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Los Alamos
National Laboratory

Environmental Programs Directorate

Waste and Environmental Services

AIRNET - Quality Assurance Project Plan

for the

RADIOLOGICAL AIR SAMPLING NETWORK

Signatures		
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REVISION HISTORY

Revision	Date	Description of Changes
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	New stations, analytical methods, and group project management.
5	7/7/97	Changes to analytical methods for alpha and beta counts; new location list and station grouping; added consent decree requirements; editorial changes.
6	1/4/99	Revised into Sampling and Analysis Plan format, parts moved to appropriate project plans.
7	6/23/00	New titles, sampler siting criteria, other details.
8	5/3/05	Changed description of sample analyses, added description of siting process, other updates, renamed as Quality Assurance Project Plan. Reflect practice at Jan 2005.
0	03/28/08	Division/Group name change, new procedure number; old procedure number: ENV MAQ AIRNET. Added text on expedited isotopic analysis.

1.0 PURPOSE

The emission of radionuclides from the Los Alamos National Laboratory (LANL) is regulated by the U.S. Environmental Protection Agency (EPA) and the Department of Energy (DOE). Routine measurement and reporting of radionuclide concentrations in the ambient air is required. A system is needed to:

- determine the environmental impact of LANL radioactive air emissions, according to requirements found in DOE Orders 5400.5, "Radiation Protection of the Public and the Environment," and 450.1, "Environmental Protection Program," and the guidance in DOE/EH-0173T, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance;" 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), "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities," as outlined in the Compliance Plan described in Appendix A of the Federal Facilities Compliance Agreement (FFCA) between DOE and EPA dated June 1996.

The Radiological Air Sampling Network (AIRNET) system does not measure the short-lived gaseous activated air product emissions from the Los Alamos Neutron Science Center (LANSCE). Such measurements are performed under ENV-EAQ-RN, Quality Assurance Project Plan for the Rad-NESHAP Compliance Team.

This quality assurance project plan (QAPP) and its implementing procedures describe how environmental air monitoring for radioactive air contaminants is conducted at LANL by the Waste and Environmental Services (WES) Division.

This procedure and its implementing procedures meet the requirements of WES Quality Management Plan (WES-QMP), and along with ENV-EAQ-RN and its implementing procedures meet the requirements of the WES Integrated Management Plan (WES-IMP), DOE Orders 5400.5 and 450.1, and the guidance of DOE/EH-0173T.

Applicable quality criteria include 40 CFR Part 61, Appendix B, Method 114, Section 4; DOE Order 414.1B, "Quality Assurance;" and LANL LPR 308 00 00.2, Integrating Quality Management. This plan was written according to 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.

2.0 ORGANIZATION

The Environmental Air Monitoring Task Leader manages the operation of the AIRNET. The task leader reports to the WES Environmental Data & Analysis (EDA) Group Leader. An analytical chemist supports the task leader in interfacing with analytical laboratories, uploads electronic data deliverables, and reviews chemistry data packages. A database administrator maintains and updates the AIRNET database. Others are deployed to work for the task leader to collect samples, process collected samples, maintain samplers, manage databases, and provide data evaluation. Other groups in LANL and subcontracting organizations provide support to AIRNET. Paragon Laboratories of Fort Collins, Colorado, currently provides analytical services for the air filters and the silica gel. Final products from AIRNET are approved by the Environmental Air Monitoring Task Leader and reported to the WES-EDA group leader.

3.0 SYSTEM DESCRIPTION

3.1 Measurements

The AIRNET at LANL is designed to continuously sample environmental levels of airborne particulate radionuclides and tritium emitted from LANL through the collection and measurement of airborne particles and tritiated water at locations around LANL, and the calculation of the dose from those measurements.

Continuous sampling of the air determines the concentration of radionuclides in the air. Analytes and their detection limits are 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 millirem (mrem) (i.e., each analyte contributes more than 0.01 mrem annually). Filters are used to collect particulate matter, and silica gel is used to collect water vapor.

Gross alpha, gross beta, and gamma spectroscopy counts are performed within 21 days (SOP-5141, AIRNET-Analytical Chemistry Data Management and Review) 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 are analyzed for tritium (as oxide). Composited AIRNET filters are analyzed for uranium-234, uranium-235, uranium-238, plutonium-238, plutonium-239/240, and americium-241. Analyses for other radionuclides can be performed for an unplanned release or other emergency situation, or if LANL operations warrant.

3.2 Equipment Requirements

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

The analysis laboratory must have equipment for analyzing low levels of radioactive elements by

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

3.3 Assessments and Reviews

Audits and management assessments are performed according to each project that uses AIRNET data. Analytical laboratories participate in inter-laboratory comparison programs.

4.0 DATA QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Data quality objectives (DQOs) are statements of the uncertainty level deemed acceptable. DQOs must strike a balance between time, money, and data quality.

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 (SOP-5142, AIRNET—Establishing and Using Action Levels) avoid these problems.

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

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 are operated continuously (defined by the FFCA), completely sampling temporal variations. Air samplers are located near sites occupied by the public, at the perimeter of LANL, and in background locations. [Samplers may also be placed near locations of probable or actual release to help understand other measurements.] Locations are to be representative of concentration measurements and are evaluated against siting criteria (SOP-5147, AIRNET-Evaluation of Sampler Sites against Siting Criteria).

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

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

Samplers are designed to achieve 95% run-time completeness for the compliance samplers (per Compliance Plan in Appendix A of the FFCA) each calendar year. In addition, at least 80% of the total possible samples (during any calendar year) must provide valid data (per Compliance Plan in Appendix A of the FFCA).

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. 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.

To confidently detect concentrations that are significantly less than 1.0 mrem and to meet DOE/EH-0173T, a smaller precision is needed. AIRNET uses 0.1 mrem as the target precision for all measurements. For known contaminants released by LANL, we aim to detect significant contributions offsite (e.g., those that contribute at least 10% to offsite doses greater than 0.1 mrem effective dose equivalent from emissions in a year).

