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Los Alamos
National Laboratory

Risk Reduction and Environmental Stewardship Division

Meteorology and Air Quality Group (MAQ)

Quality Assurance Project Plan

for

Environmental Dose Assessment

Prepared by: (signed) Mike McNaughton, MAQ Dose Assessment Team Leader	Date: 12/19/03
Approved by: (signed) Terry Morgan, MAQ QA Officer	Date: 12/19/03
Approved by: (signed) Jean Dewart, MAQ Group Leader	Date: 12/19/03

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Appendix

This plan has the following appendix:

Distribution List (A3)

List of document recipients

This document will be controlled under the organization's document control system (MAQ-030, "Document Distribution") to ensure that those performing work for the project will be notified of new revisions. Those who will be notified include:

- MAQ Group Leader
- MAQ Deputy Group Leader
- MAQ QA Officer
- MAQ Dose Assessment Team members
- Assistant Manager, Facility Operations, NNSA/DOE Los Alamos Site

Introduction

History of revision

This table lists the revision history of this plan.

Revision	Date	Description Of Changes
0	12/22/03	New document.

Purpose of this plan

This document specifies all the actions necessary to ensure the quality and accuracy of radiological dose assessments in the Los Alamos environment. The environment is defined as the locations affected by DOE activities at Los Alamos National Lab and their predecessors (beginning with the Manhattan Project) that are not part of the workplace. (Occupational dose in the workplace is monitored by HSR-1 and HSR-4 and assessed by HSR-12.)

This plan also demonstrates compliance with the DOE O414.1A requirements for a quality program.

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 Dose Assessment Team is operated in accordance with the above requirements:

- MAQ Quality Management Plan
- QA Project Plan for Dose Assessment (this document)
- implementing procedures

Revising this plan

This plan will be controlled through the MAQ document control program (MAQ-030, "Document Distribution").

The project leaders, at least one reviewer, and the group leader will approve all revisions to this plan.

Project Organization (A4)

Group organization

The Meteorology and Air Quality Group (MAQ) of the Risk Reduction and Environmental Stewardship (RRES) Division supports the Environmental Protection Program Integrated Management Plan of the Risk Reduction and Environmental Stewardship division, RRES-EPP-IMP. MAQ is responsible for the all-pathway dose assessments required by DOE Order 5400.5, as specified in the section "Dose and Risk Assessment" of RRES-EPP-IMP.

See the Group MAQ Quality Management Plan (MAQ-QMP) for a description of the group organization and chain of authorities. 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 ultimate responsibility to assure the work is completed.

Project organization

The MAQ Dose Assessment team leader manages the operation of the Dose Assessment Team. 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. Members of the group work for the team leader as needed to provide dose assessment and data evaluation. In addition, the following groups provide support to MAQ for the Dose Assessment Team: RRES-ECR provides soil data, and RRES-WQH provides sediment and water data.

Approval of final products and deliverables

Final products and deliverables resulting from Dose Assessment will be approved by the Dose Assessment Team Leader and reported to the MAQ Group Leader.

Problem Definition and Background (A5)

Problem definition

LANL emits radiation and radionuclides that are subject to regulation by EPA (under 40 CFR Part 61, 141, and 142) and DOE (under Order 5400.5). These regulations require routine annual reports and special reports of significant doses or potential doses. In addition, LANL policies mandate that doses be estimated in order to keep the doses ALARA (MAQ-QMP page 36).

Background

Los Alamos National Laboratory (LANL or the Laboratory) is a research and development institution operated by the University of California for the U.S. Department of Energy (DOE). The primary focus of Laboratory research activities are nuclear weapons, energy technology, and basic sciences. As such, Laboratory operations include the use of radioactive and hazardous materials.

Some of LANL's operations emit radiation and/or radionuclides. The Laboratory has operated monitoring networks for over 25 years to determine the impact of these emissions on the environment. The Laboratory has followed the guidance in DOE/EH-0173T for the design and operation of the networks. The impact on the environment is determined by calculating the estimated doses to individuals in millirem (mrem).

