St. Louis, Missouri and Illinois Air Quality Management Process (AQMP) Conceptual Model

BACKGROUND

EPA is working with three pilot areas to integrate non-traditional planning into air quality management. These include the states of New York and North Carolina along with the St. Louis metropolitan area that includes both Missouri and Illinois. The focus of these plans is to move away from single-pollutant planning towards multi-pollutant strategies to address all future air quality needs. The St. Louis AQMP Project is an effort that will provide a new mechanism to accomplish air quality planning and generate air quality improvements in a more efficient, expeditious, transparent, and cost-effective manner. The St. Louis AQMP is being designed to address air quality goals including nonattainment and maintenance of criteria pollutant standards and risk reductions of certain Hazardous Air Pollutants (HAP) with an emphasis on community involvement in the processes for both states. In addition, some ancillary air quality issues will be considered in the development of state plans: smart growth/transportation planning, environmental justice, and climate change. One of the primary outcomes from the St. Louis AQMP will be its use in the next generation of planning exercises for fine particulate matter (PM2.5) and ozone. Further, the problems, solutions, and outcomes of the development process will be shared with EPA and other states to foster development of other multi-pollutant planning mechanisms.

Task #3: Develop Conceptual Model [May 2008 – January 2009]

1. Provide a discussion of overall purpose and final products of the pilot project.

The overall purpose of the AQMP pilot project is to develop a new mechanism for multi-pollutant air quality planning to be utilized in a bi-state metropolitan complex. These cooperative new plans (one for Missouri and one for Illinois) will be used to develop the State Implementation Plans for criteria pollutants in violation of National Ambient Air Quality Standards while considering air toxics exposure on the public. Alternatively, the AQMP could lead to the submission of a single plan for multiple pollutants (e.g. ozone and PM2.5) that have similar sources and timelines. This single plan outcome would be a significant step forward in the AQMP process and needs to be coordinated closely with EPA-OAQPS and the respective regional offices. Based on this new paradigm, the states will continue to work closely with stakeholders (industry, environmental groups, local air agencies, the metropolitan planning organization, and concerned citizens) to ensure a transparent and informed public process for air quality management including control strategy decisions. The current Air Quality Advisory Committee inside the East-West Gateway Council of Governments (local MPO) has served as the primary means for this interaction. Meetings of this group will continue as part of the AQMP development and implementation process along with enhanced outreach to the community. This outreach will include a series of meetings to identify air quality priorities for the area including input from stakeholders regarding any policy-related issues.

The AQMP will address criteria air pollutants that have been or, in the future, will be nonattainment for counties in the St. Louis area along with toxic exposure to pollutants identified

in the St. Louis Community Air Project Air Toxics Risk Characterization. This report was a direct result of the region's attempt to address environmental concerns related to air toxics in St. Louis. This report identified the following pollutants of concern for the St. Louis area: acetaldehyde, arsenic compounds, benzene, chromium compounds, formaldehyde, and diesel particulate matter. These toxics will be specifically addressed in planning activities under the AQMP. In addition, consideration of ancillary air quality issues will be documented throughout the State Implementation Plan process including environmental justice, smart growth, and climate change. This documentation will provide information about each issue along with any potential changes that were made to the SIP as a result of these considerations. It is important to note these ancillary issues are important to air quality management in St. Louis, but are not the primary focus of the AQMP. Given the level of current and anticipated future resources, the AQMP process will focus on the criteria pollutants within the St. Louis area and on the exposure to air toxics within the core metropolitan complex. The AQMP team believes this is the best use of our available resources and will provide the best opportunity for success of the project and implementation of the AQMP.

The AQMP will provide a timeline with respect to criteria pollutants of interest for both states' regulatory process along with interim milestones for the technical air quality analysis that is necessary for development of the SIP(s). It should be noted that the AQMP will change as air quality goals are met and new goals are developed. The pollutants will include ozone, PM2.5, and lead for the St. Louis area based on revised standards promulgated by EPA during the last two years. The technical milestones will include the generation of a base-year, model-ready air toxics inventory in conjunction with the appropriate criteria pollutant inventory, a photochemical modeling exercise to evaluate certain air toxics along with PM2.5 and ozone, future-year inventory development including control strategies that account for a variety of multi-pollutant strategies, and a site-specific lead analysis for one site in Missouri along with another potential site in Illinois. It is the intention of the AQMP effort to focus air toxics evaluations on the St. Louis urban core (the areas identified in the previous air toxics evaluation) and utilize available resources to address inventory and other refinements within this area.

