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Los Alamos
National Laboratory

Environmental Stewardship Division

Meteorology and Air Quality Group (MAQ)

Quality Assurance Project Plan

for the

Radiological Air Sampling Network (AIRNET)

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Table of Contents (A2)

Appendices

This plan has the following appendices:

Distribution List (A3)

List of document recipients

This document will be controlled under the Meteorology and Air Quality Group's document control system (MAQ-030, "Document Distribution"). Those who will be notified of a new controlled copy include:

- MAQ Group Leader
- MAQ QA Officer
- MAQ Rad-NESHAP Project Leader
- MAQ Environmental Air Monitoring Project Leader
- MAQ AIRNET system staff members
- MAQ AIRNET system technicians
- Assistant Area Manager, Office of Environment and Projects, DOE Los Alamos Area Office

Introduction

History of revision

This table lists the revision history of this plan.

Revision	Date	Description Of Changes
0	---	Revision number not used.
1	5/8/87	New document.
2	1/10/90	Revisions to reflect changes in program.
3	12/21/95	Extensively revised following QA/R-5 format to meet new requirements in the FFCA and 40 CFR Part 61.
4	10/2/96	Changes to reflect new stations, analytical methods, and group project management.
5	7/7/97	Changes to analytical methods for alpha and beta counts; updated location list and station grouping; added consent decree requirements; editorial changes throughout.
6	1/4/99	Revised into Sampling and Analysis Plan format, parts moved to appropriate project plans.
7	6/23/00	Updated titles, sampler siting criteria, and other details.
8	5/3/05	Changed description of sample analyses performed, added description of siting evaluation process, other general updates, renamed as Quality Assurance Project Plan. Updated to reflect practice at start of 2005.

Purpose of this plan

This quality assurance project plan (QAPP) and its implementing procedures describe how environmental air monitoring for radioactive air contaminants is conducted at Los Alamos National Laboratory (LANL) by the Meteorology and Air Quality (MAQ) Group.

Introduction, continued

Structure of the quality program

This Quality Assurance Project Plan is a second-tier document to the MAQ Quality Management Plan (MAQ-QMP). The following documents ensure that the AIRNET program is operated in accordance with the requirements specified in the MAQ-QMP and DOE Orders 5400.5, and 450.1, as well the guidance in DOE/EH-0173T:

- QA Project Plan for Rad-NESHAP
- QA Project Plan for AIRNET (this document)
- implementing procedures

Revising this plan

This plan will be controlled through the MAQ document control program (prescribed by MAQ-030, "Document Distribution"). The team leader, at least one reviewer, and the group leader will approve all revisions to this plan.

Organization (A4)

Group organization

The MAQ Group of the Environmental Stewardship (ENV) Division supports the Environmental Stewardship Division's Integrated Management Plan (ENV-IMP). MAQ is responsible for environmental air sampling as specified in the plan and required by DOE Orders 5400.5 and 450.1. The Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T) describes the elements of an acceptable environmental surveillance program.

The MAQ Group Quality Management Plan (MAQ-QMP) describes group organization, level of authorities, and lines of communication. The group is organized by teams under the line management direction of the group leader. Teams are cross-functional and focus on specific LANL air quality responsibilities, deliverables, or products. Teams are guided by team leaders who have the responsibility to ensure the project is completed.

Project organization

The Environmental Air Monitoring Team Leader manages the operation of the AIRNET. The team leader reports to the MAQ Group Leader. A group QA specialist is assigned to work for the team leader to provide quality assurance assistance, advice, and review. The Meteorology Monitoring Team provides some meteorological data parameters. The group analytical chemist provides support to the team leader in interfacing with analytical laboratories, uploads electronic data deliverables, and reviews chemistry data packages. Other group members work for the team leader to collect samples, process collected samples, maintain samplers, manage databases, and provide data evaluation. In addition, representatives from other groups may participate and contribute to this team. The organization within each project is shown in the appropriate project plan.

Other supporting organizations

Other groups in LANL and subcontracting organizations provide support to MAQ for the AIRNET. Paragon Laboratories of Fort Collins, Colorado, currently provides analytical services for the air filters and the silica gel. Other or additional laboratories or organizations may be contracted to provide analytical support. Subcontract analytical laboratories report to, and are responsible to, the MAQ analytical chemist.

Approval of final products and deliverables

Final products and deliverables resulting from the AIRNET will be approved by the Environmental Air Monitoring Team Leader and reported to the MAQ Group Leader.

Problem Definition and Background (A5)

Problem definition

LANL emits radionuclides that are subject to regulation by the EPA and the DOE. These regulations require routine measurement and reporting of radionuclide concentrations in the ambient air. A system is needed to:

- determine the environmental impact of LANL radioactive air emissions, according to requirements found in DOE Orders 5400.5 and 450.1 and the guidance in DOE/EH-0173T; and

- determine the off-site dose contribution from non-point source LANL radioactive air emissions, according to the requirements of 40 CFR Part 61.94(b)(5) as outlined in the Compliance Plan described in Appendix A of the Federal Facilities Compliance Agreement (FFCA) between the Department of Energy (DOE) and the Environmental Protection Agency (EPA) dated June 1996.

[The AIRNET system does **not** measure the short-lived gaseous activated air product emissions produced by LACEF (Los Alamos Critical Experiment Facility) at TA-18 nor by the Los Alamos Neutron Science Center (LANSCE). Calculation of emissions from TA-18 is described in procedure MAQ-506, and measurement of LANSCE emissions is described within the "QA Project Plan for the Rad-NESHAP Compliance Project," MAQ-RN.]

System Description (A6)

Purpose of the system

The radiological air sampling network (AIRNET) at LANL is designed to continuously sample environmental levels of airborne particulate radionuclides and tritium emitted from LANL operations and sites, as required by the FFCA and the DOE Orders 450.1 and 5400.5. The method relies on the collection and measurement of airborne particles and tritiated water at locations around LANL, including the location of the maximally exposed individual (MEI), and the calculation of the dose from those measurements.

Applicable regulatory quality criteria

Applicable quality criteria include 40 CFR Part 61, Appendix B, Method 114, Section 4; DOE Order 414.1B ("Quality Assurance"); and LANL LPR308-00-00.2 ("Integrating Quality Management").

The group chose to write this plan according to the EPA standard for quality plans (EPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations"). However, some items of this standard are located in other project plan documents.

Measurements to be made

Continuous sampling of the air will be performed to determine the concentration of radionuclides in the air. Analytes and their detection limits will be chosen based on whether the analytes are emitted, or have the potential to be emitted, at a level sufficient to contribute more than 10% to an offsite dose greater than 0.1 mrem (i.e., each analyte contributes more than 0.01mrem annually). Filters will be used to collect particulate matter, and silica gel will be used to collect water vapor.

Gross alpha, gross beta, and gamma spectroscopy counts will be performed within 21 days (as specified in MAQ-033) after biweekly filter collection to detect unexpected quantities of radionuclide releases and to allow determination of any adverse trends in the ambient concentrations of radionuclides. Biweekly water vapor samples will be analyzed for tritium (^{3}H, as oxide). Composited AIRNET sample media will be analyzed for uranium (^{234}U, ^{235}U, ^{238}U), plutonium (^{238}Pu, $^{239/240}Pu$), and americium (^{241}Am). Analyses for other specific radionuclides can be performed for an unplanned release or other emergency situation, or if LANL operations warrant (e.g., to identify any contribution from a new potential source).

System Description (A6), continued

Special equipment requirements

The AIRNET will rely upon continuously operating vacuum pumps that pull air through a polypropylene fiber filter and, separately, through silica gel, both at known rates.

The sample analysis laboratory must have equipment for analyzing low levels of radioactive elements by the following methods:

- direct alpha counting (to determine the gross alpha decay activity)
- direct beta counting (to determine the gross beta decay activity)
- gamma spectroscopy (for detecting radionuclides that decay by gamma-ray emission)
- liquid scintillation counting (for detecting beta decays from tritium)
- alpha spectroscopy following radio-chemical separation (for detecting low levels of uranium, plutonium, and americium isotopes)

Assessments and reviews

Regularly scheduled system audits and management assessments will be performed according to requirements from each project that uses AIRNET data. Analytical laboratories participate in inter-laboratory comparison programs. These assessment tools are discussed in the section *Assessments and Response Actions (C1)*, page 44.

Schedule for the monitoring

The sampling will be performed on a continuous and on-going basis. This will allow collection of appropriate data for dose assessment and the identification of any unplanned release.

Required records and reports

Records of the operation of AIRNET will provide a trail that can be audited. Appropriate and sufficient records will be maintained for a minimum of 200 years (as specified by DOE requirements which exceed the 5-year requirements in 40 CFR Part 61.95) so the results can be verified or recalculated later. Such records will include, but are not limited to, documentation of field and laboratory equipment calibration, sample collection, sample analysis, and dose calculation and interpretation. See the section *Documentation and Records (A10)*, page 15, for a more specific list of the records to be preserved.

Reports of the calculated dose will be produced [see the section *Reports to Management (C2)*, page 45].

Quality Objectives and Criteria for Measurement Data (A7)

What are DQOs?

Data quality objectives (DQOs) are statements of the uncertainty level a decision-maker is willing to accept in results derived from environmental data. DQOs must strike a balance between time, money, and data quality.

Tolerable limits on decision errors

A false high measurement of radionuclides could limit LANL operations unnecessarily. A false low measurement of radionuclides might result in noncompliance with the 10-mrem dose standard.

The action levels chosen (see MAQ-201) are sufficiently low to ensure operation within regulatory limits (probability of a false negative, or a failure to detect an exceedance, is near zero), but are sufficiently high to minimize unnecessary responses and investigations (false positive responses are minimized).

Representativeness

Representativeness is a measure of the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Air samplers will be operated continuously (as defined by the FFCA; see "Completeness" below) throughout the year; consequently, there is complete sampling of temporal variations. Air samplers will be located at or near sites occupied by the public, along the perimeter of LANL and in background locations. [At times samplers may be placed near locations of probable or actual release to help understand measurements at other locations.] These locations will be chosen to obtain samples representative of the concentrations they are intended to measure and will be evaluated against the siting criteria presented later in the section *Sampling Process Design (B1)*.

Comparability

Comparability is a measure of the confidence with which one data set can be compared to another. Comparability of the sampler data is ensured because of the use of the same equipment, processes, and analytical methods at all sampler locations.

Quality Objectives and Criteria for Measurement Data (A7), continued

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

Data may be lost due to equipment malfunction, power failure, sample destruction, human error, loss in shipping or analysis, analytical error, failure to collect an adequate volume of air during the sampling period, inability to gain access to the site, or unacceptable data uncertainty.

