remaining project budget. Many local-scale monitoring efforts involve significant interaction with the public, and SLT officials reported a need to provide stakeholders with accurate information on the extent and timing of data analysis associated with a project, which can be difficult when there are uncertainties about project timelines and funding. For the project described above, JATAP was awarded an additional community-scale monitoring grant that covered further data analyses, but EPA and SLT officials noted that this is not always the case. In some other cases, SLTs have been able to leverage EPA grant funding to get industry, community, or local agencies to provide additional support. Overall, SLT and EPA officials noted that it would be useful for SLTs and EPA to share ideas on maximizing funding opportunities for short-term, local-scale monitoring projects.

Finding 4: The Complex Nature of Air Toxics Monitoring Increases Data Quality and Cross-Agency Data Comparability Challenges.

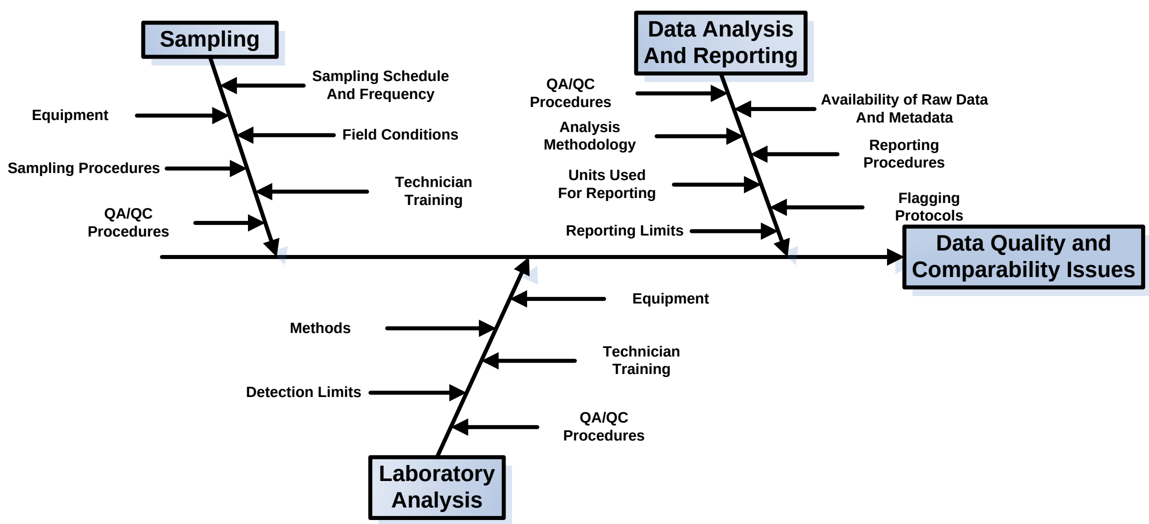
EPA, state, local, and tribal agencies all strive to develop and utilize methods and quality control procedures that will ensure high quality air toxics data that can be used for a variety of national, state, tribal, and local activities such as rulemaking, modeling, and mitigation efforts. Because the national air toxics monitoring program is relatively new, fewer time-tested methods and procedures exist than do for criteria pollutants, and therefore, for certain pollutants, there is significant variation across sampling and laboratory methods and QA/QC procedures employed by SLTs in EPA Region 9. EPA has sought to foster standard approaches for ensuring data quality and comparability through the guidance provided in the air toxics TAD, TO- and IO- compendiums, and PT testing available to all agencies, and some EPA Region 9 SLTs have also led methods development efforts to foster collaboration between SLTs in the region. Despite EPA efforts, individual SLTs cited difficulties in navigating the available options and balancing national, state, tribal, and local needs. In addition, some SLTs questioned the need for and value of adhering to national standard approaches for non-NATTS monitoring sites.

Many EPA and SLT officials interviewed for this report cited the complexity of air toxics monitoring and laboratory procedures as the root cause of the majority of the data quality and comparability challenges encountered in EPA Region 9. These officials noted that

EPA and each SLT in EPA Region 9 can be impacted by the data quality and comparability challenges encountered by their agency as well as by the challenges encountered by collaborating SLTs and contractors. EPA is involved in a number of national air toxics analyses, modeling efforts, and risk assessment activities that can be negatively impacted if any SLT contributing data to these efforts experiences data quality or comparability challenges. Similarly, SLTs that analyze data collected by other agencies, such as CARB, and SLTs that rely on other agencies or contractors for laboratory analyses, such as ADEQ, can be negatively impacted if these collaborating entities encounter data quality and comparability challenges.

Due to these potential effects of data quality and comparability challenges, EPA and SLT officials noted the benefit of clearly defining the issues which have arisen in the past in order to prompt proactive discussions on air toxics data quality and comparability challenges, with the goal of continually improving the quality of data used for local and national analyses, risk assessments, and modeling activities. Figure 1 outlines the major factors affecting air toxics data quality comparability described in this and subsequent findings and Appendix M describes an analysis of a selection of 2006 AQS data that demonstrates some of the data comparability challenges described below.

Figure 1: Factors Affecting Air Toxics Data Quality and Comparability



The Need for Cross-Agency Data Comparability Differs between EPA and Region 9 SLTs.

EPA officials have expressed a need for cross-agency data comparability to support national analyses and assessments; however, SLTs in EPA Region 9 had mixed views on whether this is a concern for all air toxics monitoring programs. As part of EPA's national air toxics monitoring program, EPA evaluates national levels and trends, which requires data comparability at sites across the country. To this end, EPA has established national requirements that NATTS program sites are expected to meet, and SLTs are encouraged to follow these guidelines for all air toxics monitoring sites. In contrast, most Region 9 SLTs compare data only within their local district. While SLT officials expressed an interest in cross-agency data comparisons, they also expressed doubt that this was a worthwhile endeavor for SLTs to pursue, noting barriers in accessing quality data in a useable format. These SLT officials expressed stronger confidence in their ability to share and compare data within Region 9 than to do so nationally. Within Region 9, SLTs can determine the quality of data from other agencies. Moreover, numerous agencies within Region 9 are jointly developing a data acquisition system that will include air toxics, which will make data formats more standardized across those agencies. Given the inherent difficulties in national cross-agency data comparability and the lack of clear benefits for SLTs, agency officials stated that developing, maintaining, and implementing national air toxics monitoring standards is likely to remain an EPA-driven activity.

EPA and SLT Officials Identified Several Categories of Cross-Agency Data Quality and Comparability Challenges for Future Discussions.

For those datasets where data comparability is needed, EPA and SLT officials identified the following four categories of challenges, discussed below, as key topic areas for future air toxics data quality and comparability discussions. EPA and SLT officials noted that increased attention to these challenges could result in significant improvements to data quality and usability, as well as cross-agency data comparability.

1. **Further Coordination and Management in the Development of New Monitoring Methods and in the Modification of Existing Methods.**

   The monitoring methods used to collect and analyze samples can greatly influence the quality of the data. A few SLTs in EPA Region 9 have participated in methods development efforts in the past, although currently CARB is the only SLT in the region that regularly develops new air toxics methods. The other SLTs in the region use various sampling and laboratory analysis methods developed by other agencies or organizations, including EPA and CARB. It is also common for these SLTs to modify the methods they use in order to better match the equipment and conditions of their laboratory and to fill any procedural gaps in the method. This can result in differences in the sampling and analysis methods used by SLTs, affecting data comparability. For example, appropriate pressurization of canisters for VOC samplers is an unresolved issue, with some SLTs preparing their canisters at sub-ambient levels and others preparing canisters at various levels of pressurization.

EPA is currently working to organize and assess the utility of available methods for air toxics compounds through the development of the TO- and IO- compendium methods, which were originally prepared in the late 1990s. SLTs in EPA Region 9 regularly reference these national standards; however, many SLTs are not confident that all of the TO- and IO- compendium methods are sufficiently time-tested and accurate for the region's air toxics monitoring activities. The SLT officials we interviewed did not typically see significant challenges with the existing TO- and IO- compendium methods; rather, the officials noted small issues, such as the pressurization example described above, which they hoped could be resolved to further stabilize the existing methods and decrease the need for each SLT to research methods options. The challenge of addressing small differences in methods can be especially difficult for SLTs using outside laboratories for data analysis, as different laboratories may return different results if different variations of methods are used. Additionally, in such situations, the laboratories may not know the field data collection procedures followed (e.g., specifics on canister pressure, volume, and flow) and therefore may not perform the appropriate QA/QC on the samples.

EPA officials noted that in general, the methods are meant to be structured but not overly prescriptive, in order to meet the needs of a broad range of SLTs. These officials added that they are continually addressing the "option points" in the existing methods, which are portions of the methods where there is currently more flexibility, and requested that SLTs discuss any challenges they encounter with their EPA Regional Officers, who can inform the EPA headquarters team updating the methods. In addition, EPA encourages SLTs to participate in the air toxics methods forum that is being initiated by EPA.

SLT laboratory officials also reported that in some cases, they are not able to achieve the MDLs specified within the national methods. EPA officials noted that this issue has been brought to their attention and is currently on their list of challenges to address. SLT officials cited differences in available laboratory equipment as a major factor in MDL discrepancies, although procedural challenges may also be a factor.

Changes within recommended methods for data collection and analysis can affect data interpretation. For certain reasons, such as new scientific knowledge or additional testing of a method, it is necessary for EPA to alter the TO- and IO- compendium methods. Although method changes are not common, SLT officials noted that agencies in EPA Region 9 with existing long-term trends networks and special studies underway, such as CARB, BAAQMD, SCAQMD, and San Diego APCD, can be negatively affected by a change in methods if it disrupts long-term trends analyses. Moreover, SLTs may not see the benefit to adopting a revised or new method if they have not been involved in the process of selecting the method. Lack of a fluid dialogue between EPA and SLTs to address potential impacts from a shift in methods can exacerbate these data comparability challenges.

In addition, for those SLTs in EPA Region 9 actively involved in air toxics methods development, it can be a challenge to balance local needs with national methods development efforts. For example, CARB is a national leader in methods development and often develops methods for locally prevalent compounds that are not currently addressed at the national level. CARB officials stated that difficulties can arise if EPA identifies different TO- or IO- compendium methods for those compounds at a later date, and noted a preference for collaborative EPA/CARB methods development efforts that result in methods useful at national and local levels. For example, officials from EPA, CARB, and other air districts in California recently collaborated on methods development for acrylonitrile, an effort that was seen as beneficial by all parties. However, officials who participated in previous collaborative methods development discussions between EPA and SLTs caution that difficulties can arise when the parties involved significantly disagree and that an agreed-upon decision-making framework must be in place prior to such discussions.

SLT and EPA officials also noted that further communication would be beneficial in instances where multiple agencies are developing and testing methods for the same compound. For example, a number of SLTs within EPA Region 9—such as CARB, Placer County APCD, and BAAQMD—previously participated in or are currently involved in studies measuring diesel particulate matter. Because diesel particulate matter cannot be directly monitored, methods development efforts for this air toxic focus on surrogates such as elemental carbon or black carbon. SLT officials noted that further inter-agency collaboration on diesel particulate matter methods would be especially beneficial given the complexity of monitoring for this pollutant.

2. **Further Clarity on Guidelines for Detection and Reporting Limits and AQS Flagging Procedures for Air Toxics Compounds.**

Standardization of detection and reporting limits is important for producing comparable datasets across air districts. The 2004 version of EPA's TAD provides guidelines on the standardization of detection and reporting limits, and for flagging data in relation to these limits in the AQS database. Several officials from EPA Region 9 SLTs reported that there are information gaps in the TAD, and noted that identifying and addressing these gaps can be time consuming and costly for individual agencies. However, since our interviews were conducted, EPA prepared an updated version of data management section of the TAD, which addresses many of the SLTs questions on guidelines for detection and reporting limits and data flagging procedures for the AQS database. Additionally, the challenges surrounding MDL determination will be addressed on future methods focus group calls for the NATTS program.

An additional challenge is that some SLTs that can achieve the detection limits documented in the air toxics TAD choose not to use these detection limits in order to be consistent with the detection limits they have used in the past. EPA officials noted that SLTs that do not receive funding from EPA are not required to follow the procedures laid out in the TAD, but that the use of different detection limits may produce data that may not be comparable with datasets from other air districts, limiting the usefulness of the data for national and regional trends analyses. Similarly, agencies that operate non-NATTS sites may choose not to use EPA's flagging guidelines, thus affecting cross-agency data comparability. As noted earlier, SLTs generally don't undertake cross-agency data comparison to the same degree as EPA and so these issues are likely to be more concerning to EPA than to SLTs.

3. **Further Standardization in QA/QC Procedures.**

Standardization of QA/QC procedures for air toxics sampling, analysis, and reporting contributes to cross-agency data comparability. Officials from all SLTs in EPA Region 9 reported that they follow rigorous QA/QC procedures for sampling and laboratory analysis. However, agency officials reported that variations in QA/QC procedures between air districts do exist, and are likely due to a variety of factors including financial constraints, lack of cross-agency communication, and training deficiencies.

In addition to regular calibration and maintenance of sampling and laboratory equipment, EPA Region 9 SLTs regularly perform internal audits of their equipment and procedures through the use of audit samples. Agency officials reported that they have purchased audit samples from a variety of consultants and organizations in the past. However, the National Institute of Standards and Technology (NIST) audit samples are widely considered the gold standard for internal audits, and most agency officials reported that they prefer to use these audit samples over other options. Several agency officials noted that one benefit of NIST audit samples is the consistency between the level of air toxics compounds found in the samples and the average level at which those compounds occur in the region. However, agency officials noted that the cost of NIST samples can be prohibitive and that samples are not available for all air toxics compounds currently monitored in EPA Region 9.

In addition, some SLTs participate in the national PT audit program which focuses on compounds monitored through the NATTS program. This audit program provides further comparison of how individual laboratories measure against other laboratories across the nation and can be used to identify data comparability concerns. Several SLT officials noted that the first round of PT audits included audit samples that contained significantly higher levels of some air toxics compounds than regularly occur in their region, which caused unexpected issues with some agencies' equipment. However, EPA officials reported that due to feedback on this initial round of audits, the PT audit samples are now prepared at lower levels. The PT testing program has been effective at helping agencies identify problems, which has led to greatly improved data quality for participating agencies. For example, San Diego APCD, which does not currently maintain NATTS sites, follows the NATTS program methods and procedures. Agency officials noted the benefits of the PT audit program and NATTS program Technical System Audit in identifying necessary refinements to agency procedures. However, EPA officials noted that some of the SLTs in EPA Region 9 choose not to participate in the PT audit program, which can diminish the effectiveness of this data comparability tool.

Several California agencies have also used through-the-probe audits to check the accuracy of their equipment and methods. In this type of audit, a sample of known quantity is inserted into an air toxics sampling device. The laboratory staff members, who are not aware that the sample is an audit, process the sample according to their standard procedures and their results are compared to the known quantity in the sample to identify any equipment or method problems.

CARB has also led several California agencies in cross-agency laboratory audits. In the annual Whole Air Toxic Audit, CARB uses a modified toxics sampler to simultaneously collect multiple canister samples from a single location. Participating laboratories analyze the sample and report values for each air toxics compound. Using the reported values that fall between established minimum and maximum values, CARB calculates the mean reported value and prepares a comparison of individual laboratory results with this mean value. In addition, CARB leads an annual "round robin" audit where NIST cylinders are distributed to participated laboratories for analysis. CARB compares the results of each laboratory and identifies whether they fall within an acceptable range of the actual quantities of air toxics within the NIST cylinders. EPA Region 9 officials acknowledged the benefit of cross-agency precision and accuracy audits like those that CARB leads, but noted that SLTs outside of California likely do not have the connectivity or infrastructure to perform similar audits.

Additionally, SLT officials in EPA Region 9 noted that one deficiency in available QA/QC resources is the lack of low-level calibration standards for agency equipment. These officials noted a concern with the stability of currently available low-level calibration cylinders and cited a need for consistently reliable standards, which would provide better calibration than diluting cylinders with higher levels of toxics.

