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U.S. Department of Energy Report
2005 LANL Radionuclide Air Emissions

Los Alamos
NATIONAL LABORATORY
EST.1943

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Contents

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by

Keith W. Jacobson and David P. Fuehne

Abstract

Amendments to the Clean Air Act, which added radionuclides to the National Emissions Standards for Hazardous Air Pollutants (NESHAP), went into effect in 1990. Specifically, a subpart (H) of 40 CFR 61 established an annual limit on the impact to the public attributable to emissions of radionuclides from U.S. Department of Energy facilities, such as the Los Alamos National Laboratory (LANL). As part of the new NESHAP regulations, LANL must submit an annual report to the U.S. Environmental Protection Agency headquarters and the regional office in Dallas by June 30. This report includes results of monitoring at LANL and the dose calculations for the calendar year 2006.

Executive Summary

Presented is the Los Alamos National Laboratory (LANL)-wide certified report regarding radioactive effluents released into the air by LANL in 2006. This report fulfills the requirements established by the Radionuclide National Emission Standard for Hazardous Air Pollutants (Rad-NESHAP). This report is prepared by LANL's Rad-NESHAP compliance team, part of the Environmental Protection Division. The information in this report is required under the Clean Air Act and is being reported to the U.S. Environmental Protection Agency (EPA). The highest effective dose equivalent (EDE) to an off-site member of the public was calculated using procedures specified by the U.S. EPA and described in this report. LANL's EDE was 6.46 mrem for 2005. The annual limit established by the EPA is 10 mrem per year.

To comply with the Rad-NESHAP regulation, LANL monitors radionuclide emissions at 28 release points, or stacks. Also, LANL uses a network of air samplers around the Laboratory perimeter to monitor ambient airborne levels of radionuclides. To provide data for dispersion modeling and dose assessment, LANL maintains and operates meteorological monitoring systems.

The EDE is evaluated at any member of the public at any off-site location where there is a residence, school, business, or office. In 2006, this location was a business located at East Gate Drive on the northeastern boundary of LANL. The majority of this dose is due to airborne effluents of short-lived radioactive gases from a linear particle accelerator located at the Los Alamos Neutron Science Center (LANSCE) near the northeastern boundary of LANL. Doses reported to the U.S. EPA for the past ten years are shown in Table E1.

In 2006, LANSCE operated in the same configuration as 2005, with beam operations to the 1L Target and the Lujan Neutron Scattering Center and other lower-level beam experimental areas. The facility operated with the beam on from April to December of 2006. In previous years, LANSCE contributed approximately 90% of the total off-site dose from LANL operations. In 2006, the contribution was about 98% of the total value.

Table E1. Ten Year Summary of NESHAPs Dose Assessment for LANL

Year	EDE (mrem)	Highest EDE Location
1996	1.93	2470 East Gate Dr
1997	3.51	2470 East Gate Dr
1998	1.72	2470 East Gate Dr
1999	0.32	County Landfill Office
2000	0.64	2470 East Gate Dr
2001	1.84	2470 East Gate Dr
2002	1.69	2470 East Gate Dr
2003	0.65	2470 East Gate Dr
2004	1.68	2470 East Gate Dr
2005	6.46	2470 East Gate Dr
2006		

2005 Events

The most notable event in 2005 was the substantially increased level of radioactive gas emissions from the LANSCE facility, resulting in a higher overall dose for 2005 than in past years. Several factors contributed to the elevated levels. First, the accelerator operated for a higher percentage of the year in 2005 than in previous years, about ten months in 2005 relative to only four months in 2004. Second, degradation of the quality of the target coolant water resulted in a continually increasing rate of emissions as the year progressed. Finally, a hairline crack at the inlet of the air emissions controls system resulted in much of the short-lived radioactive gases bypassing the controls system and being vented directly to the exhaust stack. The Rad-NESHAP compliance team used the LANSCE Radioactive Air Emissions Management Plan, which requires various notifications and approvals as the off-site doses increase, as an operating framework. Facility operations personnel performed troubleshooting activities throughout the year, finally identifying the last fix in November 2005. After this fix was implemented, the emissions rates returned to early-cycle projected levels. While the dose from 2005 is much higher than previous years, all indicators to date are that 2006 will return to lower emissions levels. A more detailed discussion of the increased LANSCE emissions and the efforts taken to reduce the emissions rate are discussed in the LANL public report LA-UR-05-9285, "A Summary of LANSCE Radioactive Air Emissions during Calendar Year 2005," available at http://www.airquality.lanl.gov/docs/reports/LA-UR-05-9285.pdf.

Report Format

This report contains two major divisions. The first division primarily describes the Rad-NESHAP program and compliance activities at LANL and is organized into five sections. The second division consists mainly of data tables required for reporting purposes. In this division, Table 14 provides doses calculated at various public locations around LANL, and Table 15 summarizes the different LANL contributions to the total highest dose for the calendar year 2005. As previously mentioned, this report was prepared by the Rad-NESHAP compliance team, which is now part of the newly formed Ecology and Air Quality Group (EAQ) at LANL.

Section I. Facility Information

61.94(b)(1) Name and Location of Facility

Los Alamos National Laboratory (LANL or the Laboratory) and the associated residential areas of Los Alamos and White Rock are located in Los Alamos County in north-central New Mexico, approximately 100 km (60 mi) north-northeast of Albuquerque and 40 km (25 mi) northwest of Santa Fe (Figure 1).

61.94(b)(2) List of Radioactive Materials Used at LANL

Since the Laboratory's inception in 1943, its primary mission has been nuclear weapons research and development. Programs include weapons development, nonproliferation, magnetic and inertial fusion, nuclear fission, nuclear safeguards and security, and laser isotope separation. There is also basic research in the areas of physics, chemistry, and engineering, and in biology that complements and draws upon basic research in the physical sciences.

The primary facilities involved in the emissions of radioactivity are outlined in this section. The facility locations are designated by technical area (TA) and building. For example, the facility designation TA-3-29 is Building 29 at Technical Area 3 (see Figure 2 showing the technical areas at LANL). Potential radionuclide release points are listed in several tables that follow. Some of the sources described below are characterized as non-point. Beginning in 1995, air sampling results from LANL's air sampling network (AIRNET) were used, with U.S. Environmental Protection Agency (US-EPA) approval, to calculate off-site impacts resulting from diffuse and fugitive emissions of radioactive particles and tritium oxide from non-point sources.

Radioactive materials used at LANL include weapons-grade plutonium, heat-source plutonium, enriched uranium, depleted uranium, and tritium. Also, a variety of materials are generated through the process of activation; consequent emissions occur as gaseous mixed activation products (GMAP) and other activation products occur in particulate and vapor (P/VAP) form.

The radionuclides emitted from point sources at LANL in calendar year (CY) 2005 are listed in the subsequent tables. Tritium is released as tritium oxide and elemental tritium. Plutonium contains traces of ^{241}Am, a transformation product of ^{241}Pu. Some of the uranium emissions are from open-air explosive tests involving depleted uranium. GMAP emissions include ^{41}Ar, ^{11}C, ^{13}N, ^{16}N, ^{14}O, and ^{15}O. Various radionuclides such as ^{197m}Hg, ^{197}Hg, ^{68}Ge, and ^{76}Br make up the majority of the P/VAP emissions.

61.94(b)(3) Handling and Processing of Radioactive Materials at LANL Technical Areas

Additional descriptions of LANL technical areas can be found in the annual environmental report for LANL. More thorough descriptions of LANL operations can be found in the annual yearbooks published by LANL's Site-Wide Issues Program Office, the most recent being published in 2004.[1]

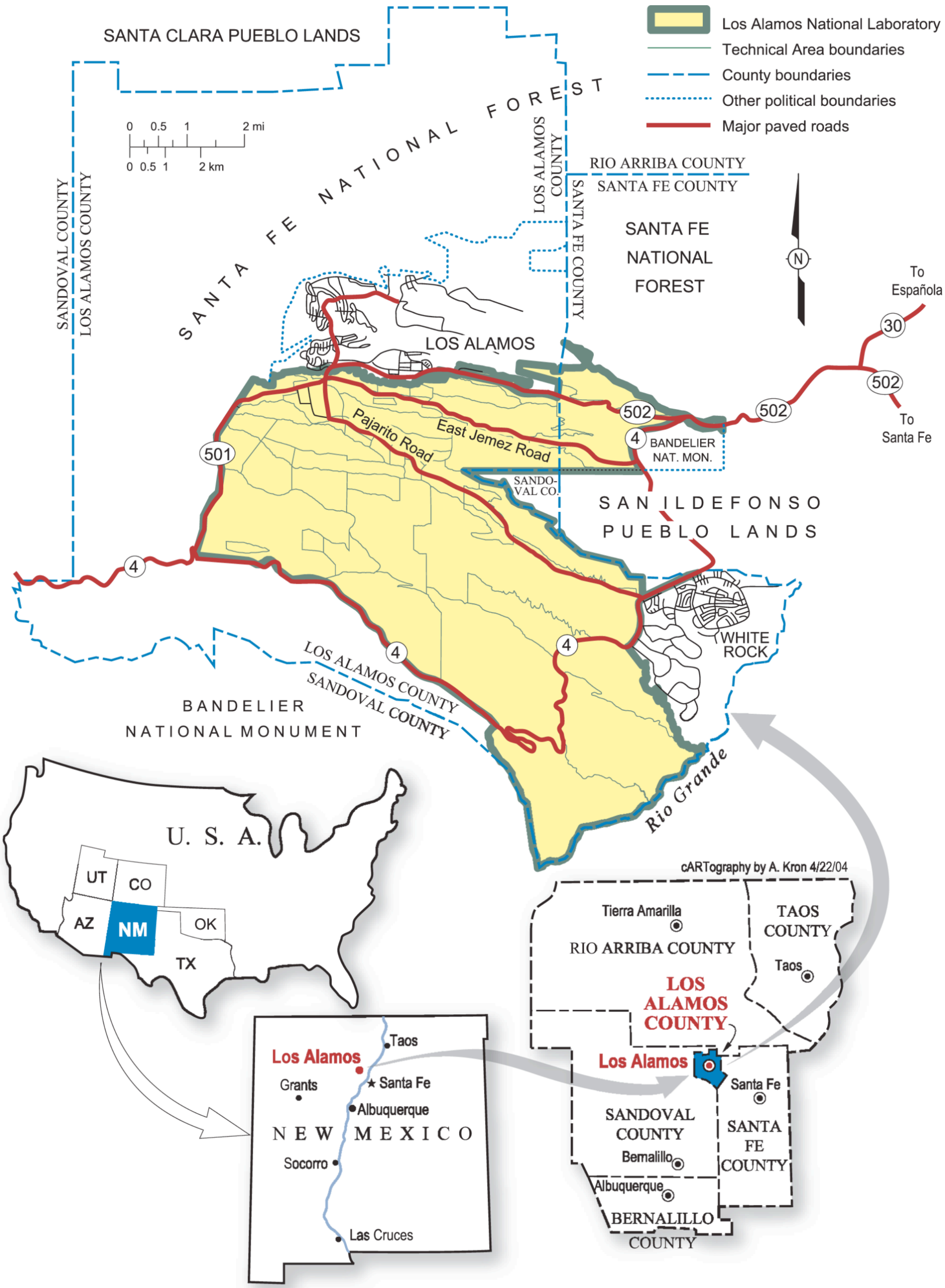

Figure 1. Location of Los Alamos National Laboratory.