Estimates of total uncertainty at 10 mrem concentrations are discussed later, but precision has been calculated from paired AIRNET stations based on the 1996 and 1997 data. The isotopic analyses were grouped together because the sample size was too small to evaluate each radionuclide individually. The table below shows that the ratio of the uncertainty (standard deviation) to the concentration decreases with increasing concentration.

Table 4.6-1
Precision Estimates from Paired AIRNET Stations

Radionuclide	Concentration per Sample	Millirem Equivalent	Precision for Annual Concentration (1 std. dev.)	Percent of Annual Concentration
Plutonium, Uranium, and Americium	100 aCi/m^3	0.5 (max)	11 aCi/m^3	11

Plutonium, Uranium, and Americium	500 aCi/m^3	2.6 (max)	35 aCi/m^3	7
Plutonium, Uranium, and Americium	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 is the degree of agreement of a measured value with the true or expected value. It is not possible to determine the accuracy of measurements in AIRNET, but an estimate of overall uncertainty (accuracy plus precision) is presented below. Any bias (known inaccuracy) is corrected for if it is known, or estimated. Examples of bias for which corrections are made include blank corrections and corrections for bound water in gels. Unknown bias are presumed zero because this is the most likely value. To reduce bias, all measurements are traceable to nationally recognized standards such as those provided by NIST.

Uncertainty analysis is driven by 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).

An analysis was performed on sources of measurement uncertainty in AIRNET. They were calculated for quarterly composite plutonium-239 and biweekly tritium measurements. Plutonium-239 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 uncertainty (%) of the sample is higher at the lower concentrations normally found by AIRNET due to the poorer counting statistics at low levels of activity. The sources, sizes, and totals of the uncertainties are shown in Table 4.8-1.

Table 4.8-1
Sources of Uncertainties of Plutonium-239 and Tritium Analyses (%)

Source of Uncertainty	Plutonium-239[a]	Tritium (oxide)
Counting statistics	1	2
Other analytical lab processes	10	5
Aliquoting	NA[b]	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[c]
Temperature	NA	0.1[c]
Other	5	5
Propagated total	16	13

[a]Summarized from memo ESH-17:95-759.

[b] = Not analyzed.

[c]Calculated from instrument specifications and estimated 99th percentile worst-case meteorological conditions.

5.0 TRAINING AND EDUCATION

All personnel performing AIRNET-related work obtain appropriate training prior to performing work governed by a procedure. Training is performed and documented according to EP-DIR-SOP-2011, R3, Personnel Training and Qualification.

Contractor analytical laboratories must have a quality management system that complies with requirements of DOE Order 414.1B, Criterion 2.

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.

6.0 DOCUMENTATION AND RECORDS

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.

The following records are kept:
- 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, and
- regulatory correspondence.

The following records are kept by sub-contracted laboratories:
- equipment and instrument calibration and maintenance records,
- laboratory quality control results, and
- 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.

Work scope documents 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. Accelerated analysis may be requested at times.

The LANL Issue Management Tracking System (LIMTS) system documents quality-affecting problems encountered in the field and laboratory.

Final results are a simple summary of the resultant air concentrations (for the Environmental Surveillance Report (ESR), see ENV-MAQ-232, R3, Preparation of the Annual Environmental Surveillance Report) and a summary of concentrations converted to dose using the levels in 40 CFR Part 61, Appendix E, Table 2.

All records are maintained and available for at least five years for inspection at the facility (as in 40 CFR Part 61.95) and up to 200 years (DOE/HQ DRAFT document, "DOE Records Schedule for Environmental Records," Nov.1996).

Records are archived in compliance with LANL and DOE requirements for records retention, storage, and management, including protection from fire, flood, or rodents. Access to records is monitored.

7.0 SAMPLING PROCESS DESIGN

7.1 Compliance Sampler Design

Locations for the compliance air samplers (listed in Appendix A) 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 (see Compliance Plan Appendix A, FFCA) includes the following.

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

From this network analysis, 21 MEI locations are currently identified. 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. See SOP-5147, AIRNET-Evaluation of Sampler Sites against Siting Criteria, for specific implementation.

7.2 Additional Sampler Locations

Temporary stations may be installed to monitor site restoration work and are removed when actual or potential emissions are assessed to be no longer a cause for concern. Other AIRNET stations may also be installed periodically. Appendix A has a list of all the current long-term sampling stations.

7.3 Future Compliance Station Siting Criteria

A special case for compliance monitoring siting occurs when there is a diffuse source of emissions located on the boundary of LANL, close to a business, office, or residence. Existing compliance criteria could require many samplers to cover each wind direction sector containing a receptor. ESH-17-238, Evaluating New Diffuse Sources and New Receptors for AIRNET Coverage, addresses this case.

7.4 Environmental Surveillance Report Station Selection

The locations used for reporting (see ENV-MAQ-232, R3, Preparation of the Annual Environmental Surveillance Report) in the ESR meet DOE Order 450.1. Primary objectives include demonstrating compliance with public dose limits, measuring accidental releases of radionuclides, identifying and quantifying new or existing air quality problems, and characterizing air emission trends.

Stations are located around the LANL site in areas occupied by the public. Stations are categorized as regional, pueblo, perimeter, onsite, waste site, and decontamination and decommissioning (D&D) stations for presenting information in the ESR, and evaluating data against action levels.

7.5 Background Station Design

DOE suggests background stations be over 15 kilometers (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. The natural uranium background is based on stations in Los Alamos County. The background for non-natural uranium is assumed zero.

7.6 Other Samplers Design

Other samplers are located on site to satisfy DOE requirements or to meet programmatic needs. The following are used (see SOP-5147, AIRNET-Evaluation of Sampler Sites against Siting Criteria).in siting such 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; and
- customer's specific programmatic needs for monitoring.