These doses are compared to radiation protection standards and regulations developed by the National Council on Radiation Protection (NCRP), the International Commission on Radiation Protection (ICRP), and the Environmental Protection Agency (EPA) in 40 CFR Parts 61, 141, and 142, as adopted by the DOE in Order 5400.5. Currently, the radiation protection dose standards for the public are:

- 100 mrem/year from all pathways,
- 10 mrem/year from the air pathway, and
- 4 mrem/year for beta emitters in the water pathway.

NOTE: 40CFR141 specifies 4 mrem/year for betas and 5-15 pCi/L for alphas; DOE Order 5400.5 extends the 4-mrem/year rule to alphas.

A more detailed discussion of the programmatic drivers is presented in the section *Quality Objectives and Criteria for Measurement Data (A7)*.

Problem Definition and Background (A5), continued

Decision makers

The principal decision maker for the team is the Dose Assessment Project Leader.

Customer for results

The results of Dose Assessment will be sent to the MAQ Group Leader. Results will also be sent to any LANL operating group that requests them and will be published in the Laboratory's annual Environmental Surveillance Report. The results will ultimately be used by the LANL division directors and the DOE to make decisions regarding mitigation measures or cessation of operations.

Project Description (A6)

Purpose

The purpose of dose assessment is to calculate the potential doses to individual members of the public and the collective dose to the population within 80 km of LANL.

Assessments

The dose assessments performed annually and reported in the Environmental Surveillance Report (ESR) as part of this project are: the collective dose to the population within 80 km of LANL, the dose to the maximally exposed individual (MEI) of the public, and the dose to representative residents of nearby communities. These calculations are described in the procedure MAQ-508 ("Radiological Dose Calculations for the Annual ESR").

This project is also responsible for the assessment of Soil Contamination Areas using the procedure MAQ-513 ("Posting of Soil Contamination Areas").

Other dose assessments are performed as the needs arise.

Quality assurance

The group chose to write this plan in accordance with the EPA standard for quality plans (EPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations").

Personnel

Personnel are required with experience or training in health physics, data evaluation and calculation, dose assessments, and quality assurance. Minimum training and education requirements are given in the section *Special Training and Certification (A8)*.

Required records and reports

Records will provide a trail, which can be audited, of the calculations and assumptions made to calculate dose. Appropriate and sufficient records will be maintained for a minimum of five years (as specified in 40 CFR Part 61.95) so the final results can be verified or recalculated later. Such records will include, but are not limited to, the procedure used to determine the effective dose equivalent. See the section *Documentation and Records (A9)* for a list of the records to be preserved.

A dose assessment is calculated annually and published in the annual Environmental Surveillance Report (ESR) as specified in DOE Orders 231.1 and 450.1, the Environmental Protection Program (EPP) Integrated Management Plan (IMP: RRES-EPP-IMP), and the procedure MAQ-508.

Quality Objectives and Criteria for Measurement Data (A7)

What are DQOs?

The DQOs for the Dose assessment team were developed in accordance with EPA QA/G-4, "Guidance for the Data Quality Objectives Process," September 1994. Data quality objectives (DQOs) are statements of the problem to be addressed, the decision to be made, and the scope of the data required for that decision.

Section A7 is organized into the following subsections:

7.1 Problem statement and requirements
7.2 Decision statement
7.3 Data types as input to the decision
7.4 Data boundaries
7.5 Completeness statement
7.6 Data accuracy
7.7 Calculation accuracy
7.8 Negligible dose

7.1 Problem statement and requirements

The objective is to assess the radiological dose to the public as required by DOE Orders and EPA regulations, and to compare with the limits and standards. In the following sections, we review the orders, regulations, and guidance issued by the DOE and EPA.

7.1.1 Requirements in DOE Order 450.1

DOE Order 450.1, "Environmental Protection Program", Attachment 2 Section 10, directs LANL to

- detect and characterize releases from DOE activities
- assess impacts
- estimate the dispersal patterns in the environment
- characterize the pathways of exposure to members of the public
- characterize the exposures and doses to individuals and to the population
- evaluate the potential impact to the biota in the vicinity of the DOE activity.