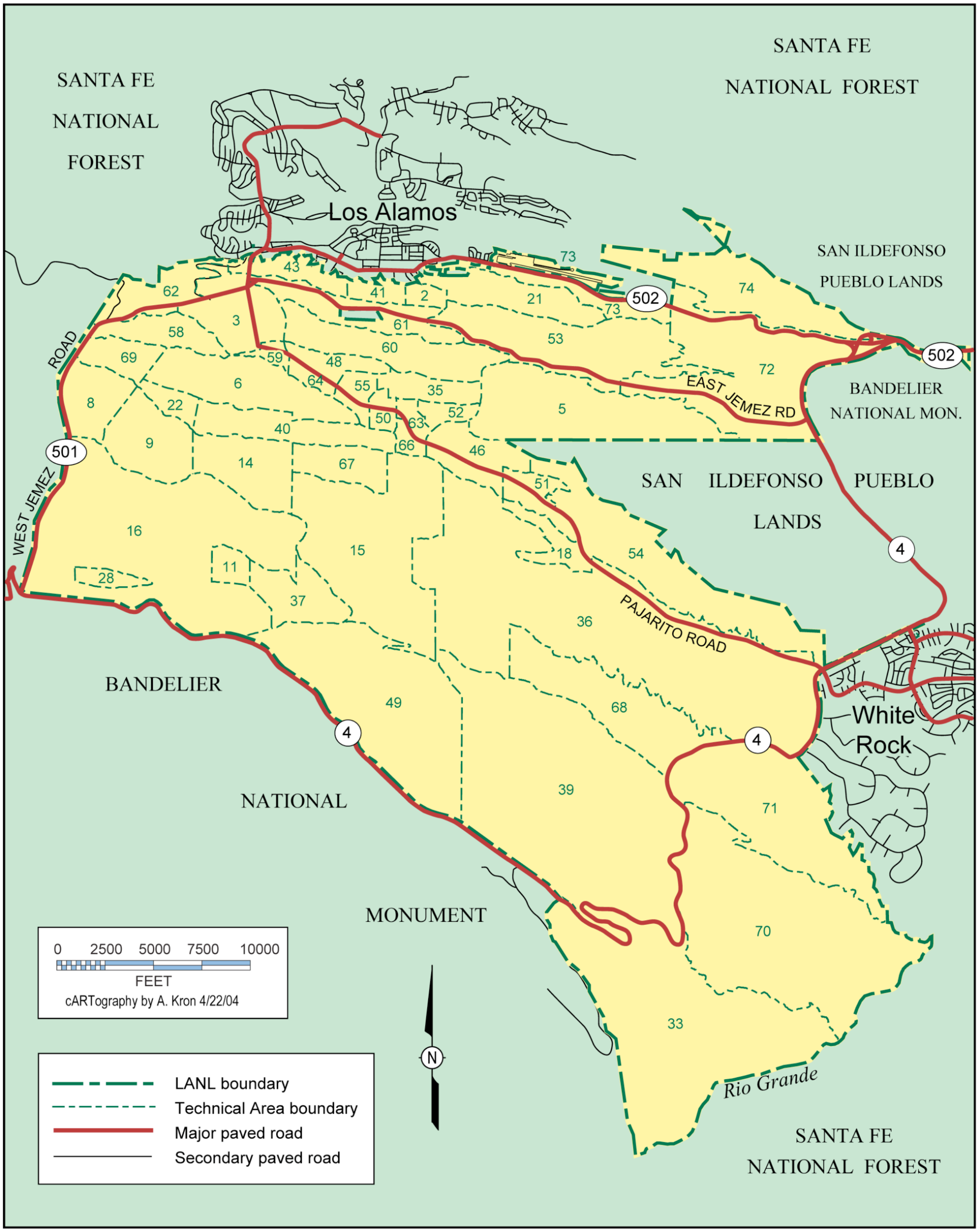

Figure 2. Los Alamos National Laboratory technical areas by number.

The primary facilities responsible for radiological airborne emissions are as follows.

TA-3-29: The Chemistry and Metallurgy Research (CMR) facility conducts chemical and metallurgical research. The principal radionuclides used are isotopes of plutonium as well as other actinides. There are a variety of activities involving plutonium and uranium, which support many LANL and other U.S. Department of Energy (DOE) programs conducted primarily at other facilities.

TA-3-66: This building and three other main buildings are used for a variety of nuclear materials work, primarily for dealing with metallic and ceramic items, including depleted uranium.

TA-3-102: This machine shop is used for the metalworking of radioactive materials, primarily depleted uranium.

TA-3-1698: This facility is designated as the Materials Science Laboratory. The building was designed to accommodate a wide variety of chemicals used in small amounts that are typical of many university and industrial labs conducting research in materials science.

TA-15 and TA-36: These facilities conduct open-air explosive tests involving depleted uranium and weapons development testing.

TA-15-312 – Dual-Axis Radiographic Hydrodynamic Test: This facility conducts high-explosive-driven experiments to investigate weapons functions and behavior during nonnuclear tests using advanced radiography. The facility completed the construction of the second stage of the flash X-ray machine in March 2003.

TA-16-205 – Weapons Engineering Tritium Facility: This facility is located in Buildings 205 and 205A in the southeast section of TA-16. Building 205 was specifically designed and built to safely process tritium and to meet user needs and specifications. The operations at WETF are divided into two categories: tritium processing and activities that support tritium processing. Examples of tritium-processing operations include the repackaging of tritium into smaller quantities and the packaging of tritium and other gases to user-specified pressures. Other operations include reacting tritium with other materials to form compounds and analyzing the effects of tritium.

TA-21: Many of the facilities at this decommissioned radiochemistry site are undergoing decontamination and demolition (D&D). Some of these operations may contribute to diffuse emissions of uranium and plutonium into the air. The DP West area has been in the D&D program since 1992; a number of buildings have been demolished.

TA-21-155 and **TA-21-209:** These facilities, located in the DP East area, previously conducted operations involving tritium. Programs included the testing of tritium-control systems for the nuclear fusion program (TA-21-155), the preparation of targets containing tritium for laser-fusion research, and the handling of tritium for defense programs. Building 155 is still being prepared for D&D in the near future. Tritium recovery operations from old equipment are being conducted at TA-21-209.

TA-18: This nuclear facility studies the behavior of nuclear materials using critical assemblies. Some of the assemblies are used as a source of fission neutrons for experimental purposes, resulting in a diffuse source of ^{41}Ar emissions.

TA-41-4: This building was formerly used as a tritium-handling facility. The tritium sources were removed in 2002. Diffuse tritium emissions could result from residual tritium contamination and cleanup operations.

TA-48-1: The principal activities carried out in this facility are radiochemical separations supporting the medical radioisotope production program, the Yucca Mountain program, nuclear chemistry experiments, and geochemical and environmental research. These separations involve nCi to Ci (hot cell) amounts of radioactive materials and use a wide range of analytical chemical separation techniques such as ion exchange, solvent extraction, mass spectroscopy, plasma emission spectroscopy, and ion chromatography.

TA-50-1: This waste management site consists of an industrial low-level (radioactive) liquid waste treatment plant. There is a wastewater outfall from TA-50-1 that may result in a diffuse source of airborne tritium.

TA-50-37: Currently, there are no operations involving radioactive material in this building; future operations may involve the use of radioactive actinides**.**

TA-50-69: This waste management site consists of a waste characterization, reduction, and repackaging facility.

TA-53: This technical area houses the Los Alamos Neutron Science Center (LANSCE), a linear particle accelerator complex. The accelerator is used to conduct research in stockpile stewardship, radiobiology, materials science, and isotope production, among other areas. LANSCE consists of the Manuel Lujan Neutron Scattering Center, the Proton Storage Ring (PSR), the Weapons Neutron Research facilities, the Proton Radiography facility, and the high-intensity beam line (Line A).

The facility accelerates protons and H^- ions to an energy of 800 MeV into target materials such as graphite and tungsten to produce neutrons and other subatomic particles. The design current of the accelerator is approximately 1000 microamperes. Medium intensity (100 micro amp) beam operations to the PSR and the Manuel Lujan Neutron Scattering Center were conducted in January through December 2005. Low-intensity (up to 10 microamps) beam operations to the PSR, the Weapons Neutron Research facility, and the Proton Radiography facility were conducted throughout the same period.

Airborne radioactive emissions result from proton beams and secondary particles passing through and activating air in target cells, beam stop, and surrounding areas, or activating water used in target cooling systems. The majority of the emissions are short-lived activation products such as ^{11}C, ^{13}N, and ^{15}O. Most of the activated air is vented through the main stacks; however, a fraction of the activated air becomes a fugitive emission from the target areas. In 1999, two solar evaporative basins were constructed and began operation to evaporate wastewater from the accelerator. Evaporation of water from these facilities can result in a diffuse source of airborne tritium.

TA-54: This waste management site consists of active and inactive shallow land burial sites for solid waste and is the primary storage area for mixed and transuranic radioactive waste. Area G at TA-54 is a known source of diffuse emissions of tritium vapor. Resuspension of soil contaminated with low levels of plutonium/americium has also created a diffuse source. Shipments of transuranic waste for disposal at the Waste Isolation Pilot Plant began in 1999.

TA-55-4: As discussed in the *Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory*, this facility is slated for a plutonium pit production mission while it continues its traditional role of housing research-and-development applications in chemical and metallurgical processes for recovering, purifying, and converting plutonium and other actinides.[2] A wide range of activities (e.g., the heating, dissolution, forming, and welding of special nuclear materials) is also conducted. Additional activities include investigating the means to safely ship, receive, handle, and store nuclear materials, and manage wastes and residues from TA-55.

Section II. Air Emissions Data

61.94(b)(4) Point Sources

Monitored and unmonitored exhaust stacks, or point sources, at LANL are listed in Table 1. The point sources are identified using an eight-digit identification number (ESIDNUM) for each exhaust stack; the first two digits represent the LANL technical area, the next four the building, and the last two digits the stack number. Also listed in Table 1 are type, number, and efficiency of the effluent controls used on the release points. Each stage of the high-efficiency particulate air (HEPA) exhaust filters is tested at least once every 12 months. The performance criteria for HEPA filter systems are a maximum penetration of 5×10^{-4} for one stage and 2.5×10^{-7} for two stages in series, in which penetration equals the concentration of aerosol downstream of the air cleaner divided by concentration upstream.

The distance between each of the 28 monitored point sources and the nearest receptor is provided in Table 2. The nearest receptor can be a residence, school, business, or office. In this report, the nearest receptor is defined as the public receptor most impacted by a given release point; that is, the air dispersion pattern is taken into account to determine the nearest or most critical receptor location. The distance to the nearest farm producing milk is 20 km east of the Laboratory's eastern boundary; the nearest farms producing meat and vegetables adjoin the Laboratory's eastern boundary, about 4 km from the main exhaust stack at LANSCE. More detailed agricultural information can be found in a supplemental LANL report.[3] At this time, LANL is not using this site-specific agricultural data in the CAP88 model; preprogrammed or default values for New Mexico are utilized for the number of beef and milk cattle and for agricultural productivity.

In addition to the 28 monitored release points, approximately 60 unmonitored release points in more than 30 LANL buildings are included in Table 1. Under 40 CFR 61.93(b)(4)(i), sampling of these release points is not required because each release point has a potential effective dose equivalent (PEDE) of less than 0.1 mrem/yr at the critical receptor. However, in order to verify that emissions from unmonitored point sources remain low, LANL conducts periodic confirmatory measurements in the form of the Radioactive Materials Usage Survey. The purpose of this survey is to collect and analyze radioactive materials usage and process information for the monitored and unmonitored point sources at LANL.

Table 1. 40-61.94(b)(4-5) Release Point Data

ESIDNUM	Location	Control Description	Number of Effluent Controls	Control Efficiency	Monitored
03001600	TA-03-16	none	0	0%	☐
03002913	TA-03-29-1	unknown	0	0%	☐
03002914	TA-03-29-2	HEPA	2	99.95% each	☑
03002915	TA-03-29-2	HEPA	2	99.95% each	☑
03002919	TA-03-29-3	Aerosol 95	1	80%	☑
03002920	TA-03-29-3	Aerosol 95	1	80%	☑
03002923	TA-03-29-4	FARR 30/30	1	~ 20%	☑
03002924	TA-03-29-4	FARR 30/30	1	~ 20%	☑
03002928	TA-03-29-5	HEPA	2	99.95% each	☑
03002929	TA-03-29-5	HEPA	2	99.95% each	☑
03002932	TA-03-29-7	HEPA	2	99.95% each	☑
03002933	TA-03-29-7	HEPA	2	99.95% each	☑
03002937	TA-03-29-V	HEPA	2	99.95% each	☑
03002944	TA-03-29-9	RIGA-Flow 220	1	80%	☑
03002945	TA-03-29-9	RIGA-Flow 220	1	80%	☑
03002946	TA-03-29-9	RIGA-Flow 220	1	80%	☑
03003299	TA-03-32	unknown	0	0%	☐
03003400	TA-03-34	none	0	0%	☐
03003501	TA-03-35	HEPA	1	99.95%	☐
03003599	TA-03-35	unknown	0	0%	☐
03003999	TA-03-39	none	0	0%	☐
03004025	TA-03-40	HEPA	1	99.95%	☐
03006601	TA-03-66	none	0	0%	☐
03006602	TA-03-66	none	0	0%	☐
03006603	TA-03-66	none	0	0%	☐
03006604	TA-03-66	none	0	0%	☐
03006605	TA-03-66	none	0	0%	☐
03006606	TA-03-66	none	0	0%	☐
03006626	TA-03-66	HEPA	1	99.95%	☐

Table 1. 40-61.94(b)(4-5) Release Point Data (Cont.)