The AQMP process will follow the schedule outlined in the State Innovation Grant (SIG) project being conducted by the state of Missouri. This project has specific timeframes, goals, and a logic model for many of the elements in the AQMP. The SIG project workplan is included as an attachment to this conceptual model document as a reference. Ultimately, the goal of the SIG is to utilize the AQMP plans created to develop SIPs for the St. Louis area.

In addition to the AQMP document and future SIP(s) developed using this multi-pollutant approach, another product will be a document that identifies the technical and policy issues that were discovered and addressed within the development of an AQMP.

2. What are the current, important pollutant-specific issues for the area (e.g. pollutant-specific conceptual description)?

<u>Ozone</u>

St. Louis has a long regulatory history for ozone and the two states are currently in the process of creating the recommendation for nonattainment designation under the 2008 8-hour ozone

standard (0.075 ppm). The 1997 St. Louis ozone nonattainment area includes: Franklin, Jefferson, St. Charles, and St. Louis Counties in Missouri along with the City of St. Louis and Jersey, Madison, Monroe, and St. Clair Counties in Illinois. Based on the 2006-08 monitoring data, there is a strong chance for the ozone nonattainment area will change to include, at least, one additional county in Missouri. Lincoln County contains a monitor that currently violates the new standard and this monitor is being strongly influenced by the St. Louis area as it is north-northwest of the core metropolitan area. The predominant wind direction for elevated ozone concentrations days in the St. Louis area is south. Most exceedance days in St. Louis have stagnant conditions in the early morning hours with southwesterly, southeasterly, southerly, or easterly surface wind flows later in the day. The synoptic scale meteorology of elevated ozone typically involves anti-cyclonic flow around a high pressure center to the east or north of St. Louis. There are violations of the new standard at many sites in the St. Louis area (both Missouri and Illinois that violate the 2008 ozone standard). The highest design values are measured at suburban sites to the north and north-northwest of the urban center. Based on source apportionment analyses conducted by Missouri using the 2009 attainment demonstration, St. Louis nonattainment area emissions still contribute more than half of the area's ozone concentrations. Also, the large oak and pine forests located to the immediate south and southwest of the St. Louis area in southern Missouri contribute a large amount of biogenic VOC emissions that impact St. Louis ozone concentrations. Further, the nature of ozone formation has changed slightly over the years in St. Louis. Prior to the 1-hour ozone SIP development, the area's ozone formed under a mixture of VOC- and NOx-limited conditions depending on meteorological conditions. Recently, St. Louis has shifted to more days with NOx-limited conditions, but with fewer days as VOC-limited. This follows the trend of significant VOC emission reductions in the high emission density areas near downtown St. Louis. More specific information about ozone precursor emissions and the overall conceptual description can be found in the 2007 8-hour ozone attainment demonstration for the St. Louis area and the Current Status of St. Louis Air Quality document for this project.

PM2.5

The St. Louis area was designated nonattainment for the annual PM2.5 standard in 2005. The area is similar to the ozone nonattainment area with Jersey County, IL being excluded and Baldwin Village in Randolph County, IL being included. 2005-07 monitoring data shows that there are two sites in violation of the annual standard. One is located in Granite City, IL close to an industrial complex that contains a large steel manufacturer. This site has the highest design value in the area and is located north-northeast of the downtown area. The other site is East St. Louis, IL and its design value is near the annual standard and it is located due east of the downtown area in another industrial location. The Granite City site is the focus of substantial analysis for the annual PM2.5 SIP since it is the only site with predicted future design values over the standard in 2012 (Missouri and Illinois are petitioning EPA for an attainment date extension). Illinois is conducting site-specific dispersion modeling analyses and Missouri has conducted a series of culpability analyses for sources nearby the monitor along with the other control strategy analysis conducted for the area. The geographic pattern of ambient PM2.5 concentrations is the downtown area is slightly lower than these two violating sites, with the suburban and rural areas lower still in nearly all cases. The conceptual description of the violating monitors finds a substantive local scale impact for primary PM2.5 industrial sources in

the area along with a large component from organic compounds with a typical seasonal variation of sulfate and nitrate (sulfate – summer and nitrate – winter).