The samplers will be designed to achieve the performance objective of 95% run-time completeness for the compliance samplers (as required by the Compliance Plan in Appendix A of the FFCA) and 90% for all other samplers. This objective means that the time during which a sampler is not operating satisfactorily due to malfunctions (including components in the sampler housing that cause a sample to be unusable), filter or sampler changes, maintenance, calibration, and similar conditions will not exceed 5% or 10% (compliance and other samplers, respectively) per calendar year. In addition, at least 80% of the total possible samples (during any calendar year) are required to provide valid data (see the Compliance Plan in Appendix A of the FFCA).

Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed conditions, expressed generally in terms of the standard deviation. It refers to the variability that occurs if the same analysis were performed again on the same sample with no change in conditions, or the degree to which repeated measurements on the same sample agree. Results of repeated analyses of standard or duplicate samples provide an estimate of laboratory or instrument precision.

The regulation 40 CFR Part 61.93 requires that the system be able to readily detect a dose of 1.0 mrem above background. Following statistical principles and assuming 95% confidence for such a measurement, we require that 95% of all measurements must fall within two standard deviations of the mean measurement. If a two standard deviation interval is 1.0 mrem, then one standard deviation is approximately 0.5 mrem. This represents the minimum acceptable precision for decision making.

Quality Objectives and Criteria for Measurement Data (A7), continued

To detect confidently environmental concentrations that are significantly less than 1.0 mrem and to meet the requirements of DOE/EH-0173T, a smaller precision is needed. The AIRNET will use 0.1 mrem as the target precision for all measurements. For known contaminants released by past or current operations, we must be able to detect significant contributions offsite (e.g., those that contribute 10% or more to offsite doses greater than 0.1 mrem effective dose equivalent from emissions in a year) (DOE/EH-0173T).

Estimates of total uncertainty at 10 mrem concentrations are discussed later, but precision has been calculated from the two sets of paired AIRNET stations for environmental concentrations based on the difference in the results using 1996 and 1997 data. These precision estimates are calculated for tritium and isotopic analyses. The isotopic analyses were grouped together because the sample size was too small to evaluate each radionuclide individually. The following table shows that the uncertainty (standard deviation) of the measurement, expressed as a percent of the concentration, decreases with increasing concentration:

Precision estimates from paired AIRNET stations

Radionuclide	Concentration per sample	millirem equivalent	Precision for an annual concentration (1 std. dev.)	Percent of annual concentration
Pu, U, and Am	100 aCi/m^3	0.5 (max)	11 aCi/m^3	11
Pu, U, and Am	500 aCi/m^3	2.6 (max)	35 aCi/m^3	7
Pu, U, and Am	1000 aCi/m^3	5.3 (max)	50 aCi/m^3	5
Tritium	10 pCi/m^3	0.07	0.38 pCi/m^3	3.8
Tritium	50 pCi/m^3	0.33	0.43 pCi/m^3	0.86
Tritium	100 pCi/m^3	0.67	0.71 pCi/m^3	0.71

Accuracy

Accuracy is the degree of agreement of a measured value with the true or expected value of the quantity of concern. It is not possible to determine the accuracy of measurements determined by this project, but an estimate of overall uncertainty (accuracy plus precision) is presented in the subsection below.

Any bias (known inaccuracy) will be corrected for if it is known, or estimated. Examples of bias for which corrections will be made include blank corrections and corrections for bound water in gels. Unknown bias will be presumed to be zero because this is the most likely value. To reduce bias, all measurements will be traceable to nationally recognized standards such as those provided by NIST.

Quality Objectives and Criteria for Measurement Data (A7), continued

Uncertainty analysis of AIRNET measurements

The Compliance Agreement in Appendix A of the FFCA requires that the overall uncertainty of all measurements be no greater than 20% at the concentrations in 40 CFR 61, Appendix E, Table 2 (These are values equivalent to an annual dose of 10 mrem).

To assess whether the AIRNET can attain the uncertainty (precision plus accuracy) required, an analysis was performed on the various sources of measurement uncertainty in the system. Uncertainties were calculated for quarterly composite ^{239}Pu and biweekly tritium measurements from AIRNET stations. ^{239}Pu was chosen for this analysis because of its more restrictive dose conversion factor (see memo ESH-17:95-759). Tritium uncertainty was calculated because it is measured and analyzed using a different process. Uncertainties were estimated at air concentrations equivalent to 10 mrem/year. The sources, sizes, and totals of the uncertainties are presented in the table below.

Sources of Uncertainties of ^{239}Pu and ^{3}H Analyses (%)

Source of uncertainty	^{239}Pu*	^{3}H (oxide)
Counting statistics	1	2
Other analytical lab processes	10	5
Aliquoting	NA	0.2
Flow meter reading	10	NA
Flow meter calibration	5	NA
Timer	0.1	NA
Collection efficiency of filter	1	NA
Collection efficiency variation of silica gel	NA	10
Absolute humidity	NA	5**
Temperature	NA	0.1**
Other	5	5
Propagated total	16	13

* Summarized from memo ESH-17:95-759.
** Calculated from instrument specifications and estimated 99th percentile worst-case meteorological conditions

Note that the uncertainty (%) for the counting of the sample will be significantly higher at the significantly lower concentrations normally found by AIRNET (due to the poorer counting statistics when counting low levels of activity).

Special Training Requirements and Certification (A9)

Required personnel education

See the project quality plans for any special personnel qualifications for the project. Personnel working for the AIRNET must understand the basics of radiation measurement and air sampling, and understand the general operation of the system. Individuals performing data review and interpretation must have additional education and/or experience as health physicists or radio-analytical chemists. Documentation of education qualification is maintained by the LANL personnel division.

Training of personnel

All personnel performing AIRNET-related work are required to obtain appropriate training prior to performing work governed by a procedure. Training for MAQ personnel will be performed and documented according to the MAQ procedures for training (MAQ-024) and orienting new employees (MAQ-032). Training of personnel in other groups will be performed and documented according to each group's training procedure.

Contractor analytical laboratories are required to have a quality management system in place that complies with the training requirements of DOE Order 414.1B, Criterion 2.

Documentation and Records (A10)

Records resulting from the sampling and analysis system

The number, type, and detail of all retained records will provide sufficient information to allow an individual with equivalent education and training to verify or reconstruct the results. Implementing procedures specify the records, forms, logbook entries, or other information to be kept as documentation of the performance of the procedure.

Records to be kept in the MAQ records system (MAQ-025, "Records Management") include the following:

- logbook entries and/or field forms to record sample collection and chain of custody
- equipment and instrument calibration and maintenance records
- laboratory analytical results
- air concentration calculation results
- dose assessments and assumptions
- station siting evaluations
- general correspondence that affects the system
- regulatory correspondence

Records to be kept by the subcontractor laboratories include the following:

- equipment and instrument calibration and maintenance records
- laboratory quality control results
- laboratory instrument calibration and maintenance records

Subcontractor analytical laboratories retain and manage all documentation related to analyses. These records include statements of work, laboratory data, corrective action reports, logbooks, bench worksheets, training documents, and similar documents.

MAQ work scopes specify that electronic data packages be returned from the analytical laboratories to the analytical chemist within 30 days for biweekly alpha/beta/gamma, 21 days for biweekly tritium, and 45 days for quarterly composites after sample submittal.

A field sampling and laboratory "case narrative" analysis of problems or special cases will not be required; instead, the deficiency procedure (MAQ-026, "Deficiency Reporting and Correcting") will be used to document quality-affecting problems encountered in the field and laboratory [see *Assessments and Response Actions (C1)*].

Documentation and Records (A10), continued

Reporting of final results

Final results for the time period in question will be presented as a simple summary of the resultant air concentrations (for the Environmental Surveillance Report) and a summary of concentrations converted to dose using the levels in 40 CFR Part 61, Appendix E, Table 2.

Records final disposition and retention period

All records will be maintained and available (after the deadline for submittal as given in applicable procedures) for auditing in the records center at the MAQ group office (MAQ-025, "Records Management"). Records will be archived in compliance with LANL and DOE requirements for records retention, storage, and management. These requirements specify the protection of records from damage due to fire, flood, or rodents; monitored access to the records; and maintenance of the records for at least 5 years for inspection at the facility (as specified in 40 CFR Part 61.95) and up to 200 years (DOE/HQ DRAFT document, "DOE Records Schedule for Environmental Records," Nov.1996).

Sampling Process Design (B1)

Sampling system design

The primary design objective for the air sampling network for airborne radionuclides is to provide accurate measurements of radionuclide concentrations in nearby public use areas, at the perimeter of LANL, at background locations, and possibly at sites on LANL property. To achieve the objective, the system design is based on expected and potential airborne releases, with consideration given to normal operational controls and unplanned releases. The system can usually allow distinction between significant radioactive material released by LANL and material that is naturally occurring or produced by non-LANL sources.

The specific media collected and the radionuclides measured are based upon the types of radioactive materials that may be released at LANL. Strategically placed sampling stations monitor radionuclide concentrations in three general areas:

- at LANL perimeter locations
- in public occupancy areas
- at background locations further than about 15 km from LANL sources.

At times samplers may be placed near locations of probable or actual release to help understand measurements at other locations.

All air samplers are operated continuously. Samplers consist of a vacuum pump, flow metering valve, timer, and sample trains. The sample trains collect airborne particles and water vapor separately. Stations were designed to collect samples of ambient air in the breathing zone (four to six feet above ground).

Sampling Process Design (B1), continued

Compliance sampler (MEI locations) design rationale

Locations for the compliance air samplers (listed in Appendix A, *AIRNET Sampler Locations*) were evaluated using a sampler network analysis. The primary consideration of this network analysis was the placement of samplers in all sectors that contain a potential maximally exposed individual (MEI). Assumptions and criteria for this analysis included the following (see the Compliance Plan Appendix A, FFCA, for more detailed information on the analysis):

- A standard 16-sector radial array (22.5° sector angle) from potential release sites was used to evaluate potential MEIs.
- Maximum off-site concentrations for non-point source emissions will occur at the site boundary since all such emissions are considered ground-level or effective ground-level releases.
- All residence or business "islands" within the LANL boundary will be monitored.

From this network analysis, 17 potential MEI locations were originally identified. Since then operations at LANL have changed and so too the AIRNET compliance sampler suite. One of those original 17 has been replaced and four others have been added, bringing the total to 21 at the time of this revision. See the discussion below for more detailed information on these added locations. All of the sectors with a potential MEI contain a sampler. These locations provide a sampler on or near the LANL boundary between or near the release point and the potential MEI for any given non-point source within LANL. This arrangement effectively provides a "wall" of samplers along the LANL boundary and all adjacent populated areas around or enclosed by LANL.