ESIDNUM	Location	Control Description	Number of Effluent Controls	Control Efficiency	Monitored
03006654	TA-3-66	HEPA	1	99.95%	☐
03006699	TA-03-66	none	0	0%	☐
03010222	TA-03-102	HEPA	1	99.95%	✓
03010225	TA-03-102	HEPA	1	99.95%	☐
03169800	TA-03-1698	none	0	0%	☐
09002103	TA-09-21	none	0	0%	☐
16020299	TA-16-202	unknown	0	0%	☐
16020504	TA-16-205	CR/MS	1	>99%	✓
16020599	TA-16-205	none	0	0%	☐
18016899	TA-18-168	none	0	0%	☐
21000507	TA-21-5	HEPA	2	99.95% each	☐
21015001	TA-21-150	HEPA	1	99.95%	☐
21015505	TA-21-155	CR/MS	1	>99%	✓
21020901	TA-21-209	CR/MS	1	>99%	✓
21020999	TA-21-209	none	0	0%	☐
21025704	TA-21-257	none	0	0%	☐
35000200	TA-35-2	none	0	0%	☐
35021305	TA-35-213	none	0	0%	☐
36000104	TA-36-1	unknown	0	0%	☐
41000104	TA-41-1	HEPA	2	99.95% each	☐
41000417	TA-41-4	none	0	0%	☐
43000100	TA-43-1	none	0	0%	☐
46002499	TA-46-24	none	0	0%	☐
46003100	TA-46-31	none	0	0%	☐
46004106	TA-46-41	none	0	0%	☐
46015405	TA-46-154	none	0	0%	☐
46015899	TA-46-158	none	0	0%	☐
46020099	TA-46-200	none	0	0%	☐
48000107	TA-48-1	HEPA/Charcoal Bed	2	99.95% each	✓
48000111	TA-48-1	none	0	0%	☐
48000115	TA-48-1	none	0	0%	☐

Table 1. 40-61.94(b)(4-5) Release Point Data (Cont.)

ESIDNUM	Location	Control Description	Number of Effluent Controls	Control Efficiency	Monitored
48000135	TA-48-1	none	0	0%	☐
48000145	TA-48-1	none	0	0%	☐
48000154	TA-48-1	HEPA	2	99.95% each	✔
48000160	TA-48-1	HEPA	1	99.95%	✔
48000166	TA-48-1	HEPA	2	99.95% each	☐
48000167	TA-48-1	HEPA	2	99.95% each	☐
48004500	TA-48-45	none	0	0%	☐
50000102	TA-50-1	HEPA	1	99.95% each	✔
50000299	TA-50-2	none	0	0%	☐
50003701	TA-50-37	HEPA	2	99.95% each	✔
50006901	TA-50-69	HEPA	1	99.95%	☐
50006902	TA-50-69	HEPA	1	99.95%	☐
50006903	TA-50-69	HEPA	2	99.95% each	✔
53000116	TA-53-1	unknown	0	0%	☐
53000303	TA-53-3	HEPA	1	99.95%	✔
53000702	TA-53-7	HEPA	1	99.95%	✔
53000799	TA-53-7	none	0	0%	☐
53001599	TA-53-15	none	0	0%	☐
53001899	TA-53-18	none	0	0%	☐
53109099	TA-53-1090	none	0	0%	☐
54003399	TA-54-33	HEPA	1	99.95%	☐
54003699	TA-54-36	HEPA	1	99.95%	☐
54004999	TA-54-49	unknown	0	0%	☐
54021599	TA-54-215	unknown	0	0%	☐
54022499	TA-54-224	unknown	0	0%	☐
54028101	TA-54-281	HEPA	1	99.95%	☐
54041201	TA-54-412	HEPA	1	99.95	☐
54100199	TA-54-1001	none	0	0%	☐
54100999	TA-54-1009	none	0	0%	☐
55000415	TA-55-4	HEPA	4	99.95% each	✔
55000416	TA-55-4	HEPA	4	99.95% each	✔

Table 1. 40-61.94(b)(4-5) Release Point Data (Cont.)

ESIDNUM	Location	Control Description	Number of Effluent Controls	Control Efficiency	Monitored
59000100	TA-59-1	none	0	0%	☐

Table 2. 40-61.94(b)(6) Distances from Monitored Release Points to Nearest Receptor

ESIDNUM	Nearest Receptor (m)	Receptor Direction
03002914	731	NE
03002915	732	NE
03002919	836	NNE
03002920	835	NNE
03002923	575	NNW
03002924	575	NNW
03002928	936	NE
03002929	937	NE
03002932	856	NNE
03002933	855	NNE
03002937	870	NE
03002944	937	NNE
03002945	939	NNE
03002946	938	NNE
03010222	746	N
16020504	778	SSW
21015505	680	NNW
21020901	712	NNW
48000107	749	NNE
48000154	751	NNE
48000160	764	NNE
50000102	1183	N
50003701	1171	N
50006903	1186	N
53000303	800	NNE
53000702	944	NNE
55000415	1016	NNE
55000416	1089	NNE

Guided by Appendix D to 40 CFR 61, we have used data collected from the facilities in conjunction with engineering calculations and other methods to develop conservative emissions estimates from unmonitored point sources. Estimated PEDEs are calculated by modeling these emissions estimates using the EPA-approved CAP88 dose modeling software. A comprehensive survey of all of LANL's monitored and unmonitored point sources is conducted annually or biannually, depending on the magnitude of potential emissions. Results of the 2005 Usage Survey can be found in the report, *2005 Radioactive Materials Usage Survey for Point Sources*.[4] The Laboratory has established administrative requirements to evaluate all potentially new sources. These requirements are established for the review of new Laboratory activities and projects, ensuring that air quality regulatory requirements will be met before the activity or project begins.[5]

Non-Point Sources

There are a variety of non-point sources within the 111 km^2 of land occupied by LANL. Non-point sources can occur as diffuse or large-area sources or as leaks or fugitive emissions from facilities. Examples of non-point sources of airborne radionuclides include surface impoundments, shallow land burial sites, open burn sites, live firing sites, outfalls, container storage areas, unvented buildings, waste treatment areas, solid waste management units, and tanks. The Laboratory measures the annual average ambient concentrations of important airborne radionuclides (other than activated gases) at a number of potential receptor locations.

Beginning in 1995, LANL began summarizing the potential impacts of non-point sources by analyzing and reporting air concentration measurements collected at ambient air-sampling sites around the Laboratory. Previously, LANL had estimated emissions from the most significant non-point sources and determined the impacts using EPA's dose assessment computer program. The Laboratory and EPA negotiated this method of assessing non-point sources as part of a Federal Facility Compliance Agreement (FFCA).[6] Results of the air sampling analysis are provided in Section III of this report. There were no unusual results recorded by the air sampling stations for 2005.

Radionuclide Emissions

Radionuclides released from monitored point sources, along with the annual emissions for each radionuclide, are documented in Table 3. The point sources are identified using an eight-digit identification number for each exhaust stack: the first two digits represent the LANL technical area, the next four digits the building and the last two digits the stack number. No detectable emissions are denoted as ND (none detected). A map showing the general locations of the facilities continuously monitored for radionuclide emissions is shown in Figure 3.

Table 3. 40-61.94(b)(7) User-Supplied Data—Air Emissions Report

Stack ID	Nuclide[a]	Emission (Ci)
03002914	U-235	6.44E–09
03002914	U-234	3.05E–09
03002914	Sr-90	9.68E–09
03002914	Y-90 (p)	9.68E–09
03002915	U-238	3.61E–08
03002915	Th-234 (p)	3.61E–08
03002915	Pa-234m (p)	3.61E–08
03002915	U-234	1.32E–08
03002919	Pu-239	4.41E–07
03002919	Am-241	8.38E–08
03002919	Pu-238	5.89E–08
03002920	Pu-239	6.79E–08
03002920	Pu-238	1.01E–08
03002920	U-234	9.98E–09
03002920	Am-241	1.92E–08
03002923	U-234	2.21E–06

Table 3. 40-61.94(b)(7) User-Supplied Data—Air Emissions Report (Cont.)

Stack ID	Nuclide[a]	Emission (Ci)
03002923	U-238	1.54E–07
03002923	Th-234 (p)	1.54E–07
03002923	Pa-234m (p)	1.54E–07
03002923	U-235	7.61E–08
03002923	Pu-238	1.78E–08
03002924	Th-230	2.15E–08
03002924	U-235	2.39E–08
03002924	U-234	7.05E–06
03002924	Am-241	9.96E–09
03002924	Pu-238	3.23E–06
03002924	Pu-239	8.67E–08
03002924	U-238	8.28E–08
03002924	Th-234 (p)	8.28E–08
03002924	Pa-234m (p)	8.28E–08
03002924	Th-228	3.28E–07
03002924	Th-230	1.83E–08
03002928	Am-241	1.86E–08
03002928	Pu-239	7.34E–08
03002928	Pu-238	4.05E–07
03002929	None	0.00E+00
03002932	None	0.00E+00
03002933	U-234	7.11E–08
03002937	U-234	4.66E–10
03002944	U-235	2.24E–08
03002944	U-238	2.37E–08
03002944	Th-234 (p)	2.37E–08
03002944	Pa-234m (p)	2.37E–08
03002944	U-234	4.36E–08
03002945	U-235	3.48E–09
03002946	U-234	8.84E–09
03002946	Ge-68	1.09E–05
03002946	Ga-68 (p)	1.09E–05
03010222	U-234	4.42E–09
16020504	H-3 (HTO)	3.17E+02
16020504	H-3 (Gas)	5.30E+01
21015505	H-3 (Gas)	1.25E+00
21015505	H-3 (HTO)	2.28E+02
21020901	H-3 (Gas)	4.13E+00
21020901	H-3 (HTO)	5.71E+01
48000107	Se-75	1.40E–05
48000107	Ge-68	1.49E–03
48000107	Ga-68 (p)	1.49E–03
48000154	U-234	5.73E–09
48000154	U-235	7.91E–10
48000160	Se-75	1.52E–07
48000160	Ge-68	4.64E–06
48000160	Ga-68 (p)	4.64E–06
50000102	None	0.00E+00
50003701	None	0.00E+00
50006903	Am-241	7.61E–10
50006903	Pu-239	5.04E–09
50006903	Pu-238	2.64E–10
50006903	Th-228	5.54E–10
50006903	Th-230	3.39E–10
50006903	Th-232	3.21E–10
53000303	H-3 (HTO)	6.27E–01
53000303	Ar-41	2.26E–02
53000303	C-11	1.81E+00
53000702	Os-191	4.99E–05
53000702	Se-75	1.45E–05
53000702	C-11	1.56E+04
53000702	Ar-41	2.76E+01
53000702	As-73	1.05E–05
53000702	Be-7	6.96E–06
53000702	Br-76	3.23E–03
53000702	Br-77	2.41E–04
53000702	Ge-68	2.27E–06
53000702	Ga-68 (p)	2.27E–06
53000702	C-10	8.98E–01
53000702	O-15	2.73E+03
53000702	Hg-197m	4.41E–03
53000702	Hg-197 (p)	4.41E–03
53000702	N-13	4.36E+01
53000702	N-16	5.31E–01
53000702	Na-24	4.62E–05
53000702	O-14	2.33E+01
53000702	Br-82	3.56E–03
53000702	H-3 (HTO)	7.20E+00
55000415	U-234	1.13E–08
55000415	U-238	8.98E–08
55000415	Th-234 (p)	8.98E–08
55000415	Pa-234m (p)	8.98E–08
55000415	Th-228	3.35E–08
55000416	H-3 (Gas)	4.25E+01
55000416	H-3 (HTO)	2.01E+00
55000416	U-238	5.64E–08
55000416	Th-234 (p)	5.64E–08
55000416	Pa-234m (p)	5.64E–08

NOTES:
[a] Radionuclides with the designator "(p)" are short-lived progeny in secular equilibrium with their parent radionuclide; e.g., Ga-68 (progeny) is in equilibrium with Ge-68 (parent).