The 24-hour PM2.5 nonattainment area was redefined by EPA in December 2008 and includes the same counties that were included in the annual PM2.5 nonattainment area. Previously, the area was designated attainment under the 65 microgram per cubic meter air quality standard. The monitoring sites over the standard are the same Granite City site that is over the annual standard and the Alton, IL site located in the suburban area north of the downtown complex. The remaining sites in the St. Louis area have 24-hour design values between 30 and 34 for the 2005-07 timeframe. Based on the analysis conducted during the designation process, it can be concluded that the area is being influenced by the same patterns as described in the annual standard conceptual description: regional/metropolitan scale concentrations near the standard with a "local" source contribution at the violating monitors.

Lead

Under the 2008 lead National Ambient Air Quality Standard (NAAQS) and using 2005-07 monitoring data, the St. Louis area could have two specific nonattainment areas. Lead is not a metropolitan scale issue in St. Louis. Violating monitors are located near large industrial sources of lead and the violations can be attributed to those sources. The considerations for lead under the AQMP will be somewhat narrow since each state will address the violations at the existing sources. However, any lead control discussions at the contributing sources will include potential controls for ozone and PM2.5 (and maybe other air toxics). This will ensure the multi-pollutant control co-benefits are examined as part of the overall SIP development exercise for the area. In the past, the state of Missouri has developed multiple lead plans for the city of Herculaneum (Jefferson County) and, under the annual PM2.5 NAAQS, a distinct SO2 rule that applies Reasonably Available Control Technology (RACT) to the lead-contributing source in Herculaneum. The overlap between the control evaluations for SO2 and lead existed, but was not codified in a formal manner. The crucial issue for this overlap is the timing of the SIP due dates and the ability to have consistent information for both evaluations. One of the main policy issues for the AQMP process will be the flexibility afforded the states when confronted with deadlines for plan submittal.

Air Toxics

The information on air toxics exposure in St. Louis is less developed than the information for the criteria pollutants. This is the case in nearly all metropolitan areas that have air quality issues with air toxics, ozone, and PM2.5. The inventory for toxic emissions in St. Louis is not ready for a photochemical modeling exercise. Some analysis has been conducted of toxic exposure (especially in the near downtown areas of both Missouri and Illinois). This analysis is not definitive when identifying sources of the pollutants of interest, but has identified the pollutants discussed previously as contributing to toxic exposure above accepted levels. The focus of the St. Louis AQMP toxics evaluation is to narrowly focus on the urban core area and to identify sources that contribute to elevated risk of citizens in this area. This will require the inventory development exercise described in detail in the SIG workplan. Then, in conjunction with the SIP exercise, evaluate the change in exposure found under various emission control scenarios, and use that information to assist decision-makers in control decisions.

3. What is the plan for development of the AQMP from a policy perspective?

The AQMP is being designed as a new mechanism to involve local regulatory partners and stakeholders in the decision-making process for air quality management. In order to accomplish this aspect of the plan, it should be noted that the current process for accepting input into the regulatory framework must change slightly. The AQMP will require the use of the Air Quality Advisory Committee (AQAC), mentioned previously, in a more direct fashion. The ultimate authority for SIP action and control strategy decisions will still lie with the respective state air quality agencies, but the process for making those decisions will be more open to stakeholders. This process will include the use of new information (e.g. air toxics exposure data) along with combined efforts on criteria pollutants. During the development of the AQMP, a series of meetings will need to occur between management of both state agencies, air quality partners, and interested stakeholders to establish a methodology for determining air quality priorities under the AQMP. Specifically, the outcome will need to identify the mechanism to prioritize the criteria pollutants and toxics of interest under the AQMP. This decision will allow for easier implementation of the AQMP and provide additional certainty to the regulated community when control decisions are made.

Another important policy issue is the flexibility for timing of Clean Air Act submittals under the AQMP. In order to provide the maximum amount of coordination and stakeholder involvement and limit the duplication of effort, the AQMP will need to address the issue of submittal timing for all plans associated with the AQMP. The cooperative technical approach between the two state agencies will continue for development of emission inventories, meteorological modeling, and photochemical modeling. The results of the analysis will then be utilized to inform control decisions using both states' regulatory process via the AQMP construct. The current methodology for addressing control requirements has been effective in both states, but the AQMP will require additional coordination between the states along with partners and stakeholders. This additional coordination will be needed to address the new technical information and provide a more transparent process for the community. As stated previously, the AQAC or an AQMP subgroup will provide the best forum to provide the necessary discussions.