4. **Further Guidance and Tools for SLTs Using Outside Laboratories to Process Their Samples.**

   Several SLTs within EPA Region 9 rely on other agencies or contractors to perform the laboratory analysis on their samples. Agency officials reported that in the past, these collaborations have led to unnecessary errors and re-work for SLTs if expectations were not clearly communicated from the onset. For example, the entity performing the laboratory analysis and the agency conducting the sampling may have different expectations for a variety of factors including the format for reporting the data, the detection and reporting limits for the air toxics compounds, and which agency is responsible for ensuring the validity of the sample. SLT officials noted that up-front and ongoing communication would prevent most of these issues. Agency officials also attributed continued difficulties with using outside laboratories to a lack in standard procedures or templates for agencies, lack of standardization in the criteria for handling samples, challenges with defining ownership of the sample, lack of communication on QA/QC audits performed at the laboratory, and few venues for agencies to discuss best practices.

Finding 5: Agencies across EPA Region 9 Expressed Strong Interest in Expanding Cross-Agency Communication, Information Sharing, Collaboration, and Training Related to Air Toxics Monitoring.

EPA Region 9 SLTs expressed an interest in enhancing communication and collaboration related to air toxics monitoring priorities, methods, results, and trends within their region and within the larger national framework. Currently existing communication and collaboration forums address some of the region's needs but there is a desire for a more cohesive collaboration strategy that consolidates and enhances the current systems. Specifically, Region 9 SLTs see a need for improvements to the available guidance and resources, enhancements to the current set of national and regional communication forums, and improvements to training tools. SLT officials noted the important role for EPA headquarters and EPA Region 9 at both the national and regional levels to provide leadership and foster coordination among agencies engaged in air toxics monitoring. At the same time, EPA and SLT officials observed that there are opportunities for SLTs in Region 9 to enhance communication and information sharing among peers.

A Patchwork of Forums Is Available for Agencies in EPA Region 9 to Share Information Related to Air Toxics Monitoring, but There Is Not Currently Systemic Coordination and Collaboration Across Agencies.

EPA Region 9 and SLTs in the region collaborate through a variety of venues. SLT and EPA Region 9 officials reported that they currently participate in a variety of conference calls and meetings targeted towards the air toxics community (see Table 4), although not all agencies participate in all forums. In addition, SLT officials noted that they regularly reference tools made available by EPA on the TTN AMTIC website and sometimes reference other SLT websites to learn more about others' monitoring approaches. Some SLT officials also reported having regular communications and collaboration with other agencies or academic institutions, but that the ability to set up and maintain this type of ad-hoc communication path varies widely among Region 9 agencies. For example, several officials in the region reported that they employ former graduates or professors from local universities, and that this has allowed their agency to build ties to academic institutions. Overall, this breadth of venues available in EPA Region 9 creates a solid infrastructure for communication and collaboration, although EPA Region 9 and SLT officials noted that each agency participates in collaboration efforts to a different extent. The EPA headquarters, EPA Region 9, and SLT officials we interviewed for this evaluation described a number of improvements to the existing communication and collaboration venues available to agencies in the region which would be beneficial if resources are available for these upgrades and enhancements.

In addition, many SLT officials in EPA Region 9 indicated interest in receiving a broader range of information on air toxics monitoring studies than what is currently available through existing venues. For example, many agency officials cited difficulty in obtaining information on the breadth of current air toxics monitoring activities across the United States, particularly on those monitoring projects not funded by EPA. SLT officials also noted that they would be interested in having more information on current and past air toxics studies categorized by source types, such as near-roadway effects or ports, as well as detailed information from past studies, including study methodologies, relevant metadata, and any data analysis. A few SLT officials also noted that access to reference materials, such as peer reviewed academic reports, templates, example QA plans, methods, and standard operating procedures developed by SLTs, and best practices guides, would enhance their ability to design and manage effective air toxics monitoring projects. Some of this type of information is currently available through EPA's TTN AMTIC website, although EPA and SLT officials noted that the current set of information could be enhanced to better meet all parties' needs. Similarly, SLT officials indicated that they could work together in linking intra-regional air toxics monitoring activities on each other's websites. In addition, some SLTs indicated interest in a message board for collaborating on monitoring issues, but acknowledged that other SLTs may not be able to answer their questions and suggested that this sort of collaboration forum would only be useful if air toxics experts could regularly monitor the message board and respond to questions.

EPA Region 9 officials and personnel from most SLTs in the region participate in collaborative committees to discuss air toxics issues or attend national meetings where air toxics topics are included on the agenda (see Table 4). For example, managers with responsibility for air toxics monitoring from most agencies in California participate in California Air Pollution Control Officers Association (CAPCOA) meetings each year, which frequently address air toxics issues. For example, the focus of a 2007 meeting was "Health Impacts of Air Pollution on Communities." In addition, some agency officials stated that EPA's Air Toxics Data Analysis Workshops and National Air Monitoring Conferences are beneficial for sharing information on monitoring related activities and issues. For example, several presentations on updates to national programs, results of recent community-scale monitoring efforts, and results of national data analysis efforts were discussed at the 2007 workshop in Chicago. However, several EPA Region 9 and SLT officials noted that agendas for the communication forums listed in Table 4 do not always sufficiently focus on air toxics monitoring, and suggested consolidation and improvements to agendas may be warranted in the future.

Table 4: EPA Region 9 Communication Forums

Air Monitoring Technical Advisory Committee (AMTAC)	National Air Toxics Trends Stations (NATTS) conference calls
Air Toxics Risk Assessment (ATRA) conference calls	National Association of Clean Air Agencies (NACAA) Air Toxics Committee
California Air Pollution Control Officers Association (CAPCOA)	Regional Air Toxics Coordinators (RATC) conference calls
EPA Air Toxics Data Analysis Workshops	Western States Air Resources Council (WESTAR) Technical Committee
EPA National Air Monitoring Conferences	

Building on the idea of consolidation of air toxics communication and collaboration forums, several SLT and EPA Region 9 officials cited a need for a more focused and cohesive regional air toxics communication and collaboration strategy. These officials noted that there are few forums focusing specifically on air toxics monitoring or technically-oriented interactions about air toxics monitoring issues, needs, and methods.

We found that SLTs in EPA Region 9 currently collaborate in a number of ways—including informal consulting and advising, collaborative monitoring projects, sharing or loaning equipment, and sharing laboratory, analysis, and auditing services—but that nearly all such collaboration occurs within state boundaries. For example, the Roseville Rail Yard project was a collaborative monitoring effort between several agencies including CARB, SCAQMD, EPA, and Placer County APCD. Placer County APCD managed the majority of the project components including development of the methodology and collection of the data, and managed the day-to-day project activities. CARB and SCAQMD provided a variety of in-kind services including modeling, participation on the project advisory board, and laboratory and auditing services, in addition to loaning Placer County APCD much of the sampling equipment for the project, and EPA provided Placer County APCD a community-scale monitoring grant and participated on the project advisory board. Several agency officials involved in the Roseville Rail Yard project and other collaborative monitoring efforts suggested that a regionally-focused air toxics meeting targeted towards a technical audience would greatly enhance regional collaboration, communication, and coordination opportunities, and could especially encourage collaboration across state boundaries.

EPA and SLT Officials Cite a Need for Improved Air Toxics Data Sharing.

As part of the national air toxics monitoring program, EPA accesses and compares data from numerous sites across the nation. In comparison, SLTs tend to focus most of their efforts on data from their own air toxics networks, although EPA Region 9 SLT officials expressed an interest in occasionally sharing and comparing data with other agencies. However, EPA and SLT officials noted that there is not a streamlined mechanism for accessing and comparing data from numerous agencies. While the AQS database serves as an effective repository for air toxics data that has been collected, SLT officials in EPA Region 9 reported difficulty with accessing comprehensive raw air toxics data and trends information. The AQS database currently provides the best means for retrieving data collected by SLTs across the nation, but several SLT officials indicated that certain aspects of AQS's data entry requirements and user interface often deter them from using the database for this function (see Table 5). A common concern among agency officials is the lack of metadata associated with the data points in the AQS database. For example, several SLT officials noted that they hesitate to compare their data to other air districts' data without a full report on any potential data quality issues. These officials noted that AQS provides a limited ability to report this information, primarily through the use of data flags, but that more detailed information is lacking. EPA and SLT officials also noted that some air districts do not report data from their community-scale air toxics monitoring projects to AQS, particularly when these projects are not funded through EPA grants, limiting the extent of data available in the database. In addition, several SLT officials reported difficulty with the AQS user interface, citing specifically that limited guidance is available to set-up and interpret data reports and that data reports cannot easily be incorporated into local applications, such as spreadsheets. Overall, SLT and EPA officials cited the complexity of air toxics data as the key contributor to continued data sharing challenges. Because air toxics data is more complex to collect and analyze than criteria pollutant data, there are many unique challenges with reporting air toxics data that are not present in criteria pollutant monitoring programs.

Table 5: Common Reported Issues with Using the AQS Database and User Interface

Report formats are difficult to integrate with local applications (e.g., spreadsheets and databases)	The user interface for AQS is not easy to navigate and it is easy to misinterpret the data reports and what information they contain
Users in different screening groups cannot report data for the same monitor so sometimes agencies and their contractors are forced to set up two monitors in AQS for a single monitor in their network	There is no standard way to pull NATTS data from the AQS database, as this data is combined with other HAPs data
There are conflicting opinions on whether zeros should be entered when data is not available or if the field should be left blank	The user interface for data entry is confusing and data entry can be time-consuming

During preparation of this evaluation, we also encountered difficulties with interpreting and using data reports from AQS, but found that EPA has a number of more user-friendly interfaces for the public to access air quality information including AirData, AirExplorer, AirNOW, and AQS Discoverer.[14] The AirData, AirExplorer, and AirNOW interfaces are targeted towards less technical audiences, and likely do not provide access to the level of information needed by SLTs in EPA Region 9; however, they do provide examples of other types of user interfaces for retrieving air quality data. The AQS Discoverer application provides access to all the data available in the AQS database and allows any user with an AQS account to prepare customized data reports that can be easily exported to common spreadsheet applications. However, there is a significant learning curve associated with use of the AQS Discoverer application, due to the complexity of developing the customized data reports.

SLT officials also noted that they regularly reference the CARB ADAM database to retrieve California air toxics data primarily because of its user-friendly interface. In addition, CARB publishes an annual air quality DVD that allows users access to an interactive interface for querying California air quality data, including air toxics data. For example, the 2007 DVD includes data from 1980-2005. These DVDs allow the user to create custom printable reports or tables in DBF, TXT, or DAT formats.

[14] AirData is located at http://www.epa.gov/air/data/, AirExplorer is located at http://www.epa.gov/airexplorer/, AirNOW is located at http://www.airnow.gov/, and AQS Discoverer is located at http://www.epa.gov/ttn/airs/airsaqs/aqsdiscover/.

Agencies Cite a Need for Additional Training Opportunities and Training Tools.

A few SLT officials in EPA Region 9 noted that past training events led by EPA in New York and California provided good opportunities for local agency staff, but that many agencies cannot send staff to training events outside of their locale. Because most training occurs within SLTs, officials indicated a need for additional guidance and mentoring for training new staff, and noted that the guidance should address the specific needs of field and laboratory staff. Many of the SLTs we interviewed observed that they had adequate in-house procedures for training laboratory staff, but that gaps exist in training procedures for field staff. Whereas laboratory staff members tend to have similar academic and professional backgrounds, field staff members often have a mix of professional backgrounds and may require a broader scope of training. Several SLT officials suggested that a regional training event with modules geared towards different types of staff could help improve consistency between agencies and provide a forum to deliberate technical issues and concerns. Other officials suggested that regional coordination that includes mentoring could be another effective means of training. In addition, SLT officials at agencies which use outside laboratories cited a need for training specific to their situation, including procedures for verifying the validity of collected samples and best practices for reviewing the laboratory's results to identify any QA/QC or transcription errors.

Finding 6: Air Toxics Monitoring Data Is Being Used and Analyzed to Varying Degrees across EPA Region 9, and There Is a General Sense that Increased Attention Is Needed to Effectively Expand the Use of the Data for Program Planning and Accountability.

Much attention over the past decade has focused on expanding efforts to monitor ambient air toxics concentrations, and there is a general sense that greater attention is needed for analyzing and using air toxics monitoring data. SLTs undertake varying levels of data analysis and EPA has had a national monitoring effort underway for the past several years. EPA and SLT officials generally asserted that additional efforts are needed to maximize the value of monitoring data. At the state and local level, agencies in California have substantial experience in analyzing, using, and reporting ambient air toxics data for purposes of program accountability and planning. Other SLTs are generally at the early stages of beginning to analyze and use collected data. EPA and SLT officials noted that any efforts to further analyze air toxics data at the national and regional levels will likely be led by EPA and a select number of SLTs in the region.

Significant Variation Exists within EPA Region 9 in How SLTs Are Using Air Toxics Monitoring Data to Inform Program Accountability and Planning.

At the state and local level, California is a clear leader in using ambient monitoring data for purposes of program accountability and planning. Ambient monitoring data is routinely analyzed to prepare an annual assessment of air toxics issues and trends in California. Since 1999, CARB has published the annual *California Almanac of Emissions and Air Quality*.[15] The 2007 *Almanac* presents an overview of emission and air quality information on TACs. It also provides summaries of statewide emissions, annual average concentrations (calculated as an average of the monthly means), and estimated health risks for ten selected TACs.[16] The 2007 *Almanac* also provides similar information for California's five most populous air basins: the South Coast, the San Francisco Bay Area, the San Joaquin Valley, San Diego County, and the Sacramento Valley air basin.

California has also included air toxics in the state's broader environmental indicators initiative to assess environmental quality trends, enhance accountability of government environmental programs, and guide future government action. The Environmental Protection Indicators for California (EPIC) Project was established in statute in 2003, [17] requiring the development and routine reporting of a set of environmental indicators for California.[18] EPIC is a collaborative effort of the California Environmental Protection Agency, the Resources Agency, the Department of Health Services, and an external advisory group, and is led by the California OEHHA. Progress reports on EPIC pilot projects show that the consideration of indicators in the development and implementation of environmental protection programs has been important in evaluating program effectiveness.

EPIC has identified three air toxics indicators for development. These include:

- Total emissions of toxic air contaminants.
- Community-based cancer risk from exposure to TACs.
- Cumulative exposure to toxic air contaminants that may pose chronic or acute health risks.

These indicators are categorized as "Type II" indicators, meaning that they will require additional data and effort to develop. As of 2007, these indicators had not been fully implemented in the EPIC project. The first indicator, total emissions of toxic air contaminants, will rely on emissions inventory data. The second indicator, community-based cancer risk from exposure to TACs, will utilize data collected from air monitors and dispersion modeling to estimate ambient concentrations of air toxics throughout California. These estimated concentrations will be used to calculate excess cancer risk for each toxic

[15] The 2007 *Almanac* is located at http://www.arb.ca.gov/Aqd/almanac/almanac.htm
[16] The TACs addressed in the 2007 *Almanac* represent the ten TACs known to have the greatest health risk in California, based primarily on ambient air quality data, including: acetaldehyde, benzene, 1,3-butadiene, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, perchloroethylene, and diesel particulate matter.
[17] EPIC was established under AB 1360.
[18] Further information is located at http://www.oehha.org/multimedia/epic/.

air contaminant, and a cumulative risk will be calculated by adding estimated risk values for the toxic air contaminants in an air basin or community. The results will be overlaid by demographic data using a GIS-based program. Additional demographic data, such as average income or ethnic background may also be utilized to address environmental justice issues. The third indicator, cumulative exposure to toxic air contaminants that may pose chronic or acute health risks, would utilize air monitoring data and dispersion modeling to estimate ambient concentrations of air toxics throughout California. Particular attention will be paid to the main air basins known to have the highest air levels of TACs in California (South Coast, San Diego County, San Joaquin Valley, San Francisco Bay Area, and Sacramento Valley). The data on long-term ambient air concentrations of TACs are being compiled and will be presented in a future indicator for chronic non-cancer risk. Officials from California OEHHA have noted that the collection of acute TAC exposure data is more resource intensive since it requires hourly ambient concentration data. The acute non-cancer risks posed by TACs may be presented in a future indicator, as more complete data on hourly levels of TACs is collected.