The number and locations of onsite samplers are subject to change. A current list of samplers is kept by the Environmental Air Monitoring Task Leader.

7.7 Sampling Frequencies

A continuous sample of air is collected during the sampling period. The samples are collected from the air sampling stations approximately every two weeks. To detect unplanned releases DOE/EH-0173T recommends that the sampling interval not exceed two half-lives of the shortest-lived radionuclide being monitored (arsenic-74 with a half life of 18 days). Samples may be collected at a shorter interval for emergency response or in unplanned release situations.

7.8 Sample Matrices

Atmospheric particle diameters range from about 0.01 to tens of microns (μm). The optimum size for deposition in the upper respiratory tract and the deep lung is 0.01–3 μm, with 1 μm often used for dose assessment (ANSI N13.1 Table). The filter paper retains a minimum of 99% of dioctylphthalate with an aerodynamic mean diameter of 0.3 μm, at the operational air face velocity and pressure drop. Filter material has a low uranium content to assist in uranium background concentration determination. Polypropylene air filtration media have been used since 1996. SOP-5143, AIRNET— Environmental Sampling of Airborne Particulate Radionuclides describes filter preparation.

Silica gel is used to collect water vapor from the sampled air. As part of the water vapor, tritium is absorbed as T_2O or HTO. Water vapor concentrations in the ambient air are measured by the meteorology program. The silica gel is discarded after use. The silica gel used has an absorption capacity of 0.26 grams (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 10–20 g are collected. The volume of bound water in the gel is determined according to SOP-5178, AIRNET - Determining Water Content of Silica Gel using the Lindberg Furnace. SOP-5144, AIRNET - Sampling of Ambient Airborne Tritium, describes silica gel cartridge preparation.

7.9 Measurement Parameters

The following parameters are measured or calculated:

- sample collection time,
- air flow rates through filter media and through silica gel,
- 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, and
- plutonium-238, plutonium-239/240, uranium-234, uranium-235, uranium-238, and americium-241 concentrations on composited filters.

7.10 Sampler Siting Evaluation Criteria

Each new proposed sampler site is evaluated against siting criteria (compiled from DOE/EH-0173T and 40 CFR Part 58, "Ambient Air Quality Surveillance") in SOP-5147, AIRNET-Evaluation of Sampler Sites against Siting Criteria.

Uniform application of these criteria is important. However, not all sites can meet all these criteria. Good scientific judgment is used to select the optimal location based on the site and on specific sampling needs. Siting evaluations are kept according to SOP-5147, AIRNET-Evaluation of Sampler Sites against Siting Criteria.

7.11 Field Decontamination

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

- Filter heads are dedicated for use at only one station.
- Filter heads are cleaned before each period in the field.
- Filter caps are used before and after filter is deployed in the field.

Operational changes at TA-54-1001, where samples are processed, are reviewed prior to implementation. This helps prevent inadvertent sample contamination.

Analytical laboratories maintain controls for prevention of cross contamination.

7.12 Analysis Frequency

Approximately every two weeks, samples are collected and sent for the analyses described in Section 10 of this document. Over LANL closures samples may be collected after three weeks. Some analysis is done quarterly.

8.0 SAMPLING METHODS REQUIREMENTS

8.1 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 oil-free, constant flow vacuum pump, all enclosed in a lockable weather-tight housing. In the housing are connecting and exhaust hoses and a 120 volt (V) electrical supply.

The air sampling pump runs continuously without overheating when the filter becomes plugged. Pumps must maintain constant flow.

The particulate filter assembly consists of a 47-millimeter (mm) particulate filter supported on wire mesh in a housing that can be disconnected by a quick-disconnect fitting. Filter holders are commercially available. The aluminum three-part holders can be screwed apart and have an O-ring seal at the joints.

The water vapor absorber cartridge is a vertically mounted plastic column holding about 135 g of silica gel. Air flows upward through the gel. The vertical position prevents the gel from settling to one side, providing maximum surface area contact with the air flow. The cartridge has a quick-disconnect fitting. The cartridges are installed in a PVC pipe mounted outside the sampler housing to keep the gel cooler to increase the vapor collection efficiency. The cartridge has a rain shield around it, preventing rain from striking the sides of the cartridge.

The silica gel cartridges are cylindrical, clear Plexiglas about 5 centimeters (cm) in diameter and 20 cm tall. The cartridge has a screen at each end to hold in the gel. The top screws off to allow filling and is sealed with an O-ring. The quick-disconnect fitting seals when disconnected.

The flow control assembly allows adjustable air flow by regulator valves connected to the sample holders and to the vacuum pump.

A Rotameter-type (floating ball) flow meter indicates the flow through the silica gel. A magnahelic gauge measures start and stop flow through filters.

A vacuum-activated digital timer records the actual run time of the pump. The timer measurement is used to calculate the true sampled air volume if a pump does not operate for the full sampling period. It contains a battery back up for continuous operation in case of loss of 120 V power.

Compliance AIRNET stations are equipped with electronic dataloggers and either a radio-frequency or cell phone communication system. The datalogger calls a central computer at TA-54-1001 if the battery voltage is too low or if the pressure switch on the pump line closes due to loss of vacuum. The operational status of these stations is checked every working day.

Samplers meet the intent of the sampling requirements in ANSI N13.1 (1969, and 1999). See memo ESH-17:97-216 on how 1969 requirements are met.

8.2 Meteorology Parameters

Absolute humidity is used to calculate tritium concentrations and is supplied by the Meteorology Monitoring Project (EP ERSS QAPP 05, Quality Assurance Project Plan for Meteorological Monitoring) and EP-ERSS-SOP-5131, R0, Calibration and Maintenance of Instruments for the Meteorology Monitoring Project. The average of two week-long averages from a network of stations is used. Each station measurement has an accuracy of ± 0.5 grams per cubic meter (g/m^3).

