AIR TOXICS MONITORING NEWSLETTER

A PUBLICATION OF THE STAPPA/ALAPCO/USEPA AIR TOXICS MONITORING STEERING COMMITTEE

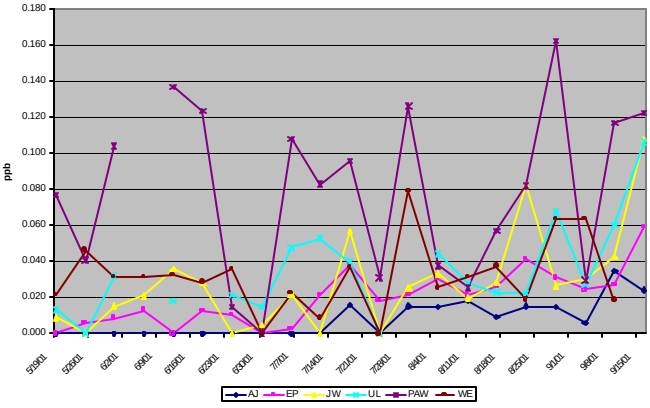
Special Edition: November 2001

October Air Toxics Workshop

The purpose of this special edition of the Air Toxics Monitoring Newsletter is to summarize the October 29 – 30 Air Toxics Workshop held in Rosemont, IL. The workshop consisted of reports from the monitoring pilot cities on the first day, and reports from the data analysis contractors (Battelle, STI, and ICF) on the second day. Copies of the workshop presentations are available on the LADCO web site (www.ladco.org).

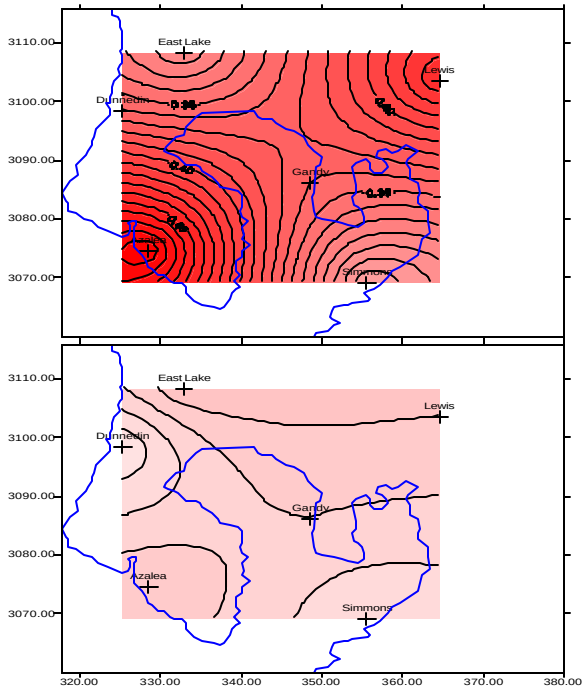
Reports from Pilot Cities: The pilot city reports began with presentations by representatives from the four urban pilot cities.

Barbara Morin (Rhode Island DEM) reviewed the Providence sampling program and time series plots of VOC, carbonyl, and metals concentrations. One such plot for 1,3-butadiene (a motor vehicle tracer) showed the site-to-site variation in motor vehicle impacts, with the highest concentration at the Pawtucket site, which is adjacent to I-95 (see below). Sampling began on May 19, 2001, and will continue for 12 months at the 5 sites and through the end of CY2002 at 1 of these sites.



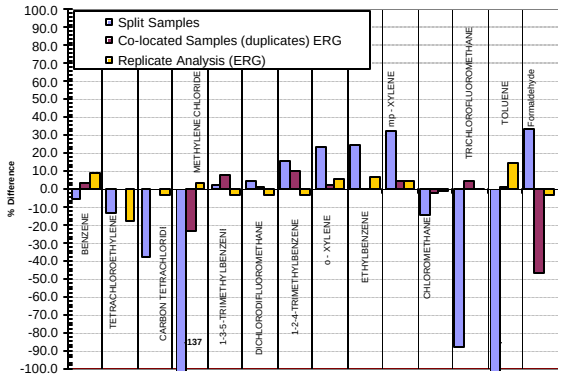
1,3-Butadiene Concentrations in Providence

Tom Stingfellow (Pinellas County DEM) and Leroy Shelton (Hillsborough County EPC) reviewed the Tampa Bay Region Air Toxics Study and presented spatial concentration plots One such plot for benzene showed the seasonal differences in concentration levels and spatial pattern, due to emissions and meteorology. Sampling began on January 1, 2001 and will continue for 12 months at the 6 sites.