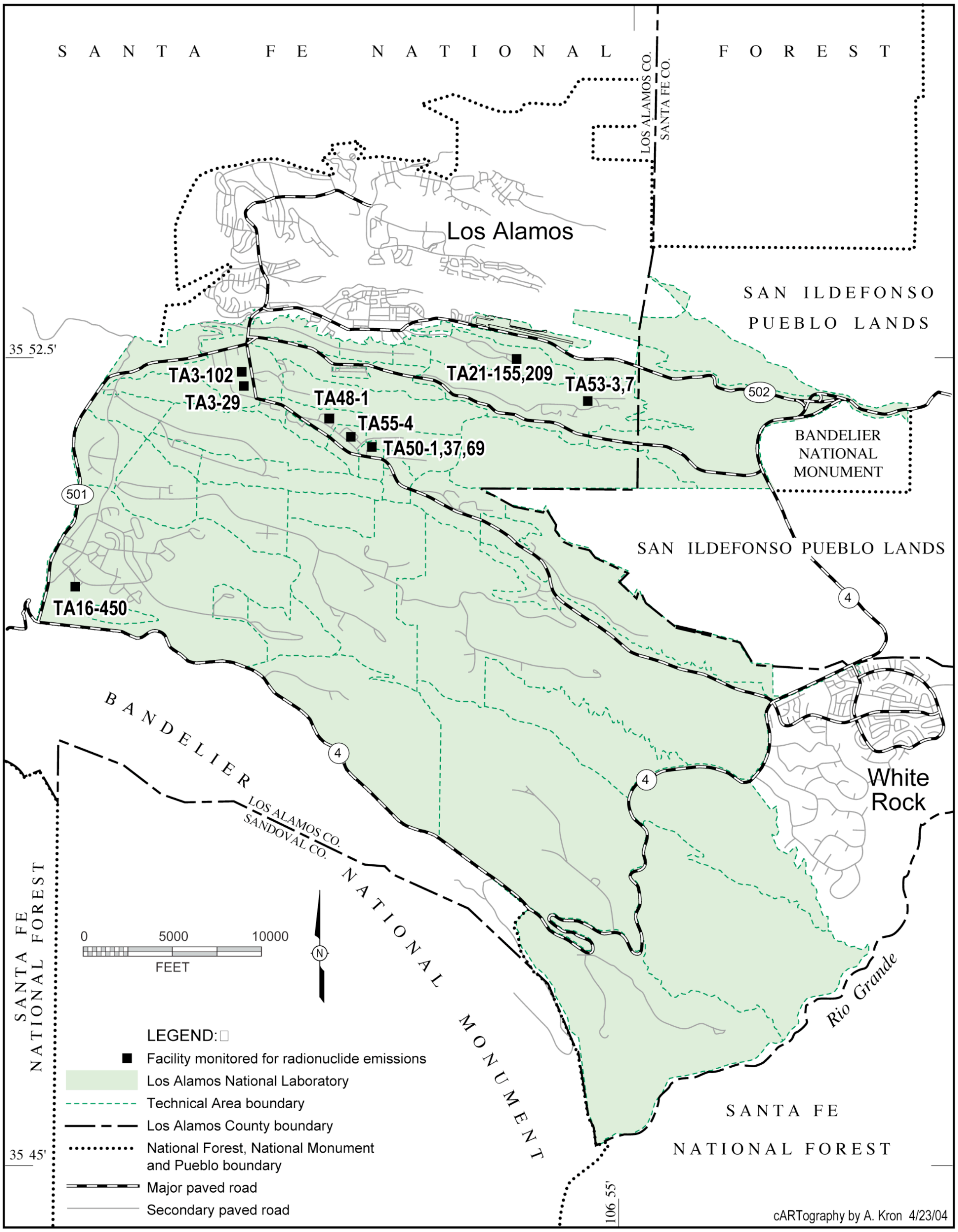

Figure 3. Locations of facilities with continuously operated stack-sampling systems for radionuclide emissions

Pollution Controls

At LANL, the most common type of filtration for emission control purposes is the HEPA filter. HEPA filters are constructed of submicrometer glass fibers that are pressed and glued into a compact, paper-like, pleated media. The media is folded alternately over corrugated separators and mounted into a metal or wood frame in eight standard sizes and airflow capacities. A Type I nuclear-grade HEPA filter is capable of removing 99.97% of 0.3-μm particles at rated airflow. Other types of filters used in ventilation systems are Aerosol 95, RIGA-FLOW 220, and FARR 30/30. These units are typically used as prefilters in HEPA filtration systems. These filters are significantly less efficient than HEPA filters and are typically used for collecting particulate matter larger than 5 μm. The above-mentioned filters are only effective for particles. When the contaminant of concern is in the form of a gas, activated charcoal beds can be used. Charcoal beds collect the gas contaminant through an adsorption process in which the gas comes in contact with the charcoal and adheres to the surface of the charcoal. The charcoal can be coated with different types of materials to make the adsorption process more efficient for different types of contaminants. Typically, charcoal beds can achieve an efficiency of 98% capture.

Tritium effluent controls are generally composed of a catalytic reactor and a molecular sieve bed. Tritium-contaminated effluent is passed through a catalyst that converts elemental tritium (HT) into tritium oxide (HTO). This HTO is then collected as water on a molecular sieve bed. This process can be repeated until the tritium level is at, or below, the desired level. The effluent is then vented through the stack.

A delay system is used to reduce some of the short-lived radionuclides generated by activation at LANSCE. Emissions from the highest source of activated gas (the off-gas system for the 1L target cooling loops) are directed into a long transport line to hold up the radionuclide gases prior to their emission. This delay system is used to provide a reduction in radionuclide emissions from the 1L target area.

Compliance with New Maintenance and Inspection Requirements under the Revised Rad-NESHAP

The 2003 revisions to Subpart H established several new inspection and maintenance requirements for monitored stacks. These requirements are based on Table 5 of ANSI/HPS N13.1-1999, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities."

As mentioned in the 2003 annual report to the EPA, LANL's approach to these requirements was threefold and included (1) administrative changes to the QA program, (2) visual inspections of systems, and (3) alternative method approval for tritium stacks. Parts (1) and (3) remain unchanged since 2003. For part (2), visual inspections, an update on the stack inspection process is worthwhile.

At LANL, there are 30 monitoring systems on 27 stacks at LANL that are used for Rad-NESHAP compliance. Some stacks have multiple types of samplers installed. Of these, four are tritium systems, subject to the alternative method mentioned above. These four are not inspected but performance tested at least annually. Two additional systems at the plutonium facility (TA-55 Building 4) were not inspected because these sampling systems were being upgraded to new systems. These new systems were installed and operational in December 2005. This upgrade process is described in memo ENV-MAQ:04-340, sent to EPA Region 6 on October 25, 2004. A copy of this memo is on the Web at http://www.airquality.lanl.gov/pdf/NESHAP/LA-UR-04-7516.pdf.

Two sampling systems at the LANSCE facility (TA-53 Building 3) were not inspected since that stack was shut down in August and at the time was not expected to restart. That fan has since been restarted in 2006, however, and the system will be back on the inspection list for 2006. It should be noted that this building at LANSCE no longer meets criteria for stack monitoring and will likely be removed formally from the monitoring list in 2006.

The remaining 22 sampling systems were inspected by the Rad-NESHAP team in 2005. One system at the Radioactive Liquid Waste Treatment Facility (TA-50 Building 1) showed signs of visible deposition on the interior surfaces. This system was removed and cleaned in early 2006. Two systems at the Chemical and Metallurgical Research facility showed a buildup of dust on the external surfaces. These systems will be addressed as part of the 2006 inspection cycle. Two other systems in this building showed signs of slight particulate deposition in the nozzles; these stacks will be addressed in 2006. The remaining eighteen sampling systems inspected required no follow-up actions.

In 2005, no radiological material was measured on inspection equipment or cleaning equipment. Therefore, no additions to the source term are required from this pathway for 2005.

The external audit of the Rad-NESHAP program that took place in 2004 had one focus area related to the stack sample system inspection processes. One observation from that audit is EAQ's interpretation that an inspection of the sample system's internal surfaces is sufficient to determine conditions that may affect nozzle performance. The auditor pointed out that in extreme cases, deposition on the external surface of a sampler and nozzle can bias airflow characteristics through the nozzle. While this level of deposition has not been noted at LANL, the intent of the regulation will be met and the external sampler surfaces were inspected along with internal surfaces for the 2005 inspection cycle. Another audit recommendation was to generate a status report each calendar year, documenting the inspections and findings for each year. This will also be implemented for the 2005 and 2006 inspection cycles. A presentation on the audit process was given at the Rad-NESHAP special session of the July 2005 Health Physics Society (HPS) meeting in Spokane.

Section III. Dose Assessment

61.94(b)(7) Description of Dose Calculations

Effective dose equivalent (or dose) calculations for point sources, unmonitored point sources, and non-point gaseous activation products from LANSCE (and TA-18) were performed with the mainframe CAP88 version of AIRDOS. This procedure included using PREPAR to prepare the input file to AIRDOS and using the DARTAB preprocessor to prepare the dose conversion factor input file for DARTAB. The calculations used dose conversion factors taken from the RADRISK database that was distributed along with the CAP88 programs.[7] Verification of the CAP88 code is performed regularly by running the EPA test cases originally distributed with the mainframe version.[8]

Development of Source Term

Tritium emissions

Tritium emissions from the Laboratory's tritium facilities are measured using a collection device known as a bubbler. This device enables the Laboratory to determine not only the total amount of tritium released but also whether it is in the elemental (HT) or oxide (HTO) form. The bubbler operates by pulling a continuous sample of air from the stack, which is then "bubbled" through three sequential vials containing ethylene glycol. The ethylene glycol collects the water vapor from the sample of air, including any tritium that is part of a water molecule (tritium oxide or HTO). After bubbling through these three vials, essentially all the HTO is removed from the air, leaving elemental tritium, or HT. The sample, containing the HT, is then passed through a palladium catalyst that converts the HT to HTO. The sample is pulled through three additional vials containing ethylene glycol, which collects the newly formed HTO. The amount of HTO and HT is determined by analyzing the ethylene glycol for the presence of tritium using liquid scintillation counting (LSC). Although LANL's measurement device can distinguish the presence of HTO from HT, all emissions of tritium are assumed to be HTO for modeling the off-site dose. Because HTO contributes approximately 20,000 times more dose than an equivalent amount of HT, this is a conservative measure, further ensuring that the dose to an off-site receptor is not underestimated.

Tritium emissions from LANSCE do not require monitoring under 40 CFR 61.93(b)(4)(i). The primary source for airborne tritium emissions at LANSCE is activation of water vapor in air and activation and subsequent evaporation of water in the cooling system of beam targets. Because of the low relative contribution of tritium to the off-site dose at LANSCE, formal monitoring for tritium was discontinued after July 2001. However, the tritium emissions for 2005 can be calculated based on the rate of generation measured in 2001. Using these rate-of-generation calculations, the tritium emissions from LANSCE stacks in 2005 were calculated to be about 3 Ci.

Radioactive particle emissions

Emissions of radioactive particulate matter, generated by operations at facilities such as the Chemistry and Metallurgy Research Building and the Plutonium Facility (TA-55), are sampled using a glass-fiber filter. A continuous sample of stack air is pulled through the filter, where small particles of radioactive material are captured. These samples are analyzed weekly using gross alpha/beta counting and gamma spectroscopy to identify any increase in emissions and to identify short-lived radioactive materials. Every six months, LANL composites these stack samples for subsequent analysis at an off-site laboratory. These composite samples are analyzed to determine the total activity of materials such as ^{234}U, ^{235}U, ^{238}U, ^{238}Pu, ^{239}Pu, and ^{241}Am. These data are then combined with estimates of sampling losses and stack and sample flows to calculate emissions. For the case of radionuclides that have short-lived daughters, LANL includes these progeny in the source term. For example, the analytical laboratory measures the parent radionuclide ^{238}U, and its short-lived progeny (^{234}Th and ^{234m}Pa) are assumed to be in equilibrium with ^{238}U.

Vapor form emissions

Vapor emissions, generated by LANSCE operations and by hot-cell activities at CMR and TA-48, are sampled using a charcoal filter or canister. A continuous sample of stack air is pulled through a charcoal filter upon which vaporous emissions of radionuclides are adsorbed. The amount and identity of the radionuclide(s) present on the filter are determined through the use of gamma spectroscopy. This information is then used to calculate emissions. Examples of radionuclides of this type include ^{68}Ge and ^{76}Br.