Several of the local air agencies in California also publish analyses of air toxics trends, drawing at least in part on ambient monitoring data. For example, BAAQMD prepares and publishes a *Toxic Air Contaminant Control Program Annual Report*, which provides the public with information regarding BAAQMD's programs to reduce ambient concentrations of TACs.[19] The report summarizes the current focus and direction of the programs that are used to identify and control TACs from stationary sources (Volume I), and contains summaries of the TAC emissions inventory and ambient monitoring network (Volume II). At present, there is a substantial lag in time for publication of the report. The most recent report that is publicly available is for 2003. In addition, SCAQMD published the results of it MATES I and MATES II studies. The MATES II study report provides comprehensive information including the data monitoring results, an updated emissions inventory for the South Coast Air Basin, and summarizes a modeling effort which characterizes the health risk due to air toxics in the Basin.

Outside of California, the availability of information and analyses of air toxics monitoring trends and performance measures is limited but increasing. For example, ADEQ publishes an *Air Quality Annual Report*,[20] which has included references to JATAP in recent years. In addition, EPA requires agencies receiving community-scale monitoring grants to develop final project reports, [21] which document the monitoring effort methodology, participants, analysis, and results.

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[19] The BAAQMD annual reports are located at http://www.baaqmd.gov/pmt/air_toxics/annual_reports/index.htm.

[20] ADEQ's 2006 Air Quality Annual Report is located at http://www.azdeq.gov/function/forms/download/2006/aqd.pdf.

[21] Information on past and current community-scale grant projects can be located at http://yosemite.epa.gov/oar/CommunityAssessment.nsf/Community%20Assessment%20List!OpenForm and the final grant reports are located at http://www.epa.gov/ttn/amtic/local.html.

SLTs in EPA Region 9 Cite a Strong Interest in Expanding and Improving the Use of Air Toxics Monitoring Data for Program Planning and Accountability Purposes.

SLT officials in EPA Region 9 generally agreed that air toxics monitoring data is not being used to the extent that is possible or desired to inform program planning and assess program performance. Opportunities for improving the availability, accessibility, and analysis of ambient data were identified at multiple levels, including regional trends data, national trend data (e.g., NATTS) and local-scale monitoring project data. SLT officials identified several types of hurdles to the effective use of air toxics monitoring data for program planning and assessment. First, delays in the availability and reporting of ambient monitoring data can hinder the ability to analyze and compare data and to assess trends. Second, the user-friendliness of information system tools can affect the ability and ease of accessing and analyzing ambient monitoring data. Third, limited availability of funding and staff resources often mean that the collection of ambient monitoring data is prioritized over analysis of monitoring data.

During our interviews with SLT officials, we found a general sentiment that analysis and use of ambient air toxics data should increase over the next few years in order to meet air toxics program objectives. Agency officials indicated that as ambient data is accumulating, and data comparability issues are being addressed, it will be increasingly important to focus attention on the analysis and communication of air toxics monitoring data, trends, and issues. Several officials noted that failure to make this shift will undermine future monitoring efforts, particularly if there is a perception that ambient monitoring investments are not providing commensurate benefits for program accountability and planning. These officials also noted that public interest and attention will likely grow related to air toxics, and that the ability of government to help the public understand and address the health risks from air toxics will be increasingly important.

In addition, SLT officials noted the need for further collaboration in developing unit risk factors. Unit risk factors, such as those developed by EPA and California OEHHA, are important inputs for risk evaluations and models. CARB officials noted that it would be helpful to receive input from external agencies during periodic updates to their unit risk factors.

Air Toxics Monitoring Data Is Playing a Small but Increasingly Important Role in Assessing the Performance and Accountability of the National Air Toxics Program.

In the past decade, ambient air toxics monitoring data has not played a major role in the national assessment of air toxics programs or of the extent to which these programs are meeting established goals and desired outcomes. The air toxics program performance measures and indicators compiled by EPA in 2007 indicate that most short-term and long-term air toxics program outcome measures are currently constructed using data from the NEI and the NATA, which model ambient air toxics concentrations and public exposure using emissions inventory data.

Recent EPA efforts to improve program performance measurement have focused on better accounting for program outcomes in addition to program outputs, in part driven by the GPRA and OMB's PART evaluation. As emphasis has shifted towards improving measures of program outcomes and results, increased attention has focused on using ambient air toxics monitoring data as an alternative or supplement to information from the NATA and the NEI. Ambient concentrations of pollutants assessed through monitoring are typically viewed, particularly by the public, as more direct and accurate indicators of public exposure to air toxics than modeled concentration values.

Concurrent with the development of the NATTS network, EPA has sought to use ambient air toxics monitoring data in efforts to assess the performance of the national air toxics program. For example, in the ambient air toxics data MIP, EPA proposed transitioning from the existing toxicity-weighted emission inventory measure to a measure that uses ambient monitoring of air toxics as a surrogate for population exposure and compares these values with health benchmarks to predict risks. EPA has proposed to use data from the NATTS sites for development of this measure, but EPA officials noted that increased management attention and resources will likely be needed.

Some EPA and SLT officials in EPA Region 9 suggested that national-scale trends data may have important, but limited, utility in assessing national air toxics program performance. The primary issue involves challenges associated with capturing a representative picture of ambient conditions and public exposures from the limited number of NATTS sites. Local factors such as geography, topography, meteorology, and source locations can dramatically affect the value of measured ambient concentrations in an area, making it difficult to find a representative site for a location despite rigorous siting criteria and methods. In its MIP for ambient air toxics data, EPA acknowledged that the current proposed measure is designed to only capture widespread risk estimates and that it may not address local-scale risks or hot spots. EPA suggested that in the future the technical approach for developing the measure could be modified to potentially account for local hot spots and variations. EPA and SLT officials also noted that the accuracy and comparability of NATTS data is an important factor in determining the usefulness of this dataset for program accountability.

The national air toxics program is driven by the CAA requirements to address specific source categories, and therefore EPA headquarters officials noted that ambient monitoring data may not always play a prominent role in program planning efforts. However, EPA headquarters and SLT officials in the region recognized the importance of using ambient monitoring data for national program planning and accountability purposes, to the extent possible. Monitored ambient concentration data can help tell important stories about air toxics trends and issues and the extent to which program activities are affecting exposure outcomes. Several EPA and SLT officials indicated that the optimal approach is to have a collection of measures, drawn from ambient monitoring data and modeled emissions inventories, to address the status of both broad-scale ambient conditions and local "hotspots." For example, a few SLT officials in EPA Region 9 noted that the UATMP has been a useful vehicle for analyzing and disseminating the results of ambient monitoring data, such as the 2005 UATMP report that focused on national trends in ambient concentrations of hexavalent chromium. The findings from such national-scale studies based on monitoring data can both inform national-scale policy making as well as state, local, and tribal efforts to better understand how these national trends may be playing out within specific communities.

EPA Officials Cite a Need to Enhance Performance Measures Addressing Air Toxics Monitoring Program Implementation and the Tracking and Communication of These Measures at the National Level.

While annual program goals and performance measures are being set by EPA for air quality programs, including air toxics monitoring, program performance measures are not being tracked, reported, and communicated in a manner that informs or drives results-based management. As part of its Annual Commitment System, EPA OAQPS and EPA Regional Air Offices develop annual tables of goals, performance measures, and activities, outputs, and targets for achieving and demonstrating progress towards goals outlined in EPA's National Monitoring Strategy. The identified activities, outputs, and targets include those sought from EPA's national program office and EPA Regional offices, as well as from SLTs. Several EPA officials, however, suggested that this effort is largely a planning exercise and that progress towards these specific program goals and targets are not consistently tracked, reported, or communicated in a manner that is useful for management of national and regional air toxics monitoring programs.

EPA officials identified a number of performance measures that could be useful in assessing the progress of national and regional air toxics program implementation. These include the timeliness or completeness of SLT air toxics data reporting to AQS and participation rates in the PT testing program and Technical System Audit program. Several EPA officials noted that improved measurement, reporting, and communication of progress in regional and national air toxics monitoring program implementation could be useful for sustaining inter-agency attention and commitment to strengthening air toxic monitoring programs. Several officials also indicated that the recent process change to allow for annual state-level review and comment on the national goals, activities, and targets is a welcome addition. They noted, however, that a more collaborative process would likely be needed to enhance buy-in from SLTs and to enable better alignment of program priorities at the federal, regional, state, and local levels.

Conclusions

There is a significant amount of air toxics monitoring activity occurring within EPA Region 9 which supports EPA's dual emphasis on national- and local-scale air toxics monitoring. Overall, there is a strong degree of consistency in the air toxics monitoring objectives articulated by EPA and the SLTs in EPA Region 9, and the monitoring efforts currently underway in the region address these objectives. Each SLT within the region has different needs, priorities, and abilities, resulting in a patchwork of monitoring activity across EPA Region 9. Despite this patchwork, there is evidence that monitoring efforts have contributed to significant advances in understanding and addressing regional, state, tribal, and local air toxics issues and associated public health risks. In particular, agencies in EPA Region 9 have pioneered local-scale monitoring activities that are improving understanding of air toxics risks and mitigation options associated with sources such as near-roadway locations, rail yards, and ports. In addition, data collected from local- and regional-scale trends networks in EPA Region 9 complement results from national-scale trends networks, providing a richer picture of air toxics concentration and exposure issues. Furthermore, the extent of progress made in establishing the diverse array of air toxics monitoring activities is impressive given the complexity of the task and the limited resources and staffing available at EPA and SLTs to support these activities, particularly when compared with criteria pollutant programs. At the same time, however, there are important opportunities to improve air toxics monitoring activities in the region and to enhance the usefulness of the resulting data to address program objectives.

It appears that air toxics monitoring activities are approaching a key juncture at the national and regional level: many SLTs have air toxics monitoring programs that are maturing, the NATTS program is becoming firmly established, and numerous local-scale monitoring projects, including EPA's community-scale air toxics monitoring grant program, have been completed. At this point there is an important window of opportunity to consider and share lessons learned, continue efforts to improve data quality and comparability, enhance the analysis and communication of monitoring results and trends for measuring program performance and informing planning, and identify future directions for air toxics monitoring activities at all levels.

First, there are opportunities to strengthen and connect air toxics monitoring activities across air districts in EPA Region 9. EPA Region 9 SLTs represent a spectrum of air toxics monitoring experience, which ranges from agencies that have managed air toxics monitoring networks for over two decades to agencies that began air toxics monitoring as recently as 2006. As a result, agencies' needs and abilities cannot be generalized as a whole, but must be categorized between agencies with significant air toxics monitoring experience and agencies newer to this type of monitoring. Agencies with significant monitoring experience have a wealth of experience and technical expertise that can be leveraged by other SLTs and EPA, and require less outside expertise and direction to continue to grow their air toxics monitoring programs. Agencies with less air toxics monitoring experience can benefit from the mentorship, tools, and best practices of more experienced agencies, all of which can help readily improve their air toxics monitoring capabilities. While there is a significant amount of interaction among air toxics monitoring program managers in California, there are important opportunities to deepen the level of staff contacts within the state and to broaden interactions to include other interested agencies in Region 9. It is clear that Region 9 SLTs can play a vital role in mentoring each other and other SLTs nationwide.

SLT officials in EPA Region 9 view EPA as fulfilling a vital leadership role in fostering communication, coordination, and collaboration related to air toxics monitoring. This role is important to strengthen and connect air toxics monitoring activities both within the region and nationally. Region 9 has the benefit of having a number of agencies with substantial air toxics monitoring experience. The continued ability of EPA headquarters, EPA Region 9, and SLTs in the region to engage in a productive partnership will enhance the efficacy of air toxics monitoring program activities regionally and nationally. In conducting this evaluation, however, we were left with a sense of missed opportunity resulting from the limited communication and collaboration between EPA and Region 9 SLTs with significant air toxics monitoring experience, and among regional SLTs. While there is undoubtedly a rich history that accounts for this, the potential benefits of closer communication, coordination, and collaboration struck us as profound.

Second, there are continued opportunities to improve both the comparability and usefulness of air toxics monitoring data. There is a strong need to collaborate around and address the data quality and comparability issues which have come to light through the NATTS program implementation and through other SLT air toxics monitoring efforts. Despite the general agreement around air toxics monitoring program objectives among EPA and SLTs, not all agencies see the benefit in adopting national standard approaches to facilitate national data comparability at non-NATTS sites. In addition, several factors have been identified that can undermine the ability to compare data in a manner that supports effective air toxics program planning and accountability within EPA Region 9 and at the national program level. As described in Figure 1, there are a variety of factors that affect data quality and comparability which could be addressed to more fully realize the value of collected air toxics monitoring data in EPA Region 9.

As air toxics monitoring activities in EPA Region 9 expand and mature, there is a greater need and opportunity to invest in the analysis, use, and communication of data for air toxics program planning and accountability purposes. Efforts to improve awareness and understanding of air toxics issues, from regional trends to "hotspots" linked to specific sources, will both enhance the usefulness of existing air toxics monitoring data and the demand for future monitoring.

Recommendations

The following five recommendations, based on the findings in this report and from a January 31, 2008 meeting between EPA headquarters, EPA Region 9, and Region 9 SLT officials, provide ideas for improving air toxics monitoring communication, collaboration, and coordination in EPA Region 9 and nationally. These recommendations do not reflect critical improvements to the national air toxics monitoring program or SLT air toxics monitoring efforts. Rather, these recommendations are presented as ideas that can be used to inform EPA headquarters' ongoing improvements to the national air toxics monitoring program and can also be used by EPA Region 9 and SLTs to improve intra-regional air toxics monitoring communication, collaboration, and coordination.

Recommendation 1: Enhance Opportunities for Regional and National Information Sharing, Communication, and Coordination on Air Toxics Monitoring Methods and Results.

Enhanced communication opportunities within EPA Region 9 would provide SLTs an opportunity to share ideas and best practices and to coordinate with EPA on air toxics monitoring methods. Specifically, a regional technical air toxics committee could greatly enhance SLTs' abilities to collaborate and coordinate on air toxics topics. At the January 31, 2008 meeting, EPA and regional SLTs discussed formation of such a committee structured in the following ways:

- EPA Region 9 program officials would coordinate initial formation of the committee, which would include representatives from regional SLTs and EPA Region 9.
- The committee would hold quarterly conference calls and call agendas would be set by the committee members.
- The committee would meet in-person once a year.
- Responsibility for hosting, organizing, or presenting on specific conference calls or at in-person meetings would rotate among SLTs.

- Conference calls and meetings would be used to share information on past or future air toxics studies within the region and to discuss technical topics, such as methods.
- Some or all conference calls would be web broadcast, allowing officials from SLTs across the nation to join the discussions and learn from Region 9's experience.
- An EPA headquarters liaison would either attend the quarterly conference calls and meetings or would be briefed by the EPA Region 9 representative following the discussions.

Potential discussion topics for the regional technical air toxics committee could include:

- Sampling and laboratory analysis challenges for specific air toxics (e.g., acrolein or diesel particulate matter).
- Integration of regional information collection and storage systems (e.g., integration of Laboratory Information Management Systems with other data management systems).
- Information sharing mechanisms for air toxics data, methods, and study results (e.g., websites, databases, clearinghouses, message boards, and blogs).
- National, regional, state, local, and tribal objectives and priorities for air toxics monitoring (see Recommendation 2).
- Scoping and innovative funding opportunities for community-scale air toxics monitoring projects (see Recommendation 3).
- Data comparability needs and solutions to common data comparability challenges (see Recommendation 4).
- Air toxics data analysis and use (see Recommendation 5).

