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2014 LANL Radionuclide Air Emissions Report

Department of Energy Report

Site Name:	Los Alamos National Laboratory
Location:	County of Los Alamos, New Mexico

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Compliance Assessment:

2014 Off-Site Effective Dose Equivalent: 0.24 mrem

Executive Summary

This report describes the emissions of airborne radionuclides from operations at Los Alamos National Laboratory (LANL) for calendar year 2014, and the resulting off-site dose from these emissions. This document fulfills the requirements established by the National Emissions Standards for Hazardous Air Pollutants in 40 CFR 61, Subpart H – Emissions of Radionuclides other than Radon from Department of Energy Facilities, commonly referred to as the Radionuclide NESHAP or Rad-NESHAP. [1] Compliance with this regulation and preparation of this document is the responsibility of LANL's Rad-NESHAP compliance program, which is part of the Environmental Protection Division. The information in this report is required under the Clean Air Act and is being submitted to the U.S. Environmental Protection Agency (EPA) Region 6.

The highest effective dose equivalent (EDE) to an off-site member of the public was calculated using procedures specified by the EPA and described in this report. LANL's EDE was 0.24 mrem for 2014. The annual limit is 10 millirem per year, established by the EPA in 40 CFR 61 Subpart H. All measured air emissions are modeled to a single location, dubbed the Maximally Exposed Individual (MEI).

During calendar year 2014, LANL continuously monitored radionuclide emissions at 28 "major" release points, or stacks. The Laboratory estimates emissions from an additional 55 "minor" release points using radionuclide usage source terms in lieu of stack monitoring. Also, LANL uses an EPA-approved 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. From these measurement systems, a comprehensive evaluation is conducted to calculate the MEI dose for the Laboratory.

The MEI can be any member of the public at any off-site location where there is a residence, school, business, or office. In 2014, this MEI location was a business at 95 Entrada Drive, located in the eastern end of Los Alamos town site. The primary contributor to the off-site dose at this location was diffuse emissions from the LANSCE accelerator complex. Overall, the MEI dose in 2014 is similar to levels in recent years, excluding the elevated releases associated with the remediation of legacy waste disposal at Materials Disposal Area B (MDA-B) in 2011, as described in that year's annual report. Doses reported to the EPA for the past 10 years are shown in Table E1.

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[1] U.S. Environmental Protection Agency, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities," *Code of Federal Regulations*, Title 40, Part 61.90, Subpart H, 1989.

Table E1. Ten-Year Summary of Rad-NESHAP Dose Assessment for LANL

Year	EDE (mrem)	Highest EDE Location
2005	6.46	2470 East Road ("East Gate")
2006	0.47	Los Alamos Airport Terminal
2007	0.52	DP Road, Airnet Station 326
2008	0.55	2470 East Road ("East Gate")
2009	0.55	2470 East Road ("East Gate")
2010	0.33	2201 Trinity Drive, Airnet Station 257
2011	3.53	278 DP Road, Airnet Station 317
2012	0.58	2201 Trinity Drive, Airnet Station 257
2013	0.21	2101 Trinity Drive, Airnet Station 324
2014	0.24	95 Entrada Drive

2014 Noteworthy Events

Several events that took place in 2014 are worth discussion in this Executive Summary; they are divided into Radionuclide NESHAP programmatic events, dealing with execution of the compliance program at LANL, and facility operational events, pertaining to changes at LANL's air emissions sources.

Radionuclide NESHAP programmatic events:

EPA Site Visit to LANL. In August 2014, the Regional Health Physicist for EPA Region 6 visited LANL. Focus areas of the visit included the upcoming pre-construction application for the new Radioactive Liquid Waste Treatment Facility (see below) and the planned modifications to the Laboratory's ambient air monitoring program, Airnet. The representative toured the current RLW facility and discussed the planned facility. He also toured the proposed sites for new ambient air monitoring locations at Bandelier National Monument and around the Laboratory perimeter. He also reviewed dose calculations for LANL diffuse sources and made recommendations for station siting. These changes were incorporated into the updated Airnet program, discussed below. A summary of the EPA site visit[2] was written and submitted to Region 6 in August 2014.

[2] LA-UR-14-26781, Summary of LANL Site Visit by EPA Region 6. August 28, 2014.

Changes to the Airnet ambient air monitoring program. The 2013 emissions report discussed plans to update the ambient air monitoring program at LANL. These changes were initiated in 2014, with the bulk of the changes taking place in early 2015. First on the list was the shutdown of Station 169 at the entrance to Technical Area 21. This station required shutdown due to planned demolition work in the summer of 2014. Notifications were made to EPA Region 6, and approvals received in May 2014. Since other existing Airnet stations are well suited to measure any radionuclide air concentrations at public locations in this area, there was no direct replacement for Station 169.