Gaseous mixed activation products (GMAP)

GMAP emissions resulting from activities at LANSCE are measured using near real-time monitoring data. A sample of stack air is pulled through an ionization chamber that measures the total amount of radioactivity in the sample. Specific radioisotopes are identified through the use of gamma spectroscopy and decay curves. This information is then used to calculate emissions. Radionuclides of this type include ^{11}C, ^{13}N, and ^{15}O.

Summary of Input Parameters

Effective dose equivalents to potential receptors were calculated for all radioactive air emissions from sampled LANL point sources. Input parameters for these point sources are provided in Table 4. The geographic locations of the release points, given in New Mexico State Plane coordinates, are provided in Table 5. The relationships of receptor locations to the individual release points are provided in Table 6. The nearest receptor location is different for each point source. However, because the majority of the yearly dose has historically been caused by LANSCE emissions, the LANSCE critical receptor location has historically been the maximum dose location for all Laboratory emissions. This location is a business approximately 800 m north-northeast of the LANSCE stacks. Emissions and doses from LANSCE are calculated on a monthly basis during beam operations to ensure continued compliance with the 10-mrem/yr standard.

Other site-specific parameters and the sources of these data are provided in Table 7. LANL operates an on-site network of meteorological monitoring towers. Data gathered by the towers are summarized and formatted for input to the CAP88 program. For 2005, data from two different towers were used for the air-dispersion modeling; the tower data that is most representative of the release point is applied. Copies of the meteorological data files used for the 2005 dose assessment are provided in Table 8.

The EAQ Group also inputs population array data to the CAP88 program. The data file represents a 16-sector polar-type array, with 20 radial distances for each sector. Population arrays are developed for each release point using U.S. Census data, updated with annual projections from the New Mexico Bureau of Business and Economic Research. An example of the population array used for the LANSCE facility is provided in Table 9. For agricultural array input, LANL is currently using the default values in CAP88. Finally, the radionuclide inputs for the point sources monitored in 2005 are provided in Table 3.

Public Receptors

Compliance with the annual dose standard is determined by calculating the highest EDE to any member of the public at any off-site point where there is a residence, school, business, or office. Late in CY 2005, a visual tour of the Laboratory vicinity was completed to identify new locations inhabited by the public, that is, new off-site public receptors that had not existed in the year previous to this assessment. Some new businesses and residences were noted in the 2005 tour. In this report, the nearest off-site point is defined to be the area of public inhabitation where the highest off-site dose occurs for a given emissions source. For the 2005 compliance assessment, LANL-wide doses were evaluated at the nearest off-site point for each monitored emissions stack, as well as a number of additional key locations.

Table 4. 40-61(b)(7) User-Supplied Data—Monitored Stack Parameters

ESIDNUM	Height (m)	Diameter (m)	Exit Velocity (m/s)	Nearest Meteorological Tower
03002914	15.9	1.07	8.07	TA-6
03002915	15.9	1.05	23.27	TA-6
03002919	15.9	1.07	22.04	TA-6
03002920	15.9	1.07	17.30	TA-6
03002923	15.9	1.07	23.03	TA-6
03002924	15.9	1.06	7.02	TA-6
03002928	15.9	1.05	21.29	TA-6
03002929	15.9	1.07	24.89	TA-6
03002932	15.9	1.07	15.55	TA-6
03002933	15.9	1.06	26.06	TA-6
03002937	16.8	0.20	11.22	TA-6
03002944	16.5	1.52	8.55	TA-6
03002945	16.5	1.52	8.06	TA-6
03002946	16.5	1.88	6.88	TA-6
03010222	13.4	0.91	0.45	TA-6
16020504	18.3	0.46	21.12	TA-6
21015505	29.9	0.79	9.29	TA-53
21020901	22.9	1.22	11.62	TA-53
48000107	13.4	0.30	20.90	TA-6
48000154	13.1	0.91	6.30	TA-6
48000160	12.4	0.38	6.45	TA-6
50000102	15.5	1.82	11.50	TA-6
50003701	12.4	0.91	5.50	TA-6
50006903	10.5	0.31	5.81	TA-6
53000303	33.5	0.91	10.37	TA-53
53000702	13.1	0.91	9.06	TA-53
55000415	9.5	0.93	7.55	TA-6
55000416	9.5	0.94	11.80	TA-6

Table 5. 40-61(b)(7) User-Supplied Data—Monitored Stack Parameters—NM State Plane Coordinates (NAD '83)

ESIDNUM	Easting	Northing
03002914	1,619,176	1,772,806
03002915	1,619,171	1,772,805
03002919	1,619,252	1,772,350
03002920	1,619,257	1,772,352
03002923	1,618,691	1,772,719
03002924	1,618,686	1,772,718
03002928	1,618,774	1,772,265
03002929	1,618,767	1,772,265
03002932	1,619,268	1,772,267
03002933	1,619,272	1,772,269
03002937	1,618,966	1,772,397
03002944	1,618,987	1,772,121
03002945	1,618,977	1,772,120
03002946	1,618,982	1,772,121
03010222	1,618,354	1,772,074
16020504	1,609,447	1,760,866
21015505	1,633,757	1,774,182
21020901	1,633,991	1,774,175
48000107	1,623,591	1,770,693
48000154	1,623,744	1,770,650
48000160	1,623,613	1,770,638
50000102	1,626,157	1,769,086
50003701	1,625,757	1,769,109
50006903	1,625,579	1,769,065
53000303	1,638,133	1,771,546
53000702	1,638,057	1,771,054
55000415	1,624,870	1,769,742
55000416	1,624,675	1,769,550

Table 6. 40-61(b)(7) User-Supplied Data—Highest Off-Site Dose Location for Monitored Release Points

ESHIDNUM	Associated Meteorological Tower	Distance to LANL Highest Dose Location (m)	Direction to LANL Highest Dose Location
03002914	TA-06	5,981	E
03002915	TA-06	5,983	E
03002919	TA-06	5,969	E
03002920	TA-06	5,967	E
03002923	TA-06	6,130	E
03002924	TA-06	6,132	E
03002928	TA-06	6,116	E
03002929	TA-06	6,118	E
03002932	TA-06	5,966	E
03002933	TA-06	5,965	E
03002937	TA-06	6,054	E
03002944	TA-06	6,055	E
03002945	TA-06	6,057	E
03002946	TA-06	6,057	E
03010222	TA-06	6,249	E
16020504	TA-06	9,799	ENE
21015505	TA-53	1,525	E
21020901	TA-53	1,453	E
48000107	TA-06	4,730	ENE
48000154	TA-06	4,714	ENE
48000160	TA-06	4,733	ENE
50000102	TA-06	4,131	ENE
50003701	TA-06	4,242	ENE
50006903	TA-06	4,297	ENE
53000303	TA-53	800	NNE
53000702	TA-53	944	NNE
55000415	TA-06	4,434	ENE
55000416	TA-06	4,508	ENE

Table 7. 40-61(b)(7) User-Supplied Data—Other Input Parameters

Description	Value	Units	CAP88 Variable Name	Reference
Annual rainfall rate	45.3	cm/y	RR	Bowen (1990)
Lid height	1525	m	LIPO	Holzworth (1972)
Annual median temp	281.9	K	TA	Bowen (1990)
E-vertical temperature gradient	0.02	K/m	TG	EPA (1995)
F-vertical temperature gradient	0.035	K/m	TG	EPA (1995)
G-vertical temperature gradient	0.035	K/m	TG	EPA (1995)
Food supply fraction: local vegetables	0.076		F1V	EPA (1989)
Food supply fraction: vegetable regional	0.924		F2V	EPA (1989)
Food supply fraction: vegetable imported	0		F3V	EPA (1989)
Food supply fraction: meat local	0.008		F1B	EPA (1989)
Food supply fraction: meat regional	0.992		F2B	EPA (1989)
Food supply fraction: meat imported	0		F3B	EPA (1989)
Food supply fraction: milk local	0		F1M	EPA (1989)
Food supply fraction: milk regional	1		F2M	EPA (1989)
Food supply fraction: milk imported	0		F3M	EPA (1989)
Ground surface roughness factor	0.5		GSCFAC	EPA (1989)

Brent M. Bowen, "Los Alamos Climatology," Los Alamos National Laboratory report LA-11735-MS (1990).

George C. Holzworth, "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution throughout the Contiguous United States," U.S. Environmental Protection Agency Office of Air Programs report (1972).

U.S. Environmental Protection Agency, "User's Guide for the Industrial Source Complex (ISC3) Dispersion Models Volume II - Description of Model Algorithms," EPA-454/B-95-003b (1995).

U.S. Environmental Protection Agency, "Risk Assessments Methodology, Environmental Impact Statement,

Table 8. 40-61(b)(7) User-Supplied Data—Wind Frequency Arrays

CAP88 Input Data for 2005 TA-6 Meteorological Tower
(99.0% Data Completeness)

1	1	0.000820.000110.000000.000000.000000.00000
1	2	0.001330.000340.000000.000000.000000.00000
1	3	0.001980.000880.000000.000000.000000.00000
1	4	0.005430.001500.000000.000000.000000.00000
1	5	0.006590.002660.000000.000000.000000.00000
1	6	0.005520.002010.000000.000000.000000.00000
1	7	0.004840.002380.000000.000000.000000.00000
1	8	0.003310.001640.000030.000000.000000.00000
1	9	0.002120.000960.000000.000000.000000.00000
1	10	0.000820.000930.000030.000000.000000.00000
1	11	0.000680.000200.000000.000000.000000.00000
1	12	0.000420.000170.000030.000000.000000.00000
1	13	0.000280.000200.000000.000000.000000.00000
1	14	0.000340.000250.000000.000000.000000.00000
1	15	0.000370.000310.000030.000000.000000.00000
1	16	0.000510.000340.000110.000000.000000.00000
2	1	0.000230.000030.000000.000000.000000.00000
2	2	0.000570.000420.000000.000000.000000.00000
2	3	0.000850.000990.000000.000000.000000.00000
2	4	0.001360.002010.000000.000000.000000.00000
2	5	0.002010.002350.000000.000000.000000.00000
2	6	0.001190.002320.000000.000000.000000.00000
2	7	0.001190.002910.000000.000000.000000.00000
2	8	0.001020.003340.000000.000000.000000.00000
2	9	0.000680.001470.000000.000000.000000.00000
2	10	0.000450.000570.000030.000000.000000.00000
2	11	0.000080.000310.000060.000000.000000.00000
2	12	0.000060.000200.000000.000000.000000.00000
2	13	0.000110.000230.000000.000000.000000.00000
2	14	0.000110.000340.000080.000000.000000.00000
2	15	0.000060.000170.000080.000000.000000.00000
2	16	0.000230.000200.000060.000000.000000.00000
3	1	0.000400.000310.000080.000000.000000.00000
3	2	0.000450.000880.000030.000000.000000.00000
3	3	0.001100.002660.000080.000000.000000.00000
3	4	0.001750.004020.000080.000000.000000.00000
3	5	0.002260.004700.000030.000000.000000.00000
3	6	0.001470.006000.000000.000000.000000.00000
3	7	0.001300.007780.000140.000000.000000.00000
3	8	0.001530.009280.000340.000000.000000.00000
3	9	0.001100.005630.000760.000000.000000.00000
3	10	0.000680.001950.000620.000000.000000.00000
3	11	0.000280.001080.000480.000000.000000.00000
3	12	0.000170.000540.000170.000000.000000.00000
3	13	0.000310.000540.000340.000000.000000.00000
3	14	0.000200.000480.000310.000030.000000.00000
3	15	0.000140.000540.000570.000000.000000.00000
3	16	0.000080.000540.000080.000030.000000.00000
4	1	0.003880.006680.002630.000590.000140.00000
4	2	0.005040.010300.004410.001840.000230.00000
4	3	0.003990.009420.003370.000400.000030.00000
4	4	0.004950.006450.001100.000060.000000.00000

Table 8. 40-61(b)(7) User-Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data for 2005 TA-6 Meteorological Tower
(99.0% Data Completeness) (Cont.)

