12. Overall Quality Assurance

Approach

An independent quality assurance audit will be done by ENSR. The major emphasis of independent quality assurance in Project MOHAVE will be 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 will play a role, major emphasis will be placed upon the efforts of senior scientists in examining methods and procedures in depth. This approach will be followed because fatal flaws in experiments 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.

System Audits - Study Planning and Preparation

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 verify 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 will include:

Determination of baseline or background concentrations and their variability.

Tests for sampler contamination.

Adequate and precise measurement 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 and calibration checks, 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.

Verification of comparability among groups performing similar measurements.

A senior auditor will visit each measurement group, laboratory and data management and analysis group prior to the intensive field studies to verify that adequate progress is being made toward beginning measurements on schedule and within acceptable quality limits. A thorough review of written procedures will be part of this evaluation, including a review of all standard operating procedures. Issues to be addressed include:

Availability of equipment and supplies.

Manpower availability.

Readiness of written procedures and data collection protocols.

Adequate sample ID and sample tracking system.

Thoroughness of method evaluation tests.

Understanding of QC procedures and adequacy of protocols for collecting QC test data.

Testing of software used for data management, data validation, and data analysis.

Measurement System and Performance Audits

Audits of the field sites, the laboratories, and the data management and analysis center will be conducted once during the study, probably at the beginning of the winter intensive measurement period. System audits will verify that the items described in the system audits section are being applied. Performance audits will include:

Field sites - Instrument calibration checks, leak checks on aerosol and tracer samplers, and on the tracer injection system.

Laboratories - Relabeling of existing samples by ENSR and reanalysis by the study laboratories to verify precision and reproducibility. Submittal of prepared samples of known concentration, where needed. If the

laboratory already participates in a regular intercomparison program or if it uses standards directly traceable to NIST, then a system audit will verify this, and no additional samples will be prepared.

Data management - Manual calculation of derived concentrations and uncertainties.

Data analysis - Manual data traceability tests to verify pre-analysis processing.

Based on audit results and discussions with project management, the auditors will identify problems which have the potential to jeopardize data quality. They will provide immediate feedback to operational personnel and will provide letter reports following the audits. Corrective action request forms, to be completed by operational personnel and returned to the auditor, will verify that problems have been addressed. Throughout the study, the auditors will review the participants' QC summary reports.