Additional compliance sampler locations
(continued on next page)

Since the original analysis discussed above, a number of other potential MEI locations have been identified and samplers put in place:

- Los Alamos Inn: Station 66 (Los Alamos) replaced Station 7 (Shell Station) in Apr 2000.
- Research Park, TA-3: Station 67 (research Park) has monitored this location since Aug 2000.
- East Park residential area west of the Los Alamos Airport: Station 68 (Airport Road) has monitored this location since Nov 2001.

Sampling Process Design (B1), continued

Additional compliance sampler locations *(continued from previous page)*

- Bandelier National Monument residences: Station 17 (Bandelier) has monitored this location since July 1991 but was converted to a compliance station in Jan 2005.
- TA-16: Station 24 (TA-16 near S-site cafeteria) has monitored this area since March 2005. It replaced Station 25, which monitored TA-16 since July 1991. Station 24 became a compliance station because it is at a site with potential public exposures (the TA-16 cafeteria).

Temporary AIRNET stations may be installed to monitor site restoration work and will be removed when actual or potential emissions are assessed to be no longer a cause for concern. Other temporary AIRNET stations, not listed in Appendix A, are also installed periodically.

See Appendix A (*AIRNET Sampler Locations*) for a list of all the long-term sampling stations in place at the time of this revision.

Locations without samplers

Some locations have been considered as potential sampler sites but were rejected for the reasons discussed below:

- Los Alamos Ski Hill: The ski hill is several kilometers away from the LANL boundary, and is not in the prevailing wind direction. A modeling analysis using CAP-88 determined that the site is not a potential MEI (memo ESH-17:00-133)
- Eastern tip of North Mesa: There are existing sampler stations between the eastern tip of North Mesa and most potential and actual sources at TA-21. The exception is MDA-U at the eastern end of TA-21. However, remediation was done on this area and final contamination levels are considered acceptable. The only case of concern may be excavation work done at MDA-U while wind speeds exceed 2.5 m/s. If excavation work begins at MDA-U the AIRNET team will evaluate the need for additional sampling.

Sampling Process Design (B1), continued

Future compliance station siting criteria

A special case for compliance monitoring siting was identified by Risk Assessment Corporation (1999 independent audit of the LANL Rad-NESHAP program). This special case occurs when there is a diffuse source of emissions (e.g., an environmental restoration project) located on the northern boundary of LANL directly adjacent to a business, office, or residence. In this case, the existing compliance criteria could require dozens of samplers to cover each wind direction sector containing a business, office, or residence.

To address this concern, procedure MAQ-238, "Evaluating New Diffuse Sources and New Receptors for AIRNET Coverage," was developed. This procedure specifies that the ESH ID database will be queried approximately monthly for new or modified sources of diffuse emissions. If a new or modified diffuse source is identified, it will be evaluated to determine if it is within 1700 meters of a compliance station. If not, a previous study, contained in the FFCA, has shown that the current AIRNET NESHAP compliance stations provide sufficient coverage for all then-current (as of the study date) potential MEIs. If the source is within 1700 meters of a potential MEI and the potential dose is equal to or greater than 0.1 mrem, an AIRNET NESHAP compliance station will be added. However, if there is an AIRNET sampler within 100 meters or ½ the meteorological-sector width of the MEI, whichever is greater, a new station will **not** be required. Using the same 100-meter/½-sector criteria, AIRNET stations will also be provided in adjacent sectors to the primary sector if the dose to a MEI in those sectors exceeds 50% of the dose of the primary-sector MEI. As new receptors are identified around LANL, similar steps will be followed to determine if sufficient AIRNET coverage is in place or needs to be added.

ESR station design rationale

(continued on next page)

The locations of stations used for reporting in the annual Environmental Surveillance Report have been selected to meet the objectives of DOE Order 450.1, Environmental Protection Programs. The primary objectives include:

- Demonstrating compliance with public dose limits.
- Measuring accidental releases of radionuclides, should they occur.
- Identifying and quantifying new or existing air quality problems.
- Characterizing trends resulting from air emissions.

Sampling Process Design (B1), continued

ESR station design rationale *(continued from previous page)*

Specifically, stations are located around the LANL site boundary in areas occupied by the public and downwind of LANL sources of radioactive air pollutants. Historically, stations have been grouped (see Appendix A, *AIRNET Sampler Locations*) as regional, pueblo, perimeter, on-site, environmental restoration, and waste site stations. These optional designations have been used for presenting information in the Environmental Surveillance Report and for evaluating data against action levels.

Background station design rationale

DOE suggests background stations be over 15 km from the site boundary. Regional background AIRNET samplers located in Española, El Rancho (less than 15 km from boundary but over 15 km from sources), and Santa Fe are used to establish background concentrations for all radionuclides except uranium. LANL sources of uranium are primarily depleted uranium, for which background is zero. The locations of the background air samplers are identified in Appendix A (*AIRNET Sampler Locations*).

Other samplers design rationale

Other samplers have been located onsite to satisfy DOE requirements or to meet programmatic needs of a particular facility or program. The following considerations were used in siting the other AIRNET samplers:

- annual average wind speed and direction
- areas of on-site predicted maximum concentrations
- topographic and other features that could influence dispersion
- availability, safety, security, and accessibility of sampler locations
- availability of power
- customer's specific programmatic needs for monitoring

Because of changing customer needs and budget priorities, the number and locations of these onsite samplers are subject to change. A current list of samplers is kept by the Environmental Air Monitoring Team Leader.

Sampling Process Design (B1), continued

Sampling frequencies

A continuous sample of air will be collected during the sampling period. The samples will be collected from the air sampling stations approximately every two weeks. For the detection of unplanned releases as required by DOE, the guide DOE/EH-0173T recommends that the sampling interval not exceed two half-lives of the shortest-lived radionuclide being monitored (^{74}As with a half-life of 18 days). Samples may be collected at a shorter interval for emergency response or unplanned release situations.

Sample matrices

Filter

Although atmospheric particle sizes range from about 0.01 to tens of microns (μm) in diameter, the optimum size for deposition in the upper respiratory tract (and subsequently the deep lung) is 0.01 μm to 3 μm, with 1 μm often used for dose assessment (ANSI N13.1 Table). The filter paper should retain a minimum of 99% of dioctylphthalate (DOP) with an aerodynamic mean diameter of 0.3 μm, at the air face velocity and pressure drop expected in use. Filters have been tested and the efficiency is greater than 99% at .3 μm. The filter material must have a low uranium content to allow better determination of uranium background concentrations. Filter material will be obtained from an appropriate supplier. Polypropylene air filtration media has been used since approximately January 1996. Procedure MAQ-202, "Environmental Sampling of Airborne Particulate Radionuclides," describes the steps to prepare filters.

Silica gel

Silica gel will be used to collect a sample of water vapor from the sampled air. As part of the water vapor, tritium in the form of either T_2O or HTO will also be absorbed. Water vapor concentrations in the ambient air are provided by the meteorology program as documented in the QAPP (MAQ-MET). The silica gel will be obtained from a commercial supplier or the LANL stock supply system and will be discarded after use. The silica gel used is medium grade with an absorption capacity of 0.26 g of water per gram of gel at 50% relative humidity. Approximately 135 g of gel are used, giving a collection capacity of 35 g of water per collection period. Normally 10 – 20g are collected. The volume of bound water in the gel will be determined according to procedure MAQ-257, "Determining Water Content of Silica Gel Using the Lindberg Furnace." Procedure MAQ-204, "Sampling of Ambient Airborne Tritium," describes the steps to prepare the silica gel tubes.

Sampling Process Design (B1), continued

Measurement parameters

Considering the actual and potential emissions of radionuclides at LANL, the following parameters will be measured or calculated:

- sample collection time
- air flow rate through filter media
- absolute humidity
- gross alpha radiation on filters
- gross beta radiation on filters
- tritium concentration in water absorbed by the silica gel
- gamma-emitting nuclides on filters
- ^{238}Pu, $^{239/240}Pu$, ^{234}U, ^{235}U, ^{238}U, and ^{241}Am concentrations on composited filters

Sampler siting evaluation criteria

Each new proposed sampler site will be evaluated against the siting criteria (compiled from DOE/EH-0173T and 40 CFR Part 58) according to MAQ-207 ("Evaluation of AIRNET Sampler Sites Against Siting Criteria"). This procedure describes the application of the following criteria:

1. **Favorable surface characteristics:** To reduce the loading of filters by particles, ideal sites will have minimal extraneous material prone to air suspension in the immediate area.

2. **Trees acceptable:** According to guidance from 40 CFR Part 58, samplers "must be 10 m from the dripline when the tree(s) act as an obstruction."

3. **Distance to obstructions (primarily buildings) greater than twice the height of the sampler:** The distance between the sampler and the obstruction must be at least twice the height difference between the sampler and the obstruction (equivalent to a rise angle from the sampler to the top of the potential obstruction of approximately 27°).

4. **Unrestricted airflow in 270° arc containing source direction:** The object (excluding trees, which are addressed under criterion #2) must not fall within the 270° arc, relative to the sampler, that contains the specific source that is being monitored (40 CFR Part 58).

5. **Good topographic location:** The area surrounding a site should be as level and flat as possible.

Sampling Process Design (B1), continued

Uniform application of these criteria is important to ensure consistency and adequacy among air sampler locations. Good scientific judgment will be used to select the optimal location based on site-specific criteria and on specific sampling needs. However, not all sites can meet all these criteria. Station #60 in Los Alamos Canyon is intended to monitor the potential up-canyon dispersal of radioactivity from TA-41 and TA-2 to potential receptor locations at the Ice Skating Rink. The sampler must be located at the bottom of the canyon between the source area and the potential receptors. In the bottom of the canyon, the canyon walls are considered obstructions according to criterion #3. At this site, the specific need for the station outweighs the site-specific criteria and the sampler was sited to best provide the data required. Elsewhere, there are few locations where trees would be considered acceptable according to criterion #2.

Because at least a few sites are changed or moved slightly during a year, it would not be possible to keep a current list of the siting evaluations in this document. The forms used to document siting evaluations are kept according to MAQ-207 ("Evaluation of AIRNET Sampler Sites Against Siting Criteria").