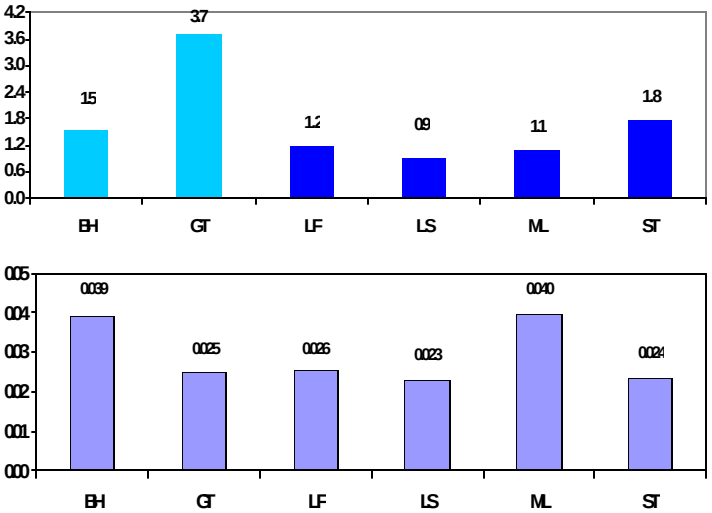
Benzene Concentrations in Tampa – Jan-March (top) & July–Sep (bottom)

Mary Ann Heindorf (Michigan DEQ) reviewed the Detroit sampling program and addressed data capture, frequency of detects, precision analyses (splits, duplicates, replicates), impact of sampling frequency, daily variability, and average concentrations by site. The preliminary data, as shown below, indicate that the sampling precision is generally within ± 20-30%, and that the major contribution to variability is the effect of different laboratories. Sampling began on April 19, 2001 and will continue for 12 months at the 8 sites and through the end of CY2002 at 1 of these sites.



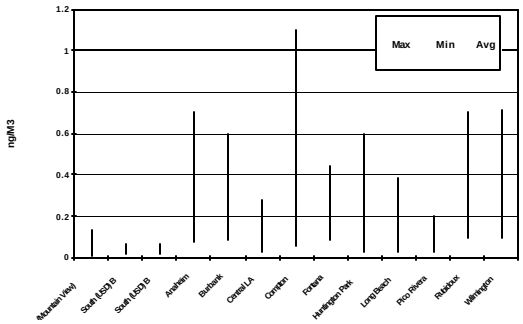
Preliminary Precision Data for Detroit

John Williamson (Washington DOE) and Hal Westburg (WSU) reviewed the Seattle sampling program and presented several plots of the spatial and temporal variation in concentrations. For example, the highest metals concentrations occurred at the Georgetown site, which is located near an industrial area, and the highest chloroform concentrations at the Beacon Hill and Maple Leaf sites, which are located near water treatment plants. Sampling began in mid-February, 2001 and will continue for 12 months at the 6 sites and through the end of CY 2002 at 3 of these sites.



Chromium (top) and Chloroform (bottom) Concentrations in Seattle

A panel session was held with representatives from the six small pilot cities. Short presentations were made by Julie Swift, ERG (San Juan); Tim Carroll (Keeney, Knob, WV); Tim Booker (Rio Rancho, NM); Kyle Lundberg and Jim Hirtz (Cedar Radips, IA); Gordon Pierce (Grand Junction, CO); and Rudy Eden (San Jacinto, CA). The San Jacinto presentation showed how low the preliminary concentration levels at these rural sites are compared to those measured at urban sites in Los Angeles measured as part of the MATES-II study.



Chromium VI Concentrations at San Jacinto Sites (first three sites) v. MATES-II Sites

Data Analysis Reports: For the past year, Battelle and STI analyzed the existing air toxics monitoring data archive to provide information about the spatial pattern, temporal profile, and general characteristics of air toxics compounds. To supplement these analyses, ICF Consulting analyzed air toxics modeling data. Copies of the final reports from these contractors are available on the LADCO web site (www.ladco.org), or from LADCO by e-mail, CDROM, or paper copy. *Please note that in view of the limitations of the existing data, these analyses cannot provide any definitive recommendations about network design. More specific recommendations must await the completion of the analyses of the forthcoming pilot city data.*

The data analysis reports began with a review of the air toxics data archive by Steve Bortnick (Battelle). The archive was created by USEPA's contractor (ICF) and includes data from 1980 – 2000 collected throughout the country (see map below). Several criteria were used to assess data quality, including values > MDL. Across all 18 HAPs core to the pilot study, only 46% of the observations met all these criteria.

Sites with Data in the Air Toxics Archive

Steve Bortnick, Hilary Main (STI), and Mike Holdren (Battelle) presented the results of several data analyses:

- An analysis of sampling frequency based on estimating the mean-variance showed that annual average concentrations can be estimated with 10 – 15% relative error in most cases with 1-in-3 or 1-in-6 day sampling. More frequent sampling (i.e., 1-in-3 day) is recommended for higher concentration and source-oriented sites.