8.3 Sample Collection

Sample collection generally occurs every two weeks, replacing the particulate filter holder and the silica gel cartridge with a pre-loaded replacement. The flow rates indicated by the flow meters, or by another type of calibrated instrument, and the time shown on the digital timer are recorded on field forms or electronically. Procedures SOP 5143, AIRNET— Environmental Sampling of Airborne Particulate Radionuclides, SOP 5144, AIRNET – Sampling of Ambient Airborne Tritium and SOP 5149, AIRNET— Management of Field Data, AIRNET Database Users Guide, provide instructions for the collection of samples and the documentation of the collection.

8.4 Corrective Actions on Sampling Equipment

Responsibility for the operation and maintenance of the field sampling equipment is assigned by the Environmental Air Monitoring Task Leader. The sample pumps are checked for proper operation and flow each time samples are collected. If the pump or flow rate are defective, the sample collector notifies the pump maintenance technician to change the pump. A record of the defect notes the defective pump condition and is used in future trending.

Equipment such as the filter holders and cartridges are inspected at each use and replaced if necessary. The silica gel cartridges are periodically leak-checked (SOP-5153, AIRNET – Leak Checking Silica Gel Cartridges).

8.5 Preparation of Sampling Equipment

Filter holders are cleaned at each use. Air pumps are cleaned (SOP-5146, AIRNET – Maintenance of Air Sampling Pumps) at each six-month rebuild. Flow control panels are cleaned and adjusted (SOP-5151, AIRNET – Maintenance of Flow Control Panels) as needed. SOP 5143, AIRNET— Environmental Sampling of Airborne Particulate Radionuclides, and SOP 5144, AIRNET – Sampling of Ambient Airborne Tritium cover the preparation of filters and silica gel cartridges.

8.6 Sample 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 chosen to use “medium volume” samplers. The pump pulls air through both the particulate filter and the silica gel cartridge at different flow-rates through separate trains. The particulate filter branch is calibrated to 4.0 ± 0.4 cubic feet per minute (ft^3/min) (roughly 0.1 m^3/min). The total volume sampled is calculated from the start and stop readings of the timer and the magnahelic gauge. The water vapor sampling branch has an initial flow rate of 200 ±20 cm^3/minute (0.0002 m^3/minute).

The amount of water vapor collected is determined both after sample collection and at the time of distillation of the water from the silica gel. The minimum water volume needed for analysis is 5 milliliters (mL) (to achieve a detection limit of at least 500 pCi/L of water). A smaller amount can be analyzed using longer count times or with a higher detection limit. Most volumes distilled are 10 to 20 mL; but less under low humidity conditions. Corrections are made for the volume of bound water in the gel.

9.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

9.1 Sample Holding Times

The water in the silica gel is recovered by distillation within 21 days of collection. The distillate is counted within 14 days of distillation.

Gamma analyses are performed on clumps of filters as soon as possible, and no later than 72 days after collection. DOE/EH-0173T recommends that the holding time not exceed four half-lives of the shortest-lived radionuclide being monitored (arsenic-74 with a half-life of 18 days). Gross alpha and gross beta counts are 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.

Composited samples collected during the previous calendar quarter are held for one month (after collection of the last filters for the composite sample) before analysis to report data within 90 days of the end of the quarter. The analytical laboratory analyzes the samples within 45 days after the field data have been validated and verified.

At times a filter sample will undergo an isotopic analysis within a few days of shipment to the analytical laboratory rather than waiting for the end of the quarter.

9.2 Sample Handling

Plugs are placed on the silica gel cartridge before and after collection to prevent entry of dirt and absorption of additional moisture. The gel is promptly analyzed after distillation to minimize the chances for contamination.

Plastic covers are installed on the filter holders before and after collection to prevent cross-contamination. Particulate filters are handled only with tweezers during installation in and removal from the filter holders. Filters are stored and shipped in glassine envelopes.

Care needs to be taken not to damage or compromise samples after retrieval from the sampling station. Samples not retrieved by AIRNET personnel should get into AIRNET personnel control as soon as possible, preferably within hours.

9.3 Sample Custody

A documented chain-of-custody is maintained for all samples collected. The possession, handling, and transfer of custody of samples are documented. A sample is in custody if it is in one's physical possession, in one's view, locked up so no one can tamper with it, or in a secure area where access is restricted to authorized personnel only.

A secured area is locked, and may be a room, cooler, cabinet, vehicle, or refrigerator. If the area cannot be secured by locking, a custody seal is sufficient. Cases of actual or suspected broken chain-of-custody must be recorded and all associated results qualified.

9.4 Sample Tracking

A pre-printed form (Attachment 2, SOP-5143, AIRNET— Environmental Sampling of Airborne Particulate Radionuclides) or direct electronic entry is used to document the sample collection and the required information regarding location, sampler status, air flow, timer reading, and initial chain-of-custody. SOP-5143 describes chain-of-custody requirements for collection.

Samples received by analytical laboratories are 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.

10.0 ANALYTICAL METHODS REQUIREMENTS

10.1 Sample Analyses

Gamma-ray spectrometry is used to determine specific gamma-ray emitting nuclides on groups of filters. Individual filters are then analyzed for gross radioactivity (alpha and beta). These prompt analyses provide early indications of unexpected types or quantities of radioactive materials.

On a quarterly basis, a composite sample of biweekly particulate filters is prepared. All composites are analyzed for selected radionuclides, including plutonium-238, plutonium-239/240, uranium-234, uranium-235, uranium-238, and americium-241 by dissolving them, chemically separating and concentrating the radionuclides, and doing alpha spectrometry.

When a filter sample requires an isotopic analysis within a few days of shipment to the analytical laboratory these samples will be split to allow an expedited analysis on one half and the normal chain of analyses on the other half.