7.1.2 Draft CFR

- The draft of 10 CFR 834.7(A) contains similar words to DOE Order 450.1; 10 CFR 834 will be addressed specifically when it is final.

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

7.1.3 Requirements in DOE Order 5400.5

DOE Order 5400.5 establishes the annual dose limits to "members of the public", who are defined in Section 10e as "persons who are not occupationally associated with the DOE facility or operations". The dose limits to members of the public are:

- 100 mrem/year by all-pathways (Chapter II Section 1a)
- 10 mrem/year by airborne emissions (Chapter II Section 1b)
- 4 mrem/year by the drinking water pathway (Chapter II Section 1d).

NOTE: 40CFR141.16 refers to NBS handbook 69, which is the same as NCRP Report No. 22.

The dose evaluations will use standard EPA or DOE methods (DOE Order 5400.5 Chapter I Section 10 and Chapter II Section 6) and include individual and collective doses within 80 km of the site (Chapter II Section 6b).

According to DOE Order 5400.5 Chapter II Section 6a, the sampling schedules are discussed in DOE/EH-173T, as summarized below.

7.1.4 Requirements in DOE/EH-0173T

DOE/EH-0173T, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance" (January 1991) [http://tis.eh.doe.gov/oepa/guidance/aea/effluent/eh0173t.pdf] discusses the appropriate monitoring for various dose rates; see Sections 2.1, 3.0, 3.3.2, 5.2.1, 5.8, 5.8.1, 5.10, 5.10.1.2, and 5.10.2; also see Tables 3-1, 5-1 and 5-2. According to Table 5-1:

- routine surveillance of all pathways should be performed if the total dose exceeds 5 mrem or 100 person-rem;
- annual surveillance should be considered if the dose is 1 mrem/year; and
- surveillance may be performed periodically at intervals ≤ 5 years if the projected dose is < 0.1 mrem/year.

Accuracy of 1 mrem/year or 10-20% are implied but not mandated.

7.1.5 Requirements in Rad NESHAP

Subpart H (radionuclides) of the national emission standards for hazardous air pollutants (NESHAP) requires emission measurements at release points that have a potential to cause 0.1 mrem/year [40 CFR 61.93(4)(i)] and monitoring at critical receptor locations if the concentrations would cause 1 mrem/year [40 CFR 61.93(5)(iii)]. The Dose Assessment Team will provide calculations and assessments as needed to support these requirements.

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

7.2 Decision statement

If any assessment indicates a source with a potential to approach or exceed a limit (100 mrem/year for all pathways, or 10 mrem/year by the air pathway, or 4 mrem/year from drinking water), LANL will make appropriate decisions, as follows:

- apply controls to maintain doses "as low as reasonably achievable," or ALARA;
- perform an ALARA review if the dose to a member of the public is 3 mrem/year or greater (MAQ-QMP chapter "Public Dose ALARA", page 36);
- take corrective actions to reduce emissions;
- recommend cleanups;
- cease certain operations; and/or
- take the necessary actions to achieve compliance with regulations.

7.3 Data types as input to the decision

Inputs to the decision require the following types of data:

1. stack emissions from the RADAIR database
2. air concentrations from the AIRNET database
3. direct penetrating radiation doses from the DPRNET database
4. periodic samples of radionuclide concentrations in soil and/or food at selected locations near the LANL perimeter
5. periodic samples of radionuclide concentrations in ground water from drinking water or the Los Alamos aquifer
6. periodic samples of radionuclide concentrations in the surface water and sediments of the stream channels near LANL.

Each type of data (1-6) is discussed in the following subsections (7.3.1-6)

7.3.1 Data from RADAIR

Airborne emissions are measured at the stacks and recorded in the RADAIR database according to MAQ-RN. The dose is calculated from the stack plumes using CAP88 (MAQ-501) and standard EPA methods. As specified in 40 CFR 61.93(4)(i), all radionuclides that could contribute more than 10% of the potential dose are measured.