In addition, EPA could support Region 9's communication and information sharing efforts through enhancements to the EPA Region 9 and TTN AMTIC websites. For example, EPA could consider the following website improvement ideas to help disseminate air toxics information to SLTs in Region 9 and nationally:

- More clearly articulate national and regional air toxics monitoring objectives and provide ready access to detailed information on EPA-funded monitoring efforts, the data collected through these efforts, and resulting final reports and analyses. During these enhancements, EPA could consider adding more explanatory text to the main pages of the websites, so that users can access summary information without downloading large reports.
- Improve ability to access information by air toxics themes (e.g., pollutants or source types) or to search EPA websites by common air toxics key words.

- Improve access to the data contained in the AQS database. This could be achieved through continued improvements to current user interfaces such as AQS Discoverer.
- Provide access to user-friendly spreadsheet tools that enable SLTs to benchmark their air toxics monitoring data against annual averages from other SLTs and/or NATTS locations.
- Identify and provide contact information for air toxics experts (e.g., representatives from EPA, Northeast States for Coordinated Air Use Management (NESCAUM), academia, and EPA Region 9 SLTs).
- Add training resources (e.g. audio and visual presentations on air toxics topics).

In addition, officials from EPA and SLTs in EPA Region 9 could coordinate to help develop agendas for future national Air Toxics Data Analysis Workshops and National Air Monitoring Conferences. Many SLTs in the region are involved in innovative air toxics monitoring projects and could use their experience to help inform agenda planning for these meetings.

Recommendation 2: Increase Communication and Alignment of Regional Air Toxics Monitoring Program Objectives and Elevate Importance of Linking Air Toxics Monitoring to Emissions Reductions.

Further communication about air toxics monitoring program objectives could help SLTs in EPA Region 9 better understand regional priorities and could facilitate completion of monitoring activities that address these priorities. For example, many Region 9 SLTs have indicated interest in more consistently identifying the links between air toxics monitoring efforts and actual emission reductions within air districts, and in communicating these achievements to the public. Region 9 SLTs could discuss this and other enhancements to regional priorities at the quarterly meetings of the EPA Region 9 technical air toxics committee.

In addition, regional SLTs could work with EPA Region 9 to better understand the connections between the national air toxics monitoring program objectives and regional objectives. The National Air Toxics Program Logic Model could be used as a tool for understanding the connections between each agency's objectives and anticipated monitoring program outcomes, and to better understand the national objectives specific to the NATTS program and the community-scale monitoring grant program. These discussions of objectives could help Region 9 SLTs and EPA better understand future directions for air toxics monitoring programs and identify any needed enhancements to regional or national objectives.

Recommendation 3: Enhance Scoping of Local-Scale Air Toxics Monitoring Efforts and Communication about These Activities to Improve Alignment with National, Regional, State, Local, and Tribal Objectives.

Further scoping and preparation for local-scale air toxics monitoring efforts could help SLTs in EPA Region 9 focus their activities to better reflect national, regional, state, local, and tribal objectives. For example, SLTs could further scope their local-scale monitoring efforts by clearly identifying the extent of monitoring that will be conducted, the objectives of the monitoring effort, the anticipated impacts of the monitoring on the local community, and how that community will be involved in the monitoring process and any mitigation efforts that may result from the monitoring. It may also be important for SLTs to more clearly articulate the links between the monitoring effort and actual air toxics reductions. For example, SLTs could identify key stakeholders—such as regulators and source representatives—as part of their scoping efforts and describe the ways in which these parties could contribute to air toxics mitigation efforts if monitoring shows evidence of significant levels of toxics emissions. SLTs could also more clearly articulate the levels of risk at which mitigation or other actions are needed, as well as the levels at which monitoring will conclude. In some cases the regulators or stakeholders may be the federal government, and engaging the appropriate federal Branch and Division early in the scoping process may help align expectations and maximize mitigation opportunities. To better involve local sources and encourage voluntary mitigation efforts, SLTs could also consider broader incorporation of source attribution studies (e.g., through the use of local emissions inventories and receptor modeling) as part of their local-scale monitoring efforts.

Enhancements to EPA's current community-scale air toxics monitoring grant program could further focus SLT air toxics monitoring efforts on identified air toxics monitoring objectives. For example, new applicants during a given grant cycle could be encouraged to focus on particular themes that tie directly to current national objectives for problem identification, trends analysis, and science support, while giving equal weight to the review of applications that aim to complete activities outside the selected themes. Potential themes could be developed around specific source types or monitoring and methods development for specific air toxics. These themes could include near-roadway effects, goods movement, micro-scale chrome platers, diesel particulate matter, hexavalent chromium, acrolein, and naturally-occurring asbestos. In addition, EPA could help SLTs further scope their community-scale monitoring efforts by more clearly articulating national objectives for community-scale monitoring activities and how these may differ from objectives of other air toxics monitoring programs (e.g., the NATTS and PAMS programs) in the grant program guidelines.

Further communication about local-scale monitoring activities could also enhance Region 9's ability to meet identified air toxics monitoring objectives. For example, regional SLTs and EPA Region 9 could collaborate to share the results of regional local-scale monitoring projects through agency websites by posting documentation on study designs, objectives, and results. Adding key word searches to these websites would also facilitate access to information on past air toxics monitoring studies. In addition, SLTs could increase public communication efforts at the conclusion of air toxics monitoring efforts to further enhance the public's understanding of the results of the monitoring efforts and any mitigation measures resulting from the monitoring. EPA could also enhance the distribution of EPA-funded monitoring study results by providing communication links to other federal agencies and offices concerned with air toxics, such as the Federal Highway Administration and EPA Office of Transportation and Air Quality.

Additionally, EPA Region 9 and SLTs within the region could collaborate to enhance SLTs' abilities to conduct future local-scale air toxics monitoring studies. For example, these agencies could open a regional dialogue aimed at understanding funding options for local-scale air toxics monitoring projects. Officials from these agencies could share ideas for funding opportunities from all available sources—including federal, state, local, tribal, and private options—and discuss best practices for securing funding for mid-term community-scale monitoring projects. In addition, SLTs could optimize these discussions by identifying potential collaborative projects that could distribute resource needs between several agencies.

Recommendation 4: Collaborate to Identify Solutions to Common Data Quality and Comparability Problems and Develop Tools to Enhance Data Usability.

EPA Region 9 and SLTs in the region could use the regional technical air toxics committee to discuss the common data comparability issues documented in this report, including methods, detection limits, QA/QC procedures, and other technical topics relevant to air toxics of concern in the region (including those compounds currently outside the scope of the NATTS program). For example, at the January 31, 2008 meeting EPA and SLT officials from Region 9 expressed interest in discussing standard approaches for setting MDLs for specific compounds, differences in AQS reporting procedures for agencies with higher or lower MDLs, seasonal issues affecting data comparability, co-located data reporting precision, needs for future round robin and through-the-probe audits, and common series of data flags for AQS reporting. It may also be necessary for the participants in these technical committee discussions to agree on a decision-making framework to use during these meetings so that all parties follow the same process when there are disagreements on methods development or other technical issues.

EPA and Region 9 SLTs could also open a broader dialogue on the differences in data comparability needs at national, regional, and local levels. For example, EPA headquarters representatives could join a Region 9 technical air toxics committee meeting to discuss national needs for data comparability and how these may differ from the needs of some SLTs. This dialogue could help EPA and SLTs understand objectives and priorities at varying levels and identify priority data comparability challenges to address. While data quality issues are of great importance to both EPA and SLTs, EPA should remain sensitive to the fact that data comparability across districts is generally a higher priority to EPA than SLTs. The following three options for national data comparability were identified during the January 31 meeting:

1. Find consensus from all agencies on a consistent set of national standards for air toxics monitoring and implement these standards at all agencies;
2. Rely solely on NATTS data for establishing national trends; or
3. Conduct in-depth data analysis that assesses data quality and comparability of each site prior to inclusion in trends analyses.

SLTs in EPA Region 9 expressed an interest in working towards uniform monitoring methods but cannot currently commit to following national standards at non-NATTS sites; therefore, option 1 should be considered a potential goal that cannot yet be implemented. In the meantime, options 2 and 3 remain viable alternatives that have little direct impact on SLTs. This dialogue between EPA and SLTs on data comparability could also provide an opportunity to discuss methods requirements for major air toxics programs, such as NATTS, PAMS, and PM speciation studies. Considering these programs together could provide opportunities for resource savings.

In addition, EPA and Region 9 SLTs could discuss needs for an air toxics laboratory certification program. At the January 31, 2008 meeting, SLT officials in EPA Region 9 suggested that all laboratories should meet EPA's National Environmental Laboratory Accreditation Program standards, and expressed a desire to open a conversation with EPA on extending this accreditation standard as a national air toxics grant requirement.

EPA could support Region 9's efforts to address common data comparability challenges by continuing to support national air toxics data analysis and providing SLTs with tools to assist in data comparability challenges. For example, EPA could consider the following ideas:

- Enhance efforts to further analyze the national air toxics datasets and share this information with SLTs (e.g., via teleconference or webcast). This analysis could be conducted and documented in a method similar to the analysis conducted by EPA contractors on the UATMP data.
- Develop and provide access to user-friendly tools that enable SLTs to benchmark their air toxics monitoring data against annual averages from other SLTs. For

example, provide training on AQS Discoverer specifically tailored for air toxics staff or user-friendly spreadsheet tools.

- Expand the availability of online training resources.
- Assist SLTs with accessing NIST standards and/or develop a national stockpile of these standards.

Recommendation 5: Explore Methods for Using Air Toxics Monitoring Data to Evaluate Programs and Their Ability to Address Monitoring Objectives.

Data analysis and use could be highlighted during Region 9 technical air toxics committee discussions. In particular, EPA and Region 9 SLTs could discuss how each agency currently uses air toxics data, how they would like to use data in the future, how data is being used by other SLTs across the nation, best practices for data analysis, common QA/QC challenges associated with data analysis, best practices for benchmarking and comparing datasets, and potential changes to current practices or mechanisms that could facilitate further data analysis and use in the future. The SLTs in EPA Region 9 could use these meetings to highlight analysis of compounds prevalent in the region, and could web broadcast their discussions to assist other SLTs nationwide. In addition, regional SLTs could work with EPA to identify important national data analysis efforts and provide web broadcasts on these topics.

EPA could also support broader use of air toxics data on a national level by continuing to explore approaches for using air toxics monitoring data to evaluate national air toxics programs and their results, and to respond to the 2004 air toxics program PART assessment. For example, EPA could enhance efforts to fully implement the Measure Implementation Plan for using air toxics monitoring data to develop a risk-weighted performance measure. EPA could also use the annual goal-setting and performance measure process that is part of EPA's Annual Commitment System to support a more collaborative process of tracking and communicating air toxics monitoring program implementation. EPA's Air Toxics Monitoring Program Logic Model could be used to inform the development of program implementation performance measures.

Appendix A: Quality Assurance Plan

This appendix describes the Quality Assurance Plan that was developed for this air toxics monitoring program evaluation prior to the start of the evaluation.

Quality Assurance Plan

Title: EPA Region 9 Air Toxics Monitoring Program Evaluation

Contractor: Ross & Associates Environmental Consulting, Ltd. (Ross & Associates), subcontractor to Industrial Economics, Incorporated (IEc)

Plan Summary: EPA's National Center for Environmental Innovation (NCEI), located in the Office of Policy, Economics, and Innovation (OPEI), promotes new ways to achieve better environmental results. As part of its effort to encourage the effective use of program evaluations throughout the Agency, NCEI's Evaluation Support Division (ESD) has collaborated with the Office of Planning, Accountability and Analysis in EPA's Office of the Chief Financial Officer (OCFO), to promote program evaluation through a Program Evaluation Competition. This competition is part of an ongoing, long-term effort to help build the capacity of EPA headquarters and regional offices to evaluate activities and to improve measures of program performance. A project to evaluate the EPA Region 9 Air Toxics Monitoring Program (R9 ATMP) was selected in the 2006 Program Evaluation Competition.

Under this work assignment, Ross & Associates will assist EPA in evaluating the R9 ATMP. The objectives of this program evaluation are to (1) characterize air toxics monitoring programs across EPA Region 9, including identifying State and local network member objectives as well as those of EPA Region 9; (2) assess the network's design and the extent to which it meets stated objectives; (3) distinguish ways in which EPA Region 9's monitoring program contributes to the objectives of the national Air Toxics Monitoring Program and areas for improvement; and (4) identify potential performance metrics for evaluating air toxics monitoring programs at national and regional levels. Ross & Associates collaborated with EPA OPEI, the EPA Office of Air Quality Planning and Standards (OAQPS), and EPA Region 9 in designing this evaluation. Key points of agreement include:

- **Data Sources:** Key data sources include: (1) the Air Quality System (AQS) and California Air Resources Board (CARB) air quality information databases; (2) interviews with officials from EPA OAQPS, EPA Region 9, and EPA Region 5; (3) interviews with officials from the eleven State and local air toxics monitoring programs EPA set within the scope of the evaluation[22]; and (4) publicly available

[22] The eleven State and local air toxics monitoring programs EPA set within the scope of the evaluation are: Arizona Department of Environmental Quality; Bay Area Air Quality Management District; California Air Resources Board; Clark

information from the websites of the eleven programs set within the evaluation scope and EPA Region 9.

- **Design:** Ross & Associates designed its data collection and analysis in the context of the overarching evaluation questions and national Air Toxics Monitoring Program logic model provided by EPA.
- **Consistency:** Ross & Associates collaborated with EPA to develop an evaluation methodology document and interview guide for this project. Please refer to these documents for further information on how Ross & Associates will achieve consistency in data collection and analysis.
- **Audience:** Key audiences for the evaluation report include: EPA Region 9 Air Division; EPA OAQPS; EPA Air Toxics Monitoring Advisory Committee; and Region 9 State and local air toxics monitoring programs.

