

# A COMPILATION OF AMBIENT AIR MONITORING PARAMETERS AT DOE FACILITIES

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## Abstract

This report details specific operating parameters of ambient air sampling and analysis for radioactive contaminants and tritium at Department of Energy (DOE) facilities. It also identifies contacts familiar with the ambient air program at each DOE site. Thirty-two sites were contacted to determine if particulate matter was collected and analyzed for a variety of radioactive materials and if water vapor was collected and analyzed for tritium. Eighteen of the sites perform radioactive particulate monitoring and twelve perform tritium monitoring. Of the facilities collecting particulate matter, 83% collect total suspended particulate; 27% collect particles with aerodynamic diameters  $<10\ \mu\text{m}$ . The majority (67%) of facilities use glass fiber filters. Generally, facilities choosing to use other types of media did so because uranium levels were too high and variable in the glass fiber of the blank filters. Eleven of the eighteen facilities use high-volume flow rates of 35–45 cfm; seventeen facilities collect particulate for one or two weeks continuously. Fourteen facilities count the weekly or biweekly samples for gross alpha and gross beta, for which the detection limits are generally within an order of magnitude of  $10^{-3}\ \text{pCi/m}^3$ . Fourteen sites prepare composites for the analyses of nuclides specific to the facility. The most common nuclides include  $^{238}\text{Pu}$ ,  $^{239+240}\text{Pu}$ ,  $^{234}\text{U}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$ , and  $^{241}\text{Am}$ . Eight of the twelve facilities collecting ambient water for tritium analysis use a collection period of one or two weeks. Silica gel is used by 75% of the sites. Detection limits for tritium at most facilities range from 0.4 to  $50\ \text{pCi/m}^3$ .

## **Introduction**

Department of Energy (DOE) Order 5400.1 requires facilities to monitor ambient air for radioactive emissions and the DOE guidance on environmental surveillance DOE/EH-0173T provides instruction on how to perform the required monitoring. In this document I summarize specific operating parameters for monitoring radioactive particulates and tritium in ambient air at DOE sites. For the purpose of this paper, "monitoring" refers to sampling and analysis. This compilation of data on the two types of ambient air monitoring is in response to a recommendation by an independent audit of the Los Alamos National Laboratory (LANL) air monitoring program.

I contacted thirty-two DOE sites for information about their ambient air monitoring programs. Eighteen of the thirty-two sites perform ambient air radioactive-particulate monitoring, and twelve of those perform ambient air tritium monitoring. Several facilities have more than one type of collection system for particulate collection, and one facility has two systems for water vapor collection.

The parameters I summarize include radioisotopes of interest, particle sizes collected, airflow rates, filter media and size, length of sampling periods, number of air monitoring stations used, composite data, detection limits, and types and volumes of adsorbent used for tritium collection. The term "individual sample" shown in the summary table refers to a single particulate sample collected over one sample period. "Composite" refers to a group of the individual samples submitted simultaneously for analyses as a single sample.

The DOE facilities or sites conducting ambient air monitoring for radionuclides include Los Alamos National Laboratory (LANL), Savannah River Site (SRS), Hanford Site, Brookhaven National Laboratory (BNL), Idaho National Engineering & Environmental Lab (INEEL), Nevada Test Site (NTS), Oak Ridge National Laboratory (ORNL), E.O. Lawrence Berkeley National Laboratory (Berkeley), Sandia National Laboratory (Sandia), Argonne National Laboratory (ANL), Pantex, Lawrence Livermore National Laboratory (LLNL), Waste Isolation Pilot Plant (WIPP), Rocky Flats, Mound Plant, Fernald Environmental Management Project, Knolls Atomic Power Laboratory, and Bettis Atomic Power Laboratory.

We are aware that state agencies monitor ambient air at DOE sites. We are not including those agencies in this compilation because they do not necessarily have similar monitoring requirements.

All respondents were contacted in November 1999 to review this document. Changes to ambient air monitoring programs made since then are not reflected here. Due to the variations in facility-specific air monitoring programs, the comparisons found in this paper are not intended to be used for cost analyses. In addition, it is not sufficiently comprehensive to allow us to assess quality across programs.

## **Ambient Air Radioactive Particulate Monitoring — Summary of Findings**

Of the 18 DOE laboratories that perform ambient air monitoring, 15 collect total suspended particulate (TSP) matter and do not differentiate among particle sizes. Sandia and ANL collect only particles  $\leq 10 \mu\text{m}$  using PM-10s (PM-10s are instruments that collect only particles whose aerodynamic diameters are  $\leq 10 \mu\text{m}$ ), and INEEL and Rocky Flats collect both TSP and particles  $\leq 10 \mu\text{m}$ .