A review of LANL diffuse sources[3] was performed by ENV Division and presented to EPA Region 6 during the August site visit. This review comprehensively looked at all significant diffuse sources at the Laboratory, both current and likely near-term sources, and evaluated public receptor doses in every compass sector to evaluate Airnet station siting needs. The Region 6 representative provided suggestions to the plan, and gave preliminary approval of the changes in August 2014. The plan was finalized in late 2014, with the formal proposal submitted to EPA Region 6 in November 2014.[4] Written approval was received in January 2015.

Under this new plan, ten existing Airnet stations have or will be shut down; nine new stations have or will be started up. The majority of these changes are simply relocation of existing stations to locations which will better evaluate dose consequences from any LANL diffuse emissions to present-day public receptors in the surrounding communities. Other changes were driven by LANL administrative operations; e.g., the desire to move stations off of private property and onto land owned by the Department of Energy or Los Alamos County. Other changes made in this plan clarify the operational uptime of the Airnet program (minimum of 90% for any compliance station, and 95% or more for the entire program). More information is provided in the approved ambient air monitoring plan.

General policy & administrative changes. There were four general policy changes submitted to EPA Region 6 and approved in 2014. The first dealt with peer review of electronically uploaded data; this requirement to validate electronically uploaded data has been in place since the 1990s, when data management programs were not as mature as they are now. In current operations,

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[3] LA-UR-14-27873, "Dose Assessment of Diffuse Sources at Los Alamos National Laboratory (Rev. 1)." David Bruggeman, Jean Dewart, and David Fuehne, ENV-CP. Final version published October 21, 2014.

[4] ENV-DO-15-0046, "Update to the Ambient Air Sampling Network (Airnet) at LANL." Anthony Grieggs, LANL ENV-CP, to George Brozowski, EPA Region 6, February 17, 2015. LA-UR-15-21001.

electronically delivered data is standard practice by analytical laboratories. There has never been an error identified by the peer review in over 15 years of performing such evaluation, and to streamline operations, the requirement was removed. The second policy change was the manner of handling stack flow rates from the LANSCE facility. Most LANL stacks use a three-year maximum flow rate for calculating emissions and an annual average flow rate for determining off-site dose consequence. These assumptions result in conservative estimates of both emissions and public dose. The TA-53 LANSCE stacks used actual measured flow for both calculations, which is slightly more accurate but more problematic to implement. To streamline operations and ensure consistent, conservative calculations, the LANSCE facility is now treated like all other LANL stacks for stack flow management. Notifications of these two changes were made to EPA Region 6 in May 2014, with EPA's acknowledgement of receipt later in the month. No formal approval is required.

Another change involved the tritium stack performance testing process. The current process of injecting a known amount of tritium into stacks and measuring the response of the tritium sampler is no longer considered "As Low As Reasonably Achievable" (ALARA) given the very low nature of LANL's current tritium operations. Rather, these instruments are now tested via benchtop, resulting in the ability to easily identify and isolate any issues with the sampler. The installed stack system is visually inspected annually, similar to other LANL emissions sources. This change was proposed to EPA Region 6 in an October 2014 letter[5] and approved in November 2014. The benchtop tests began in late 2014, with visual inspections starting in the 2015 calendar year inspection cycle.

The final program change concerned inspection methods at the LANSCE facility. Safety and access issues were identified with the methods used in 2013 and prior; these were discussed with EPA Region 6 during a site visit in November 2013. At that time, the representative from Region 6 gave approval for a new process to perform these system inspections from the ground level, using a long flexible videoscope. This inspection via videoscope was successfully performed in 2014 at the LANSCE facility, and LANL is evaluating other sites where such a test could be performed to simplify operations and still meet regulatory requirements.

[5] Memo ENV-DO-14-0335, Request for EPA Approval: Alternative Method for Stack Inspections on Tritium-Emitting Stacks. Anthony Grieggs, LANL ENV-CP, to George Brozowski, EPA Region 6, October 29, 2014. LA-UR-14-0335.

Changes at LANL Emissions Sources

Changes at TA-55-400, RLUOB. The Radiological Laboratory/Utility/Office Building (RLUOB) at TA-55 Building 400 is the first phase of the Chemistry & Metallurgy Research – Replacement (CMRR) facility. EPA Region 6 approved construction of the facility and its potential emissions in 2005, based on the Pre-Construction Application[6] submitted at that time. In late 2013, the planned scope of operations changed, and this was communicated in a letter[7] to EPA Region 6 in late 2013. The change to the operational scope at RLUOB is related to the radionuclide inventory of the facility.

