

AIR PATHWAY DOSE ASSESSMENT

Purpose

This Air Quality Group procedure describes the methods used to calculate the air pathway dose based on radionuclide concentrations measured by the radiological air sampling network (AIRNET).

Scope

This procedure applies to requirements set by the EPA in 40 CFR 61 (air-pathway dose limit).

In this procedure

This procedure addresses the following major topics:

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Signatures

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General information about this procedure

Attachments This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Example of Dose Table	1

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	8/15/96	New document.
1	3/9/99	Change “error term” to “concentration uncertainty”, modify steps to calculate and report dose.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- ESH-17 group members assigned to perform air pathway dose assessments

Training method

The training method for this procedure is “self-study” (reading) and is documented in accordance with the procedure for training (ESH-17-024).

Hazard Control Plan

The Hazard Control Plan that documents the hazards of work described in this procedure is:

- HCP-ESH-17-Office Work

This plan is on file in the ESH-17 group office.

General information, continued

Definitions specific to this procedure

Background/fallout: For this procedure, the air concentration which represents the expected activity of naturally occurring (background) and man-made (fallout) radionuclides, i.e., the environmental radionuclide concentration value which is not contributed by LANL activities.

Effective Dose Equivalent (EDE): The representation of radiation dose where the absorbed dose from alpha, beta, and neutron radiation is made equivalent to gamma radiation. The dose to specific organs is weighted to an effective whole body dose. In this procedure, the term “dose” represents EDE.

Dose conversion factor: The EPA-derived air concentration values which would represent a dose of 10 mrem (per radionuclide) to a person if continuously exposed to that concentration for one year. These values include all potential routes of exposure including inhalation, immersion (air and ground shine), and ingestion. See 40 CFR 61, Appendix E, Table 2.

References

The following documents are referenced in this procedure:

- ESH-17-024, “Personnel Training”
 - ESH-17-201, “Evaluating AIRNET Data Against Action Levels”
 - ESH-17-208 “Evaluation of Biweekly AIRNET Data”
 - ESH-17-223, “Evaluation of Quarterly AIRNET Data”
 - ESH-17-507, “Preparation of the Annual Rad-NESHAP Report”
 - ESH-17-AIRNET, “Sampling and Analysis Plan for the Radiological Air Sampling Network”
 - 40 CFR 61, Subpart H, “National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities”
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Note

Actions specified within this procedure, unless preceded with “should” or “may,” are to be considered mandatory guidance (i.e., “shall”).

Air concentration measurements

Calculation of net air concentration Calculate and evaluate the 12 month (mean) air-concentration for each AIRNET sampler and radionuclide using the methods of ESH-17-208 and -223. The net (gross minus background and fallout) concentration for each sampler and radionuclide is determined using the steps described in this section. The concentration uncertainty is calculated in a similar manner.

Note: The only uncertainties considered in this procedure are those which represent the environmental variability of each radionuclide measured. The counting uncertainty is reviewed via procedure ESH-17-033. Sample measurement uncertainty in terms of precision and accuracy of results is discussed in ESH-17-AIRNET.

Background and fallout values Use the 12 month mean values from the Regional AIRNET stations to represent background/fallout (Pu, ²⁴¹Am, ³H) concentrations. These currently consist of #1 Española, #53 El Rancho, and #3 Santa Fe. The values used for representative background (U) will be from the on-site or perimeter sampler with the lowest (12 month) total U concentration. The concentration uncertainty for each result is also calculated in this step.

Calculate the concentration Once the field data and radiochemistry data have been entered into the ESH-17 Access database, use or create appropriate queries to calculate the radionuclide concentrations for each station.

Air pathway dose

Calculating the dose

Using the net concentration and concentration uncertainty, the associated air-pathway dose can be determined from Table 2, Appendix E of 40 CFR 61. Note that the concentrations given in Table 2 incorporate all significant routes of exposure for an airborne radionuclide, including inhalation, immersion, ground deposition, and ingestion.