EPA Office: Office of Policy, Economics, and Innovation

EPA Project Leaders:

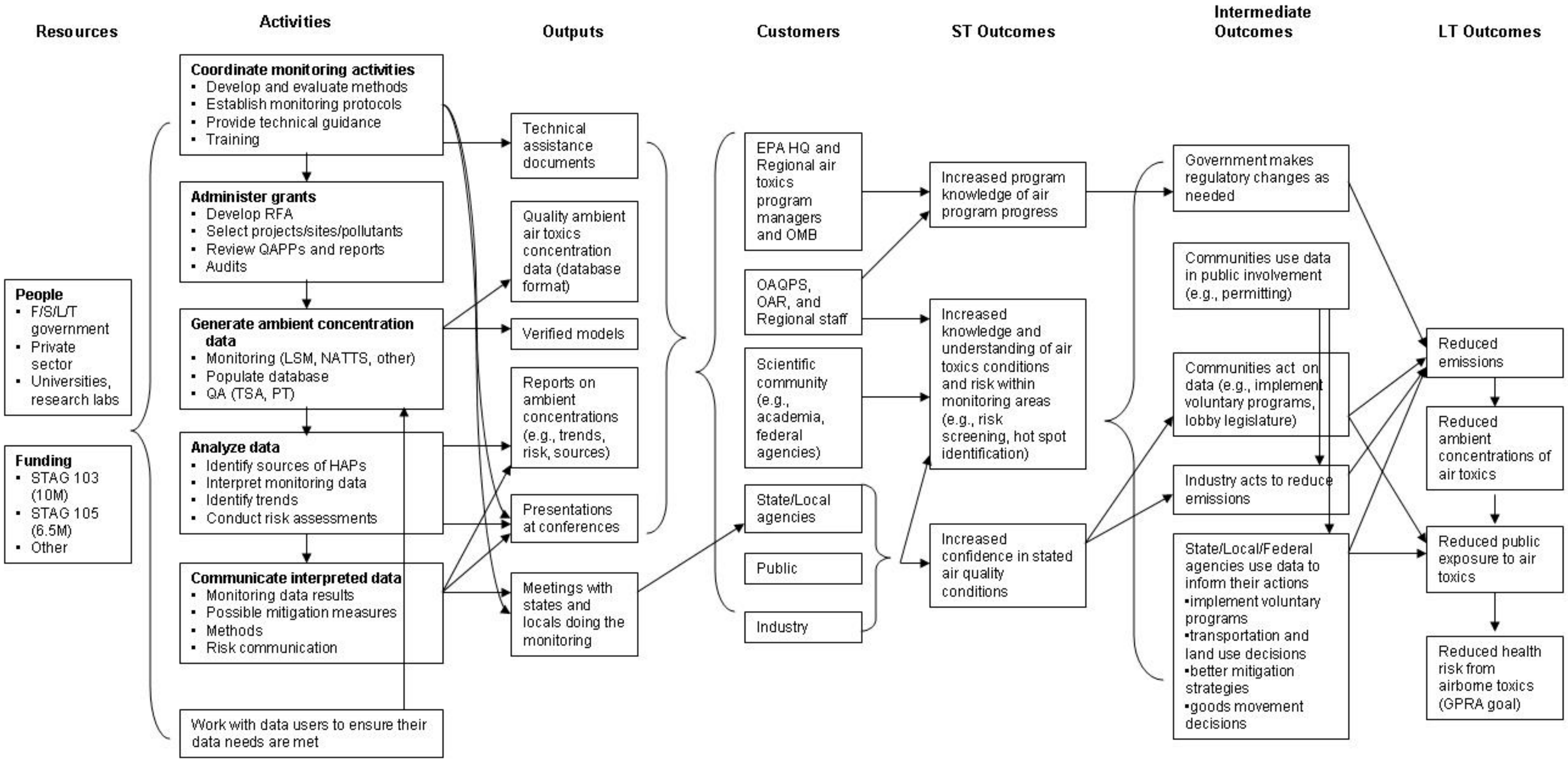
- Michelle Mandolia, OPEI
- Meredith Kurpius, Region 9

EPA Quality Manager: Michelle Mandolia, OPEI

County, Nevada; Hawaii State Department of Health; Joint Air Toxics Assessment Project; Nevada Division of Environmental Protection; Placer County Air Permit Control District; San Diego County Air Pollution Control District; South Coast Air Quality Management District; and Washoe County, Nevada.

Appendix B: National Air Toxics Program Logic Model

Program purpose: To inform actions that reduce public exposure to hazardous air pollutants by monitoring ambient air toxics concentrations.



External factors: Level and type of resources available, how customers use the data, the objectives of state and local agencies (which may differ from EPA's objectives), differing levels of ability to account for how funds are used depending on grant type, no national statutory requirement to monitor any HAPs.

Appendix C: List of Evaluation Contributors

This appendix lists the EPA officials, SLT officials, and additional contributors who provided input to this evaluation.

Name	Affiliation
Leonard Montenegro	ADEQ
Marnie Greenbie	ADEQ
Michael Sundblom	ADEQ
Randy Sedlacek	ADEQ
Sandra Wardwell	ADEQ
Steve Peplau	ADEQ
Eric Stevenson	BAAQMD
Jim Hesson	BAAQMD
Scott Lutz	BAAQMD
Karen Magliano	CARB
Ken Stroud	CARB
Lynn Baker	CARB
Mena Shah	CARB
Mike Poore	CARB
Dennis Mikel	EPA OAQPS
James Hemby	EPA OAQPS
Mike Jones	EPA OAQPS
Ted Palma	EPA OAQPS
Christina Kakoyannis	EPA OPEI
Michelle Mandolia	EPA OPEI
Carl Nash	EPA Region 5
Motria Caudill	EPA Region 5
John Brock	EPA Region 9
Matt Lakin	EPA Region 9
Meredith Kurpius	EPA Region 9
Mike Bandrowski	EPA Region 9
Sean Hogan	EPA Region 9
Wilfred Nagamine	Hawaii DOH
Leroy Williams	JATAP
Mehrdad Khabiti	JATAP
Tom Christofk	Placer County APCD
Yu-Shuo Chang	Placer County APCD
Janet Cawyer	San Diego APCD

Mike Kaszuba	San Diego APCD
Philip Fine	SCAQMD
Rudy Eden	SCAQMD
Mae Gustin	University of Nevada

Appendix D: SLT Interview Questions

This appendix lists the interview questions which were distributed to the participating SLT officials and referenced during interviews with these officials. Not all SLT officials were asked all questions, but the question list served as a guide for the interviews.

1. Characterization of Air Toxics Monitoring Programs

a. Air Monitoring Program Objectives
   i. What are the stated objectives of your agency's air toxics monitoring program?
   ii. If there are tribal lands within your State or local boundaries, are you familiar with the Tribe(s) stated objectives for air toxics monitoring? If so, what are they?

b. Air Toxics Monitoring Network and Information Collection
   i. Please describe your agency's medium- to long-term air toxics monitoring efforts (efforts which will last at least one year).
      a. What are the purposes and/or objectives for these efforts?
      b. What monitoring sites are associated with each of these efforts?
      c. What approaches are used for each of these monitoring efforts?
         a. Which air toxics are measured?
         b. At what detection levels/thresholds are these air toxics measured?
         c. What methods/tools are used for sampling and analysis?
         d. What is the frequency and duration of sampling?
         e. What quality assurance processes are used?
   ii. Please describe any short-term air toxics monitoring studies underway in your jurisdiction (studies which will last less than one year).
   iii. What are your future objectives for air toxics monitoring?

c. Data Management, Analysis, and Reporting
   i. Please describe the information systems you use to store and manage air toxics monitoring information.
   ii. What is the process for making air toxics monitoring information available in EPA's Air Quality System (AQS)?
   iii. Does your agency make air toxics monitoring data and/or information available to the public or others outside of the agency? If so, what information to whom?
   iv. What analyses, if any, are conducted using the air toxics monitoring data collected?

v. Does your agency prepare any reports based on air toxics monitoring data? If so, what are the purpose, scope, format, frequency, and audience for these reports?
vi. How could EPA assist or enhance your agency's air toxics data management, analysis, and reporting activities?

d. Sources of Program Support
   i. What non-EPA monetary and other contributions (e.g., lab equipment, staff time) do your agency and/or monitoring site staff use for air quality monitoring efforts?

2. Reflections on Air Toxics Monitoring Program Implementation

a. Program Objectives and Monitoring Design/ Implementation
   i. Is the air toxics monitoring program in your agency's jurisdiction, as currently designed and implemented, capable of meeting the stated program objectives? If not, how could the program be modified to meet the stated program objectives?
   ii. What can you do with the data being generated and what are the data limitations?
   iii. Do you have a need to use data from other jurisdictions? What are the limitations associated with this?

b. Assessing Risks and Health Effects
   i. Does the monitoring program address priority source categories and priority geographic locations (risk drivers)?
   ii. What activities are underway in your agency's jurisdiction to improve understanding of the human health risks associated with exposure to air toxics? What outcomes have you seen from these activities?
   iii. Are there any activities underway or planned to better understand the effects of air toxics on ecological conditions using monitoring data?

c. Communication, Coordination, and Collaboration in EPA Region 9
   i. Are there any efforts you are aware of to foster communication, coordination, and/or collaboration related to air toxics monitoring between agencies in your state or in EPA Region 9?
   ii. What type of communication, coordination, and/or collaboration would you like to see in the future?

Appendix E: List of Documents and Websites Referenced During Development of This Report

The following tables provide a list of the websites and additional documents referenced as background materials during development of this evaluation report.

Table 6: EPA and SLT Websites

Arizona Department of Environmental Quality	Air Quality Monitoring webpage: http://www.azdeq.gov/environ/air/monitoring/index.html Air Quality Annual Reports: http://www.azdeq.gov/function/forms/reports.html
Bay Area Air Quality Management District	Main webpage: http://www.baaqmd.gov/ Toxic Air Contaminant Control Program Annual Reports: http://www.baaqmd.gov/pmt/air_toxics/annual_reports/index.htm
California Air Resources Board	Air Toxics Program: http://www.arb.ca.gov/toxics/toxics.htm ADAM database: http://www.arb.ca.gov/adam/welcome.html Department of Pesticide Regulation: http://www.cdpr.ca.gov/ California Almanac of Emissions and Air Quality: http://www.arb.ca.gov/aqd/almanac/almanac.htm
Environmental Protection Agency	EPA Region 9 main webpage: http://www.epa.gov/region09/ EPA Technology Transfer Network Ambient Monitoring Technology Information Center: http://www.epa.gov/ttn/amtic/ EPA Technology Transfer Network Air Toxics Website: http://www.epa.gov/ttn/atw/ Office of Air and Radiation grants and funding webpage: http://www.epa.gov/air/grants/#closed Air Quality System website: http://www.epa.gov/ttn/airs/airsaqs/ Community-based Air Toxics Projects webpage: http://yosemite.epa.gov/oar/CommunityAssessment.nsf/Community%20Assessment%20List!OpenForm AirData webpage: http://www.epa.gov/air/data/ AirExplorer webpage: http://www.epa.gov/airexplorer/ AirNOW webpage: http://airnow.gov/ AQS Discoverer webpage: http://www.epa.gov/ttn/airs/airsaqs/aqsdiscover/ Urban Air Toxics Monitoring Program webpage: http://www.epa.gov/ttn/amtic/uatm.html PAMS program website: http://www.epa.gov/oar/oaqps/pams/
Hawaii Department of Health	Main webpage: http://www.hawaii.gov/doh
Joint Air Toxics Assessment Project	Main webpage: http://www4.nau.edu/jatap/
Nevada Division of Environmental Protection	Main webpage: http://ndep.nv.gov/
Placer County Air Pollution Control District	Roseville Rail Yard Air Quality Study: http://www.placer.ca.gov/Departments/Air/railroad.aspx
San Diego Air Pollution Control District	Air toxics webpage: http://www.sdapcd.org/toxics/air_toxics.html
South Coast Air Quality Management District	Main webpage: http://www.aqmd.gov/

Table 7: Additional Documents and Websites Referenced in Development of This Evaluation

Document	Website Location or Source
2001 EPA Pilot City Air Toxics Measurement Summary	http://www.epa.gov/ttnamti1/files/ambient/airtox/toxics2a.pdf
2002 EPA Air Toxics Research Strategy	http://www.epa.gov/ord/htm/documents/Air_Toxics.pdf
2004 Air Toxics Component of the National Monitoring Strategy	http://www.epa.gov/ttnamti1/files/ambient/airtox/atstrat804.pdf
2004 Analysis of Air Toxics Monitoring Data Work Plan	http://www.ladco.org/toxics/reports/Work%20Plan%20for%20toxics%20data%20analysis%20-%20WP2.pdf
2004 Measurement Implementation Plan for the air toxics program	Provided by EPA
2004 Technical Assistance Document for the National Ambient Air Toxics Trends and Assessment Program	http://www.epa.gov/ttnamti1/files/ambient/airtox/toctad04.pdf
2005 Draft National Ambient Air Monitoring Strategy	http://epa.gov/air/particlepollution/pdfs/naam_strategy_20051222.pdf
2005 EPA Office of Inspector General Evaluation Report	http://www.epa.gov/oig/reports/2005/20050302-2005-P-00008.pdf
2005 Mercury Pollution in Northeast Nevada Air report	http://www.theminingnews.org/pubs/ICLHginNVair.pdf
2006 United States Government Accountability Office air toxics program report	http://www.gao.gov/new.items/d06669.pdf
2006-2011 EPA Strategic Plan	http://www.epa.gov/ocfo/plan/2006/entire_report.pdf
2007 Inventory of Measures, Indicators, and Data for Air Toxics	Provided by EPA
April 2007 State of Nevada news release	http://ndep.nv.gov/pio/file/05-2006_mercury_research.pdf
California Office of Environmental Health Hazard Assessment Environmental Indicators for California	http://www.oehha.org/multimedia/epic/
December 2007 National Air Toxics Trends Stations Work Plan Template	Provided by EPA
Logic model for EPA's Air Toxics Monitoring Program	Provided by EPA
Mercury Deposition Network	http://nadp.sws.uiuc.edu/mdn/
Office of Management and Budget Program Assessment and Rating Tool air toxics report	http://www.whitehouse.gov/omb/expectmore/summary/10000226.2004.html

Appendix F: Federal Hazardous Air Pollutants

This appendix lists the federal HAPs. This list was compiled by accessing the original list of federal HAPs and removing the three compounds (methyl ethyl ketone, caprolactam, and hydrogen sulfide) which EPA de-listed following publication of the list in 1990. The list of original HAPs and modifications to this list was accessed through the EPA website[23] on November 20, 2007.

Acetaldehyde	Hydrazine
Acetamide	Hydrochloric acid
Acetonitrile	Hydrogen fluoride (Hydrofluoric acid)
Acetophenone	Hydroquinone
2-Acetylaminofluorene	Isophorone
Acrolein	Lindane (all isomers)
Acrylamide	Maleic anhydride
Acrylic acid	Methanol
Acrylonitrile	Methoxychlor
Allyl chloride	Methyl bromide (Bromomethane)
4-Aminobiphenyl	Methyl chloride (Chloromethane)
Aniline	Methyl chloroform (1,1,1-Trichloroethane)
o-Anisidine	Methyl hydrazine
Asbestos	Methyl iodide (Iodomethane)
Benzene (including benzene from gasoline)	Methyl isobutyl ketone (Hexone)
Benzidine	Methyl isocyanate
Benzotrichloride	Methyl methacrylate
Benzyl chloride	Methyl tert butyl ether
Biphenyl	4,4-Methylene bis(2-chloroaniline)
Bis(2-ethylhexyl)phthalate (DEHP)	Methylene chloride (Dichloromethane)
Bis(chloromethyl)ether	Methylene diphenyl diisocyanate (MDI)
Bromoform	4,4¬-Methylenedianiline
1,3-Butadiene	Naphthalene
Calcium cyanamide	Nitrobenzene
Captan	4-Nitrobiphenyl
Carbaryl	4-Nitrophenol
Carbon disulfide	2-Nitropropane
Carbon tetrachloride	N-Nitroso-N-methylurea
Carbonyl sulfide	N-Nitrosodimethylamine

[23] http://www.epa.gov/ttn/atw/pollsour.html

Catechol	N-Nitrosomorpholine
Chloramben	Parathion
Chlordane	Pentachloronitrobenzene (Quintobenzene)
Chlorine	Pentachlorophenol
Chloroacetic acid	Phenol
2-Chloroacetophenone	p-Phenylenediamine
Chlorobenzene	Phosgene
Chlorobenzilate	Phosphine
Chloroform	Phosphorus
Chloromethyl methyl ether	Phthalic anhydride
Chloroprene	Polychlorinated biphenyls (Aroclors)
Cresols/Cresylic acid (isomers and mixture)	1,3-Propane sultone
o-Cresol	beta-Propiolactone
m-Cresol	Propionaldehyde
p-Cresol	Propoxur (Baygon)
Cumene	Propylene dichloride (1,2-Dichloropropane)
2,4-D, salts and esters	Propylene oxide
DDE	1,2-Propylenimine (2-Methyl aziridine)
Diazomethane	Quinoline
Dibenzofurans	Quinone
1,2-Dibromo-3-chloropropane	Styrene
Dibutylphthalate	Styrene oxide
1,4-Dichlorobenzene(p)	2,3,7,8-Tetrachlorodibenzo-p-dioxin
3,3-Dichlorobenzidene	1,1,2,2-Tetrachloroethane
Dichloroethyl ether (Bis(2-chloroethyl)ether)	Tetrachloroethylene (Perchloroethylene)
1,3-Dichloropropene	Titanium tetrachloride
Dichlorvos	Toluene
Diethanolamine	2,4-Toluene diamine
N,N-Diethyl aniline (N,N-Dimethylaniline)	2,4-Toluene diisocyanate
Diethyl sulfate	o-Toluidine
3,3-Dimethoxybenzidine	Toxaphene (chlorinated camphene)
Dimethyl aminoazobenzene	1,2,4-Trichlorobenzene
3,3'-Dimethyl benzidine	1,1,2-Trichloroethane
Dimethyl carbamoyl chloride	Trichloroethylene
Dimethyl formamide	2,4,5-Trichlorophenol
1,1-Dimethyl hydrazine	2,4,6-Trichlorophenol
Dimethyl phthalate	Triethylamine
Dimethyl sulfate	Trifluralin
4,6-Dinitro-o-cresol, and salts	2,2,4-Trimethylpentane
2,4-Dinitrophenol	Vinyl acetate