- Data variability is composed of spatial, temporal, sampling, and analytical variability. Overall data variability is mostly

driven by temporal variability. Spatial variability is the driving force behind extremely high overall variability. (Often this reflects strong concentration gradients in the vicinity of a large point source.) Analytical error only appears to be significant at low concentrations. There is no apparent trend for sampling error. These findings suggest that in areas not dominated by local emission sources, very few monitors may be needed to represent annual average concentrations. (Note, inter-laboratory variability may also be important , as noted above for the Detroit pilot, but there was not sufficient information in the archive to evaluate such variability. This issue will be addressed further in the analysis of the pilot city data.)

- Seasonal variation was evident for some compounds at some sites, but there was no consistent trend across seasons and compounds. This suggests that sampling schedules which vary by season are not recommended.

- Day-of-week variations were sometimes found for benzene, but generally not for other compounds. Hour-of-day variations were also sometimes found for benzene and formaldehyde, but generally not for other compounds. These findings suggest that 24-hour averages are generally sufficient, but fine resolution for benzene (urban sites) and formaldehyde may be desirable to support health effects and source identification studies.

- Several case studies were conducted, including VOCs, carbonyls, and metals in Portland, OR; lead TSP in Iron County, Missouri, and manganese TSP in Cook County, IL. These studies demonstrated the need for high quality emissions inventories for monitor siting.

- An examination of spatial, temporal, and inter-compound correlations found; (a) to the extent that concentrations are influenced by local sources, wind influenced distance-based relationships will tend to hold, (b) the three compounds from three (possibly source-oriented) sites studied do not exhibit strong correlation between measurements obtained on different days, and (c) even though inter-compound relationships (i.e., VOC-to-VOC) are sometimes strong, individual ratios can vary dramatically. These findings suggest the local wind patterns should be considered to determine monitor locations, sampling frequency is dependent on monitoring objectives and monitor location, and sampling individual compounds (rather than a subset) is recommended.

- The relationship between elemental carbon (EC) concentrations and diesel emissions was considered by analyzing recent PM2.5-speciation data. The analysis showed that: (a) organic carbon (OC): EC and EC:PM2.5 ratios vary significantly among the sites, (b) EC and OC concentrations vary regionally and seasonally, (c) EC:PM2.5 ratios vary seasonally, and (d) EC concentrations and EC:PM2.5 ratios vary by day-of-week. Additional suggested measurements include certain semi-volatile organic compounds, continuous measurements of black carbon (BC), OC:EC ratios and PM2.5-mass, and speciated OC measurements to support source apportionment studies.

- Examination of monitoring technologies found: (a) the existing PAMS monitoring methods for VOCs and carbonyls produce the highest quality data, (b) there was a consistent bias between canister and auto-GC VOC measurements, and (c) of several approaches considered for treating data below the MDL, using a value of MDL/2 was preferred.

Jonathan Cohen (ICF) reviewed the analysis of modeling data (ASPEN and ISCST) and monitoring data for select compounds in three cities: Houston, Baltimore, and Minneapolis. Several key findings were noted:

- Model-to-monitor comparisons indicate generally good agreement for benzene in all three cities, but model underestimates for the other compounds considered (i.e., 1-3,butadiene and tetrachloroethylene in Houston and Baltimore, and lead and formaldehyde in Minneapolis).

- Statistical “models” were applied to determine the number of monitoring sites needed to estimate the domainwide mean concentrations with minimal mean square error. The results indicate that within the subdomain represented by the existing monitors, the number and location of monitors generally produced an acceptable mean square error (i.e., about 20%). Note also that the models suggest that the

monitors should be > 5 km apart to minimize spatial covariance in values.

- The modeling results indicate that there are significant seasonal (quarterly) differences for several compounds (e.g., benzene and tetrachlorethylene are higher in the fall/winter). To represent seasonal (quarterly) averages, at least 1-in-6 day sampling is needed (i.e., detection probability > 70%). With less frequent sampling (e.g., 1-in-12 day) the detection probability is generally less than 50%.

Web Site: Mark Davis (Battelle) presented the initial version of the air toxics website, which was developed to provide a web-based query interface to the data archive capable of producing tabular and graphical summaries, maps, and downloadable files. Currently, website is available at http://www.sdas.battelle.org/airtoxics/index.php (user id = airtoxics, password = ladco). (Eventually, the site will be moved to www.airtoxics.org and will be managed in the interim by LADCO.) User feedback on this website is requested, but please be patient in exploring the site, because the sheer size of the archive sometimes makes access a little slow. Future work includes improvements in response to user comments, additions to the archive, and improved speed and scalability.