The biweekly silica gel samples are distilled by the analytical laboratory and the distillate analyzed for tritium by liquid scintillation counting.

10.2 Target Minimum Detectable Activity

The minimum detectable activity (MDA) is defined for the AIRNET system as two standard deviations above the average analytical background count rate. The MDAs for each analyte are presented below.

The DOE does not specify an MDA for any radionuclide. The AIRNET project has 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 varies from sample to sample. Specifying a maximum MDA requires 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.

The MDA for alpha and beta is to be no more than 1 and 2 pCi/filter, respectively, and complies with 40 CFR Part 61, Appendix B, Method 114 (A-4 and B-4).

Gamma-ray spectroscopy provides identification and quantitative analysis of gamma-ray emitting radionuclides. These measurements are conducted using high-resolution germanium detectors and 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 mrem; however, all measurements should meet the MDA equivalent to 0.5 mrem. The MDA and the target MDA are provided in Table 10.2-1.

To obtain lower detection limits and reduce analytical costs, multiple sample filters are grouped (“clumped”) together for counting. By increasing the mass of material and counting for a longer time, 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. Up to 10 filters may be in a clump. (Filters may also be composited for a site over time to improve the detection for a specific location.) Specific procedures pertinent to this analytical method are described in the analytical laboratory’s quality management plans.

Table 10.2-1
MDA Levels 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
Arsenic-73	0.55	0.11
Arsenic-74	0.11	0.022
Beryllium-7	1.15	0.23
Cadmium-109	0.0295	0.0059
Cobalt-57	0.065	0.013
Cobalt-60	0.00085	0.00017
Cesium-134	0.00135	0.00027
Cesium-137	0.00095	0.00019
Manganese-54	0.014	0.0028
Sodium-22	0.0013	0.00026
Lead-210	0.000028	0.00014
Rubidium-83	0.017	0.0034
Rubidium-86	0.028	0.0056
Ruthenium-103	0.13	0.026
Selenium-75	0.0085	0.0017
Zinc-65	0.00455	0.00091

After collection of the gel cartridges, the silica gel is transferred to clean plastic bottles and shipped to the analytical laboratory where it is distilled then counted using liquid scintillation counting to determine tritium concentration. Procedures pertinent to this analytical method complies 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 provided in Table 10.2-2. 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.

Table 10.2-2
MDA for Tritium Analyses

Radionuclide	0.1 mrem Dose Concentration (Ci/m^3 air)*	Maximum MDA for 0.1 mrem Dose (pCi/mL Distillate)	Target MDA to Meet DOE Requirements (pCi/mL Distillate)
Tritium	1.5×10^{-11}	6	0.5

*From 40 CFR Part 61, Appendix E, Table 2.

Composite filter samples for a calendar quarter are analyzed for uranium-234, uranium-235, uranium-238, plutonium-238, plutonium-239/240, and americium-241 by dissolving one-half of the composited filters in an acid solution, separating, and concentrating (e.g., electroplating or co-precipitating) the radionuclides onto sample planchettes. The concentrated material is measured by alpha spectrometry methods, which 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 provided in Table 10.2-3. The target MDAs were chosen based on the MDAs achieved in the past. Radioanalytical procedures pertinent to this analytical method are in the analytical laboratory's procedures.

Table 10.2-3
MDA Levels for Alpha Spectroscopy

Radionuclide	0.1 mrem Dose Concentration (Ci/m^3)*	Maximum MDA for 0.1 mrem Dose (pCi/half filter composite)	Target MDA to Meet DOE Requirements (pCi/half filter composite)
Uranium-234	7.7×10^{-17}	0.53	0.04
Uranium-235	7.1×10^{-17}	0.49	0.04
Uranium-238	8.3×10^{-17}	0.57	0.04
Plutonium-238	2.1×10^{-17}	0.14	0.05
Plutonium-239/240	2.0×10^{-17}	0.14	0.04
Americium-241	1.9×10^{-17}	0.13	0.05

*From 40 CFR Part 61, Appendix E, Table 2.

10.3 Sample Disposition

After the analyses are complete, the analytical laboratory stores the covered planchettes (with the dissolved composite filters) and the remaining half filters in a clean protected area until notified by AIRNET staff at which time the remaining half filters are returned to the AIRNET staff. In the case of expedited isotopic analysis there is no remaining half filter.

In case of sample loss or analytical problems, it may be necessary to use the remaining half filters for a new composite sample so AIRNET staff store the remaining half filters at the task leader's discretion. The task leader must approve any additional analyses that would destroy the remaining half filters.

11.0 QUALITY CONTROL REQUIREMENTS

11.1 Duplicate Sampling

There are two locations with duplicate AIRNET samplers: 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 are analyzed by evaluating the measurement differences between stations.

11.2 Trip and Matrix Blanks

As part of the regular sample submission every two weeks, five trip blanks (one for each collection route) are submitted with each filter and tritium set.

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

11.3 Laboratory Sample Duplicates

The duplicate field samples serve as the primary check for laboratory duplicate analyses. AIRNET staff may submit additional duplicate samples, such as previously-analyzed filters (for recounting), or a split of the silica gel distillate.

Analytical laboratories perform sample duplicate or spike analyses on their equipment according to internal procedures. Three tritium spikes are submitted with each biweekly tritium set. These laboratories have procedures that call for the 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.

11.4 Analytical Laboratory Checks and Calibration

Analytical laboratories perform appropriate quality control checks on their equipment, to meet the accuracy and precision requirements in this procedure. Each laboratory is responsible for maintaining appropriate records of checks and supplying quality control information, as required by the contract. Each analytical laboratory is responsible for corrective actions for their equipment.

For gross alpha, gross beta, gamma spectroscopy, alpha spectroscopy and liquid scintillation counting, calibration is performed at least as often as the manufacturer's recommended interval. Background and efficiency data are maintained. Check sources are run periodically on the counting instrument to check for proper operation and response.