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

7.3.2 Data from AIRNET

Air concentrations are measured at receptor locations and recorded in the AIRNET database according to the sampling and analysis plan for AIRNET (MAQ-AIRNET). As specified in 40 CFR 61.93(5)(iii), all radionuclides that could contribute more than 10% of the standard are measured. Furthermore, as recommended in the Environmental Regulatory Guide, DOE/EH-0173T, "radionuclides that contribute 10% or more of offsite dose greater than 0.1 mrem/year" are measured. These data are used to calculate the dose from diffuse sources such as Area G (see MAQ-502, “Air Pathway Dose Assessment”).

7.3.3 Data from DPRNET

Direct penetrating radiation (DPR) in the form of gammas and neutrons is monitored both close to the source and at receptor locations and recorded in the DPRNET database according to MAQ-DPRNET. The report “Siting of Environmental Direct-Penetrating-Radiation Dosimeters”, LA-UR-00-1168 specifies the procedure to ensure all locations with a potential for 5 mrem/year are monitored for both gammas and neutrons.

7.3.4 Data from soil and sediment

Generally, the dose from soil will be calculated using RESRAD, as specified in MAQ-513 "Posting of Soil Contamination Areas". All radionuclides that could cause a dose of more than 10% of the standard should be measured.

7.3.5 Data from food

Global fallout results in an ingestion dose of a few tenths of a millirem per year (see Section 7.6.4). The concentration of global fallout from atmospheric nuclear-weapons testing varies by location, generally as a function of the average rainfall so it is difficult to determine accurately. Because of this difficulty, the food data should be supplemented with soil data. The ingestion dose may be assessed from soil data using RESRAD, or NCRP Report No. 129, or Table 1 of the Memorandum of Understanding between the EPA and the NRC: http://www.nrc.gov/reading-rm/doc-collections/news/2002/mou2fin.pdf.

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

7.3.6 Data from drinking water and surface water

All pertinent pathways are considered. The radionuclide concentrations in the aquifer and/or in tap water are used to calculate the drinking-water dose using the tables in NBS Handbook 69, which is reproduced in NCRP Report No. 22, or using the tables in DOE Order 5400.5. All radionuclides that contribute more than 10% of the standard should be measured.

The radionuclide concentrations in surface water are used to calculate the dose using realistic scenarios that include direct ingestion of water, crop irrigation, and cattle watering as appropriate.

7.4 Data Boundaries

The following considerations constrain the boundaries of the monitored region.

- Air calculations using RADAIR data are required to be performed to a radius of 80 km from the source.
- Beyond a radius of 16 km from the source, air concentrations are too small to measure with AIRNET and contribute < 0.1 mrem/year.
- Beyond a radius of 1 km from the source, direct radiation is too small to measure with DPRNET and contributes < 1 mrem/year.
- Soil, food, water, and sediment should generally be sampled close to the present or historical technical areas.

7.5 Completeness statement

The dose assessment described in this plan is complete because it includes complete assessment of all pathways:

- air (inhalation of and direct radiation, Section 7.3.1-2);
- direct radiation (gamma and neutron, Section 7.3.3);
- soil and sediment (ingestion of both soil and crops, Section 7.3.4);
- food (natural, cultivated, domesticated, and hunted, Section 7.3.5);
- drinking water (ingestion, Section 7.3.6); and
- surface water (irrigation and cattle watering, Section 7.3.6).

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

7.6 Data Accuracy

For the purpose of dose assessment, the desired accuracy of the input data is 1 mrem/year. This is appropriate because it is a small fraction of the limits and so it provides reasonable assurance that the limits are not exceeded.

When possible, individual components (pathways) of the total effective dose equivalent should be assessed with an accuracy between 0.1 and 1 mrem/year or 10% of the standard for that pathway, whichever is less.

For airborne emissions, the dose assessment must determine potential doses of 0.1 mrem/year [see 40 CFR 61.93(4)(i) and 40 CFR 61.96(b)].

From the viewpoint of dose assessment, doses less than 0.1 mrem/year are insignificant.

7.6.1 Accuracy limitations

In practice, the following technical considerations limit the accuracy in some cases to approximately 1 mrem/year.