Cover Page of Air Toxics Web Site

Next Steps: The pilot city monitoring and analysis of existing air toxics data represent important steps in developing network recommendations. Additional steps include completion of the full year of pilot city monitoring in all 10 areas (which should be done by summer 2002), a thorough analysis of these data (which can be done by late 2002), and consideration of any additional material, such as updated emissions inventories and modeling, and information on current monitoring methods. (Note, the second year of monitoring projects will be performed mostly in CY2002. Analyses of these data should also be considered in developing the national network.) Of course, implementation of a national (as well as a regional and local) monitoring network is expected to require substantial resources. At this time, the cost (and funding) for this monitoring is unclear.

Survey Results: A survey was distributed at the workshop to obtain thoughts and comments about a national air toxics monitoring network. Survey responses were received from 34 of the workshop attendees. A summary of the responses is provided below:

(1) Objectives: Most respondents ranked the objectives of the national network in the following order: characterization, trends, and model evaluation. Other important objectives for the national network that were identified include source-oriented/hot-spot, source apportionment, and health effects/exposure. The most common objectives for existing local monitoring include characterization, source-oriented, source apportionment, and risk assessments. Note, one comment was made that "characterization" is a very broad objective and needs to be defined better with respect to spatial scale and averaging time.

(2) Role of Local Monitoring: Most respondents felt that local monitoring should be a component of the national network, especially to ensure a stable funding source. While the need for a national network of sites with consistent protocols and specific, limited objectives was acknowledged, many recognized that there are a variety of local concerns which necessitate flexibility. Additional (local) resources and local monitoring activities will likely be necessary to address local concerns completely. Note, one comment was made that the on-going network reviews and divestment of criteria pollutant monitors will not be sufficient to support a national air toxics monitoring network.

(3) Design of National Network: Most generally agreed with a nested approach for the national network (e.g., 20 or so sites with wide geographic distribution for trends purposes, and 50 or so sites in a few metro areas for model evaluation purposes), although many wondered whether 70 might be enough, especially to address local concerns. Comments included: (a) it was premature to design a national network until the results of the pilot city monitoring and subsequent data analyses were available, (b) the current plans seem too focused on a handful of compounds (i.e., more effort should be made to address other compounds with a lack of readily available

sampling/analysis methods), and (c) possible alternative approaches include limiting the 50 or so sites in metro areas to one year of sampling and then moving these to other cities; or start with a network of more than 70 sites in a variety of urban, rural, and background locations for three years, then establish subnetworks for trends and model evaluation purposes.

(4) Network Design Recommendations: Several comments were offered on the network design:
   - o Sampling technology, sampling frequency, and the number of monitors are interrelated. Network design must achieve the best balance of these factors to ensure good data quality within the available funding.
   - o There is a need for affordable, continuous methods for many compounds (e.g., acrolein).
   - o Sampling frequency (and averaging time) should be appropriate for the health impacts associated with each compound.
   - o Focus on the 4 – 6 "worst" pollutants and, if appropriate, then ensure adequate seasonal characterization for these pollutants.
   - o Meteorological measurements should be included in the network.
   - o Methods to address diesel contributions should be identified.

(5) Emerging Technologies: Many recognized the potential advantages of continuous measurements, but acknowledged that they may involve high capital costs, require trained operators, and impose additional data quality assurance/quality review. A few commented that continuous measurements may be needed only when the monitoring objectives require an understanding of diurnal characteristics (e.g., for benzene and formaldehyde). There was mixed reaction to mobile monitoring platforms. Many noted that these platforms were good for local source assessments, but not for national trends purposes.

Steering Committee Meeting: On October 31, the Air Toxics Monitoring Steering Committee met in Rosemont, IL. Highlights from this meeting are as follows:

- Steve Bortnick (Battelle) outlined possible future data analyses (e.g., MDLs, inter-lab variability, urban- v. regional-scale patterns, case studies for each pilot city, analyze newest data submitted to archive, further website development, consider quarterly averages, meteorological analyses)

- A small group was formed to prepare a proposal on the transition from the archive-to-AIRS and the future of the website.

- A subcommittee was formed to prepare (over the next few months) a strawman which lays out the major concepts for the national air toxics monitoring network, and provides recommendations for allocation of the $3M in FY2002 grant funds.

For information on the monitoring pilot projects, please contact Sharon Nizich, USEPA, OAQPS, nizich.sharon@epamail.epa.gov, 919-541-2825. For further information on the data analysis projects, please contact Michael Koerber, LADCO, koerber@ladco.org, 847-296-2181. This newsletter will be issued on a regular (quarterly) basis to provide status reports on air toxics monitoring activities.