One of the remaining policy questions is, how do the regulatory agencies tailor the process to reflect St. Louis air quality priorities and the overall multi-pollutant regulatory mechanism? Due to resource savings from the simultaneous evaluation for all the pollutants, some of the efficiencies gained will be used to further develop the co-benefit evaluation of all controls for the multi-pollutant AQMP. The technical process is being designed to provide decision makers with the information necessary to evaluate highest priority air quality issues in St. Louis including a multi-pollutant focus. The policy/air quality management activities for multiple pollutants will be combined into a single SIP action (where appropriate) for the St. Louis area. This change will allow for rulemakings that address more than a single pollutant and will endeavor to balance the timeframes associated for each NAAQS implementation with affected industry controls that may require multiple projects for different pollutants at the same facility. When issues of "trade-offs" exist (one pollutant concentration decreases, while another increases based on a particular control scenario), the air quality priorities identified will guide the necessary decision-making along with an eye toward compliance with the NAAQS and an aim toward reducing overall risk for the affected population.

It is important to note that when discussing alternative control scenarios with co-benefits, the state of Missouri has a specific statutory provision that limits regulations to be no sooner or more strict than federal regulations. This is another policy issue that will need to be addressed in the final development of the AQMP. The statute does allow for more stringent and sooner regulation to address nonattainment area problems.

4. What is the proposed technical approach for plan implementation?

As with any labor-intensive technical exercise, the goals must be understood to allow for the best and most resource-effective approach. The goals for the St. Louis AQMP are:

a) the completion of all required Clean Air Act submittals for compliance with the NAAQS in St. Louis (preferably using one air quality planning exercise and under a combined SIP),
b) the inclusion of air toxics exposure as an important metric for consideration of alternative control requirements for all NAAQS,
c) the incorporation of extensive community involvement in the decision-making process including the regulated and environmental communities,
d) consideration of other ancillary air quality issues in the development of the SIP including smart growth/transportation, environmental justice, and climate change

To develop the technical approach for these goals, an evaluation of the current status of air quality management was necessary. After that evaluation, the "new" tasks have been identified and evaluated for level of effort. Both states have much expertise in developing SIPs and supporting technical analyses for ozone and PM2.5. The primary new technical task is the use of air toxics exposure as a planning metric for the St. Louis area. This will require the evaluation of tools developed by EPA during the recent multi-pollutant air quality studies that include air toxics. This evaluation is underway and the St. Louis team is intent on using the expertise gained by OAQPS staff to assist in making decisions about specific technical details. After AQMP approval, the first task for the working group will be to determine the appropriate inventory base-year to use for the upcoming technical analyses and begin development of the modeling inventory including air toxics. This decision will be driven by EPA guidance on the ozone and 24-hour PM2.5 planning exercise development. After that decision, then a regional air toxics inventory will be chosen to use as the starting point for the local scale toxics inventory refinements.

In general, the air toxics evaluation exercise will likely include a 1 km modeling grid structure within the core downtown area and somewhat beyond to address potential emission sources. This modeling will be conducted using the same modeling system as used for the PM2.5 and ozone analysis unless the modeling system is not capable of handling the pollutants of interest or a better tool exists (e.g. heavy metal air toxic compounds). This grid structure will be kept narrow to minimize run times and maximize ability to evaluate different emission scenarios. The larger, regional grid structure will be defined based on EPA guidance, but will likely resemble

the previous ozone and PM2.5 evaluations conducted in St. Louis (Figure 1 – ozone and Figure 2 – PM2.5).