4	5	0.004810.003230.000230.000000.000000.00000
4	6	0.004640.005180.000540.000030.000000.00000
4	7	0.004950.008660.001730.000110.000000.00000
4	8	0.006030.019360.009930.000230.000000.00000
4	9	0.006310.025220.030650.002860.000030.00000
4	10	0.005690.021250.028550.005210.000170.00000
4	11	0.005150.013240.019160.007020.000740.00003
4	12	0.003990.010070.013440.009030.000820.00011
4	13	0.003880.007640.013730.010730.003450.00020
4	14	0.004160.007020.014860.011570.006370.00260
4	15	0.004440.009740.009930.006110.002180.00011
4	16	0.004050.007020.004870.001700.000110.00000
5	1	0.002070.004100.001160.000000.000000.00000
5	2	0.001730.003710.001580.000000.000000.00000
5	3	0.001190.002010.000480.000000.000000.00000
5	4	0.001270.000680.000000.000000.000000.00000
5	5	0.001500.000340.000000.000000.000000.00000
5	6	0.001050.000400.000000.000000.000000.00000
5	7	0.001270.000960.000060.000000.000000.00000
5	8	0.001700.001670.000060.000000.000000.00000
5	9	0.002580.007920.001730.000000.000000.00000
5	10	0.002750.020430.003480.000000.000000.00000
5	11	0.002010.015680.006740.000000.000000.00000
5	12	0.002600.008910.004920.000000.000000.00000
5	13	0.001980.004050.002460.000000.000000.00000
5	14	0.002120.004240.004980.000000.000000.00000
5	15	0.001950.009030.006250.000000.000000.00000
5	16	0.002690.005720.001500.000000.000000.00000
6	1	0.005740.006760.000420.000000.000000.00000
6	2	0.004160.002150.000060.000000.000000.00000
6	3	0.002690.000680.000000.000000.000000.00000
6	4	0.001300.000060.000000.000000.000000.00000
6	5	0.000650.000030.000000.000000.000000.00000
6	6	0.000910.000060.000000.000000.000000.00000
6	7	0.001080.000060.000000.000000.000000.00000
6	8	0.001730.000080.000000.000000.000000.00000
6	9	0.002180.000760.000000.000000.000000.00000
6	10	0.003370.002860.000000.000000.000000.00000
6	11	0.007270.011890.000310.000000.000000.00000
6	12	0.007810.026690.001360.000000.000000.00000
6	13	0.006990.027510.002320.000000.000000.00000
6	14	0.006590.022920.002860.000000.000000.00000
6	15	0.007810.026520.000960.000000.000000.00000
6	16	0.008120.014570.000450.000000.000000.00000

Table 8. 40-61(b)(7) User-Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data for 2005 TA-53 Meteorological Tower
(99.0% Data Completeness)

1	1	0.001120.000280.000000.000000.000000.00000
1	2	0.002270.000530.000000.000000.000000.00000
1	3	0.004530.001340.000000.000000.000000.00000
1	4	0.006970.003130.000000.000000.000000.00000
1	5	0.005540.003550.000000.000000.000000.00000
1	6	0.004140.003220.000030.000000.000000.00000
1	7	0.003670.002850.000000.000000.000000.00000
1	8	0.003080.002600.000000.000000.000000.00000
1	9	0.001650.001820.000000.000000.000000.00000
1	10	0.001090.001090.000000.000000.000000.00000
1	11	0.000640.000700.000000.000000.000000.00000
1	12	0.000360.000420.000060.000000.000000.00000
1	13	0.000390.000170.000000.000000.000000.00000
1	14	0.000450.000360.000060.000000.000000.00000
1	15	0.000420.000170.000000.000000.000000.00000
1	16	0.000620.000280.000000.000030.000000.00000
2	1	0.000220.000170.000030.000000.000000.00000
2	2	0.000390.000780.000060.000000.000000.00000
2	3	0.001260.001480.000060.000000.000000.00000
2	4	0.001710.003390.000030.000000.000000.00000
2	5	0.001200.003970.000000.000000.000000.00000
2	6	0.000530.002380.000000.000000.000000.00000
2	7	0.000920.001730.000000.000000.000000.00000
2	8	0.000640.002740.000000.000000.000000.00000
2	9	0.000220.001730.000030.000000.000000.00000
2	10	0.000250.000870.000000.000000.000000.00000
2	11	0.000200.000480.000030.000000.000000.00000
2	12	0.000060.000200.000000.000000.000000.00000
2	13	0.000060.000420.000080.000000.000000.00000
2	14	0.000000.000360.000110.000000.000000.00000
2	15	0.000000.000280.000060.000000.000000.00000
2	16	0.000170.000310.000000.000000.000000.00000
3	1	0.000760.000730.000280.000030.000000.00000
3	2	0.000950.001820.000450.000030.000000.00000
3	3	0.001400.004140.000760.000000.000000.00000
3	4	0.001900.007390.000250.000000.000000.00000
3	5	0.001570.006520.000110.000000.000000.00000
3	6	0.000760.004140.000110.000000.000000.00000
3	7	0.000730.004950.000140.000000.000000.00000
3	8	0.000900.006630.000560.000000.000000.00000
3	9	0.000670.005120.000810.000030.000000.00000
3	10	0.000250.002180.000840.000000.000000.00000
3	11	0.000360.001260.000560.000000.000000.00000
3	12	0.000140.000950.001370.000000.000000.00000
3	13	0.000170.000900.001570.000060.000000.00000
3	14	0.000200.000700.001040.000030.000000.00000
3	15	0.000140.000310.000640.000060.000000.00000
3	16	0.000060.000340.000200.000030.000000.00000
4	1	0.006380.009230.006490.001900.000220.00000
4	2	0.006070.012090.008560.002380.000620.00006
4	3	0.005400.009850.003720.000530.000030.00000
4	4	0.004450.007530.002040.000140.000000.00000

Table 8. 40-61(b)(7) User-Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data for 2005 TA-53 Meteorological Tower
(99.0% Data Completeness) (Cont.)

4	5	0.004390.005990.000730.000030.000000.00000
4	6	0.003360.004900.000730.000220.000000.00000
4	7	0.003050.006070.002010.000340.000000.00000
4	8	0.003810.012200.012140.002240.000170.00000
4	9	0.003920.018690.034390.012090.000200.00000
4	10	0.003050.016960.038670.017400.001040.00008
4	11	0.002690.014910.023670.009600.001260.00017
4	12	0.002880.008140.012370.008510.001200.00008
4	13	0.002240.008980.016030.006210.001180.00031
4	14	0.002770.006130.009650.004980.001650.00076
4	15	0.003670.004230.004980.003890.000530.00011
4	16	0.004510.005600.004670.001850.000140.00000
5	1	0.005930.009400.002410.000000.000000.00000
5	2	0.005010.007580.002380.000000.000000.00000
5	3	0.003360.003970.000700.000000.000000.00000
5	4	0.002570.002210.000200.000000.000000.00000
5	5	0.001850.001260.000000.000000.000000.00000
5	6	0.001460.001370.000000.000000.000000.00000
5	7	0.001460.001040.000170.000000.000000.00000
5	8	0.001540.002410.001090.000000.000000.00000
5	9	0.001430.008110.005850.000000.000000.00000
5	10	0.001510.019900.023780.000000.000000.00000
5	11	0.002130.025740.013350.000000.000000.00000
5	12	0.002630.014300.012980.000000.000000.00000
5	13	0.002210.012790.010940.000000.000000.00000
5	14	0.003020.010300.003780.000000.000000.00000
5	15	0.004650.006550.001870.000000.000000.00000
5	16	0.005370.008620.002770.000000.000000.00000
6	1	0.005060.001460.000000.000000.000000.00000
6	2	0.005460.001060.000110.000000.000000.00000
6	3	0.005230.000980.000000.000000.000000.00000
6	4	0.004170.000840.000000.000000.000000.00000
6	5	0.003110.000060.000000.000000.000000.00000
6	6	0.002800.000390.000000.000000.000000.00000
6	7	0.002710.001400.000000.000000.000000.00000
6	8	0.003080.001430.000080.000000.000000.00000
6	9	0.003390.002630.000110.000000.000000.00000
6	10	0.004280.005710.000310.000000.000000.00000
6	11	0.003580.002240.000060.000000.000000.00000
6	12	0.002430.005740.001060.000000.000000.00000
6	13	0.003050.006100.001180.000000.000000.00000
6	14	0.003190.004620.000060.000000.000000.00000
6	15	0.003810.001930.000080.000000.000000.00000
6	16	0.003970.001760.000080.000000.000000.00000

Table 9. 40-61.94(b)(7) User-Supplied Data—Population Array

Estimated 2002 Population within 80 km of Los Alamos National Laboratory

	Distance from TA-53-LANSCE (km)															
Direction	**0.8–1.0**	**1.0–1.5**	**1.5–2.0**	**2.0–2.5**	**2.5–3.0**	**3.0–3.5**	**3.5–4.0**	**4.0–5.0**	**5.0–6.0**	**6.0–7.0**	**7.0–8.0**	**8.0–10**	**10–20**	**20–30**	**30–40**	**40–80**
N	9	17	56	27	53	82	94	139	0	0	0	0	16	97	1003	1483
NNW	7	17	48	230	169	89	257	278	21	0	0	0	8	22	276	492
NW	9	17	21	57	320	384	208	678	415	393	54	0	2	26	53	1076
WNW	0	0	10	15	68	210	819	1047	1866	2613	723	0	0	33	38	3195
W	0	0	0	0	0	0	96	163	0	0	0	0	9	80	356	175
WSW	0	0	0	0	0	0	0	0	0	0	0	2	9	45	493	2909
SW	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	2932
SSW	0	0	0	0	0	0	0	0	0	0	0	35	4	1048	1564	72580
S	0	0	0	0	0	0	0	0	0	0	0	19	7	20	177	3953
SSE	0	0	0	0	0	0	0	0	0	336	220	313	56	349	6351	3057
SE	0	0	0	0	0	0	0	0	0	1546	3305	563	1	1160	81840	9164
ESE	0	0	0	0	0	0	0	0	0	0	0	11	13	788	9029	3085
E	0	0	0	0	0	0	0	0	0	0	2	1	1928	4593	447	490
ENE	0	0	0	0	0	0	0	0	0	0	0	0	2309	5111	3953	3153
NE	7	10	2	0	0	0	0	0	0	0	0	0	1298	15818	2690	6744
NNE	7	17	53	8	38	32	25	24	0	0	0	0	15	2514	413	1047

Starting in CY 2001, LANL began leasing some office buildings and property to parties not directly employed by LANL. One such example is the ICON facility located at TA-46. Another case is the establishment of office and workspace for U.S. Forest Service personnel to be housed on site during periods of increased danger from wildfires. In neither case are these personnel determined to be public receptors. Personnel of this type are considered to be subcontractors to DOE, similar to security guards and maintenance workers. These workers must carry a LANL identification badge and pass through a gate controlled for access by LANL/DOE employees and contractors only. This determination is in compliance with the EPA guidance on leased DOE facilities.[9]

Point Source Emissions Modeling

The CAP88 program was used to calculate doses from both the monitored and unmonitored point sources at LANL. The CAP88 program uses on-site meteorological data to calculate atmospheric dispersion and transport of the radioactive effluents. There are a number of radionuclides monitored in LANL effluents that are not included in the dose factor database used by CAP88.[8] For these radionuclides, such as ^{76}Br, ^{68}Ge, ^{10}C, ^{14}O, and ^{16}N, LANL uses the CAP88 code to calculate airborne concentrations. We then apply exposure-to-dose conversion factors from EPA-approved sources, such as dose conversion factors from U.S. DOE reports[10,11] or EPA's Federal Guidance Reports.[12,13] At the LANL-wide maximum dose location for 2005, the total estimated dose arising from emissions of radionuclides not included in the CAP88 library was about 0.04 mrem. This number is included in the total annual dose. The LANL EAQ Group has informed the regional office of the U.S. EPA of the various steps and methods used to calculate the doses from such radionuclides.[14]

LANSCE Fugitive Emission Modeling

Some of the GMAP created at the accelerator target cells migrate into room air and into the environment. These fugitive sources are continuously monitored throughout the beam-operating period. In 2005, approximately 530 Ci of ^{11}C and 22 Ci of ^{41}Ar were released from LANSCE as fugitive emissions. These sources were modeled as area sources using CAP88 and meteorological data coinciding with the LANSCE run cycle. Fugitive effluents were modeled from three areas at LANSCE. The additional source information is provided in Table 10.

TA-18 Non-Point Emission Modeling

This site consists of a variety of nuclear assemblies that are operated at near-critical conditions. During the near-critical operations, neutrons are generated that in turn activate argon atoms in the air surrounding the assembly. Operations conducted in 2005 were evaluated for their potential to create ^{41}Ar gas. In 2005, there were no operations that resulted in the generation of ^{41}Ar. Additional source information is provided in Table 10.