2,4-Dinitrotoluene	Vinyl bromide
1,4-Dioxane (1,4-Diethyleneoxide)	Vinyl chloride
1,2-Diphenylhydrazine	Vinylidene chloride (1,1-Dichloroethylene)
Epichlorohydrin (l-Chloro-2,3-epoxypropane)	Xylenes (isomers and mixture)
1,2-Epoxybutane	o-Xylenes
Ethyl acrylate	m-Xylenes
Ethyl benzene	p-Xylenes
Ethyl carbamate (Urethane)	Antimony Compounds
Ethyl chloride (Chloroethane)	Arsenic Compounds (inorganic including arsine)
Ethylene dibromide (Dibromoethane)	Beryllium Compounds
Ethylene dichloride (1,2-Dichloroethane)	Cadmium Compounds
Ethylene glycol	Chromium Compounds
Ethylene imine (Aziridine)	Cobalt Compounds
Ethylene oxide	Coke Oven Emissions
Ethylene thiourea	Cyanide Compounds
Ethylidene dichloride (1,1-Dichloroethane)	Glycol ethers
Formaldehyde	Lead Compounds
Heptachlor	Manganese Compounds
Hexachlorobenzene	Mercury Compounds
Hexachlorobutadiene	Fine mineral fibers
Hexachlorocyclopentadiene	Nickel Compounds
Hexachloroethane	Polycylic Organic Matter
Hexamethylene-1,6-diisocyanate	Radionuclides (including radon)
Hexamethylphosphoramide	Selenium Compounds
Hexane	

Appendix G: National Air Toxics Trends Stations Compounds

This appendix lists the air toxics compounds currently measured through the NATTS program. This list was drawn from the December 3, 2007 version of the NATTS Work Plan Template.

1,2- dichloropropane	dichloromethane
1,3- butadiene	formaldehyde
acetaldehyde	hexavalent chromium (TSP)
acrolein	lead
arsenic compounds (PM_{10})	manganese compounds (PM_{10})
benzene	napthalene
benzo(a)pyrene	nickel compounds (PM_{10})
beryllium	perchloroethylene (tetrachloroethylene)
cadmium compounds (PM_{10})	trichloroethylene
carbon tetrachloride	vinyl chloride
chloroform	

Appendix H: Photochemical Assessment Monitoring Stations Compounds

This appendix lists the hydrocarbons and carbonyls currently included on the list of PAMS program compounds. This list was drawn from the PAMS program website[24] on January 21, 2008.

Table 8: Hydrocarbons Monitored Through the PAMS Program

Ethylene	2-methylpentane	n-Octane
Acetylene	3-Methylpentane	Ethylbenzene
Ethane	2-Methyl-1-Pentene	m&p-Xylenes
Propylene	n-hexane	Styrene
Propane	Methylcyclopentane	o-Xylene
Isobutane	2,4-dimethylpentane	n-Nonane
1-Butene	Benzene	Isopropylbenzene
n-Butane	Cyclohexane	n-Propylbenzene
t-2-Butene	2-methylhexane	m-Ethyltoluene
c-2-Butene	2,3-dimethylpentane	p-Ethyltoluene
Isopentane	3-methylhexane	1,3,5-Trimethylbenzene
1-Pentene	2,2,4-trimethylpentane	o-Ethyltoluene
n-Pentane	n-Heptane	1,2,4-trimethylbenzene
Isoprene	Methylcyclohexane	n-Decane
t-2-pentene	2,3,4-trimethylpentane	1,2,3-trimethylbenzene
c-2-pentene	Toluene	m-Diethylbenzene
2,2-Dimethylbutane	2-methylheptane	p-Diethylbenzene
Cyclopentane	3-methylheptane	n-Undecane
2,3-dimethylbutane		

Table 9: Carbonyls Monitored Through the PAMS Program

Formaldehyde
Acetone
Acetaldehyde

[24] The PAMS program website is located at http://www.epa.gov/oar/oaqps/pams/.

Appendix I: Air Toxics Performance Measures, Indicators, and Data

This appendix includes a table prepared by EPA which details measures, indicators, and data sources that provide information relevant to the air toxics strategic targets documented in the 2006-2011 EPA Strategic Plan.[25]

	Responses by EPA or Society		**Pressures on the Environment**		**State of the Environment**	
	Actions by Regulators	Responses of Regulated Community or Society	Emissions	Ambient Conditions or Quantities of Natural Resources	Uptake or Assimilation	Health, Ecology, or Other Effects
Performance Measures (*official* measures of OAR performance)	Timeliness of "key" actions (reported to DA in QMR, data from SCOUT)		Cumulative % reduction in toxicity-weighted [for cancer and non-cancer risk] emissions compared to 1993 baseline (reported in PART and GPRA, data from NEI and EPA's Health Criteria Data for Risk Characterization)			

[25] The 2006-2011 EPA Strategic Plan is located at http://www.epa.gov/ocfo/plan/2006/entire_report.pdf.

	Responses by EPA or Society		Pressures on the Environment		State of the Environment	
	Actions by Regulators	Responses of Regulated Community or Society	Emissions	Ambient Conditions or Quantities of Natural Resources	Uptake or Assimilation	Health, Ecology, or Other Effects
Indicators (other info available or published by OAR or EPA)	Regulations issued / standards implemented Compliance assistance provided Voluntary programs developed Tech info developed, studies conducted, reports published Tech methods developed Infrastructure developed or deployed Tech or financial assistance provided Outreach and education conducted Cooperation with other Feds	Compliance Implement or participate in voluntary or innovative programs Results of enforcement & compliance efforts	Air toxics emissions (reported in NEI & ROE, data from NEI) Emissions of five air toxics that present the greatest nationwide risk for cancer and non-cancer effects (reported in ROE, data from NATA) Mercury emissions (reported in ROE, data from NEI) Maps and data tables of emissions and emissions density information for 177 toxics + diesel PM (data from NATA)	Ambient concentrations of benzene (reported in ROE (data from NATTS & AQS) Mercury deposition (reported in ROE, data from MDN) Modeled ambient concentrations of 177 toxics + diesel PM (data from NATA) Exposure estimates for 177 toxics + diesel PM (data from NATA) Risk estimates for 177 toxics + diesel PM (data from NATA)	Contaminants in coastal fish tissue (reported in ROE, data from NCCR) Contaminants in lake fish tissue (reported in ROE, data from NSCRLFT) Blood mercury levels in women & children (reported in ROE, data from CDC) Blood cadmium levels (reported in ROE, data from CDC) Fish advisories issued (reported on EPA website, data from NLFA)	

	Responses by EPA or Society		**Pressures on the Environment**		**State of the Environment**	
	Actions by Regulators	Responses of Regulated Community or Society	Emissions	Ambient Conditions or Quantities of Natural Resources	Uptake or Assimilation	Health, Ecology, or Other Effects
Data & Databases	SCOUT MACTRAX	AFS ECHO	NEI TRI NATA Health Criteria Data for Risk Characterization	NATA NATTS AQS MDN	NATA	Estimated effects avoided, 812 Study

Appendix J: Air Toxics Monitored by State and Local Agencies in EPA Region 9

This appendix lists the air toxics monitored in several of the trends networks and long-term special studies referenced throughout this evaluation. These lists were collected during interviews with state and local agency officials that took place during July-September 2007.

Bay Area Air Quality Management District

Table 10: Air Toxics Monitored through the BAAQMD Trends Network

1,1,2 Trichlorotrifluoroethane	Methyl chloroform
1,3-Butadiene	Methyl ethyl ketone
Acetone	Methyl tertiary-butyl ether
Benzene	Methylene chloride
Carbon tetrachloride	O-Xylene
Chloroform	Perchloroethylene
Ethylbenzene	Toluene
Ethylene dibromide	Trichloroethylene
Ethylene dichloride	Trichlorofluoromethane
M/P Xylene	Vinyl chloride

California Air Resources Board

Table 11: Air Toxics Monitored through the CARB Trends Network

1,3-Butadiene	Cobalt	Perchloroethylene
Acetaldehyde	Copper	Phosphorus
Acetone	Ethyl Benzene	Potassium
Acetonitrile	Formaldehyde	Rubidium
Acrolein	Hexavalent Chromium	Selenium
Acrylonitrile	Iron	Silicon
Aluminum	Lead	Strontium
Antimony	Manganese	Styrene
Arsenic	Mercury	Sulfur
Barium	meta/para-Xylene	Tin
Benzene	Methyl Chloroform	Titanium
Bromine	Methyl Ethyl Ketone	Toluene

Calcium	Methylene Chloride	Trichloroethylene
Carbon Disulfide	Molybdenum	Vanadium
Carbon Tetrachloride	Nickel	Zinc
Chlorine	ortho-Dichlorobenzene	Zirconium
Chloroform	ortho-Xylene	
Chromium	para-Dichlorobenzene	

Table 12: Pesticides Monitored by CARB

Acephate	Chloropicrin	Linuron	Oxydemeton-methyl
Acrolein	Chlorothalonil	Malathion	Paraquat
Alachlor	Chlorpyrifos	Mancozeb	Permethrin
Aldicarb	Cycloate	Metam-sodium/MITC	Phorate
Amitraz	DEF	Methamidophos	Propargite
Atrazine	Diazinon	Methidathion	Simazine
Azinphos-methyl	Dichloropropene	Methomyl	Sodium arsenite
Benomyl	Endosulfan	Methyl bromide	Sulfuryl fluoride
Bifenthrin	EPTC	Methyl parathion	Ziram
Bromoxynil	Ethoprop	Molinate	
Captan	Ethyl parathion	Monocrotophos	
Carbofuran	Fenamiphos	Naled	

Hawaii Department of Health

Table 13: Air Toxics Monitored at the Pearl City Site

1,2-Dichloropropane	Formaldehyde
1,3-Butadiene	Lead
Acetaldehyde	Methylene Chloride
Benzene	Manganese
Beryllium	Nickel
Cadmium	Tetrachloroethene
Carbon Tetrachloride	Trichloroethylene
Chloroform	Vinyl Chloride
Chromium	

San Diego Air Pollution Control District

Table 14: Pollutants Monitored at Community-scale Monitoring Sites

Acetaldehyde	1,4-Dichlorobenzene	Nickel
Acetone	1,1-Dichloroethane	Selenium
Arsenic	1,2-Dichloroethane	Styrene
Benzene	1,1-Dichloroethene	1,1,2,2-Tetrachloroethane
Beryllium	cis-1,2-Dichloroethene	Tetrachloroethene
Bromoform	trans-1,2-Dichloroethene	Toluene
Bromomethane	Dichlorodifluoromethane	1,2,4-Trichlorobenzene
1,3-Butadiene	1,2-Dichloropropane	1,1,1-Trichloroethane
Cadmium	cis-1,3-Dichloropropene	1,1,2-Trichloroethane
Carbon Tetrachloride	trans-1,3-Dichloropropene	1,2,4-Trimethylbenzene
Chlorobenzene	Dichlorotetrafluoroethane	1,3,5-Trimethylbenzene
Chloroethane	Ethylbenzene	Trichloroethene
Chloroform	formaldehyde	Trichlorofluoromethane
Chloromethane	Hexachlorobutadiene	Trichlorotrifluoroethane
Chromium	Lead	Vinyl Chloride
Copper	Manganese	m-Xylene
1,2-Dibromoethane	Methylene Chloride	o-Xylene
1,2-Dichlorobenzene	Methyl Ethyl Ketone (2-Butanone)	p-Xylene
1,3-Dichlorobenzene	2-Methoxy-2-methylpropane	

Table 15: Additional Pollutants that will be Monitored at Community-scale Monitoring Sites Starting in 2008

Acrolein	Chlorine	Antimony
Acrylonitrile	Cobalt	Silicon
Hexavalent Chromium	Iron	Tin
Organic Carbon	Mercury	Titanium
Elemental Carbon	Potassium	Uranium
Aluminum	Molybdenum	Vanadium
Barium	Phosphorus	Yttrium
Bromine	Rubidium	Zinc
Calcium	Sulfur	

South Coast Air Quality Management District

Table 16: Pollutants Monitored during MATES II

1,3- butadiene	Dichlorobenzene (ortho- & para)	PAHs
Acetaldehyde	Dichloroethane [1,1]	Perchloroethylene
Acetone	Elemental carbon	Selenium
Arsenic	Ethyl benzene	Styrene
Benzene	Formaldehyde	Toluene
Carbon tetrachloride	Hexavalent chromium	Trichloroethylene
Chloroform	Lead	Vinyl chloride
Chloromethane	Methylene chloride	Xylene (m-, p-, o-)
Chromium (total)	Nickel	Zinc
Copper	Organic carbon	

Table 17: Air Toxics Monitored during MATES III

1,3-Butadiene	Dichlorobenzene	Organic Carbon
Acetaldehyde	Dichloroethane	PAHs
Acetone	Elemental Carbon	Perchloroethylene
Arsenic	Ethylbenzene	PM_{10}
Benzene	Formaldehyde	$PM_{2.5}$
Beryllium	Hexavalent Chromium	Styrene
Cadmium	Lead	Toluene
Carbon Tetrachloride	Manganese	Trichloroethylene
Chloroform	Methylene Chloride	Vinyl Chloride
Chloromethane	Naphthalene	Xylene
Copper	Nickel	Zinc

Appendix K: Arizona Hazardous Air Pollutants

This appendix lists the compounds considered to be HAPs in Arizona. This list was accessed from the ADEQ website[26] on December 4, 2007.