The distillation of water from silica gel is covered by the analytical laboratory procedure which describes the distillation process and specifies cleanliness steps.

12.0 INSTRUMENTATION AND EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Every six months, the pumps are replaced with another that has received preventive maintenance. This ensures high overall reliability. Pump vanes and certain gaskets, filters, O-rings, and seals are changed and the pump tested before sampling use. A database is used to track the replacement schedule of all the pumps (SOP-5146, AIRNET – Maintenance of Air Sampling Pumps).

Periodic cleaning and adjustment of the flow control panels includes cleaning of the control valve and all lines, and lubrication of the sealing O-ring (SOP-5151, AIRNET – Maintenance of Flow Control Panels).

Compliance samplers (see Appendix A) are checked for normal operation every working day using the automated telemetry. See SOP-5152, AIRNET – Station Telemetry.

13.0 INSTRUMENT CALIBRATION

13.1 Calibration of Pumps, Calibrators, and Balances

Upon installation of the pump in the sampler enclosure, the air flow through the filter, and separately through the gel cartridge, is measured with a calibrated air flow measuring device and adjusted. Calibration is performed about every six months and upon change of any major permanent component of the system. Records are maintained to document the calibrations. SOP-5145, AIRNET – Calibration of Air Sampling Stations, describes recalibration. Calibration follows the ENV Division Rad-NESHAP calibration protocol "Calibration of Measurement and Test Equipment" which conforms to P330-2, Control and Calibration of Measuring and Test Equipment (M&TE) and in cooperation with the LANL Standards and Calibration Laboratory.

The single-pan balance, used for determining gel weights, is calibrated annually by the LANL Standards and Calibration Laboratory. Check weights are used to verify proper operation before each use.

13.2 Analytical Laboratory Instrument Calibrations

Analytical laboratory instrument calibration intervals have been set to an appropriate frequency so data generated meets the accuracy and precision requirements given in this document. Each laboratory is responsible for maintaining appropriate records of calibration and supplying calibration information in the data packages.

13.3 Meteorology Instrument Calibration

The instruments for measuring atmospheric relative humidity and temperature are maintained as specified in the QA project plan for meteorology (EP ERSS QAPP 05) and SOP-5131, Calibration and Maintenance of Instruments for the Meteorology Monitoring Program.

14.0 INSPECTION AND ACCEPTANCE OF EQUIPMENT AND SUPPLIES

Responsibility for inspection and maintenance of the field sampling equipment and supplies is assigned by the Environmental Air Monitoring Task Leader. A visual inspection of most consumables is sufficient to detect problems that may cause loss of data.

Filters are semi-automatically cut by AIRNET personnel for the filter holders, allowing detection of defective filters. Filters are inspected again when installed in the filter holders.

Silica gel acceptance is based on information included in shipped quality certification documents. Before use the gel is dried in an oven (see SOP-5144, AIRNET – Sampling of Ambient Airborne Tritium) and inspected visually when loaded into cartridges.

Pumps receive initial preparation and testing prior to use (run for at least five minutes, tested for a minimum vacuum of 21 inches of mercury), as in SOP-5146, AIRNET – Maintenance of Air Sampling Pumps.

Inspection and maintenance of analytical laboratory supplies is the responsibility of the analytical laboratory. Supplies are accepted based on information included in quality certification documents shipped with the materials. Laboratories inspect and accept supplies based on the risk to the analytical results.

15.0 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

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).

16.0 DATA MANAGEMENT

16.1 Data Integrity

Long-term data integrity is ensured through the use of limited access archive tables in an independent database that holds the quality assured verified and validated field and chemical analysis data on all samples collected from 1958 to present. Data archivists receive training from the senior archivist. Documented approval from the task leader, with concurrence from the trainer, is required before new archivists are added to the list of archivists. [The AIRNET Database Administrator has full write-access to these assets but is only authorized to move data into the archive tables or make documented changes to archived data if he/she has trained to procedures SOP-5141, AIRNET – Analytical Chemistry Data Management and Review, and SOP-5149, AIRNET – Management of Field Data and does so with the knowledge of an archivist.]

16.2 Data Preservation

Long-term data integrity includes a system by which electronic data in the AIRNET databases are backed up to securely stored external media.

16.3 Data Transfer and Management

Data from the field are entered into a database within two weeks of sample collection and evaluated (SOP-5149, AIRNET – Management of Field Data). To eliminate data transcription errors, field data are entered directly into small computers and later electronically uploaded to the database (SOP-5149, AIRNET – Management of Field Data). Data undergo validation and verification 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 are transferred electronically from the analytical laboratories to AIRNET personnel 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 SOP-5141, AIRNET – Analytical Chemistry Data Management and Review, and SOP-5149, AIRNET – Management of Field Data. AIRNET 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 completed by an authorized archivist.

17.0 ASSESSMENTS AND RESPONSE ACTIONS

17.1 Corrective Actions

Corrective actions are addressed with the LANL Issue Management Tracking System (LIMTS).

17.2 Inter-laboratory Comparisons

Besides regular instrument calibration procedures, the analysis laboratory participates in appropriate inter-laboratory comparison programs (e.g. 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 meet acceptable performance standards on each applicable analyte. Failure to meet these standards may result in disqualification of the laboratory until corrective actions are implemented. The analytical laboratory participates in at least one appropriate comparison program (specified in the scope of work document) to evaluate its performance.

The analytical laboratory analyzes filter and tritium evaluation samples at least annually. The laboratory’s results are satisfactory if they meet the system’s acceptance criteria. A report is sent to AIRNET to document the results of the evaluations.

A test gamma spectrum, supplied as an electronic file, is used to check the identification of gamma emitting isotopes. The DOE-EML inter-laboratory comparison program supplies file spectra. The analytical laboratory participates in this program of checking gamma analyses, or an equivalent, at least annually.