Field decontamination procedures and materials

No special field decontamination steps are required for the samples because of the low levels of activity, although every effort will be taken to avoid cross contamination and ensure that the levels are representative of environmental concentrations. Sampling procedures will specify the handling and packaging requirements to prevent cross-contamination and will include:

- Filter heads will be dedicated for use at only one station to prevent potential cross-contamination.
- Filter heads will be cleaned before each period in the field.

Operational changes in the Cave (TA-54-1001, where samples are processed) will be reviewed prior to implementation. This will help prevent inadvertent sample contamination (e.g., changes in janitorial cleaning supplies that can contaminate tritium samples).

Analytical laboratories will be required to maintain appropriate controls for prevention of cross contamination.

Analysis frequency

Approximately every two weeks, samples will be collected and sent for the analyses described above in "Measurement parameters" and in the section *Analytical Methods Requirements (B4)*, page 31. Occasionally (e.g., over long holidays or LANL closures), samples may be collected after three weeks.

Sampling Methods Requirements (B2)

Air sampling equipment

Each standard model air sampler consists of a particulate filter assembly, a silica gel water vapor absorber, two flow metering units, and an oilless, constant flow vacuum pump, all enclosed in a lockable weather-tight housing. Included in the housing assembly are various connecting and exhaust hoses and a 117 volt electrical supply circuit. All equipment will meet the following requirements:

Vacuum Pump
The air sampling pump must be capable of running continuously without overheating should the filter material become mostly plugged. The vacuum pump used is a vane-type, oilless, 117-volt, 3/4 hp, electrically powered constant flow air vacuum pump from Gast Manufacturing Company.

Filter holder
The current particulate filter assembly consists of a 47-mm particulate filter supported on wire mesh in an aluminum housing that can be disconnected without tools from the air suction tube by a mechanical quick-disconnect fitting. The filter holders are commercially available items. The aluminum three-part holders can be screwed apart and have an O-ring seal at the joints.

Silica gel tubes
The water vapor absorber tube is a vertically mounted plastic column holding about 135 g of silica gel. Air flows upward through the silica gel. The vertical position prevents the silica gel from settling to one side and provides maximum surface area contact with the air flowing through the tube. The tube is disconnected from the suction tube by a quick-disconnect fitting. The silica gel tubes are installed in a PVC pipe mounted outside the sampler housing to keep the silica gel cooler and increase the vapor collection efficiency.

The silica gel tubes are commercially available items (“refillable gas filter” from Lab Clear, Inc.) made from clear Plexiglas about 5 cm in diameter and 20 cm tall. The tube has a screen at each end to hold in the silica gel. The top screws off to allow filling and is sealed with an O-ring. The quick-disconnect fitting contains a ball that seals the fitting when the connecting part is removed.

Flow control
The flow control assembly must regulate the flow of air as the filter becomes loaded with captured particles over the two-week sampling period. The current assembly (SAIC Model LANL 420) consists of flow regulator valves and a pressure-activated timer assembly to record the actual pump run time. This assembly is connected to the sample holders and to the vacuum pump by laboratory-grade tubing of the appropriate size.

Sampling Methods Requirements (B2), continued

Flow meters

A Rotameter-type flow meter (a ball floating on the air rising through the tube) is used to indicate the flow through the silica gel. A magnahelic gauge is used to measure start and stop flow through filters because the previous setup with a rotameter did not accurately measure airflow.

Timer assembly

A vacuum-activated digital timer will be used to record the actual run time of the pump. This device will record the true sampling time to allow calculation of true sampled air volume if a pump does not operate for the full sampling period because of power outages, pump failure, or other causes. Because the timer is battery-powered and is activated by the vacuum created by the proper operation of the pump, it will accurately record the true sampling duration, even for rare problems such as pump failure or connecting-hose breakage.

Electronic dataloggers and notification system

The compliance AIRNET stations are equipped with electronic dataloggers and either a radio-frequency or cell phone communication system. The datalogger is programmed to call (via radio or phone) a central computer if the battery voltage drops too low or if the pressure switch on the pump closes due to loss of vacuum. The operational status of these stations is checked every working day. This system is intended to assist with meeting the completeness criteria for the system.

ANSI standards for sampling

Samplers meet the intent of the sampling requirements in ANSI N13.1 (1969, and 1999). See memo ESH-17:97-216 for a description of how each requirement (of the 1969 version) is met.

Meteorology parameters

Absolute humidity will be used to calculate tritium concentrations. This parameter will be derived from temperature and relative humidity measurements by the Meteorology Monitoring Project according to requirements in the project plan (MAQ-MET) and procedure (MAQ-402, "Calibration and Maintenance of Instruments for the Meteorology Monitoring Program"). The average of two week-long averages from a network of stations is used. Each station measurement has an accuracy of ± 0.5 g/m^3.

Sampling Methods Requirements (B2), continued

Sample collection

Sample collection will generally involve traveling to each sampler every two weeks to replace the quick-disconnect particulate filter holder and the silica gel tube with a pre-loaded holder and tube. The flow rates indicated by the flow meters, or by another type of calibrated instrument, and the time shown on the digital timer will be recorded on pre-printed field forms or recorded electronically.

The following procedures give detailed instructions for the collection of samples and the documentation of the collection:

- MAQ-202, "Environmental Sampling of Airborne Particulate Radionuclides"
- MAQ-204, "Sampling of Ambient Airborne Tritium"
- MAQ-216, "Management of AIRNET Field Data"

Corrective actions on sampling equipment

Operation and maintenance of the field sampling equipment is the responsibility of personnel assigned to perform this work by the Environmental Air Monitoring Project or Team Leader. The sample pumps will be checked for proper operation and flow each time the samples are collected. If the pump is defective or if flow rate cannot be brought into specification, the individual collecting the samples will immediately notify the technician responsible for pump maintenance to change the pump. A record of the defect will document the defective pump condition and will be used in future trending [see *Assessments and Response Actions (C1)*]. The timer device on the pump will record the actual run time of the pump to allow proper calculation of the air volume sampled.

Equipment such as the filter holders and tubes will be inspected at each use and replaced if found unserviceable. The respective procedures (MAQ-202 or MAQ-204) describes the inspection of the filter holders and gel tubes. The silica gel tubes are periodically leak-checked according to MAQ-234 ("Leak Checking Silica Gel Cartridges").

Preparation and decontam-ination of sampling equipment

Decontamination of the equipment is generally not required due to the low environmental levels of activity involved, but general cleanliness of the equipment will be maintained. Equipment such as the filter holders will be cleaned at each use, as specified in procedure MAQ-202.

Pumps will be cleaned at each six-month rebuild. Procedure MAQ-206 ("Maintenance of Air Sampling Pumps") describes the maintenance, decontamination, and cleaning steps for the air pumps.

Sampling Methods Requirements (B2), continued

Flow control panels in each station will be cleaned and adjusted as necessary according to procedure MAQ-229 ("Maintenance of AIRNET Flow Control Panels").

Procedures MAQ-202 and -204 describe the preparation of the filters and the silica gel tubes.

Sample volume

Air volume

Though high-volume samplers are recommended by EPA (Appendix A, "Guidance on Implementing the Radionuclide NESHAPS"), they cannot operate for the two-week sampling period without plugging the filter materials and are too noisy for use near homes or businesses. LANL has therefore chosen to use "medium volume" samplers. Sample volume requirements are based on the optimum flow rate of the pump combined with the collection media. The air sampling pump pulls air through both the paper particulate filter and the silica gel tube at different flow-rates through separate trains.

The particulate filter branch is calibrated to sample 4.0 ±0.4 cubic feet of air per minute [roughly 0.1m^3/min]. The total volume of air sampled can be calculated from the start and stop readings from the timer and the magnahelic gauge.

The water vapor sampling branch requires a reasonably constant flow. Historically and currently, a flow rate of 200 ±20 cc/min [0.0002 m^3/min] has been used.

Water vapor

About 135 g of silica gel is used to collect enough water vapor for analysis within the needed detection limits. The amount of water vapor collected will be determined after sample collection (by weighing the cartridges) and at the time of distillation of the water from the silica gel. The minimum water volume needed for analysis is 5 milliliters (to achieve a detection limit of at least 500 pCi/L of water), though a smaller amount can be analyzed using longer count times or with a higher detection limit. Most volumes distilled are between 10 and 20 milliliters, though on occasion, less is recovered due to very low humidity conditions. Corrections will be made for the volume of bound water in the gel.

Sampling Methods Requirements (B2), continued

Sample preservation methods

No sample preservation steps are required for the filter and silica gel sample media.

Sample holding times

Biweekly samples

Filters: Gamma analyses should be performed on the sample filters or clumps of filters as soon as possible after collection (in order to reliably detect short-lived radionuclides such as ^{74}As), but will be performed no later than 72 days after collection. The DOE/EH-0173T recommends that the holding time not exceed four half-lives of the shortest-lived radionuclide being monitored (^{74}As with a half-life of 18 days). Gross alpha and gross beta counts will be measured by front-face counting a minimum of 3 days (to allow decay of short-lived naturally-occurring radon daughter isotopes) and a maximum of 90 days after collection.

Silica gel: The water in the silica gel will be recovered by distillation within 21 days of collection. The distillate will be submitted and counted within 14 days of distillation.

Quarterly samples

The composited samples collected during the previous calendar quarter may be held for a maximum of one month (after collection of the last filters for the composite sample) before analysis (to allow sufficient time to meet the requirement to report data within 90 days of the end of the quarter). The analytical laboratory will analyze the samples within 45 days after the field data have been validated and verified.

Sample handling and shipment
(continued on next page)

Particulate filters

Plastic covers will be installed on the filter holders before and after collection to prevent cross-contamination. Particulate filters will be handled only with tweezers during installation in and removal from the filter holders. After removal, filters will be stored and shipped in glassine envelopes. These steps are specified in procedure MAQ-202, "Environmental Sampling of Airborne Particulate Radionuclides."

Sampling Handling and Custody Requirements (B3)

Sample handling and shipment *(continued from previous page)*

Silica gel

Plugs will be placed over the silica gel tubes before and after collection to help prevent entry of dirt and absorption of additional moisture. The silica gel will be promptly distilled and analyzed to minimize the chances for contamination. These steps are specified in procedure MAQ-204, "Sampling of Ambient Airborne Tritium."

Sample custody

A documented chain of custody will be maintained for all samples collected from the air sampler stations. The possession, handling, and transfer of custody of samples will be documented. A sample is considered in custody if it is one of the following:

- In one's physical possession.
- In one's view.
- Locked up so no one can tamper with it.
- Kept in a secure area where access is restricted to authorized and accountable personnel only.

A secured area is an area that is locked, such as a room, cooler, vehicle, or refrigerator. If the area cannot be secured by locking, a custody seal will be used to secure the area or the sample container.

