

A "BRAVO Database Information" web page will also be placed on the internet for user access. This latter page contains information about the BRAVO database, specifically, the date and time of the last database update, the nature of the update (i.e. what was changed from the previous version), the current status of the database, and a general description of the database.

7. Quality Assurance

A well-defined program to assure the quality of data collected in a monitoring program is essential to the credibility of its results. Each of the monitoring components (e.g. aerosol sampling, laboratory analysis, & upper air meteorology) has written protocols that describe how the method is done. These protocols also identify the quality control procedures used to avoid problems with the data and to document their quality. An independent quality assurance audit program is used to check how well the protocols, especially the quality control procedures, are being followed.

The major emphasis of independent quality assurance in BRAVO is upon verifying the adequacy of the participants' measurement procedures and quality control procedures, and upon identifying problems and making them known to project management. Although routine audits play a major role, emphasis is also placed upon the efforts of senior scientists in examining methods and procedures in depth. This approach has been adopted because fatal flaws in experiments often emerge not from incorrect application of procedures by operators at individual sites or laboratories, but rather from incomplete procedures, inadequately tested methods, deficient quality control tests, or insufficient follow-up of problems.

At the beginning of the study, senior auditors will review study design documents to ensure that all measurements are being planned to produce data with known precision and accuracy. The auditors will focus on verifying that adequate communications exist between measurement and data analysis groups to ensure that measurements will meet data analysis requirements for precision, accuracy, detection limits, and temporal resolution. Quality control components of the measurements include: determination of baseline or background concentrations and their variability; tests for sampler contamination; adequate measurements of aerosol and tracer sampler volume and time; blank, replicate, and collocated samples; assessment of lower quantifiable limits (LQL), and determination of measurement uncertainty at or near the LQL; regular calibrations traceable to standard reference materials; procedures for collecting QC test data and for calculating and reporting precision and accuracy; periodic QC summary reports by each participant; documented data validation procedures; and verification of comparability among groups performing similar measurements.

Field performance and system audits will be conducted at each of the BRAVO monitoring sites in Texas and adjoining states. Measurement systems to be audited at the majority of sites included aerosol sampling using the IMPROVE sampler and tracer sampling using the Brookhaven BATS sampler. Performance audits will include flow rate

checks of the IMPROVE sampler and checks of the various settings on the BATS sampler. System audits will evaluate the adequacy of project components such as Standard Operating Procedures, measurement documentation, operator training, quality control checks, and sample chain of custody.

In addition to the IMPROVE and BATS sampler audits, system and performance audits of additional special measurements will be conducted at the Big Bend K-Bar site. Nephelometers will be challenged with SUVA gas, and transmissometer sight paths were evaluated. A high-sensitivity sulfur dioxide monitor and a continuous particulate sulfate monitor will both be challenged with an independent SO₂ audit standard gas. Flow rates will be audited on a variety of aerosol instruments designed to measure aerosol composition and particle size distribution. System audits will be conducted on the radar profiler/RASS system at K-Bar and at several other sites in Texas. The profiler/RASS audits will focus on the orientation of the profiler modules and on the operational status of the instrument.

Field system audits will be conducted at each of the BRAVO tracer release sites in Texas. The audits will focus on the ability of the tracer release system to control the tracer emission rates and to quantify the rates accurately and precisely. The audits will also evaluate the adequacy of project components such as Standard Operating Procedures, measurement documentation, operator training, and quality control checks.

A laboratory system audit will be conducted at Brookhaven National Laboratory (tracer analysis), and additional system audits will be conducted at UC Davis (elemental analysis), Desert Research Institute (carbon), and. These system audits evaluate the adequacy of project components such as Standard Operating Procedures, measurement documentation, quality control checks, operator training, and sample chain of custody. Performance audits specific to Project BRAVO will not be conducted. Instead, senior auditors will evaluate the results of prior audits or performance tests in which these laboratories have participated.

A system audit will be conducted on-site at the BRAVO central data management center (DRI- Las Vegas). The audit will evaluate the adequacy of project components such as communications between the study participants and the data manager, calculation procedures, handling of quality control test data, data archiving procedures, data base security, and data validation procedures. It will also include a spot check of data flow, in which a few selected data points will be subjected to manual calculation at all steps from field generation to final form in the validated data base.