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

7.6.2 DPRNET gamma accuracy

As described in " Environmental Surveillance at Los Alamos during 2001", LA-13979-ENV, Chapter 4C.1, natural gamma radiation varies from 100 to 200 mrem/year and is measured with a 1-standard-deviation accuracy of about 10 mrem/year. As a result, DPRNET measurements of the LANL contribution after background subtraction at a fixed location are limited to an accuracy of about 10 mrem/year. The accuracy of the public dose assessment is usually better than 10 mrem/year because of factors related to (a) distance, and (b) occupancy, as follows.

(a) Whenever possible, dosimeters are placed closer to the source than the publicly-accessible locations, therefore an appropriate factor is applied to the measured doses [the inverse-square law predicts a factor of 1/9 in dose when the distance increases by a factor of 3; a more accurate factor may be calculated with the Monte Carlo N-Particle code MCNP (http://laws.lanl.gov/x5/MCNP/) or a similar program].

(b) In some cases, an occupancy factor is applied. Where other occupancy data are not available, the dose assessment team uses the occupancy factors on page 65 of NCRP Report No. 49. Specifically, we use an occupancy factor of 1 for residences and offices and a factor of 1/16 for publicly-accessible roads or trails. Other occupancy factors may be used if justified in writing.

Where the distance factor is 1/9 or the occupancy factor is 1/16, the dosimeter accuracy of 10 mrem/year corresponds to a public-dose accuracy of about 1 mrem/year.

7.6.3 DPRNET neutron accuracy

The DPRNET neutron measurements are more accurate than the gamma measurements because the raw TLD data are multiplied by a neutron correction factor of 0.145 (refer to the memo ESH-17:00-322, "Environmental Neutron Monitoring", June 13, 2000, which is also Attachment 3 of procedure MAQ-505.) Cosmic-ray-neutron background is about 10±1 mrem/year and must be subtracted, which limits the neutron accuracy to about 1 mrem/year. When a distance factor or an occupancy factor is applied, the accuracy is better than 1 mrem/year.

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

7.6.4 Accuracy limited by fallout

Radioactive fallout from atmospheric nuclear-weapons testing must be subtracted. According to page 40 of NCRP 93 (1987), the dose rate from fallout is less than 1 mrem/year. According to UNSCEAR 2000 (http://www.unscear.org/reports/2000_1.html, pages 170-1 and 225-230), the present worldwide-average dose rate is the sum of:

- 0.3 mrem/year external dose from Cs-137
- 0.2 mrem/year internal dose from C-14
- 0.05 mrem/year internal dose from Sr-90
- 0.03 mrem/year internal dose from Cs-137
- <0.001 mrem/year from tritium and transuranics.

The doses predicted by RESRAD (http://web.ead.anl.gov/resrad/home2/) tend to be larger than the UNSCEAR values because of the cautious assumptions used in RESRAD. For example, for transuranics: we use concentration-to-dose conversion factors that correspond to soluble forms, but transuranics that remain in the soil are likely insoluble; and we assume all airborne particles are respirable, though some may be attached to larger particles.

Because these doses vary from one calculation to another and from one location to another (especially as a function of altitude and rainfall), they are impossible to subtract accurately, and this limits the accuracy of the public dose assessments from soil and food to several tenths of a mrem/year.

7.7 Calculation accuracy

Next, we consider the accuracy of the calculations used to convert data (with typical units pCi/m^3, pCi/g, pCi/L, etc.) to annual dose equivalent. Often, the calculations obtain dose-conversion factors from models such as:

- the EPA Gaussian-plume program, CAP88
- the DOE soil-contamination program, RESRAD

or from tables such as:

- Table A2 of LANL's Environmental Surveillance Report
- Table 2 of Appendix E of 40 CFR 61
- Figure III of DOE Order 5400.5
- NBS Handbook 69, a.k.a. NCRP publication No. 22
- EPA Federal Guidance Reports No. 11 and 12
- DOE/EH-0070 and DOE/EH-0071
- EPA Manual of Protective Action Guides, 400R92001

(Refer to Appendix A for the details of each reference.)