MAQ sample tracking

A pre-printed form (see Attachment 2 of MAQ-202) or direct electronic entry (see MAQ-216) will be used to document the sample collection and the required information regarding location, sampler status, air flow, timer reading, and initial chain of custody. Procedure MAQ-202 describes appropriate chain-of-custody requirements for collecting samples.

Sample tracking at laboratories

Samples received by analytical laboratories will be considered physical evidence and handled according to procedures established to meet EPA chain-of-custody requirements. Sample tracking requirements are described in the respective laboratories' quality management plans.

Analytical Methods Requirements (B4)

Sample analyses to be made

Gross alpha, gross beta, and gamma spectroscopy measurements

Gamma-ray spectrometry will be used to determine specific gamma-ray emitting nuclides on groups ("clumps") of biweekly filters from stations with related purposes (e.g., all perimeter stations may be clumped together). Following this, individual filters from each sampling location will be analyzed for gross radioactivity (alpha and beta) by front face counting. These prompt (see MAQ-033 "Analytical Chemistry Data Management and Review for AIRNET" for time limits) analyses are done to provide an early indication of unexpected types or quantities of radioactive materials that may be present from an unplanned release or unusual occurrence and will comply with 40 CFR 61, Appendix B, Method 114 (A-4, B-4, and G-1).

Isotopic analyses

On a quarterly basis, a composite sample of biweekly particulate filters will be prepared. All composites will be analyzed for the presence of selected radionuclides, including ^{238}Pu, $^{239/240}$Pu, ^{234}U, ^{235}U, ^{238}U, and ^{241}Am by dissolving them in an acid solution, chemically separating and concentrating the radionuclides onto sample planchettes, and performing alpha spectrometry. The method will comply with 40 CFR Part 61, Appendix B, Method 114 (A-1).

Tritium analyses

After collection, the biweekly silica gel samples will be heated to distill and collect the water, which will be analyzed for tritium by liquid scintillation counting to comply with 40 CFR Part 61, Appendix B, Method 114 (B-5).

Definition of MDA

The minimum detectable activity level (MDA) has been defined for the AIRNET system at two standard deviations above the average analytical background count rate. The MDAs for each analyte are presented in the subsections below.

Analytical Methods Requirements (B4), continued

Definition of target MDA

The DOE does not specify a minimum detectable activity level (MDA) for any radionuclide. To meet DOE requirements, the project has historically requested MDAs as close to environmental background as practical. Due to differences in the sample quantity, interfering elements, changes in background count rates, natural random variation, and other factors, the MDA will vary from sample to sample. Specifying a maximum MDA will require the laboratory to reach an MDA significantly lower, thus raising costs significantly. Therefore, the project has chosen to specify "target" MDAs to meet DOE requirements.

Conformance to the target MDAs will be determined by averaging the MDAs achieved by the laboratory over any six-month period. Therefore, a target MDA may not always be met, depending on analytical conditions, for a given analytical result.

Gross alpha and beta measurement requirements

The minimum detectable alpha and beta activity will be no more than 1 and 2 pCi/filter, respectively, and will comply with 40 CFR Part 61, Appendix B, Method 114 (A-4 and B-4).

Gamma spectroscopy requirements

Measurements of gamma-ray emission by gamma-ray spectroscopy of either individual or clumped filters can provide, simultaneously, both identification and quantitative analysis of gamma-ray emitting radionuclides. These measurements will be conducted using high-resolution germanium detectors coupled with computerized multichannel analyzers and will comply with 40 CFR Part 61, Appendix B, Method 114 (G-1).

For some of the gamma emitting radioisotopes shown in the table below, it is not possible to consistently achieve a detection limit that meets the target MDA equivalent to 0.1 millirem; however, all measurements should meet the MDA equivalent to 0.5 millirem. (as defined in the section *Quality Objectives and Criteria for Measurement Data (A7)*, "Precision," page 11). The MDA and the target MDA are given in the following table.

Analytical Methods Requirements (B4), continued

To obtain lower detection limits and reduce analytical costs, multiple sample filters may be "clumped" together for counting. By increasing the mass of material to count and counting for a longer time, significantly lower detection limits per cubic meter of sampled air are obtained. If a high count is detected in the "clumped" filters, the filters can be counted individually to determine which contain the radioactive material. Currently, up to 9 filters are combined into one "clump." The "clumping" of filters is described in procedure MAQ-202 ("Environmental Sampling of Airborne Particulate Radionuclides"). Filters may also be composited for a site over time to improve the detection for a specific location.

Minimum Detectable Activity Levels (MDA) to meet DOE Requirements for Gamma Spectroscopy

Radionuclide	MDA (pCi/m^3) for 0.5 mrem dose	Target MDA(pCi/m^3) for 0.1 mrem dose
^{73}As	0.55	0.11
^{74}As	0.11	0.022
^{7}Be	1.15	0.23
^{109}Cd	0.0295	0.0059
^{57}Co	0.065	0.013
^{60}Co	0.00085	0.00017
^{134}Cs	0.00135	0.00027
^{137}Cs	0.00095	0.00019
^{54}Mn	0.014	0.0028
^{22}Na	0.0013	0.00026
^{210}Pb	0.000028	0.00014
^{83}Rb	0.017	0.0034
^{86}Rb	0.028	0.0056
^{103}Ru	0.13	0.026
^{75}Se	0.0085	0.0017
^{65}Zn	0.00455	0.00091

Specific procedures pertinent to this analytical method are described in the respective analytical laboratory's quality management plans.

Analytical Methods Requirements (B4), continued

Liquid scintillation requirements

After collection of the silica gel tubes, the silica gel will be removed and heated to distill and collect the water; this may be done either at TA-54-1001 or by an external analytical laboratory. Distillate samples will be shipped to an analytical laboratory where the water will be mixed in a scintillation vial with a liquid scintillation cocktail and then counted using liquid scintillation counting to determine tritium concentration. Measurement procedures pertinent to this analytical method will comply with 40 CFR Part 61, Appendix B, Method 114 (B-5). The maximum MDA to meet EPA requirements and the target MDA to satisfy DOE requirements are given in the table below. Note that the target MDA may not always be met, depending on the quantity of water collected and distilled, or if elevated levels of tritium activity exist in a given sample:

Minimum Detectable Activity Levels (MDA) for Tritium Analyses

Radio-nuclide	0.1 mrem dose conc. (Ci/m^3 air)*	Max. MDA for 0.1-mrem dose (pCi/mL distillate)	Target MDA to meet DOE requirements (pCi/mL distillate)
^{3}H	1.5×10^{-11}	6	0.5

* This value obtained from 40 CFR Part 61, Appendix E, Table 2.

Alpha spectroscopy requirements

Composite filter samples for a calendar quarter will be analyzed for ^{234}U, ^{235}U, ^{238}U, ^{238}Pu, $^{239/240}Pu$, and ^{241}Am by dissolving one-half of the composited filters in an acid solution, separating, and concentrating (e.g., by electroplating or co-precipitating) the radionuclides onto sample planchettes. The concentrated material will be measured by alpha spectrometry. Alpha spectroscopy methods will comply with 40 CFR Part 61, Appendix B, Method 114 (A-1). For each radionuclide, the maximum MDAs to meet EPA requirements and the target MDAs to satisfy DOE requirements are given in the table below. The target MDAs were chosen based on the MDAs achieved in the past. Radioanalytical procedures pertinent to this analytical method are given in the analytical laboratory's procedures. Different subcontract laboratories may be utilized in the future for filter analyses.

Analytical Methods Requirements (B4), continued

Minimum Detectable Activity Levels (MDA) for Alpha Spectroscopy

Radionuclide	0.1 mrem dose conc. (Ci/m^3)*	Max. MDA for 0.1-mrem dose (pCi/half filter composite)	Target MDA to meet DOE req's (pCi/half filter composite)
^{234}U	7.7×10^{-17}	0.53	0.04
^{235}U	7.1×10^{-17}	0.49	0.04
^{238}U	8.3×10^{-17}	0.57	0.04
^{238}Pu	2.1×10^{-17}	0.14	0.05
$^{239/240}Pu$	2.0×10^{-17}	0.14	0.04
^{241}Am	1.9×10^{-17}	0.13	0.05

* These values obtained from 40 CFR Part 61, Appendix E, Table 2.

Sample disposition

After the analyses are completed, the analytical laboratory will store the covered planchettes (with the dissolved composite filters) and the remaining half filters in a clean protected area until notified by MAQ. This notification will be made after the results of the quarterly composites are received and have been accepted. At this time the remaining filter halves will be returned to the MAQ group.

In case of sample loss or analytical problems, it may be necessary to use the remaining half filters for a new composite sample so MAQ stores the remaining half filters at the team leader's discretion. The Environmental Air Monitoring Team Leader must approve any additional analyses that would destroy the remaining half filters.

Quality Control Requirements (B5)

Duplicate sampling and analysis

There are two locations where duplicate samplers are operated in the AIRNET project: Station 39 collocated with Station 26, and Station 10 collocated with Station 90. These duplicate samplers serve as process duplicates to validate the overall sample collection, and analysis process and methodology. Data from these duplicate stations will be analyzed by evaluating the measurement differences between stations.

Trip sample blanks

As part of the regular sample submission every two weeks, five trip blanks are submitted with each filter and tritium sample set. The field sampling procedures (MAQ-202 and MAQ-204) describe the preparation, handling, and submission of these blank samples.

Matrix blanks

As part of the regular sample submission, three matrix blanks are submitted with each filter and tritium sample set.

Laboratory sample duplicates

The duplicate samples collected at the two stations described above serve as the primary method for laboratory duplicate analyses. MAQ may occasionally submit additional duplicate samples, such as:

- previously-analyzed filters (for recounting)
- a split of the silica gel distillate, when sufficient distillate is collected

Analytical laboratories will perform sample duplicate or spike analyses on their equipment according to their internal procedures and plans. Three tritium spikes are submitted with each biweekly tritium sample set. Contract laboratories generally have policies or procedures that call for analysis of blanks and spikes which are carried through all chemistry steps. For composites, these may consist of a preparation blank and/or a filter blank plus one preparation spike and/or filter spike with every set of 20 samples.

Analytical laboratory instrument checks and calibration

Analytical laboratories must perform appropriate quality control checks on their equipment, so that data generated meets the accuracy and precision requirements given in the section *Quality Objectives and Criteria for Measurement Data (A7)* (“Precision,” page 11 and “Accuracy,” page 12). Each laboratory will be responsible for maintaining appropriate records of checks and supplying quality control information in the data packages, as required by the contract. Each analytical laboratory is responsible for corrective actions for their equipment.