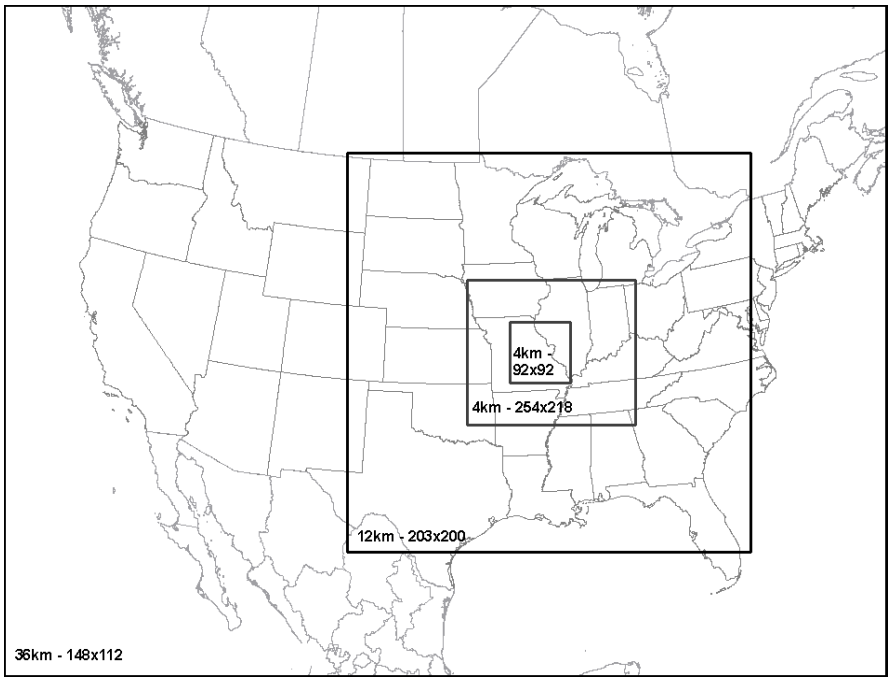

Figure 1 – St. Louis 1997 8-hour Ozone Modeling Grid Domains

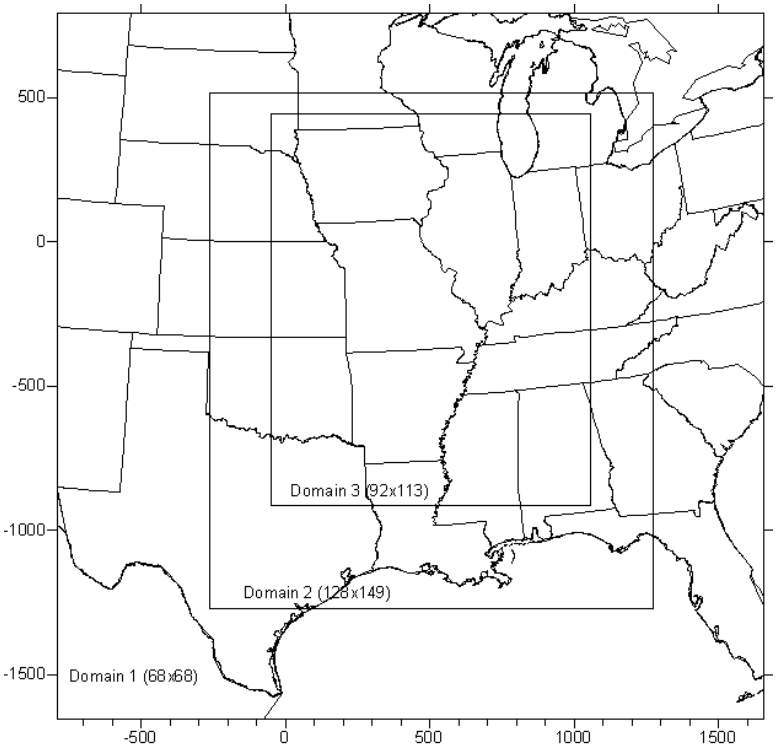

Figure 2 – St. Louis Annual PM2.5 Modeling Grid Domains

As part of the SIG project, the state of Missouri is beginning to train staff in the use of air toxics inventories for modeling evaluations, including SMOKE modeling activities. This training process will continue as the AQMP is developed for both emission and air quality models and issues discovered will be documented. This training is critical to ensure timely implementation of the multi-pollutant process when the AQMP is finalized.

When a decision regarding the evaluation year (dates for ozone) and grid structure is reached, the training activities completed by the technical group will be used to commence modeling activities for the AQMP. Traditional monitoring data evaluations for toxics and criteria pollutants will also be a critical component to the AQMP technical process. These may include receptor modeling, "urban excess" data contribution analysis, and PM2.5 speciation data and air toxics monitoring data evaluations.