Acetaldehyde	1,2-Dichloroethane	Nickel Acetate
Acetic Acid	1,1-Dichloroethane	Nitric Acid
Acetone	1,2-Dichloroethane	Nitrobenzene
Acetonitrile	Dichloromethane	Nitrogen Oxide
Acetophenone	1,2-Dichloropropane	2-Nitropropane
Acrolein	2,4-Dichlorophenol	N-Nitrosodiethylamine
Acrylamide	Dichlorosilane	N-Nitrosodimethylamine
Acrylic Acid	Dicofol	N-Nitrosopyrrolidine
Acrylonitrile	Dieldrin	N-Nitroso-di-nbutylamine
Aldrin	Diethylene Glycol Monobutyl Ether Acetate	Octane
Aliphatic Naptha	Diethylene Glycol Monobutyl Ether	Oxoheptyl Acetate
Allyl Alcohol	Diethylene Triamine	Oxohexyl Acetate
Aluminum Oxide	Diethyl Phthalate	Pentachlorobenzene
Ammonia	Diethyl Telluride	Pentachloronitrobenzene
Aniline	Dimethoate	Pentachlorophenol
Antimony	Dimethylnitrosoamine	Pentanal
Arsenic	Di-n-butyl Phthalate	Pentane
Arsenic Pentoxide	Di-n-Octyl Phthalate	2-Pentanone
Arsenic Trioxide	2,4-Dinitrophenol	Phenol
Arsine	2,4-Dinitrotoluene	p-Phenylenediamine
Azinphos	1,4-Dioxane	Phenylmercuric Acetate
Barium	Diphenylamine	Phosmet
Barium Oxide	1,2-Diphenylhydrazine	Phosphamidon
Barium Sulfate-td	N,N-Dipropyl-4-trifluro methyl-2,6-Dinitroaniline	Phosphine
Barium Sulfate-rf	Dithane	Phosphoric Acid
Benzene	Endosulfan	Phosphorous Pentafluoride
Benzidine	Endrin	Phosphorous Pentadsulfide
Benz(a)anthracene	Epichlorohydrin	Phosphorous Pentoxide
Benzo(a)Pyrene	Ethanol	Polychlorinated Biphenyls [PCBx]

[26] http://www.azdeq.gov/environ/air/monitoring/haz.html

Benzyl Chloride	2-Ethoxy Ethyl Acetate	Potassium Carbonate
Beryllium	Ethyl Acetate	Potassium Fluoride
Bis(2-chlorethyl) Ether	Ethylbenzene	Potassium Hydroxide
Bis(chloromethyl) Ether	Ethyl-3-Ethoxy Propionate	Propane-asphyxiant
Bis(2-ethylhexyl) Phthalate	Ethylene Glycol Dimethyl Ether	n-Propanol
Bismuth Oxide	Ethylene Glycol	Pronamide
Borates	Monopropyl Ether	Propionic Acid
Boron	Ethylene Oxide	n-Propyl Acetate
Boron Oxide	Ethyl Parathion	Propylene Gylcol Monomethyl Ether
Boron Trichloride	Fiberglass	Propylene Oxide
Boron Trifluoride	Fluorine	Pyridine
Bromodchloromethane	Formaldehyde	Selenium
Bromoform	Formic Acid	Silane
Bromomethane	Glycerol	Silica-amorphous fumed
1,3-Butadiene	Glycol Monobutylether Acetate	Silver
n-Butanol	Heptachlor	Sodium Aluminofluoride
2-Butoxyethanol	Heptachlor Epoxide	Sodium Fluoride
1-Butyl Acetate	2-Heptanone	Sodium Hydroxide
n-Butyric Acid	n-Heptane	Sodium Sulfate
Cadium	Hexchlorobenzene	Strychnine
Calcium Carbonate-td	Hexachlorobutadine	Styrene-includes dimers
Calcium Carbonate-rf	Hexchlororcyclohexane (all isomers)	Sulfuric Acid
Calcium Fluoride	Hexachlorocyclopentadine	Talc
Calcium Oxide	Hexachloroethane	1,2,4,5-Tetrachlorobenzene
Captan	n-Hexane	2,3,7,8-Tetrachlorodibenzo-p-Dioxin
Carbaryl	Hydrofluoric Acid	1,1,2,2-Tetrachloroethane
Carbon Black	Hydrogen Chloride	Tetrachloroethene
Carbon Disulfide	Hydrogen Cyanide	Tetraethyl Lead
Carbon Tetrachloride	Hydrogen Sulfide	Tetrafluoromethane
Carbonyl Fluoride	1-Hydroxy-2-Propanone	Thallium
Carbonyl Sulfide	Iron Compounds-soluble	Thorium
Cellulose Nitrate-td	Iron Compounds -insoluble	Titanium Dioxide-td
Cellulose Nitrate-rf	Iron (II) Chloride	Titanium Dioxide-rd
Chlorine	Iron (III) Chloride	Toluene
Chlorobenzene	Iron (II, III) Oxide	Toxaphene
2-Chloro-1,3-butadiene	Iron (III) Oxide	1,2,4-Trichlorobenzene
Chlorodane	Isobutyl Acetate	1,1,1-Trichloroethane
Chloroform	Isobutyl Alcohol	1,1,2-Trichloroethane

Chloromethane(Methyl Chloride)	Isobutyl Isobutyrate	Trichloroethene
3-Chloropropene	Isopropanol	Trichlorofluoromethane
Chlorothalonil	Isopropyl Acetate	2,4,5-Trichlorophenol
Chromic Oxide	Magnesium Fluoride	2,4,6-Trichlorophenol
Chromium	Magnesium Oxide-td	Trichlorotrifluoroethane
Chromium VI	Magnesium Oxide-rf	Triethylenetetramine
Copper-Fume	Magnesium Silicate	1,2,4 Trimethylbenzene
Cresols	Manganese - metal, fume	1,3,5 Trimethylbenzene
Cuprous Chloride	Manganese Dioxide	2,2,4 Trimethyl-1,3-pentanediol Isobutyrate
Cuprous Oxide	Malathion	Tungsten Trioxide
Cupric Chloride	Mercury	Uranium 238-soluble
Cupric Oxide	Methanol	Uranium 238-insoluble
Diacetone Alcohol	Methomyl	Vanadium
Dichloeodiphenyl-trichloroethane (DDT)	Methoxychlor	Vinyl Chloride
DDD	1-Methoxy-2-Propanol Acetate	Xylenes-mixed isomers
DDE	Methyl n-Butyl Ketone	Xylene (meta)
Diazinon	3-Methylcholanthrene	Xylene (ortho)
Dibenzo(a,h)anthracene	Methyl Ethyl Ketone [2-Butanone]	Xylene (para)
Diborane	4,4'-Methylene-bis-2-chloroanaline	Zinc Chloride
Dibromochloromethane	Methylhydrazine	Zinc Oxide-fume
1,2-Dibromo-3-chloropropane	Methyl Parathion	Zinc Oxide-rd
1,2-Dibromoethane	a-Methylstyrene	Zinc Oxide-td
1,2-Dichlorobenzene	Methyldenum Trioxide	Zinc Stearate
1,4-Dichlorobenzene	Myclobutanil	Zirconium
1,4-Dichlorodifluoromethane	Napthalene	Zirconium Carbide
1,1-Dichloroethane	Nickel-metal, fume	Zirconium Oxide

Appendix L: California Toxic Air Contaminants

This appendix lists the compounds considered to be TACs in California. This list was accessed from the CARB website[27] on November 20, 2007.

Acetaldehyde	Fine mineral fibers
Acetamide	Formaldehyde
Acetonitrile	Glycol ethers
Acetophenone	Heptachlor
2-Acetylaminofluorene	Hexachlorobenzene
Acrolein	Hexachlorobutadiene
Acrylamide	Hexachlorocyclopentadiene
Acrylic acid	Hexachloroethane
Acrylonitrile	Hexamethylene-1,6-diisocyanate
Allyl chloride	Hexamethylphosphoramide
4-Aminobiphenyl	Hexane
Aniline	Hydrazine
o-Anisidine	Hydrochloric acid
Antimony compounds	Hydrogen fluoride (Hydrofluoric acid)
Inorganic Arsenic and Arsenic compounds (inorganic including arsine)	Hydroquinone
Asbestos [asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite (amosite), tremolite, actinolite, and anthophyllite]	Isophorone
Benzene (including benzene from gasoline)	Inorganic Lead and Inorganic lead compounds (includes elemental lead)
Benzidine	Lead and compounds (does not include elemental lead)
Benzotrichloride	Lindane
Benzyl chloride	Maleic anhydride
Beryllium Compounds	Manganese and compounds
Biphenyl	Mercury and compounds
Bis(chloromethyl)ether	Methanol
Bis(2-ethylhexyl)phthalate (DEHP)	Methoxychlor
Bromoform	Methyl bromide (Bromomethane)
1,3-Butadiene	Methyl chloride (Chloromethane)
Cadmium and cadmium compounds (metallic cadmium and cadmium compounds)	Methyl chloroform (1,1,1-Trichloroethane)

[27] http://www.arb.ca.gov/toxics/quickref.htm

Calcium cyanamide	Methyl ethyl ketone (2-Butanone)
Caprolactam	Methyl hydrazine
Captan	Methyl iodide (Iodomethane)
Carbaryl	Methyl isobutyl ketone (Hexone)
Carbon disulfide	Methyl isocyanate
Carbon tetrachloride (Tetrachloromethane)	Methyl methacrylate
Carbonyl sulfide	Methyl tertiary butyl ether (MTBE)
Catechol	4,4'-Methylene bis(2-chloroaniline)
Chloramben	Methylene chloride (Dichloromethane)
Chlordane	4,4-Methylenedianiline
Chlorinated dibenzo-p-dioxins and dibenzofurans	Methylene diphenyl diisocyanate (MDI)
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	Naphthalene
Chlorine	Nickel and compounds (metallic nickel & inorganic nickel compounds)
Chloroacetic acid	Nitrobenzene
2-Chloroacetophenone	4-Nitrobiphenyl
Chlorobenzene	4-Nitrophenol
Chlorobenzilate	2-Nitropropane
Chloroform	N-Nitroso-N-methylurea
Chloromethyl methyl ether	N-Nitrosodimethylamine
Chloroprene	N-Nitrosomorpholine
Chromium and Compounds	Parathion
Chromium VI (Hexavalent chromium)	Particulate emissions from diesel-fueled engines
Cobalt Compounds	Pentachloronitrobenzene (Quintozene)
Coke Oven Emissions	Pentachlorophenol
Cresols/Cresylic acid (isomers and mixture)	Perchloroethylene (Tetrachloroethylene)
m-Cresol	Phenol
o-Cresol	p-Phenylenediamine
p-Cresol	Phosgene
Cumene	Phosphine
Cyanide compounds	Phosphorus
2,4-D, salts and esters	Phthalic anhydride
DDE (p,p-Dichlorodiphenyldichloroethylene)	Polychlorinated biphenyls (PCBs)
Diazomethane	Polycyclic organic matter (POM)
Dibenzofuran	Benzo[a]pyrene
1,2-Dibromo-3-chloropropane (DBCP)	1,3-Propane sultone
Dibutylphthalate	beta-Propiolactone
1,4-Dichlorobenzene (p-Dicholorobenzene)	Propionaldehyde
3,3'-Dichlorobenzidene	Propoxur (Baygon)
Dichloroethyl ether (Bis(2-chloroethyl) ether)	Propylene dichloride (1,2-Dichloropropane)

1,3-Dichloropropene (Telone)	Propylene oxide
Dichlorvos (DDVP)	1,2-Propylenimine (2-Methyl aziridine)
Diethanolamine	Quinoline
N,N-Diethyl aniline (N,N-Dimethylaniline)	Quinone
Diethyl sulfate	Radionuclides (including radon)
3,3'-Dimethoxybenzidine	Selenium and compounds
4-Dimethyl aminoazobenzene	Styrene
3,3-Dimethyl benzidine (o-Tolidine)	Styrene oxide
Dimethyl carbamoyl chloride	1,1,2,2-Tetrachloroethane
Dimethyl formamide	Titanium tetrachloride
1,1-Dimethyl hydrazine	Toluene
Dimethyl phthalate	2,4-Toluene diamine (2,4-Diaminotoluene)
Dimethyl sulfate	Toluene-2,4- diisocyanate
4,6-Dinitro-o-cresol, and salts	o-Toluidine
2,4-Dinitrophenol	Toxaphene (Chlorinated camphene)
2,4-Dinitrotoluene	1,2,4-Trichlorobenzene
1,4-Dioxane (1,4-Diethyleneoxide)	1,1,2-Trichloroethane
1,2-Diphenylhydrazine	Trichloroethylene
Epichlorohydrin (1-Chloro-2,3-epoxypropane)	2,4,5-Trichlorophenol
1,2-Epoxybutane	2,4,6-Trichlorophenol
Ethyl acrylate	Triethylamine
Ethyl benzene	Trifluralin
Ethyl carbamate (Urethane)	2,2,4-Trimethylpentane
Ethyl chloride (Chloroethane)	Vinyl acetate
Ethylene dibromide (1,2-Dibromoethane)	Vinyl bromide
Ethylene dichloride (1,2-Dichloroethane)	Vinyl chloride
Ethylene glycol	Vinylidene chloride (1,1-Dichloroethylene)
Ethylene imine (Aziridine)	Xylenes (isomers and mixture)
Ethylene oxide (1,2-Epoxyethane)	m-Xylene
Ethylene thiourea	o-Xylene
Ethylidene dichloride (1,1-Dichloroethane)	p-Xylene

Appendix M: Analysis of AQS Data for the Six Core NATTS Pollutants

This appendix describes the distribution of the six core NATTS pollutants—acrolein, PM_{10} arsenic, benzene, 1, 3- butadiene, formaldehyde, and hexavalent chromium— across EPA Region 9 in 2006, based on data accessed from the AQS database on November 23, 2007. This appendix is not intended to provide a full analysis of the data, but rather, is intended to provide a snapshot of the core NATTS pollutants data submitted by state and local agencies in EPA Region 9. A description of the methodology used in preparing this analysis is listed below.

Methodology for Preparing AQS Data Analysis

Step 1: Data Collection

- On November 23, 2007, we downloaded a 'raw data report' (AMP 350) from the AQS database. This report included the following specifications:
  - Geographic range: states of Arizona, California, Hawaii, and Nevada.
  - Compounds: acrolein (43505), PM_{10} arsenic (82103), benzene (45201), 1, 3-butadiene (43218), formaldehyde (43502), and hexavalent chromium (12115).
  - Timeframe: January 1, 2006 through December 31, 2006.
  - Type of data: reported.
- In addition, on November 23, 2007, we downloaded an 'extract raw data report' (AMP501) from the AQS database. This report included the following specifications:
  - Geographic range: states of Arizona, California, Hawaii, and Nevada.
  - Compounds: acrolein (43505), PM_{10} arsenic (82103), benzene (45201), 1, 3-butadiene (43218), formaldehyde (43502), and hexavalent chromium (12115).
  - Timeframe: January 1, 2006 through December 31, 2006.

Step 2: Analysis of Reported Mean Concentrations

- We prepared a table of the reported mean concentrations of each of the six compounds for each monitor and the units these concentrations were reported in, based on the AMP 350 report. Monitors were considered to belong to the agency listed as the "support agency" in these reports, and all data from agencies not participating in this evaluation was excluded from the analysis.
- We used three different methods for defining the yearly mean concentration of the air toxics compounds at each monitoring site:
  - For the majority of monitoring sites, the AMP 350 report provided a yearly mean concentration of each compound. In these cases, we used that value in the analysis.

- For some monitoring sites, the AMP 350 report provided monthly mean concentrations for each month the compound was monitored. In these cases, we averaged the monthly means to estimate the yearly mean for the analysis.
  - For most of the monitoring sites reporting hexavalent chromium data, the AMP 350 report provided quarterly mean concentrations of the compound. In these cases, we averaged the quarterly means to estimate the yearly mean for the analysis.
- We rounded all values to three decimal places.
- Using the table of mean concentrations, we prepared box and whisker charts demonstrating the range of mean concentrations found across monitoring sites.
- Note that no state or local agency in EPA Region 9 reported PM_{10} arsenic data in 2006, so the analysis which follows does not include this compound.

Step 3: Analysis of Data Completeness

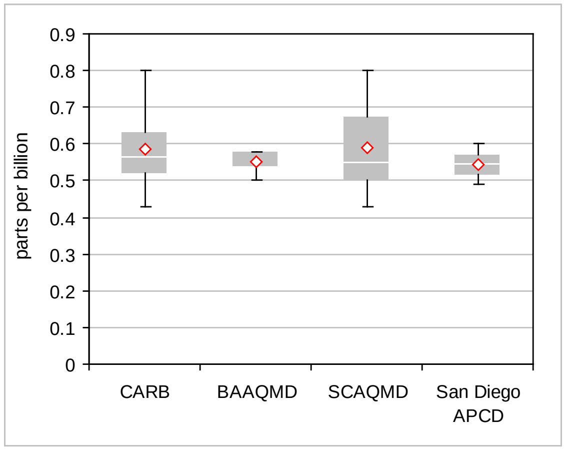
- We prepared a table of the number of days in 2006 that non-null values were reported for each compound at each monitor. We used two different methods to define the number of non-null values reported:
  - For the majority of monitors, the AMP 350 report provided the number of days in 2006 that non-null values were reported. In these cases, we used that value in the analysis.
  - For some monitors, the AMP 350 report provided the number of times that non-null values were reported each month. In these cases, we manually counted the number of days that non-null values were reported.
- Using the table of the number of days in 2006 that non-null values were reported for each compound at each site, we prepared bar charts comparing these data points.