The filter media used include glass fiber (12 facilities) and, less commonly, polypropylene, acrylic copolymer, Teflon, quartz, cellulose, and polyester. Generally, those facilities that do not use glass fiber filters switched to other filter media because uranium levels were too high and variable in the glass fiber of the blank filters.

Airflow rates for particulate sampling ranged from 0.5 to 45 cfm. Eight facilities use flow rates of 2.0–4.0 cfm and eleven facilities use high-volume flow rates of 35–45 cfm. Four facilities (INEEL, NTS, LLNL, and ORNL) used a combination of high-volume and low-volume flows.

Sizes of particulate filters varied. The majority of facilities (10) use circular filters 47 mm–50.8 mm (2 inches) in diameter; seven facilities use 8- \_ 10- inch rectangular filters and the remaining facilities use assorted sizes. Typically the 8- \_ 10- inch filters are used for the high-volume sampler and the 47-mm filters for the low-to medium-flow rates.

The number of ambient air particulate monitoring stations at the individual facilities range from 2 (Bettis and Knolls) to 125 (Hanford).

The length of the sampling period for particulate monitoring in 17 of 18 facilities is one or two weeks of continuous collecting. Two facilities collect one sample over a 24-hour period every sixth day. One facility collects continuously over a one-month period.

Most of the facilities (14) count the weekly or biweekly samples for gross alpha and gross beta. Detection limits for gross alpha and gross beta are generally within an order of magnitude of  $10^{-3}$  pCi/m<sup>3</sup>. Five facilities also perform isotopic gamma counts (see Appendix A, Table A-1).

Fourteen facilities prepare composites (six do so monthly, eight quarterly, one semi-annually, and one annually). ORNL prepares composites for some stations quarterly and for some annually; Hanford prepares them for some stations semi-annually and for others quarterly; and PNNL sometimes uses a group of stations as one composite see Appendix A, Table A-2). The detailed data on detection limits for composites provided by each facility are compiled in Table A-3 of Appendix A.

## **Ambient Air Tritium Monitoring—Summary of Findings**

Twelve of the 32 contacted DOE facilities routinely collect water vapor (or precipitation) for tritium analysis. Four facilities sample ambient air continuously over a two-week period, four collect over a one-week period, three collect over a one-month period, and two have variable collection periods depending on loading. Pantex has two systems for ambient tritium collection.

The number of ambient air tritium-monitoring stations at the individual facilities range from 3 (Rocky Flats) to 52 (LANL).

Adsorbents used or methods of collection include silica gel (nine facilities), molecular sieve (two facilities), collection of precipitation (Rocky Flats), and ethylene glycol bubblers (Mound). The masses of the adsorbents used range from 135 to 1,000 g.

Airflow rates through the adsorbents are typically in the range of 100–1,000 cm<sup>3</sup>/min.

Detection limits for tritium at the facilities range from 0.4 to 50 pCi/m<sup>3</sup>. ORNL and Pantex have much higher detection limits. Detailed data provided by each facility are compiled in Appendix B.

## **DOE Laboratories and Facilities That Do Not Conduct Ambient Air Radioactive Particulate or Tritium Monitoring**

Ames Laboratory  
Fermi National Accelerator Laboratory  
Princeton Plasma Physics Laboratory  
Stanford Linear Accelerator Center  
Thomas Jefferson National Accelerator Facility  
Oak Ridge Operations Environmental Management Program  
Oak Ridge Institute for Science and Education  
Y-12 Plant (air monitoring conducted by ORNL)  
Grand Junction Projects Office  
Kansas City Plant  
National Renewable Energy Laboratory  
New Brunswick Laboratory  
Environmental Measurements Laboratory

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## **Other Information**

Ken Duvall, Office of Environmental Policy and Assistance, DOE headquarters, has compiled a list of DOE sites and their Clean Air Act compliance doses. This list includes the computer code (e.g., CAP-88) that the site uses to demonstrate compliance with 40 CFR 61 Subpart H.

## **References**

- 1) US DOE Order 5400.1, "General Environmental Protection Program," November 9, 1988.
- 2) US DOE Guidance DOE/EH-0173T, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance," January 1991.

## **Appendix A**

Compilation of Ambient Air Monitoring Program Parameters at DOE  
Facilities:

Radioactive Particulate Matter