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

7.7 Calculation accuracy *(continued)*

The uncertainty in the calculation does not contribute significantly to the final result for one or more of the following reasons.

1. In some cases, the method is mandated by DOE orders or EPA regulations. In these cases, if the goal is compliance the resulting error is assumed to be zero and neither the uncertainty nor the confidence level is part of the decision.
2. The dose assessment models are biased by "conservative" assumptions; i.e., when there is more than one possible assumption, the chosen assumption is the one that yields the largest dose. In this case, the uncertainty is one-sided: the true dose could be smaller than the calculated dose, but not larger.
3. For most pathways, the calculated dose is less than 1 mrem/year and the true dose is less than the calculated dose so the difference is less than 1 mrem/year.

7.8 Negligible dose

Doses less than 1 mrem/year are negligible (see the Federal Register Vol. 68 No. 40, February 28, 2002 http://www.regulations.gov/fredpdfs/03-04752.pdf; last paragraph of page 9598 and the top of the middle column on page 9599).

Pathways with potential doses between 0.1 and 1 mrem should be assessed because together they can contribute to a total dose of 1 mrem.

Pathways with potential doses < 0.1 mrem/year do not contribute significantly to the total dose. They should be assessed periodically to confirm that they are still < 0.1 mrem/year.

According to DOE Order 5400.5 Chapter II Section 6b(3)(b): "Doses calculated should be as realistic as practicable." Considering realistic dose-assessment scenarios, annual average concentrations less than those in the table below are not likely to result in a public dose > 0.1 mrem/year from LANL. (These concentrations include global fallout and natural radioactivity, which have not been subtracted.) For dose assessment, concentrations less than those in the table do not need to be considered.

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

Source	transuranics	uranium	Sr-90	Cs-137	tritium
air	20 aCi/m^3	80 aCi/m^3	200 aCi/m^3	200 aCi/m^3	15 pCi/m^3
drinking water	0.03 pCi/L	0.6 pCi/L	0.2 pCi/L	3 pCi/L	500 pCi/L
other water	0.1 pCi/L	10 pCi/L	2 pCi/L	10 pCi/L	5 nCi/L
soil, sediment	1 pCi/g	3 pCi/g	1 pCi/g	1 pCi/g	10 pCi/g
food (dry)	0.003 pCi/g	0.1 pCi/g	0.1 pCi/g	0.3 pCi/g	
food (wet)					10 pCi/mL
bone (dry)			3 pCi/g		

Concentrations greater than these do not necessarily imply a source from LANL, as in the following examples.

1. Natural U-238 in water often exceeds these concentrations. Kraig and Gladney reported 28 pCi/L U-238 in Espanola drinking water (see "Tap water sampling and analysis during calendar year 2001 for calculation of radiological dose to the public," LA-UR-01-6643).
2. Natural U-238 often exceeds 3 pCi/g in soil: 200 pCi/g was measured in a sample from San Jose claim No. 13 between Pojoaque and Espanola and 700 pCi/g was measured near La Bajada (pages 263 and 264 of "Santa Fe Country" published by the New Mexico Geological Society (1979)).
3. Cs-137 and Sr-90 from global fallout sometimes exceed the concentrations in the table.

Notes on the table

The concentrations in the table are annual averages, and are based on residential scenarios. The air concentrations in the table are 1% of the concentrations in 40 CFR 61 Appendix E Table 2. The drinking water concentrations are similarly derived from DOE Order 5400.5, except for strontium-90 and tritium which are derived from 40 CFR 141 Table A. The concentrations for "other water", soil, and food include annual consumption of 100 lbs of home-grown vegetables irrigated with contaminated water, 10 lbs of fish taken from contaminated water, and 1 lb of contaminated bone. The values for strontium-90 and cesium-137 in soil have been adjusted to be consistent with NCRP 93 and UNSCEAR 2000, after considering the wide range of bioaccumulation factors in the literature.

Special Training and Certification (A8)

Personnel education

Individuals performing dose assessments for the Dose Assessment Team must have education and/or experience as health physicists or an equivalent academic discipline. Documentation of education qualification is maintained by the LANL personnel division and in accordance with the MAQ Quality Management Plan (MAQ-QMP).