Steps to calculate the dose

Perform the following steps to calculate the dose for each radionuclide at each sampler location:

Step	Action
1	Obtain the AIRNET concentrations and concentration uncertainty for each radionuclide analysis.
2	For each radionuclide, calculate the 12-month dose by dividing the net 12-month average concentration by the corresponding concentration given in EPA's Table 2; multiply the result by 10. This is the best estimate of dose (mrem).
3	Sum the dose for each radionuclide to obtain the total or annual net effective does equivalent for each sampling location. The format should be suitable for publishing to EPA (see example attachment 1).
4	Obtain peer review of the doses calculated in the above steps. Document the peer review by technical report (see next chapter).
5	Include the table of doses by location in the annual Rad-NESHAP report to the EPA, as described in ESH-17-507.

Reporting the dose calculations

Summary of data evaluation and reporting

The first step in the reporting of the data is to review and evaluate the results. The primary questions to be answered are “Are the obtained results adequate for the intended use?” and “Are there outliers to be investigated before final reporting?”

After the data evaluation step, a technical report is created which summarizes the results. The reports will identify which station(s) have exceeded any action levels. The reports will also be combined with previous reports to identify trends in the data which may indicate a potential to exceed the 10 mrem standard.

Steps to report the dose

Follow these steps to report the results.

Step	Action
1	Obtain the concentration uncertainties and net air-concentration result for each sampler.
2	Validate that the calculated uncertainties meet the established data quality objectives outlined in the AIRNET sampling and analysis plan.
3	Inter-compare the results with each other; flag suspicious results as outliers.
4	Review data following steps in this procedure and ESH-17-208 and -223 to verify outlier results.
5	Generate an ESH-17 technical report that tabulates the data by sampler number, sampler name, sampler 12-month dose, the uncertainty for the dose, and flagged or outlier data.
6	If the 10 mrem dose is exceeded, immediately notify group management of a potential compliance issue. See ESH-17-201 for appropriate actions.
7	Compare the results for each station with previous technical reports, preferably using a control chart. Upon identifying trends, outliers, or results which exceed any actions levels (see ESH-17-201), notify the AIRNET project manager so that appropriate investigative steps can be initiated.
8	Format the technical report data into a form suitable for the official EPA monthly or annual report.

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be submitted as records to the records coordinator:

- technical report on AIRNET doses

[Click here to record "self-study" training to this procedure.](#)

EXAMPLE OF DOSE TABLE

Table 9. 1996 Effective Dose Equivalent (net, in mrem) at Air Sampling Locations around LANL

#	Station Name	³ H	²⁴¹ Am	²³⁸ Pu	²³⁹ Pu	²³⁴ U	²³⁵ U	²³⁸ U	Rounded Total
06	48th Street	0.001	0.000	0.000	0.000	0.007	0.000	0.000	0.01
07	Shell Station	0.003	0.000	0.001	0.001	0.004	0.000	0.006	0.01
08	McDonalds	0.013	0.001	0.000	0.002	0.003	0.000	0.006	0.03
09	Los Alamos Airport	0.007	0.000	0.000	0.011	0.005	0.000	0.007	0.03
10	East Gate (location of MEI)*	0.009	0.000	0.000	0.003	0.005	0.000	0.007	0.02
11	Well PM-1 (E. Jemez Road)	0.004	0.000	0.000	0.000	0.003	0.000	0.006	0.01
12	Royal Crest Trailer Court	0.006	0.000	0.004	0.004	0.004	0.000	0.003	0.02
13	White Rock Pinon School	0.010	0.001	0.000	0.002	0.005	0.000	0.006	0.02
14	Pajarito Acres	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.00
15	White Rock Fire Station	0.006	0.001	0.001	0.001	0.007	0.000	0.007	0.02
16	White Rock Nazarene Church	0.013	0.000	0.000	0.002	0.004	0.000	0.001	0.02
20	DP Road	0.008	0.001	0.002	0.005	0.003	0.000	0.007	0.03
32	County Landfill	0.007	0.008	0.003	0.021	0.048	0.001	0.047	0.13
60	LA Canyon	0.006	0.000	0.001	0.002	0.006	0.001	0.006	0.02
61	LA Hospital	0.005	0.000	0.001	0.000	0.018	0.000	0.016	0.04
62	Trinity Bible Church	0.008	0.000	0.000	0.002	0.006	0.000	0.008	0.02
63	White Rock Monte Rey South	0.005	0.000	0.000	0.000	0.002	0.000	0.003	0.01

*The net dose measured at this station is considered the dose to the MEI and is reported in Table 10 as the estimated dose from all other nonpoint sources.