The current technical tools to conduct the necessary local-scale toxics and regional-scale criteria pollutant modeling analyses are as follows:

i. MM-5 or WRF meteorological model

ii. MOBILE 6.2 or MOVES mobile emission factor model
iii. NONROAD or MOVES nonroad emission factor model
iv. Point source inventories (EPA, RPOs, state-provided)
v. Area source inventories (EPA, RPOs, state-provided)
vi. BEIS3 biogenic model
vii. VMT estimates (RPOs, state DOT)
viii. SMOKE or CONCEPT emissions model for preparing emissions to be used in the air quality model

ix. CMAQ and/or CAMx air quality model

x. BenMAP illustrate criteria and air toxic exposure/risk
xi. PAVE or other visualization program for model outputs

xii. EGAS growth factor model or similar tool
xiii. AirControlNet and any other multi-pollutant control strategy development tools

The technical process will strongly resemble the current SIP development process and include base-year inventory development (including emissions modeling), meteorological modeling, initial base-case modeling (including model performance evaluations), iterative revisions to modeling inputs as a result of findings, approval of base-case inputs/results, growth of emissions to a future year, inclusion of "on-the-books" controls for all pollutants, and subsequent control strategy iterations. The new aspects for the St. Louis area will include the use of BenMAP to evaluate benefits on risk/exposure for changes in all pollutant concentrations, the inclusion of air toxics in the modeling activities and monitoring data evaluations, and a prioritization of control based on air quality priorities in St. Louis.

The health outcomes from BenMAP will be used to inform decision makers regarding the monetary benefits of various control programs compared to the cost of control. This is accomplished by using population data contained within BenMAP and incorporating changes in modeled or monitored concentrations along with the health outcomes associated with those concentration changes. This data will be utilized in conjunction with the traditional SIP tests (attainment demonstrations, exceedance days per year, overall concentration reductions, monitoring trend analyses, etc.) to gauge the effectiveness of control scenarios for all pollutants. As a part of the collaborative effort for the AQMP, the Lake Michigan Air Directors Consortium has expressed an interest and willingness to participate in the BenMAP analysis portion for the St. Louis area.

Another component of the St. Louis AQMP technical process will stress performance based measures of progress or "accountability" to environmental goals of the plan. An accountability system will lay out an iterative process for evaluating the effect or verifying improvements as a result of AQMP action or control strategy selection. The measures evaluated during this process will include: a) reductions in emissions for each action, b) improvement in air quality related to emission changes, c) reduction in human exposure, and d) response in public health and welfare. The St. Louis AQMP workgroup will need to decide on a set of human health indicators for the St. Louis area (e.g. hospital admissions for respiratory problems). Each suggested indicator will be identified and discussed for inclusion in the formal AQMP. For Human Health, various epidemiological studies stress improvements in respiratory or cardiovascular responses for criteria pollutants. However, the human health science is not as well defined for air toxics exposure on a large scale as they are for the criteria pollutants. The workgroup will reach out to experts to help identify a set of these indicators.

5. How will the ancillary issues be addressed in the AQMP process including smart growth/transportation planning, environmental justice, and climate change?

The inclusion of all these issues in the potential control strategy discussion may identify measures that are more favorable for environmental justice concerns or climate change impact reduction. The formal inclusion of these issues within the AQMP will necessitate this discussion and will cause these concerns to be considered at the control strategy development stage of the process.

6. What other problems, issues, or concerns exist with the AQMP process?

The constantly changing EPA guidance for attainment of new standards is an on-going issue with the development of SIPs. This will be further exacerbated when attempting to develop a single plan for multiple pollutants. For the St. Louis AQMP effort to succeed, EPA will need to acknowledge that not all “state of the art” tools, information, etc., can be used in the development of the technical analysis. At the beginning of the technical evaluation process, there will be an opportunity to consider new or different techniques for inclusion with the technical analyses. However, given the complexity of the multi-pollutant evaluation, there will be very limited flexibility in changing technical tools or methods during each planning window.

One of the goals for the AQMP process is to achieve a quicker, more efficient means of accomplishing air quality goals. Through the implementation of the AQMP, these efficiencies will not be realized immediately and the process will seem to take longer than old SIP development due to the inclusion of multiple pollutants in the same planning exercise and an expanded stakeholder process. The amount of time and resources necessary to complete the multi-pollutant approach will be tracked and compared to the previous SIP submittals for the relevant pollutants. Specifically, the team will track staff resources, contract dollars, and total time for SIP development within the AQMP and compare that with the same information from the latest SIP development exercises in the St. Louis area. This will allow for a measure of efficiency to be calculated for the AQMP mechanism.

Further, it will be necessary to provide an extensive amount of documentation when considering control strategies that impact multiple pollutants (especially air toxics). This documentation will allow for a discussion of the "trade-off" issue along with the specific rationale for a decision to potentially choose a strategy that does not provide the most air quality benefit for all pollutants. EPA should be aware that control decisions are not always the most beneficial for air quality due to cost concerns and other factors.