Training of personnel

All personnel performing 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 new employee orientation (MAQ-032). Training of personnel in other groups will be performed and documented according to each group's training procedure.

Documentation and Records (A9)

Records resulting from the project

Dose assessments for the annual Environmental Surveillance Report and for compliance will be peer-reviewed and fully documented as required by RRES-EPP-IMP. The number, type, and detail of all records will provide sufficient information to allow an individual with equivalent education and training to verify or reconstruct the results. Implementing procedures specify the 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 dose assessments, assumptions, and references to the data sets used in the calculations.

Reporting of final results

A dose assessment is calculated annually and published in the annual Environmental Surveillance Report (ESR) as specified in DOE Orders 231.1 and 450.1, and in the Environmental Protection Program Integrated Management Plan (RRES-EPP-IMP).

Records final disposition and retention period

All records will be maintained and be available for auditing in the records center at the MAQ group office (MAQ-025, "Records Management"). Records will be archived in compliance with Laboratory 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 (as specified in 40 CFR Part 61.95).

Data Generation and Acquisition (Group B)

Data

See the individual QA project plans for each process that contributes data to Dose Assessment.

Assessments and Response Actions (C1)

Internal management assessments

Internal management assessments will be conducted in accordance with the MAQ QMP and procedure MAQ-029, "Management Assessments." This procedure requires periodic assessments by the group leader of the effectiveness of programs or teams. These assessments are documented and filed as records.

LANL required audits

LANL audit groups external to MAQ may be delegated responsibility for assessments under the LANL QMP. These may apply to any program or project within MAQ.

MAQ requested audits

The MAQ Group Leader may request assessments of any program or project within MAQ. These assessments may also include assessment of organizations which supply information to MAQ or from which MAQ obtains services (e.g., analytical laboratories).

Corrective actions within MAQ

The group has adopted the word "deficiency" to replace other commonly used terms such as finding, condition adverse to quality, and nonconformance. The group QMP defines a deficiency as a malfunction of a process that negatively impacts the quality specifications of MAQ products.

MAQ will document and track external and internal audit findings, or other deviations from requirements found during an audit or assessment as deficiencies. The deficiency, corrective actions, and any resulting root cause analyses, follow-ons, and closures, will be handled in accordance with MAQ-026, "Deficiency Reporting and Correcting."

Corrective actions within other participant organizations

Corrective actions will be initiated, tracked, corrected, and documented according to the organization's requirements and procedures for corrective action. Analytical laboratories must have a corrective action program in place that provides for the identification, tracking, correcting, and documentation of problems found within the organization that affect or could affect the quality of data or products used in Dose Assessment.

Assessments and Response Actions (C1), continued

Trending of deficiencies

Periodically, the team leader reviews the deficiency reports and other records of equipment problems to look for trends in the occurrence of deficiencies. Trending is intended to determine the existence of systematic design or implementation problems. The trending analysis results are documented in a memo or report, forwarded to the responsible managers [see the section Reports to Management (C2)], and copied to the records system for filing as a record.

Emergency response actions

MAQ may be asked by the Laboratory Emergency Management Office to respond to a suspected release of radioactive materials. In such cases, dose may be calculated if necessary, for example as described in MAQ-503, "Calculation of Doses from Unplanned Releases."

Reports to Management (C2)

Dose reports

The Dose Assessment team leader will prepare reports on an annual or as-needed basis. These reports may be supplemented, as needed, to address problems or situations of a more immediate nature.

Distribution of reports

Distribution of reports will include, at a minimum:

- MAQ Group Leader

Other interested parties may be added to distribution as needed or desired.

Data Review, Validation, and Verification (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

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.

Validation and Verification (D2)

Professional evaluation of qualified data	A professional evaluation 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.
Rejected data	Rejected data will not be used for dose assessment.

Reconciliation with Data Quality Objectives (D3)

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

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 414.1A, "Quality Assurance," issued September 29, 1999, changed July 12, 2001.

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

DOE/EH-0070, "External Dose-Rate Conversion Factors for Calculation of Dose to the Public", (1988).