Other Non-Point Sources

In 2005, there were two additional diffuse source releases. One case was the release of tritium from four waste drums at TA-46 that were opened for characterization and sorting of contents and repacking. A hand-held tritium ionization chamber "sniffer" was used to sample the air within each drum at the time of opening. Based on the readings collected, the total amount of tritium released from the four drums was estimated to be 0.1 Ci. The resulting maximum potential dose to a member of the public was calculated to be about 2×10^{-6} mrem.

Table 10. 40-61.94(b)(7) User-Supplied Data—Modeling Parameters for LANL Non-Point Sources

LANL Air Activation Sources

Source	Radionuclide	Emission (Ci)	Area of Source (m^2)	Distance to LANL Maximum Dose Location (m)	Direction to LANL Maximum Dose Location
TA-53 Switchyard	^{41}Ar	1.42e+00	484	774	NNE
	^{11}C	3.42e+01	484	774	NNE
TA-53-1L Service Area	^{41}Ar	8.72e+00	1.0	943	NNE
	^{11}C	2.09e+02	1.0	943	NNE
TA-53-Isotope Production	^{41}Ar	1.20e+01	na*	1,230	NE
	^{11}C	2.89e+02	na*	1,230	NE
TA-18	^{41}Ar	none	31,400	3,894	NNE

*Emissions from this source are released via a small ventilation stack.

Another case of a diffuse release occurred when three bottles containing chemicals that were potentially explosive were rendered safe at the TA-49 burn site that is operated by LANL's Emergency Management and Response Team. The bottles of chemicals were destroyed via a detonation burn in a "burn box" (which is designed for this type of destruction). One of the three bottles was known to contain a trace amount of Am-241. Based on radiological measurements of the bottles, the estimated airborne release from this event was about 1×10^{-8} Ci of Am-241. The resulting maximum potential dose to a member of the public was calculated to be about 2×10^{-5} mrem.

In both of these cases, the diffuse emissions were the type that could be measured by the AIRNET system. However, since specific release information is known for these releases, they are included here for completeness.

Environmental Data

The net annual average ambient concentration of airborne radionuclides measured at 18 air sampling stations (Figure 4) is calculated by subtracting an appropriate background concentration value. The net concentration at each air sampler is converted to the annual EDE using Table 2 of Appendix E of 40 CFR 61 and applying the valid assumption that each table value is equivalent to 10 mrem/yr from all appropriate exposure pathways (100% occupancy assumed at the respective location).[15] Dose assessment results from each air sampler are given in Table 11. The operational performance and analytical completeness of each air sampler is provided in Table 12.

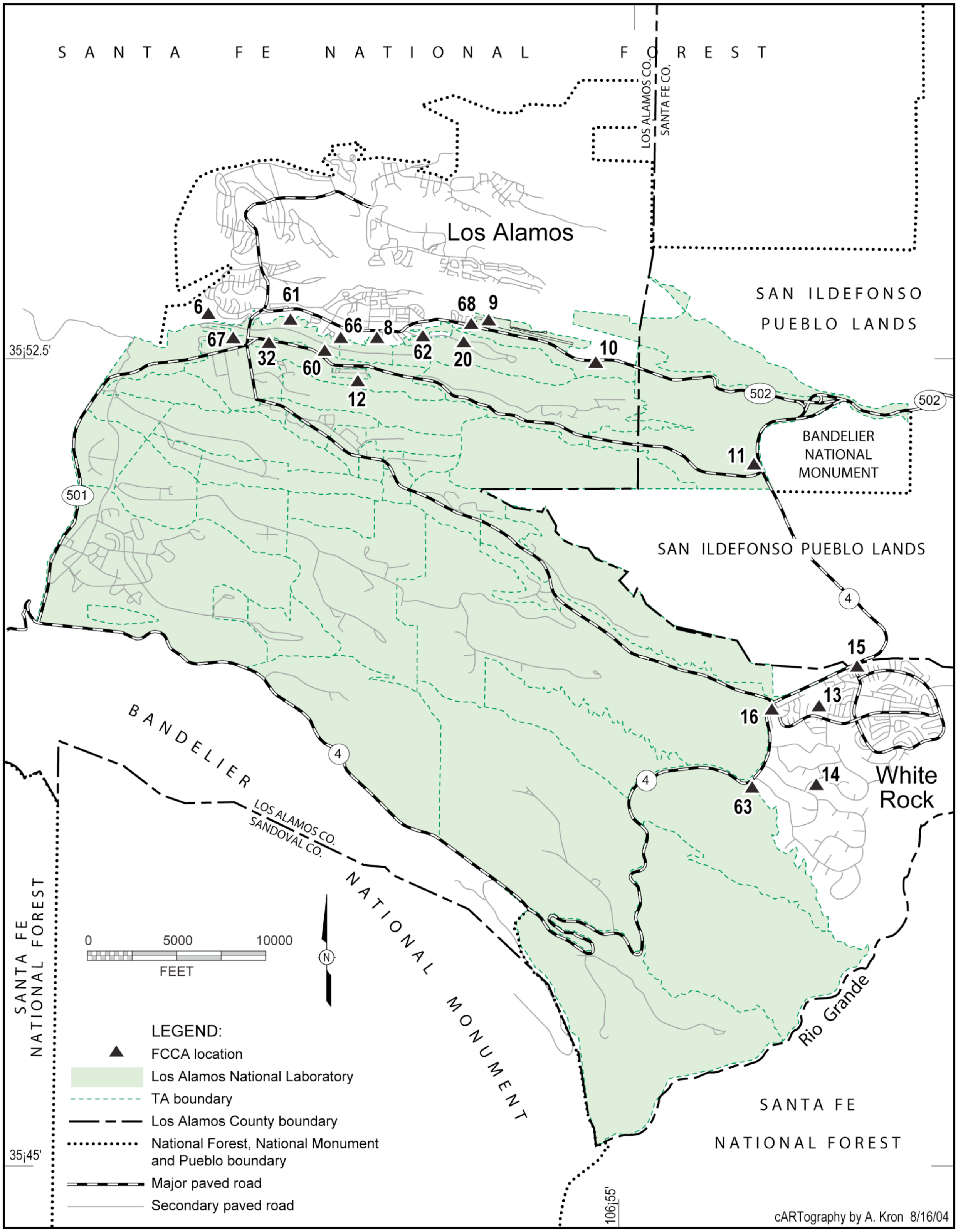

Figure 4. Locations of air sampling stations used for non-point source compliance.

Table 11. Environmental Data—Compliance Stations: 2005 Effective Dose Equivalent (net in mrem) Measured at Air Sampling Locations Around LANL

Site Number and Name		H-3	Am-241	Pu-238	Pu-239	U-234	U-235	U-238	Rounded Total (mrem)
06	48th Street	0.007	0.002	0.001	–0.002	0.000	0.000	0.000	0.01
08	McDonalds	0.013	0.001	0.001	0.002	0.008	0.001	0.009	0.03
09	Los Alamos Airport	0.030	0.003	0.000	0.006	0.006	0.001	0.007	0.05
10	Eastgate	0.024	–0.003	–0.002	0.002	0.008	0.002	0.008	0.04
11	Well PM-1 (East. Jemez)	0.011	0.005	–0.001	–0.003	0.002	0.002	0.003	0.02
12	Royal Crest Trailer Court	0.013	0.003	0.001	–0.004	0.006	0.003	0.007	0.03
13	Rocket Park	0.016	–0.002	–0.002	0.002	0.002	0.001	0.001	0.02
14	Pajarito Acres	0.008	–0.003	0.002	0.006	0.000	0.001	0.000	0.01
15	White Rock Fire Station	0.010	–0.002	0.002	–0.001	0.001	0.000	0.001	0.01
16	White Rock Nazarene Ch.	0.024	0.000	–0.001	0.000	0.006	0.002	0.001	0.03
20	TA-21 Area B	0.028	0.023	0.001	0.237	0.074	0.008	0.031	0.40
32	County Landfill	0.012	–0.003	0.000	–0.001	0.049	0.006	0.051	0.11
60	LA Canyon	0.007	–0.002	–0.001	0.002	0.004	0.002	0.001	0.01
61	LA Hospital	0.008	0.001	0.000	0.001	0.010	0.001	0.008	0.03
62	Crossroads Bible Church	0.015	0.001	0.000	0.001	0.013	0.002	0.014	0.05
63	Monte Rey South	0.006	–0.003	–0.001	–0.001	0.001	0.001	0.002	0.01
66	Los Alamos Inn - South	0.012	–0.004	–0.001	0.079	0.005	0.001	0.005	0.10
67	TA-3 Research Park	0.011	0.002	0.002	0.002	0.009	0.003	0.016	0.04
68	Los Alamos Airport Road	0.024	0.006	–0.003	0.010	0.007	0.002	0.008	0.05

Table 12. Environmental Data—Compliance Stations: 2005 Analytical Completeness and Air Sampler Operation Summary

Site Number and Name		Percent Analytical Completeness							Percent Run Time
		H-3	Am-241	Pu-238	Pu-239	U-234	U-235	U-238	
06	48th Street	96.2	100	100	100	100	100	100	99.6
08	McDonalds	96.2	100	100	100	100	100	100	99.5
09	Los Alamos Airport	96.2	100	100	100	100	100	100	99.0
10	Eastgate	96.2	100	100	100	100	100	100	98.5
11	Well PM-1 (East. Jemez)	96.2	100	100	100	100	100	100	99.6
12	Royal Crest Trailer Court	96.2	100	100	100	100	100	100	99.6
13	Rocket Park	96.2	100	100	100	100	100	100	99.6
14	Pajarito Acres	96.2	100	100	100	100	100	100	98.2
15	White Rock Fire Station	96.2	100	100	100	100	100	100	99.6
16	White Rock Nazarene Ch.	96.2	100	100	100	100	100	100	99.6
20	TA-21 Area B	96.2	100	100	100	100	100	100	99.0
32	County Landfill	96.2	100	100	100	100	100	100	99.6
60	LA Canyon	92.3	100	100	100	100	100	100	99.6
61	LA Hospital	96.2	100	100	100	100	100	100	99.6
62	Crossroads Bible Church	96.2	100	100	100	100	100	100	99.1
63	Monte Rey South	96.2	100	100	100	100	100	100	99.2
66	Los Alamos Inn - South	96.2	100	100	100	100	100	100	98.3
67	TA-3 Research Park	96.2	100	100	100	100	100	100	99.8
68	Los Alamos Airport Road	96.2	100	100	100	100	100	100	99.0

LANSCE Monthly Assessments

The EAQ Group evaluates and reports the dose from short-lived radioactive gases released from LANSCE on a monthly basis. The monthly dose values are evaluated with the actual meteorology for the month. These doses are shown in Table 13. For 2005 the EAQ Group also evaluated the total LANSCE emissions for the year with run-cycle meteorology and compared the results to the monthly values summed for the calendar year; the values for these two assessments were 6.44 and 6.05 mrem, respectively. The values would not be expected to match, but should show satisfactory agreement between each other. We used the values from the monthly sum (6.05 mrem) in the calculation of the total dose since it is a more accurate estimation of the dose from GMAP emissions.

Highest EDE Determination

A major change to the procedure for determining the highest EDE was necessary for CY 1999 because of significantly reduced emissions from the LANSCE facility. Over the nine years prior to 1999, the off-site EDE from LANSCE operations averaged about 5 mrem. For 1999, the highest off-site EDE from the LANSCE facility was about 0.01 mrem. The highest off-site EDE location for LANSCE effluents is a business in the East Gate area (2470 East Gate Drive). Because the contribution from LANSCE for 1999 was greatly reduced, the location of the highest off-site dose was not as readily established as had been in the past.

In late 1999, LANL began working on a plan to ensure that the location of the highest public dose could be determined. This plan uses a multistep approach, and the steps used were presented to the local Citizens' Advisory Board (CAB) for LANL for their review and comment. This approach was approved by the CAB for CY 1999 and has since been used in all subsequent dose assessments. Table 14 shows the sites identified by LANL for the purposes of finding the location of the highest off-site dose. Also shown in the table is the AIRNET sampling station that the EAQ Group associated with the selected public receptor location. The LANL-wide doses at these various off-site locations are provided in Table 14. The highest off-site dose location was determined to be the East Gate area because of increased emissions from LANSCE in 2005 as compared to the 1999 emissions.