17.3 Action Levels

After the data evaluation is done, all data from the AIRNET samples are reviewed. SOP-5142, AIRNET – Establishing and Using Action Levels, describes how the action levels are developed and the actions to be taken to verify a high reading, notify appropriate personnel and managers, and document the actions. The procedure describes the two different action levels (“investigation” and “alert”).

17.4 Emergency Response Actions

AIRNET personnel may be asked 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 are presented in SOP-5173, AIRNET – Sample Analyses for Unplanned Releases. See also SOP-5222, Analytical Chemistry Analysis of Air Filters during an Emergency Event. Results are forwarded to the responsible LANL management for decision making. Dose may be calculated as described in ESH-17-503, Calculation of Doses from Unplanned Airborne Releases.

18.0 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

18.1 Criteria to Accept, Reject, or Qualify Data

All data will be evaluated for one of three outcomes: accept, qualify, or reject. Data evaluation criteria include being within expected range of values, using proper laboratory methods, and having an acceptable analytical uncertainty. Acceptability limits and methods used are covered elsewhere in this document.

18.2 Data Evaluation

Data are evaluated according to SOP-5141, AIRNET – Analytical Chemistry Data Management and Review, 5148, AIRNET – Technical Evaluation of Data and Air Concentrations, and SOP 5149, AIRNET – Management of Field Data. Many of the checks described here are performed electronically with database queries.

The data needed for determining air concentrations are categorized into three areas: field, analytical chemistry, and meteorological data. Field data include: 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 and comments.

Analytical chemistry data packages are generated by the analytical laboratory. Data packages are reviewed for conformance to contract specifications and for data usability which includes the presence of narrative letter and a 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, and complete calibration documentation traceability of standards.

The radiochemical analytical data extracted from the packages include the analyte, date of analysis, result, uncertainty, units and 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 is flagged as “qualified.”

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

Air concentration records are generated for each radionuclide at each sampler using field, meteorological, and analytical laboratory data. Air concentration records are reviewed for acceptance, rejection, or

qualification. The air concentration record is evaluated within 30 days of the completion of the field data record and radiochemistry record. The data used to calculate air concentrations 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, and analyte concentration units for the sample.

18.3 Outliers

During data evaluation, various statistical techniques are used to identify concentrations that are considered outliers. At times, it is not appropriate to include known outliers in the calculation of the summary statistics. Professional judgment is exercised in these decisions (SOP-5148, AIRNET – Technical Evaluation of Data and Calculated Air Concentrations).

18.4 Summary Statistics

Each year summary statistics for each sampler are calculated and are then published in the annual ESR. The summary includes values for the annual mean radionuclide concentration at each station, standard deviation or confidence interval of the annual concentration calculated from the individual measurements at each station, and 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.

18.5 Negative Values and Data Less than MDA

Environmental data with negative or “less than” values are used in calculations 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 arbitrarily discarding negative values improperly biases the estimate of the true value (see memo ESH 17:95 384).

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

Radio-analytical values are reported even if the result is below the published laboratory MDA level, 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.

19.0 VALIDATION AND VERIFICATION METHODS

19.1 Field Data Evaluation

Most of the checks described in this section are automated in a computer database program. Each of the field data types listed in the previous section are evaluated for completeness and expected range.

For completeness each field element should have a value. If a value is missing, an explanation is provided. If a datum is missing without an acceptable explanation, the record is considered “qualified” or “rejected” depending on the missing information. The more frequent explanations for missing data points include power outage, timer or vacuum switch malfunction, timer not reset or pump failure.

Each element has a nominal value with a range of possible values. If the element is outside its range of normal values, the record is qualified. Nominal values and normal ranges for data elements are in SOP-5149, AIRNET – Management of Field Data.

If the field record is not qualified or rejected, it is accepted. If the field record is qualified, further validation and verification may be performed. Best professional judgment is applied to qualified data. Amended field records are considered acceptable but are flagged as "qualified." Amendments are documented.

19.2 Analytical Data Evaluation

The analytical data (gross alpha, gross beta, and gamma spectroscopy) packages are evaluated by the analytical chemist for acceptability. Data are then evaluated for completeness and expected range.

If a value is missing, the record is rejected with an explanation.

The analytical data should be within an expected range. If a value is outside its normal range, it is investigated (SOP-5142, AIRNET – Establishing and Using Action Levels).

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

19.3 Calculation of Air Concentrations

Air concentrations are calculated (SOP-5148, AIRNET – Technical Evaluation of Data and Calculated Air Concentrations) using total sampler run time for sample period, sampler air flow rate for sample period, reported total concentration of radionuclide on the filter or in the water vapor sample, and absolute humidity and bound water volume (for tritium concentrations).

The nominal values and their normal ranges for air volume per sample period are specified in the database. If the volume is out of range, it may be flagged as "qualified." If any source datum used to calculate an air concentration value is qualified, then the air concentration value is qualified. Air concentrations that are not qualified are considered accepted, having satisfied all the data review, validation, and verification requirements.

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

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 (Appendix A) are used, in conjunction with other data, to demonstrate compliance with the 10 mrem EPA standard. Doses from all AIRNET stations are evaluated to calculate the dose to the public from all pathways. The all pathway dose is compared to the DOE annual public dose limit of 100 mrem. See ESH-17-502,R1, Air Pathway Dose Assessment, for details.

For an unplanned release or an emergency response, dose can be calculated as described in ESH-17-503, Calculation of Doses from Unplanned Airborne Releases.

Air concentrations are reviewed to see if any exceed the "investigation" or the "alert" action levels as covered in SOP–5142, Establishing and Using AIRNET Action Levels.