Quality Control Requirements (B5), continued

Required quality control steps of the laboratory analytical processes are described in the subsections to follow.

Gross alpha and beta analyses or radioactivity measurement
Calibration will be performed at least as often as the manufacturer's recommended interval. Background and efficiency data will be maintained. Check sources will be run periodically on the counting instrument to check for proper operation and response.

Gamma spectroscopy analyses
Calibration will be performed at least as often as the manufacturer's recommended interval. Background and efficiency count data will be maintained. Check sources will be run periodically on the instrument to check for proper operation and response.

Distillation of water from silica gel
A single-pan balance will be used to weigh the silica gel. The calibration requirements are given in the section *Instrument Calibration and Frequency (B7)*. No other specialized laboratory equipment requiring checks and calibrations is used in the distillation process. Procedure MAQ-204 or the appropriate subcontractor laboratory procedure describes the distillation process and specifies cleanliness steps.

Liquid scintillation counting
Calibration and detection limit determinations will be performed at least as often as the manufacturer's recommended interval. Background and efficiency calibration data will be maintained. Check sources will be run periodically on the instrument to check for proper operation and response.

Alpha spectroscopy
Calibration will be performed at least as often as the manufacturer's recommended interval. Background and efficiency data will be maintained. Check sources will be run periodically on the instrument to check for proper operation and response.

Quality Control Requirements (B5), continued

Use of negative values

As a result of the random nature of radioactive decay, negative results can be expected from radioactivity measurement analyses. Negative values will be used in averages and other calculations of air concentrations when the data are known to be acceptable. It is not appropriate to arbitrarily delete negative data from calculations. See discussion on the use of negative numbers in data calculations in the section *Data Review, Validation, and Verification Requirements (D1)*, "Use of negative values," page 49.

Use of data less than MDA

All acceptable data will be used in calculating accuracy, precision, and completeness. See discussion on the use of less-than values in data calculations in the section *Data Review, Validation, and Verification Requirements (D1)*, "Use of data reported as less than MDA," page 49.

Instrumentation and Equipment Testing, Inspection, and Maintenance Requirements (B6)

Preventive maintenance of the air pumps

Operation and maintenance of the field sampling equipment is the responsibility of personnel assigned to perform this work by the Environmental Air Monitoring Team Leader. Every six months, the pumps will be replaced with a unit that has received preventive maintenance. This will ensure that the overall reliability of the system is as high as possible.

Pump vanes and certain gaskets, filters, O-rings, and seals will be changed on each pump every six months and the pump will be tested before sampling use. A database will be used to record the serial numbers and track the replacement schedule of all the pumps. Procedure MAQ-206, "Maintenance of Air Sampling Pumps," specifies the tracking, preventive maintenance, and testing of the pumps.

Preventive maintenance of the flow control panels

Periodic cleaning and adjustment of the flow control panels in each station will be performed according to MAQ-229, "Maintenance of AIRNET Flow Control Panels." This maintenance includes cleaning of the control valve and all lines and lubrication of the sealing O-ring.

Operational checks of compliance samplers

During the week between sample collection, compliance samplers (see Appendix A, *AIRNET Sampler Locations*) are checked every working day using the automated notification systems (either radio or phone) to ensure they are still operating properly. These checks will minimize the amount of sample lost in the case of sampler malfunction, power failures, etc.

Instrument Calibration and Frequency (B7)

Calibration of pumps, calibrators, and balances

Pump air flow calibration

Upon installation in the sampler enclosure, the air flow through the pump will be measured with a calibrator (described below) and adjusted, as described in MAQ-205, "Calibration of Air Sampling Stations." The calibration procedure will also be performed at least every six months and upon change of any major permanent component of the system; i.e., replacement of the flow regulator assembly or replacement of the tubing during maintenance. Calibration results will be recorded in a logbook.

Calibrator calibration

Three models of air flow calibrators will be used for calibrating the flow through the air sampling pumps: SAIC Radeco Model C-828 Calibrator, Hi-Q calibrator model CF-18V, Buck Model M-5, and Buck Model M-30 Calibrator. Records will be maintained to document the calibrations. The procedure MAQ-205 describes the annual recalibration of these instruments by the manufacturers and specifies the records to be kept.

Laboratory balance

A single-pan balance will be used to weigh the silica gel before and after moisture collection. This balance will be calibrated at least annually by the Standards and Calibration Group according to their procedures and the Laboratory "Calibration Handbook" (LALP-93-47). In addition, calibrated check weights will be used to verify proper operation of the balance before each use.

Laboratory instrument calibrations

The laboratory instrument calibration intervals have been set to an appropriate frequency so data generated meets the accuracy and precision requirements given in the section *Quality Objectives and Criteria for Measurement Data (A7)* ("Accuracy," page 12 and "Precision," page 11). Each laboratory will be responsible for maintaining appropriate records of calibration and supplying calibration information in the data packages. See the section *Quality Control Requirements (B5)* for details on calibration frequency.

Meteorological instrument calibration

The instruments for measuring atmospheric relative humidity and temperature will be maintained as specified in the QA project plan for meteorology (MAQ-MET) and procedure MAQ-402, "Calibration and Maintenance of Instruments for the Meteorology Monitoring Program." Currently, these instruments are calibrated annually.

Inspection and Acceptance Requirements for Supplies and Consumables (B8)

Field equipment and supplies

Inspection and maintenance of the field sampling equipment and supplies are the responsibility of personnel assigned to perform this work by the Environmental Air Monitoring Team Leader. A visual inspection of most consumables is sufficient to detect problems that may cause loss of data.

Air filters

Filters will be manually cut to the proper size for the filter holders; this process will allow detection of defective filters. Filters are inspected again when installed in the filter holders.

Silica gel

Silica gel will be accepted based on information included in quality certification documents shipped with the materials. Before use, the gel will be dried in an oven to reduce the moisture content (see procedure MAQ-204). The gel will be inspected visually when loaded in the tubes.

Air sampling pumps

Pumps will receive initial preparation and testing prior to use (run for at least five minutes and tested for a minimum vacuum of 21 in. of mercury), as described in MAQ-206, "Maintenance of Air Sampling Pumps."

Laboratory supplies

Inspection and maintenance of laboratory supplies is the responsibility of the individual laboratories. Supplies will be accepted based on information included in quality certification documents shipped with the materials. Subcontract laboratories will appropriately inspect and accept supplies based on the risk to the analytical results.

Data Acquisition Requirements (Non-direct Measurements) (B9)

Non-measurement data sources

The only data acquired from non-measurement sources such as databases, spreadsheets, programs, or literature files are certain dose conversion factors (e.g., 40 CFR Part 61 Appendix E Table 2).

Data Management (B10)

Data integrity

Long-term data integrity is ensured through the use of limited access archive tables in an independent database (AIRNET_ARCHIVE) that holds the quality assured, verified and validated field and chemical analysis data on all samples collected from 1958 – present. By default, both the MAQ Database Administrator and AIRNET Program Applications Designer have full write access to these assets. However, since neither has been trained in the details of the data management documented in procedures such as MAQ-033 and MAQ-216, they are not on the approved list of Archivists that is maintained within the AIRNET database. Only these individual(s) are formally authorized to move data into the archive tables or make documented changes to data already archived.

Prospective Archivists are selected by the Team Leader for on-the-job training from the senior Archivist in the details and procedures used to operate and maintain the AIRNET data archives. Following that training, documented approval from the Team Leader, with concurrence from the trainer, is required prior to new Archivists being added to the Archivist table within the AIRNET database which actually controls the authority to conduct archiving operations.

Data preservation

Long term data integrity includes a system by which electronic data on the MAQ databases are backed up. All MAQ drives, including those holding databases, are backed up to external media tapes at the end of each work day. These tapes are stored in a fire-proof safe. In addition, the data are backed up monthly to a LANL machine outside the MAQ offices in White Rock.

Data transfer and management

Data from the field are entered into a database within two weeks after sample collection and evaluated according to MAQ-216 ("Management of AIRNET Field Data"). To eliminate data transcription errors, field data are entered directly into small computers and later electronically uploaded to the database (see MAQ-216, "Management of AIRNET Field Data" and the AIRNET Database Users Guide). Data undergo V&V by the Field Team Leader and are transferred to the Field Data Archive in the AIRNET_ARCHIVE database when complete by an authorized Archivist.

Most analytical data will be transferred electronically from the analytical laboratories to MAQ via an Electronic Data Deliverable (EDD) specified in the Statements of Work (SOW) governing these analytical chemistry procurements. Some data may be manually entered into a database. Data will be electronically managed and stored according to procedure MAQ-033 and the AIRNET Database Users Guide. MAQ personnel have been assigned responsibility for the establishment and management of the databases and electronic transfer network. These data undergo validation and verification by the Chemistry Coordinator and are transferred to the Chem Data Archive in the AIRNET_ARCHIVE database when complete by an authorized Archivist.

Assessments and Response Actions (C1)

Assessments

See the appropriate project quality plan for a description of the various assessments that are conducted.

Corrective actions

Corrective actions are addressed with the group's deficiency system, described in MAQ-QMP, procedure MAQ-026, and the appropriate project quality plan.

Interlaboratory comparisons

In addition to the regular instrument calibration procedures, each analysis laboratory is required to participate in appropriate interlaboratory comparison programs (such as the program sponsored by the EPA-LV "Performance Evaluation Study" for air filters and for tritium measurements; or the program by DOE-EML that also provides standard air filters, tritium samples, and test gamma spectra). All laboratories must meet acceptable performance standards on each applicable analyte. Failure to meet these standards may result in disqualification of the laboratory until corrective actions have been implemented. Each laboratory must participate in at least one comparison program (as appropriate for the sample types they analyze; these requirements are given in the appropriate scope of work document) to evaluate their performance on the following sample types:

Air filter standards: Each analytical laboratory performing filter counts for the AIRNET must analyze filter evaluation samples at least annually. MAQ will consider the laboratory's results to be satisfactory if they meet the system's acceptance criteria. A report must be sent to MAQ to document the results of the evaluations.

Tritium standards: Each analytical laboratory performing tritium analyses for the AIRNET must analyze tritium evaluation samples at least annually. MAQ will consider the laboratory's results to be satisfactory if they meet the system's acceptance criteria. A report must be sent to MAQ to document the results of the evaluations.

Gamma equipment comparison: A test gamma spectrum, supplied as electronic files, will be run through the gamma software to check the proper determination of gamma emitting elements. The DOE-EML interlaboratory comparison program supplies file spectra. Each analytical laboratory performing gamma analyses for the AIRNET should attempt to participate in this program, or an equivalent, at least annually.