Step 4: Analysis of Reported Methods and MDLs

- We prepared a table of the methods and associated MDLs reported for each monitor.
  - We used the method code identified for each monitor in the AMP 350 report to determine the method followed at each site.
  - We defined the reported MDL for each monitor in two different ways:
    - For the majority of monitors, the AMP 350 report identified the MDL for 2006. In these cases, we used that value in the analysis.
    - For those monitors where more than one MDL were reported in 2006, the AMP 350 report did not list the MDLs. In these cases, we referenced the AMP 501 report to identify the set of MDLs reported throughout the year.
- We used the December 3, 2007 version of the National Air Toxics Trends Stations Work Plan Template to identify the EPA recommended MDLs for each compound, and converted units using standard conversions provided by EPA.
- Using the methods and MDLs reported by state and local agencies and the EPA recommended MDLs, we prepared tables comparing these data points.

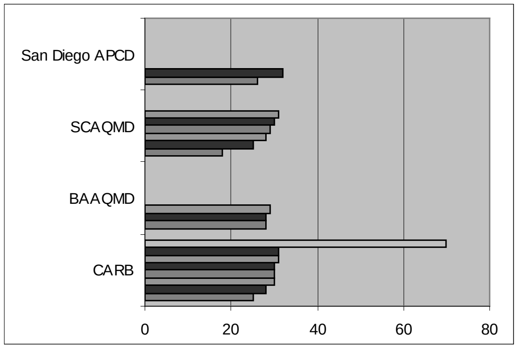
Acrolein

Mean Concentration of Acrolein in 2006



	CARB	BAAQMD	SCAQMD	San Diego APCD
Number of Monitors	8	3	6	2
Mean	0.586	0.553	0.588	0.545
Median	0.565	0.58	0.55	0.545
Minimum	0.43	0.5	0.43	0.49
Maximum	0.8	0.58	0.8	0.6

Number of Days in 2006 that Non-Null Acrolein Samples were Entered into AQS, by Monitor

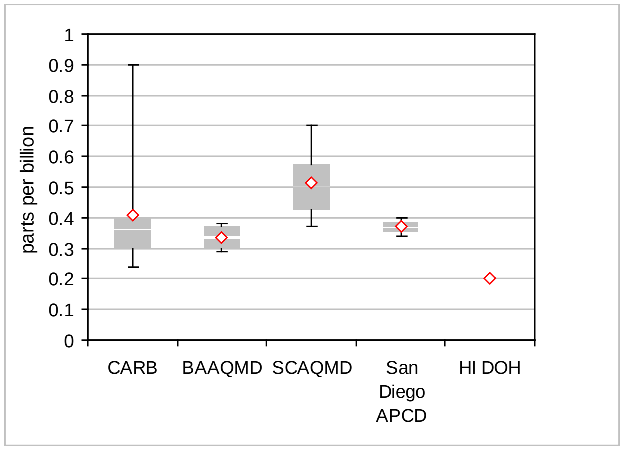


Reported Methods and MDLs for 2006

Agency	Method Number	MDL (in ppb)	EPA Recommended MDL (in ppb)
CARB	172	0.3	0.04
BAAQMD	172	0.3	
SCAQMD	172	0.3	
San Diego APCD	172	0.3	

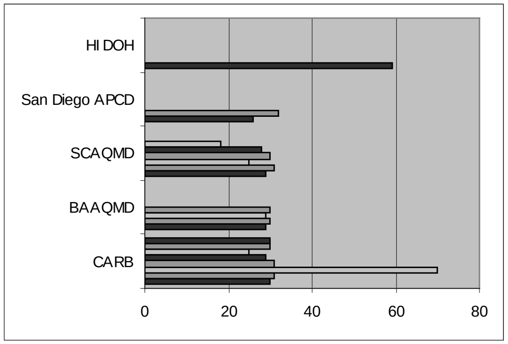
Benzene: Samples Taken in Parts Per Billion

Mean Concentration of Benzene in 2006



	CARB	BAAQMD	SCAQMD	San Diego APCD	HI DOH
Number of Monitors	8	4	6	2	1
Mean	0.408	0.335	0.512	0.37	0.2
Median	0.36	0.336	0.5	0.37	0.2
Minimum	0.240	0.290	0.370	0.34	0.2
Maximum	0.9	0.38	0.7	0.4	0.2

Number of Days in 2006 that Non-Null Benzene Samples were Entered into AQS, by Monitor

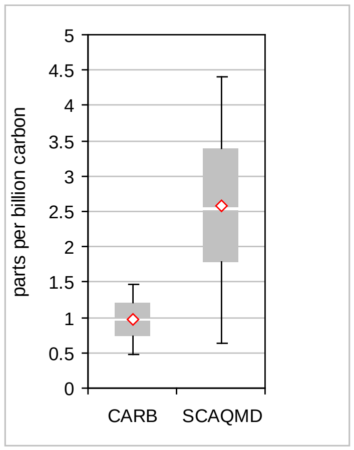


Reported MDLs for 2006

Agency	Method Number	MDL (in ppb)	EPA Recommended MDL (in ppb)
CARB	171	0.05	0.04
BAAQMD	171	0.05	
	153	0.1	
SCAQMD	171	0.05	
San Diego APCD	171	0.05	
HI DOH	109	0.1	

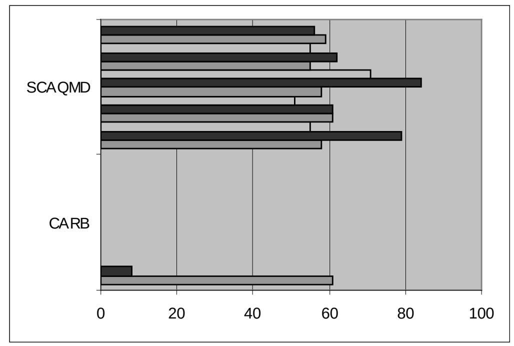
Benzene: Samples Taken in Parts Per Billion Carbon

Mean Concentration of Benzene in 2006



	CARB	SCAQMD
Number of Monitors	2	14
Mean	0.973	2.571
Median	0.973	2.538
Minimum	0.480	0.629
Maximum	1.467	4.397

Number of Days in 2006 that Non-Null Benzene Samples were Entered into AQS, by Monitor

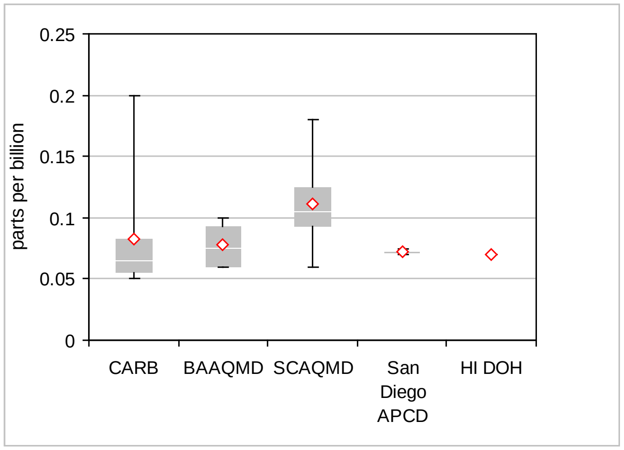


Reported MDLs for 2006

Agency	Method Number	MDL (in parts per billion carbon)	EPA Recommended MDL (in parts per billion carbon)
CARB	177	0.1	0.24
SCAQMD	126	0.1	

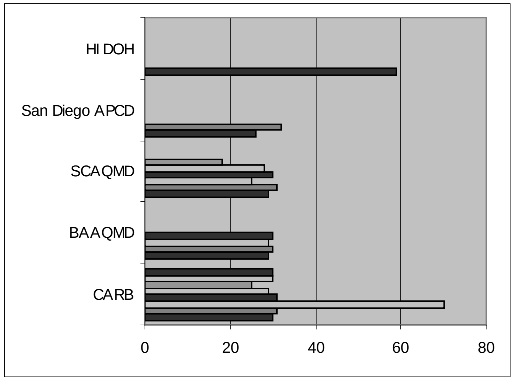
1,3– Butadiene

Mean Concentration of 1,3– Butadiene in 2006



	CARB	BAAQMD	SCAQMD	San Diego APCD	HI DOH
Number of Monitors	8	4	6	2	1
Mean	0.082	0.078	0.112	0.0725	0.07
Median	0.065	0.075	0.105	0.0725	0.07
Minimum	0.05	0.06	0.06	0.07	0.07
Maximum	0.2	0.1	0.18	0.075	0.07

Number of Days in 2006 that Non-Null 1,3– Butadiene Samples were Entered into AQS, by Monitor

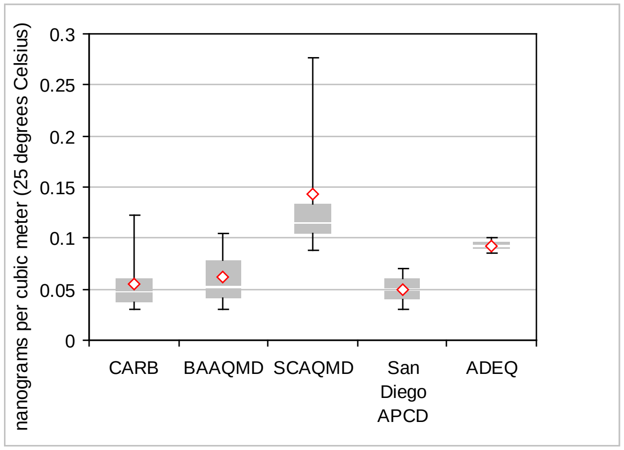


Reported MDLs for 2006

Agency	Method Number	MDL (in ppb)	EPA Recommended MDL (in ppb)
CARB	171	0.04	0.045
BAAQMD	171	0.04	
	153	0.08	
SCAQMD	171	0.04	
San Diego APCD	171	0.04	
HI DOH	109	0.025	

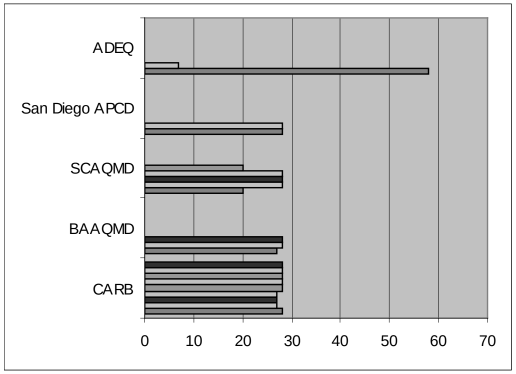
Hexavalent Chromium

Mean Concentration of Hexavalent Chromium in 2006



	CARB	BAAQMD	SCAQMD	San Diego APCD	ADEQ
Number of Monitors	9	3	5	2	2
Mean	0.06	0.06	0.14	0.05	0.09
Median	0.05	0.05	0.12	0.05	0.09
Minimum	0.03	0.03	0.09	0.03	0.09
Maximum	0.12	0.11	0.28	0.07	0.10

Number of Days in 2006 that Non-Null Hexavalent Chromium Samples were Entered into AQS, by Monitor

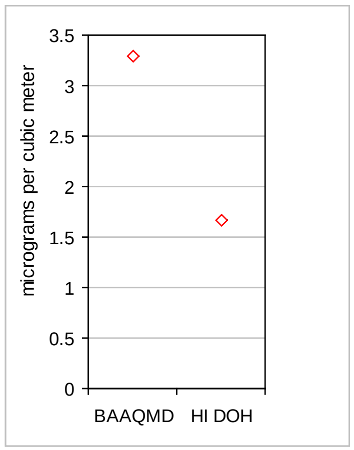


Reported MDLs for 2006

Agency	Method Number	MDL (in nanograms per cubic meter)	EPA Recommended MDL (in nanograms per cubic meter)
CARB	920	0.06	0.08
BAAQMD	920	0.06	
SCAQMD	920	0.06	
San Diego APCD	920	0.06	
ADEQ	921	0.0201, 0.01, 0.012, 0.0111, 0.0093, 0.0092	

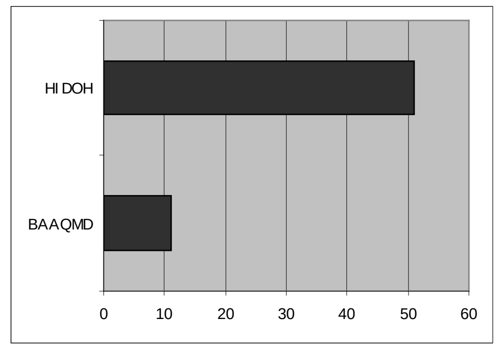
Formaldehyde: Samples Taken in Micrograms Per Cubic Meter

Mean Concentration of Formaldehyde in 2006



	BAAQMD	HI DOH
Number of Monitors	1	1
Mean	3.29	1.66
Median	3.29	1.66
Minimum	3.29	1.66
Maximum	3.29	1.66

Number of Days in 2006 that Non-Null Formaldehyde Samples were Entered into AQS, by Monitor

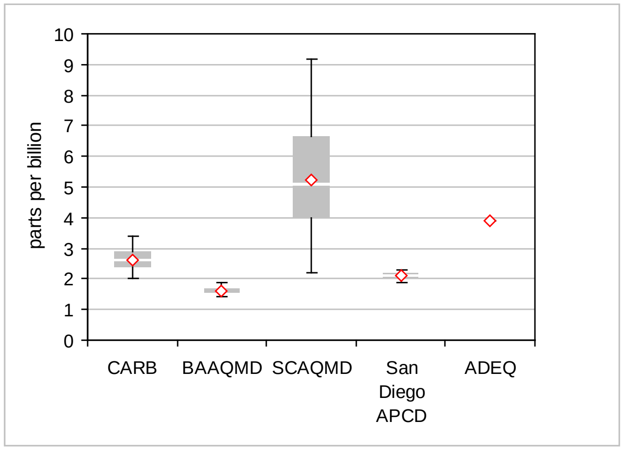


Reported MDLs for 2006

Agency	Method Number	MDL (in micrograms per cubic meter)	EPA Recommended MDL (in micrograms per cubic meter)
BAAQMD	202	0.025	0.98
HI DOH	114	0.10446	

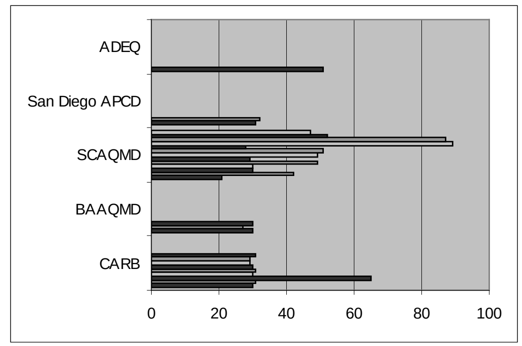
Formaldehyde: Samples Taken in Parts Per Billion

Mean Concentration of Formaldehyde in 2006



	CARB	BAAQMD	SCAQMD	San Diego APCD	ADEQ
Number of Monitors	9	3	13	2	1
Mean	2.633	1.6	5.208	2.105	3.9
Median	2.6	1.5	5.1	2.105	3.9
Minimum	2.000	1.4	2.200	1.9	3.9
Maximum	3.4	1.9	9.17	2.31	3.9

Number of Days in 2006 that Non-Null Formaldehyde Samples were Entered into AQS, by Monitor



Reported MDLs for 2006

Agency	Method Number	MDL (in ppb)	EPA Recommended MDL (in ppb)
CARB	202	0.1	0.8
BAAQMD	202	0.1	
SCAQMD	102	0.1	
	202	0.1	
San Diego APCD	202	0.1	
ADEQ	202	0.1	