DOE/EH-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public", (1988).

DOE/EH-0173T, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance," January 1991 http://tis.eh.doe.gov/oepa/guidance/aea/effluent/eh0173t.pdf .

EPA Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Con\version Factors for Inhalation, Submersion and Ingestions", (1988) http://www.epa.gov/radiation/federal/docs/fgr11.zip .

EPA 400R92001 "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (1992) http://www.epa.gov/cgi-bin/claritgw?op-Display&document=clserv:OAR:0017;&rank=4&template=epa

EPA 402R93081, Federal Guidance Report No. 12, "External Exposure to Radionuclides in Air, Water, and Soil", http://www.epa.gov/radiation/federal/docs/fgr12.pdf .

EPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," EPA/240/B-01/003, March 2001.

EPA QA/G-4, "Guidance for the Data Quality Objectives Process," September 1994.

EPA/NRC "Memorandum of Understanding between the Environmental Protection Agency and the Nuclear Regulatory Commission", http://www.nrc.gov/reading-rm/doc-collections/news/2002/mou2fin.pdf .

NBS Handbook 69: see NCRP Report No. 22.

NCRP Report No. 22, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure" (a.k.a. NBS Handbook 69) (1963).

NCRP Report No. 129, "Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-specific Studies", (1999).

RRES-EPP-IMP, "Integrated Management Plan for the Environmental Protection Program", Risk Reduction and Environmental Stewardship Division, LANL.

MAQ Group documents:

MAQ-QMP, "Quality Management Plan for the Air Quality Group"

MAQ-AIRNET, "Sampling and Analysis Plan for the Radiological Air Sampling Network"

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

MAQ-DPRNET, "Quality Assurance Project Plan for the Direct Penetrating Radiation Monitoring Network"

MAQ-022, "Preparation, Review and Approval of Procedures"

MAQ-024, "Personnel Training"

MAQ-025, "Records Management"

MAQ-026, "Deficiency Reporting and Correcting"

MAQ-029, "Management Assessments"

MAQ-030, "Document Distribution"

MAQ-032, "New Employee Orientation"

MAQ-501, "Dose Assessment Using CAP88"

MAQ-502, "Air Pathway Dose Assessment"

MAQ-503, "Calculation of Doses from Unplanned Releases"

MAQ-508, "Radiological Dose Calculations for the Annual ESR"

MAQ-513, "Posting of Soil Contamination Areas"

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

ESH-17:95-759, "AIRNET Uncertainty Calculations," Keith Jacobson to file, December 20, 1995.

Other references:

AAHP, "American Academy of Health Physics", http://www.hps1.org/aahp/

HPS, "Health Physics Society", http://www.hps.org/

ICRP, "Limits for Intakes of Radionuclides by Workers," International Commission on Radiological Protection, ICRP Publication 30, Annals of the ICRP; Vol. 3, No. 11-4 (1979); Vol. 5, No. 1-6 (1981); Vol. 7, No.1-3 (1982); and Vol. 8, No. 1-3 (1982).

ICRP, "International Commission on Radiological Protection", http://www.icrp.org/

MCNP, "Monte Carlo N-Particle" LANL group X-5 home page, http://laws.lanl.gov/x5/MCNP/

National Academy of Sciences, http://www.nas.edu/

NBS Handbook 69: see NCRP 22.

NCRP, "National Council on Radiation Protection", http://www.ncrp.com/

NCRP Report No. 93, "Ionizing Radiation Exposure of the Population of the United States" (1987).

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UNSCEAR, "United Nations Scientific Committee on the Effects of Atomic Radiation", http://www.unscear.org/

UNSCEAR 2000, "Sources and Effects of Ionizing Radiation", http://www.unscear.org/reports/2000_1.html

LA-UR-01-6643, "Tap water sampling and analysis during calendar year 2001 for calculation of radiological dose to the public"

"Santa Fe Country," published by the New Mexico Geological Society (1979), ed. Raymond V. Ingersoll, LANL library QE143.N48, pages 263 and 264.

RESRAD, http://web.ead.anl.gov/resrad/home2/