Assessments and Response Actions (C1), continued

AIRNET action levels

After the data evaluation process [see the section *Validation and Verification Methods (D2)*, page 50], all data from the AIRNET samples will be reviewed for high, and in some cases low, values according to procedure MAQ-201, "Establishing and Using AIRNET Action Levels." This procedure describes how the action levels are developed and the actions to be taken to verify the high reading, notify appropriate personnel and managers, and document the actions. The procedure describes the two different action levels (*investigation* and *alert*).

Emergency response actions

MAQ may be asked by the Emergency Management Office at LANL to respond to a suspected release of radioactive materials. In such cases, air filters and silica gel samples may be collected as soon as possible and may be analyzed on a priority basis. Analytical chemistry requirements for these air filters and silica gels are presented in MAQ-230, "AIRNET Sample Analyses for Unplanned Releases." Results will be forwarded to the responsible LANL management for appropriate use in decision making. Dose may be calculated if necessary as described in MAQ-503, "Calculation of Doses from Unplanned Airborne Releases."

Reports to Management (C2)

Reports

Data reports will be prepared and distributed as specified in the respective project quality plans.

Data Review, Validation, and Verification Requirements (D1)

Criteria used to accept, reject, or qualify data

All data will be evaluated for one of three outcomes: accept, qualify, or reject. Data evaluation criteria will include:

- within expected range of values
- proper laboratory methods
- acceptable analytical uncertainty

The limits for acceptability and the methods used are explained in the next two sections [*Validation and Verification Methods (D2)* and *Reconciliation with Data Quality Objectives (D3)*].

Data types to be evaluated

Data are evaluated according to procedures MAQ-033 ("Analytical Chemistry Data Management and Review for AIRNET"), MAQ-208 ("Technical Evaluation of AIRNET Data and Calculated Concentrations"), and MAQ-216 ("Management of AIRNET Field Data"). Many of the checks described in this section are performed electronically utilizing database queries.

The data needed for determining air concentrations can be categorized into three areas: field, analytical chemistry, and meteorological data. Each data category is made up of various data elements, as listed below.

Field data:

- collection date and time
- sampler number
- timer reading
- filter flow rate at installation
- filter flow rate at removal
- silica gel flow rate at installation
- silica gel flow rate at removal
- silica gel mass at installation
- silica gel mass at removal
- moisture distillation volume
- comments

Data Review, Validation, and Verification Requirements (D1), continued

Radiochemistry data:
Analytical chemistry data packages are generated by the subcontractor laboratories. Data packages will be reviewed within 3 weeks for conformance to contract specifications and for data usability according to procedure MAQ-033 ("Analytical Chemistry Data Management and Review for AIRNET"), which includes:

- presence of narrative letter
- presence of summary data table
- properly completed chain-of-custody forms
- analytical completeness
- proper holding times and analytical time sequences
- required detection limits on analytical methods
- expected blank sample values
- evidence of cross-contamination
- numbers that appear inconsistent
- complete calibration documentation
- traceability of standards

The radiochemical analytical data to be extracted from the packages are:

- analyte
- date of analysis
- result
- uncertainty
- units
- MDA

Missing analytical data can be reconstructed or estimated based on a professional evaluation of the reasons for the missing or incomplete data if clearly documented. In some cases, an appropriate estimated value may be used. Such data will be flagged as "qualified."

Meteorological data:
Absolute humidity is calculated on a weekly basis from Tuesday midnight to the following Tuesday midnight (MST). The two weekly values are averaged to estimate the average absolute humidity for the biweekly sampling period. Absolute humidity will be determined as the average of all tower locations not used for site-specific monitoring. These averaging periods were evaluated in memo ESH-17:98-283.

Data Review, Validation, and Verification Requirements (D1), continued

Air concentration data:
Air concentration records are generated for each radionuclide at each sampler using field, count, and analytical laboratory data. Air concentration records will also be reviewed for acceptance, rejection, or qualification. The air concentration record will be evaluated within thirty days of the completion of the field data record and radiochemistry record. The data used to calculate air concentration values consist of:

- air volume through filter during sample period
- sum of air volumes for quarterly composited filters
- average absolute humidity during the sampling period
- radiochemical analyses
- analyte concentration in the sample
- analyte concentration uncertainty in the sample
- analyte concentration units for the sample

Handling of outliers

During the data evaluation process, steps may be taken to identify and test for individual concentration values that would be considered outliers by applying various statistical techniques. In some cases, it is not appropriate to include known outliers in the calculation of the summary statistics for a sampler. Professional judgment will be exercised in these decisions (MAQ-208, "Technical Evaluation of AIRNET Data and Calculated Concentrations").

Data Review, Validation, and Verification Requirements (D1), continued

Calculation of summary statistics

Summary statistics for each sampler will be calculated. These summary statistics will be published in the annual environmental surveillance report. The elements of the summary record consist of:

- annual mean radionuclide concentration at each station
- standard deviation or confidence interval of the annual concentration calculated from the individual measurements at each station
- uncertainty of analytical results or comparisons to the MDAs.

The environmental variability is characterized by the sample standard deviation of either the biweekly or quarterly analyte. The variation due to the radio-analytical process is included in the sample standard deviation.

Use of negative values

Environmental data with negative or "less than" values will be used in calculations in order to obtain the best estimate of the true value (DOE/EH-0173T). The true value, which is always unknown for a continuous variable, cannot be negative but is estimated by the average of many measurements, some of which may be negative (especially when the true value is very close to zero). Thus, arbitrarily discarding negative values will improperly bias the estimate of the true value. For a full explanation of this statistical principle, see memo ESH-17:95-384.

Use of data reported as less than MDA

When data are reported as being "below minimum detectable activity level" (when an actual value is not presented), the concentration will not be assumed to be zero, but can be calculated using a methodology suggested in "Guidance for Data Quality Assessment" (EPA QA/G-9, pages 4-54 to 4-61). The method depends on the percentage of results reported as "non-detects."

Use of data reported with value less than MDA

Radio-analytical values will be reported even if the result is below the published laboratory minimum detectable activity level (MDA), since the background count is usually some positive value. Reported values of less than the detection limit require professional evaluation to interpret. Statistically, these results have a low level of confidence associated with them (50% or less), and actions and decisions based on such data may not be warranted.

Validation and Verification Methods (D2)

Evaluation of field data

The group continues to automate most of the checks described in this section in a computer database program.

Each of the field data types listed in the previous section will be evaluated as described in MAQ-208 ("Technical Evaluation of AIRNET Data and Calculated Concentrations") and MAQ-216 ("Management of AIRNET Field Data") for completeness and expected range of values:

1) Completeness
Each field element should have a value. If a value is missing, an explanation should be provided. If a datum is missing without an acceptable explanation, the record will be considered "qualified" or "rejected" depending on the missing information. The following table lists the more frequent explanations for missing data points.

Common Explanations for Incomplete Data Points

Field Element	Explanation
Timer reading	Power out
Timer reading	Timer or vacuum switch malfunction
Timer reading	Timer not reset
Filter flow rate	Power loss / pump failure
Gel mass	Sample lost in distillation

2) Expected range of values
Each element has a nominal value with a range of possible values. If the element is outside its range of normal values, the record will be identified as "qualified." The nominal and normal range of values for data elements are given in the procedure MAQ-216, "Management of AIRNET Field Data."

If the field record is not "qualified" or "rejected," it will be accepted. If the field record is "qualified," further validation and verification will be performed. Best professional judgment will be applied to "qualified" data. Amended field records will be considered acceptable but will be flagged as "qualified." In addition these amendments must be documented.

Validation and Verification Methods (D2), continued

Evaluation of analytical data

The analytical data (gross alpha, gross beta, and gamma spectroscopy) packages will be evaluated by the MAQ analytical chemist according to procedure MAQ-033, "Analytical Chemistry Data Management and Review for AIRNET," to verify that the count data package is acceptable according to the criteria given in the previous section [*Data Review, Validation, and Verification Requirements (D1)*]. After this review, the data will be evaluated as described in MAQ-208 ("Technical Evaluation of AIRNET Data and Calculated Concentrations") for completeness and expected range of values:

1) Completeness
If a value is missing, the record will be rejected. An explanation must be provided.

2) Expected range of values
The analytical data should be within an expected range of possible values. If the value is outside its range of normal values, it will be investigated according to MAQ-201 ("Establishing and Using AIRNET Action Levels").

If the analytical data are not "qualified," they will be accepted. If the data are "qualified," further validation and verification will be performed. Amended field records will be considered acceptable but will be flagged as "qualified." No datum will be rejected unless it can be clearly shown that it is incorrect or non-representative.

Calculation of air concentrations

Air concentrations are calculated (MAQ-208, "Technical Evaluation of AIRNET Data and Calculated Concentrations") with the following data:

- total sampler run time for sample period
- sampler air flow rate during sample period
- reported total concentration of the radionuclide on the filter or in the water vapor sample
- for tritium concentrations, absolute humidity and bound water volume will be used

The nominal and normal ranges of values for air volume per sample period are specified in the database. If the respective volume is out of range, it may be flagged as "qualified."

Validation and Verification Methods (D2), continued

If any source datum used to calculate an air concentration value is "qualified," then the air concentration value is considered "qualified." Air concentration values that do not have a "qualified" status are considered accepted values, having satisfied all the data review, validation, and verification requirements.

Professional evaluation of qualified data

A professional evaluation (MAQ-208) will be performed to estimate or otherwise complete data labeled as "qualified." After this evaluation, the data will be either rejected or accepted for use in calculating the air concentration values. If the value remains qualified, it will be used in concentration calculations.

Calculation of dose from air concentration values

See the respective quality project plan for project-specific requirements for calculation of doses and reporting of data. To demonstrate compliance with the 10-mrem EPA standard, doses are calculated from AIRNET mean concentration data using 40 CFR Part 61, Appendix E, Table 2. The doses for the FFCA compliance stations (see Appendix A, *AIRNET Sampler Locations*) are used, in conjunction with other data, to demonstrate compliance with the 10 mrem EPA standard. Doses from all AIRNET stations are also evaluated for use in calculating the dose to the public from all pathways. The dose from all pathways is compared to the DOE annual public dose limit of 100 mrem.

In the case of an unplanned release or an emergency response, dose can be calculated as described in MAQ-503, "Calculation of Doses from Unplanned Airborne Releases."