61.92 Compliance Assessment

The highest effective dose equivalent to any member of the public at any off-site point where there is a residence, school, or business was 6.46 mrem for radionuclides released by LANL in 2005. This dose was calculated by adding up the doses for each of the point sources at LANL, the diffuse and fugitive gaseous activation products from LANSCE, and the dose measured by the ambient air sampler in the vicinity of the public receptor location. The compliance assessment also includes a potential dose contribution of about 0.1 mrem from unmonitored stacks. Because the emissions estimates do not account for pollution control systems, the actual dose will be significantly less for the unmonitored point sources. Also, this dose includes a minor contribution from radionuclides not included in CAP88. Table 15 of this report provides the compliance assessment summary. The location of the off-site point of highest EDE for 2005 was a business at 2470 East Gate Drive; this location is the same as the location of the previous year's assessment.

Table 13. LANSCE Monthly Assessments and Summary

Description	ESIDNUM	Dose at East Gate Receptor
LANSCE-stack-January	53000303	3.05E-05
LANSCE-stack-February	53000303	5.89E-05
LANSCE-stack-March	53000303	3.49E-05
LANSCE-stack-April	53000303	6.75E-05
LANSCE stack-May	53000303	6.61E-05
LANSCE stack-June	53000303	4.77E-05
LANSCE stack-July	53000303	9.55E-05
LANSCE stack-August	53000303	3.13E-06
LANSCE stack-September	53000303	na
LANSCE-stack-October	53000303	na
LANSCE-stack-November	53000303	na
LANSCE-stack-December	53000303	na
LANSCE-stack-PVAP*	53000303	3.06E-05
LANSCE-stack-January	53000702	1.13E-03
LANSCE-stack-February	53000702	4.14E-02
LANSCE-stack-March	53000702	6.98E-02
LANSCE-stack-April	53000702	3.25E-01
LANSCE stack-May	53000702	3.60E-01
LANSCE stack-June	53000702	1.41E-01
LANSCE stack-July	53000702	9.91E-02
LANSCE stack-August	53000702	8.68E-01
LANSCE stack-September	53000702	1.15E+00
LANSCE-stack-October	53000702	1.81E+00
LANSCE-stack-November	53000702	1.10E+00
LANSCE-stack-December	53000702	8.12E-02
LANSCE-stack-PVAP*	53000702	7.71E-04
LANSCE-Non-CAP88 Radionuclides*	53000702	3.96E-02
LANSCE-Fugitive Emissions - Switchyard	530003sy	2.92E-02
LANSCE-Fugitive Emissions - 1L Area	5300071L	1.21E-01
LANSCE-Fugitive Emissions - IP	530007IP	7.40E-02
LANSCE Summary		**6.31E+00**

*Annual Value

Table 14. Effective Dose Equivalent at Selected Public Locations

	Location	Easting	Northing	Nearest Airnet Location	AIRNET Number	Air Pathway EDE (mrem)*
1	Residence in White Rock	1,654,280	1,756,910	WR Fire Station	15	5.59E–02
2	Residence Near Urban Park	1,618,400	1,780,000	48^{th} Street	06	2.50E–02
3	Residence on Fairway Drive	1,618,602	1,776,052	48^{th} Street	06	3.00E–02
4	Los Alamos Apts Trinity Drive	1,623,890	1,775,900	Los Alamos Inn-S	66	1.44E–01
5	Los Alamos McDonald's	1,626,450	1,775,350	LA McDonald's	08	1.11E–01
6	Los Alamos Airport	1,632,902	1,776,247	Los Alamos Airport	09	3.98E–01
7	Tsankawi Visitor Center	1,648,105	1,758,380	Well PM-1	11	3.62E–01
8	Royal Crest Trailer Court - West	1,624,256	1,773,065	Royal Crest Tlr. Crt.	12	9.14E–02
9	Royal Crest Trailer Court - East	1,625,778	1,772,955	Royal Crest Tlr. Crt.	12	1.13E–01
10	Residence near WR Rocket Park	1,651,950	1,755,300	Rocket Park	13	6.39E–02
11	Residence in Pajarito Acres	1,650,770	1,750,520	Pajarito Acres	14	5.47E–02
12	White Rock Fire Station	1,653,580	1,756,630	WR Fire Station	15	5.77E–02
13	White Rock Nazarene Church	1,648,778	1,754,676	WR Nazarene Ch.	16	9.32E–02
14	Bandelier Fire Lookout	1,635,700	1,739,005	Bandelier†	17	2.37E–02
15	Residence on Nambe Loop	1,621,568	1,776,046	Airport Road	68	3.09E–01
16	Ponderosa Campground	1,608,575	1,758,460	TA-49†	26	9.44E–02
17	County Landfill Office	1,620,569	1,774,763	County Landfill	32	1.44E–01
18	Los Alamos Ice Rink	1,617,852	1,775,692	LA Canyon	60	3.40E–02
19	Los Alamos Hospital	1,620,200	1,776,300	LA Hospital	61	5.65E–02
20	Crossroads Bible Church	1,629,200	1,776,000	Cross. Bible Church	62	1.70E–01
21	Residence on Monte Rey South	1,647,976	1,750,376	Monte Rey South	63	4.57E–02
22	Los Alamos Inn	1,624,450	1,775,300	Los Alamos Inn-S	66	1.50E–01
23	Research Park	1,618,300	1,774,600	TA-3 Research Park	67	6.79E–02
24	Business on DP Road	1,630,445	1,775,350	TA-21 Area B	20	5.89E–01
25	Business at East Gate (NNE sector)	1,638,825	1,774,097	East Gate	10	6.46E+00
26	Residence at East Gate (N sector)	1,638,616	1,774,231	East Gate	10	4.60E+00
27	Business at East Gate (NE sector)	1,640,230	1,774,090	East Gate	10	4.01E+00

* Note, to allow for more meaningful comparisons, these doses do not include the estimated contribution from unmonitored point sources.

† Note, these samplers are not part of the regular NESHAPs compliance network for LANL.

Table 15. Highest Effective Dose Equivalent Summary

ESIDNUM	Description	Dose for Release Site Receptor	Dose at East Gate Receptor
03002914	CMR Stack	2.28E–06	1.91E-07
03002915	CMR Stack	2.55E–06	2.76E-07
03002919	CMR Stack	1.04E–04	1.00E-05
03002920	CMR Stack	2.02E–05	1.88E-06
03002923	CMR Stack	1.53E–04	1.47E-05
03002924	CMR Stack	1.47E–03	1.09E-04
03002928	CMR Stack	5.89E–05	7.53E-06
03002929	CMR Stack	none	none
03002932	CMR Stack	none	none
03002933	CMR Stack	4.11E–06	4.18E-07
03002937	CMR Stack	4.12E–08	3.34E-09
03002944	CMR Stack	5.69E–06	5.69E-07
03002945	CMR Stack	2.17E–07	2.16E-08
03002946	CMR Stack	5.89E–07	5.89E-08
03002946	CMR Stack non-CAP88 radionuclides	3.40E–05	3.40E-06
03010222	Shops Addition Stack	5.18E–07	3.11E-08
16020504	WETF Stack	1.57E–02	2.08E-03
18000001	TA-18 Diffuse Emissions	none	none
21015505	TSTA Stack	9.43E–03	5.10E-03
21020901	TSFF Stack	2.76E–03	1.59E-03
48000107	Radiochemistry Stack	2.13E–06	2.24E-07
48000107	Radiochemistry Stack/non-CAP88 radionuclides	8.00E–03	8.00E-04
48000154	Radiochemistry Stack	7.46E–07	7.29E-08
48000160	Radiochemistry Stack	2.56E–08	2.49E-09
48000160	Radiochemistry Stack/non-CAP88 radionuclides	2.75E–05	2.50E-06
50000102	Waste Management Stack	none	none
50003701	Waste Management Stack	none	none
50006903	Waste Management Stack	1.14E–06	2.59E-07
53000303	LANSCE-Stack-Annual	4.35E–04	4.35E-04
530000sy	LANSCE Fugitive Emissions-Switch Yard	2.92E–02	2.92E-02
53000702	LANSCE-Stack-Annual	6.05E+00	6.05E+00
53000702	LANSCE-Stack/non CAP88 radionuclides	3.96E–02	3.96E-02
5300071L	LANSCE Fugitive Emissions-1L Service Area	1.21E–01	1.21E-01
530003IP	LANSCE Fugitive Emissions-Isotope Production	7.66E–02	7.40E-02
55000415	Plutonium Facility Stack	1.29E–05	1.96E-06
55000416	Plutonium Facility Stack	3.52E–03	7.04E-04
99000000	Unmonitored Stacks-gross	1.00E–01	1.00E-01
99000010	Air-Sampler Net Dose	3.90E–02	3.90E-02
	Total	**6.49E+00**	**6.46E+00**

Section IV. Constructions and Modifications

61.94(b)(8) Constructions, Modifications, and 61.96 Activity Relocations

A brief description of constructions and modifications that were completed and/or reviewed in 2005 but for which the requirement to apply for approval to construct or modify was waived under 61.96 is normally provided here. The EAQ Group for LANL/DOE maintains the documents developed to support the waiver. We are providing additional information on other Rad-NESHAP activities noteworthy for 2005.

In August and September 2005, radiochemical separation experiments using Technetium-99 (Tc-99) took place in TA-53, Building 15. This project resulted in potential radionuclide air emissions being released for the first time from this building, designated stack 53001599. The process consisted of thermal decomposition, oxidation, and reduction of ammonium pertechnetate to produce technetium oxide. For these experiments, it was conservatively assumed that 100% of all radioactive Tc-99 was released. The uncontrolled off-site dose was modeled using CAP88 and estimated to be 1.7E-04 mrem/yr. If experiments continue in 2006, the maximum uncontrolled dose from activities could increase to approximately 1.4E-03 mrem/yr. This type of radiochemical separation is existing and ongoing at LANL; this notification is provided to address first-time radiological emissions from this building.

Section V. Additional Information

This section is provided pursuant to DOE guidance and is not required by Subpart H reporting requirements.

Unplanned Releases

During 2005, the Laboratory had no instances of increased airborne emissions of radioactive materials that required reporting to the EPA. There were no instances of an unplanned event.

Environmental Monitoring

An extensive environmental monitoring network is operated at LANL, which includes several environmental monitoring stations located near the LANSCE boundary inhabited by the public. Measurement systems at these stations include thermoluminescent dosimeters, continuously operated air samplers, and in situ high-pressure ion chambers. The combination of these measurement systems allows for monitoring of radionuclide air concentrations and the radiation exposure rate. Results for air sampling are published here; results for all monitoring data are published in the Annual Site Environmental Surveillance Report for DOE order compliance.

Other Supplemental Information

- 80-km collective effective (population) dose equivalent for 2005 airborne releases: 2.5 person-rem
- Compliance with Subparts Q and T of 40 CFR 61—Radon-222 Emissions

  These regulations apply to ^{222}Rn emissions from DOE storage/disposal facilities that contain by-product material. "By-product material" is the tailings or wastes produced by the extraction or concentration of uranium from ore. Although this regulation targets uranium mills, LANL has likely stored small amounts of by-product material used in experiments in the TA-54 low-level waste facility, Area G; this practice makes the Laboratory subject to this regulation. Subject facilities cannot exceed an emissions rate of 20 pCi/m^2 s of ^{222}Rn. In 1993 and 1994, LANL conducted a study to characterize emissions from the Area G disposal site.[16] This study showed an average emission rate of 0.14 pCi/m^2 s for Area G. The performance assessment for Area G has determined that there will not be a significant increase in ^{222}Rn emissions in the future.[17]

- Potential to exceed 0.1 mrem from LANL sources of ^{222}Rn or ^{220}Rn emissions: not applicable at LANL
- Status of compliance with EPA effluent monitoring requirements as of June 3, 1996: LANL came into compliance with EPA effluent monitoring requirements.

61.94(b)(9) Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. See 18 U.S.C. 1001.

Signature: ____ Date: ________________

Edwin L. Wilmot, Owner
Manager
Los Alamos Site Office
National Nuclear Security Administration
U.S. Department of Energy

Signature: ____ Date: ________________

R.S. Watkins, Operator
Associate Director
Environment, Safety, Health and Quality Division
Los Alamos National Security, LLC, successor to the University of California as of June 1, 2006
Los Alamos National Laboratory

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