20.0 RECONCILIATION WITH DQO FOR PRECISION AND COMPLETENESS

Periodically, the precision of the analytical results are evaluated by a method similar to that in the estimation of overall uncertainty presented in the DQOs of the appropriate project quality plan (see ESH-17:95-759). The precision is 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).

Two measures of data completeness are calculated annually for each sampling location: run-time fraction is the total operating hours (from timer readings) divided by the hours in the time period being evaluated, and sample completeness is the number of verified and validated sample results divided by the total number of possible samples in a calendar year.

The required completeness for run time fraction is 95% for compliance stations and 90% for other samplers. Sample completeness must be at least 80%. Occasions on which precision and completeness criteria are not met are recorded, their causes investigated, reported to management, and corrected where possible.

21.0 REFERENCES

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APPENDIX A AIRNET SAMPLER LOCATIONS

The following samplers are in place on the date of this procedure. For a current list, contact the Environmental Air Monitoring Team Leader.

Key to groups: R = Regional Pu = Pueblo P = Perimeter W = Waste storage stations
D = Decontamination and Decommissioning O = Onsite stations

Station Number	Group	Station Name	Location
1[b]	R	Española	Northern New Mexico College, SH84, east of Science Bldg
3[b]	R	School for Deaf	New Mexico School for Deaf at Cerrillos Rd/St. Francis Rd
4	P	Barranca School	Barranca Elementary, Barranca Rd, south side of school
5	P	Urban Park	Intersection of Sycamore St./North Rd
6[a]	P	48th Street	Off 48th St. then Sandia St, inside fence of the water tanks
8[a]	P	McDonald's	South of McDonald's, Trinity Dr, south of containers
9[a]	P	L A Airport	100 m west of airport terminal building
10[a]	P	East Gate	Old guard tower, SR502, near east end of airport runway
11[a]	P	Well PM-1	North of SR4/E Jemez Rd, at service bldg
12[a]	P	Royal Crest	South of Royal Crest Trailer Court, East Jemez Rd
13[a]	P	Rocket Park	100 m S of White Rock Post Office, Sherwood Ave
14[a]	P	Pajarito Acres	Piedra Dr, White Rock
15[a]	P	White Rock Fire Station	Old fire station, Rover Blvd, White Rock
16[a]	P	White Rock Nazarene	Intersection of Pajarito Rd/SR4, White Rock
17[a]	P	Bandelier NM	Fire tower Bandelier Natl Mon, 1.5 km from entrance
20[a]	D	TA-21	TA-21, at water tower, DP Rd
23	O	TA-5	TA-5, transformer station
24[a]	O	TA-16	TA-16 carpark, West Jemez Rd
26	P	TA-49	TA-49 entrance on SR4
27	W	Area G Bldg 375	Northeast of Bldg 375, Area G, TA-54
30	O	Pajarito Booster	Intersection of Rex Rd/Pajarito Rd, TA-54
31	O	TA-3	West of steam plant, Diamond Dr, TA-3
32[a]	P	LA County Landfill	LA County Disposal Site, East Jemez Rd
34	W	Area G NE	Northeast corner, Area G, TA-54
35	W	Area G South	South boundary, Area G, TA-54
36	W	Area G Pit 38 W	West end Pit 38, Area G, TA-54
39	P	TA-49 QA	TA-49 entrance on SR4
40	P	LA Airport Runway	East end Los Alamos Airport Runway
42[a]	D	A-15 West End	A-15 Parcel, West End, DP Rd
43	D	East Rd Fire Station	East Road Fire station, East Rd
44	D	New Beginnings Church	Intersection of Sombrillo Ct/East Rd
45	W	Area G East	East end, Area G, TA-54
46	D	Hedge Row	East Rd, 200m east of Fire station
47	W	Area G Bldg 226	North of Bldg 226, Area G, TA-54

APPENDIX A AIRNET SAMPLER LOCATIONS

Station Number	Group	Station Name	Location
49	O	Pajarito Rd	TA-36, 1.5 km east of TA-18, Pajarito Rd
50	W	Area G Bldg 33	North of Bldg 33, Area G, TA-54
51	W	Area G Pit 38 E	East end Pit 38, Area G, TA-54
53	O	TA-50, MDA C	East of MDA-C, TA-50
55[b]	R	Santa Fe West	Booster Station #4, Camino la Tierra, Santa Fe
56[b]	R	El Rancho	North of SH502 at private residence in El Rancho
59	Pu	Jemez	Visitor Center, Jemez Pueblo, SR4
60[a]	P	Los Alamos Canyon	Los Alamos Canyon, east of Ice Rink
61[a]	P	Los Alamos Hospital	East of LA Medical Center
62[a]	P	Crossroads Church	Intersection of Canyon Rd/East Rd
63[a]	P	Monte Rey South	SR4/Monte Rey South, White Rock
66[a]	P	Los Alamos Inn	South of Los Alamos Inn, Trinity Dr
67[a]	O	Research Park	West of Los Alamos Fire Station, West Jemez Rd
68[a]	P	Airport Rd	Intersection of Airport Rd/SR502
70	Pu	San Ildefonso	San Ildefonso Pueblo, waste transfer station
71[a]	D	DP Rd Fire Station	Across road from Fire station, DP Rd
72[a]	D	DP Rd Ace Hardware	Across road from Ace Hardware, DP Rd
73[a]	D	DP Rd LA Monitor	Across road from Los Alamos Monitor, DP Rd
74[a]	D	A-15 Center West	A-15 Parcel, 100 m east of West End station, DP Rd
75[a]	D	A-15 Center East	A-15 Parcel, 200 m east of West End station, DP Rd
79[a]	D	A-15 East End	A-15 Parcel, 300 m east of West End station, DP Rd
84	Pu	Picuris	Picuris Pueblo, SR75 (60 km northeast of LANL)
90[a]	P	East Gate QA	Old guard tower, SR502, near east end of airport runway

[a] Compliance station

[b] Background station