Comparison to action levels

The air concentrations will be reviewed to determine if any exceed the investigation action levels or the alert action levels, as described in the section *Assessments and Response Actions (C1)*, "AIRNET action levels". Procedure MAQ-201 ("Establishing and Using AIRNET Action Levels") describes the process and the actions to be taken.

Reconciliation with Data Quality Objectives (D3)

Calculating data precision

Periodically, the precision of the analytical results will be evaluated by a method similar to that used in the estimation of overall uncertainty presented in the DQOs of the appropriate project quality plan (see memo ESH-17:95-759). The precision will be compared to the required overall precision of 20% at the levels in 40 CFR Part 61, Appendix E, Table 2 (equivalent to an annual dose of 10 mrem).

Calculating data completeness

For all stations, data completeness will be calculated on at least an annual basis for each sampling location (compliance stations will be calculated more frequently). Completeness will be calculated as follows:

- Run time of each station: the total operating hours of each sampler (from the timer readings) divided by the hours in the time period being evaluated.
- Sample completeness: number of verified and validated sample results obtained at a sampler divided by the total number of possible samples (adjusting for stations that were established for only part of the year) in a calendar year.

These data will be compared to the completeness criteria for run time (95% for compliance stations and 90% for other samplers) and sample completeness (80%)

Failure to meet specified DQOs

When differences are identified between specified and measured values for precision and completeness, a deficiency report will be generated (MAQ-026), and the causes of the differences will be investigated, reported to management, and corrected where possible.

Click here to record “self-study” training to this procedure.

APPENDIX A

AIRNET Sampler Locations

The following samplers are in place on the date of this plan. For a current list, contact the Environmental Air Monitoring Team leader or the MAQ records coordinator.

Key to groups: R = Regional stations Pu = Pueblo stations P = Perimeter stations
W = Active waste storage stations O = Other onsite stations

Station number	Group	Station Name	Location
1†	R	Española	Northern New Mexico Community College on west side of Española (Chama highway) east of two-story science building.
3†	R	NM School for the Deaf	Santa Fe at the school for the deaf near the intersection of Cerrillos and St. Francis roads.
4	P	Barranca School	Barranca School on Barranca Road, on south side of school.
5	P	Urban Park	From Diamond Dr turn west onto Sycamore. Station on North Rd near south end of Urban Park near water tanks.
6*	P	48th Street	Off 48th Street off Sandia, inside the fences of the water tanks.
8*	P	McDonald's Restaurant	South of the McDonald's on Trinity Drive, south of storage buildings, over the south rim.
9*	P	LA Airport	Near airport terminal building, northwest of terminal building.
10*	P	East Gate	Abandoned guard tower next to Highway 502 east of airport.
11*	P	Well PM-1	West of intersection of SR 4 with East Jemez Rd, west and outside of service building for Well PM-1.
12*	P	Royal Crest Trailer Court	South of Royal Crest Trailer Court off East Jemez Road, enclosed by a chain-link fence.
13*	P	Rocket Park	White Rock, east of Tennis Courts north of Piñon School, south of "Rocket Park" off Sherwood Drive.
14*	P	Pajarito Acres	White Rock at corner of Piedra Drive and Monte Rey North.
15*	P	White Rock Fire Station	White Rock on Rover Blvd., at the firehouse, in the vacant area on the side of the building.
16*	P	White Rock Nazarene Ch.	White Rock, corner of Pajarito Rd and SR 4, back of building.
17*	P	Bandelier Fire Lookout	Bandelier National Monument, at fire tower lookout about 1 mile past entrance.
20*	O	TA-21/ Area B	TA-21, DP Road, east of paved parking area before guard gate.
23	O	TA-5 Beta Area	TA-5, transformer station on east side of road, east of TA-52.
25*	O	TA-16 S-site cafeteria	Travel west on West Jemez . Turn east intoTA-16. Station is straight ahead on edge of carpark, NE of cafeteria.
26	P	TA-49	Entrance to TA-49 along SR 4 near Bandelier NM.
27	W	TA-54/ Area G	TA-54, about halfway down the site along the north fence.
30	O	Booster P-2	TA-54 turn off from Pajarito Rd, inside fence for water tank and pump house.
31	O	TA-3	From Diamond Dr. turn north after Eniwetok then east at steam plant.
32*	P	County Landfill	County Disposal site, East Jemez Rd to the right of entrance.
34	W	Area G-1/ NE corner	TA-54, in the far northeastern corner of the area, outside the perimeter fence of Area G.

Station number	Group	Station Name	Location
35	W	Area G-2/ back fence	TA-54, halfway down the site along the southern fence.
36	W	Area G-3/ office	TA-54, east of the main office building for TA-54.
39	P	TA-49/ QA	Next to station #26.
45	W	Area G - SE perimeter	TA-54, in outer perimeter area southeast of the fence.
47	W	Area G - N perimeter	TA-54, in outer perimeter area north of the fence.
49	O	Pajarito Rd. TA-36	Pajarito Road to east of TA-18, at old sludge pond (TA-36).
50	W	Area G - expansion	TA-54, near power pole 2939 northwest of preparation facility.
51	W	Area G - expansion pit	TA-54, along the north fence of new pit near power pole 2942.
55†	R	Santa Fe West	Northwest of Santa Fe, along Camino la Tierra at Booster Station #4.
56†	R	El Rancho	North of Highway 502 between Pojoaque and Rio Grande.
59	Pu	Jemez Pueblo	Jemez Pueblo on SR 4, west of Jemez Springs (35 mi. from Los Alamos), at visitor center.
60*	P	LA Canyon	In Los Alamos Canyon, along road east of Ice Rink.
61*	P	LA Hospital	Near intersection of Trinity Drive and Diamond Drive, east of the LA Medical Center building.
62*	P	Crossroads Bible Church	North and across the road from LA Crossroads Bible Church.
63*	P	Monte Rey South	White Rock, near intersection of SR 4 and Monte Rey South.
66*	P	LA Inn South	South of LA Inn on north wall of LA Canyon.
67*	O	Research Park	Northwest corner of exit of LA Fire Station West Jemez Rd.
68*	P	Airport Road	Northeast corner of entrance to LA Airport.
70	Pu	San Ildefonso Pueblo	Near San Ildefonso waste transfer station.
84	Pu	Picuris Pueblo	Near Penasco on SR 75 about 60km NE of LANL
90	P	East Gate backup and QA	Next to station #10.

* compliance station † background station

APPENDIX B

References

Requirements and guidance documents:

Title 40 Code of Federal Regulations Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities," December 15, 1989

Title 40 Code of Federal Regulations Part 58, "Ambient Air Quality Surveillance," Appendix E

DOE Order 5400.5, "Radiation Protection of the Public and the Environment," changed January 7, 1993

DOE Order 414.1B, "Quality Assurance," issued 4/29/04

DOE/EH-0173T, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance," January 1991

DOE/EP-0071, "Internal Dose Conversion Factors for Calculating Dose to the Public", July 1998

DOE/HQ DRAFT document, "DOE Records Schedule for Environmental Records," November 1996

LPR308-00-00.2, "Integrating Quality Management," 13 December 2001

LALP-93-47, "Calibration Handbook," Los Alamos National Laboratory, June 1993

EPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," Interim Final, January 1994

EPA QA/G-9, "Guidance for Data Quality Assessment," External Working Draft, March 27, 1995

EPA "Guidance on Implementing the Radionuclide NESHAPS," July 1991

FFCA, "Appendix A Compliance Plan" of the "Federal Facility Compliance Agreement, June 1996

ANSI N13.1-1969, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities"

Group MAQ Air Quality documents:

MAQ-QMP, "Quality Management Plan for the Meteorology and Air Quality Group (MAQ)"

MAQ-MET, "Quality Assurance Project Plan for the Meteorology Monitoring Project"

MAQ-RN, "Quality Assurance Project Plan for the Rad-NESHAP Compliance Project"

MAQ-024, "Personnel Training"

MAQ-025, "Records Management"

MAQ-026, "Deficiency Reporting and Correcting"

MAQ-030, "Document Distribution"

MAQ-032, "Orienting New Employees"

MAQ-033, "Analytical Chemistry Data Management and Review for AIRNET"

MAQ-201, "Establishing and Using AIRNET Action Levels"

MAQ-202, “Environmental Sampling of Airborne Particulate Radionuclides”

MAQ-204, “Sampling of Ambient Airborne Tritium”

MAQ-205, “Calibration of Air Sampling Stations”

MAQ-206, “Maintenance of Air Sampling Pumps”

MAQ-207, “Evaluation of AIRNET Sampler Sites Against Siting Criteria”

MAQ-208, “Technical Evaluation of AIRNET Data and Calculated Concentrations”

MAQ-216, “Management of AIRNET Field Data”

MAQ-229, “Maintenance of AIRNET Flow Control Panels”

MAQ-230, “AIRNET Sample Analyses for Unplanned Releases”

MAQ-234, “Leak Checking Silica Gel Cartridges”

MAQ-238, “Evaluating New Diffuse Sources and New Receptors for AIRNET Coverage”

MAQ-257, “Determining Water Content of Silica Gel Using the Lindberg Furnace”

MAQ-402, “Calibration and Maintenance of Instruments for the Meteorology Monitoring Program”

MAQ-503, “Calculation of Doses from Unplanned Airborne Releases”

MAQ-506, “Calculation of Air Activation Activity from TA-18”

Memo ESH-17:95-384, “Statistical Analysis of Environmental Data With Negative Values,” Craig Eberhart to Distribution, May 19, 1995

Memo ESH-17:95-759, “AIRNET Uncertainty Calculations,” Keith Jacobson to file, December 20, 1995

Memo ESH-17:97-216, “Comparison of Environmental Sampling for Rad-NESHAP Compliance with the Guidance of ANSI N13.1,” Scott Miller to records, May 12, 1997

Memo ESH-17:97-499 “Gamma Analysis of AIRNET Filters,” from Jean Dewart, Dave Kraig, and Scott Miller to Craig Eberhart, Nov 6, 1997

Memo ESH-17:97-524, “Results Based on Gamma Data Meeting (11/19/97),” Craig Eberhart to Distribution, November 25, 1997

Memo ESH-17:97-561, “Update on Gamma Measurement Decisions,” Craig Eberhart to Distribution, December 12, 1997

Memo ESH-17:98-283 “Use of Relative Humidity and Temperature to Calculate Atmospheric Water Vapor and Tritium Concentrations,” from Jean Dewart, Dave Kraig, and Scott Miller to Craig Eberhart, July 16, 1998

Memo ESH-17:00-133, “AIRNET Sampling at Ski-Hill”, from Keith Jacobson to Rad-NESHAP project records, February 18, 2000