As described in the 2013 report, the Department of Energy issued a guidance document[8] for implementation of DOE Technical Standard 1027. This guidance, dubbed SD 1027G, changed the allowable inventory limits for radionuclides in different categories of DOE facilities. RLUOB is adopting these revised inventory from SD 1027G; this guidance raises the allowable inventory from 8.6 grams of plutonium-239 (or equivalent) up to 38.6 grams of plutonium-239 (or equivalent). Other radionuclide limits changed as well, with the inventory limit for some radionuclides increasing and others decreasing. The anticipated impacts of the SD 1027G changes on the Radionuclide NESHAP compliance program were documented in an assessment[9] which was finalized in early 2014. A draft of this assessment was discussed with Region 6 in late 2013, and the final version was transmitted to Region 6 during the August 2014 site visit. For the inventory changes at RLUOB, no dose impacts are anticipated since the total annual throughput amounts approved in the original Pre-Construction Application are still bounding values for the facility. The new limits will be offset by conducting fewer than predicted operations in the facility.

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[6] LA-UR-05-3912, Application for Pre-Construction Approval for Compliance with 40 CFR 61 Subparts A and H (Radionuclide NESHAP). Chemistry and Metallurgy Research – Replacement Facility; Radiological Laboratory / Utility / Office Building (RLUOB). Susan Terp, David Fuehne, Jackie Hurtle. Transmitted via memo ENV-MAQ:05-173, June 10, 2005.

[7] ENV-DO-13-0337, Notification of Operational Scope Change at the RLUOB, TA-55-400. Anthony Grieggs, LANL ENV-CP, to George Brozowski, EPA Region 6, December 17, 2013. LA-UR-13-29481.

[8] Department of Energy (DOE) Supplemental Guidance NA-1 SD G 1027, "Guidance on Using Release Fraction and Modern Dosimetric Information Consistently with DOE Standard 1027-92," November 2011. Commonly referred to as SD 1027G. Provides updates to original document DOE Technical Standard 1027, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports," December 1992, Change Notice No. 1, September 1997.

[9] LA-UR-13-28472 (Rev. 2), Evaluation of DOE Technical Standard 1027 and Supplemental Guidance NA-1 SD G 1027. Examining Radionuclide NESHAP Impacts and Off-Site Dose Consequences. David Fuehne, January 28, 2014.

Construction on the RLUOB was completed in 2012, and the building has been managed as an active source of emissions since that time. However, the facility has been outfitting its laboratory spaces since the end of construction, and radioactive material was not introduced into the building until September 2014. Notification of the commencement of radiological operations within RLUOB was sent via letter[10] to EPA Region 6 in September 2014. While the initial post-startup notification occurred in 2012 as the stack fan and sampling system came on-line, this second notification of radiological operations was made for completeness. In discussion about this change, EPA Region 6 acknowledged that the special notification requirements established in their Approval of the Pre-Construction Application are complete, and recommended that RLUOB be treated as all other LANL active sources. Notifications and communications regarding scope changes and other modifications will be handled per regulatory requirements in 40 CFR 61, Subpart H.

Approved Pre-Construction Application for the new Radiological Liquid Waste Treatment Facility. A major focus of regulatory interest in 2014 was the proposed new treatment facility for low-level radioactive liquid waste. This new facility will be an upgrade/replacement for the existing RLWTF at TA-50 Building 1. The facility, proposed engineering controls, potential air emissions, and resulting dose consequences were discussed at length during the August 2014 site visit by EPA Region 6. The final Application for Pre-Construction Approval[11] was submitted to EPA Region 6 in November 2014, with approval received on January 14, 2015. Construction commenced on January 28, 2015.

It should be noted that much of the attention on the RLWTF upgrade project in 2014 resulted from negotiations between LANL and the State of New Mexico regarding the groundwater discharge permit for the proposed facility, with special focus on the evaporation of treated liquid effluent. Evaporation of treated water takes place by either a mechanical evaporation system (called the MES) which uses a fuel-fired boiler, or at a pair of solar evaporation tanks (called the SET) which relies on natural evaporation. Both of these systems

[10] ENV-DO-14-0251, Notification of Actual Start of Radiological Operations at Technical Area 55, Building 400. Anthony Grieggs, LANL ENV-CP, to George Brozowski, EPA Region 6. September 3, 2014. LA-UR-14-26882.

[11] LA-UR-14-27898 (Rev. 1), Application for Pre-Construction Approval under 40 CFR 61 Subparts A and H for Radiological Liquid Waste Treatment Facility for Low Level Liquid Waste Streams (RLWTF-LLW). David Fuehne and Marjorie Stockton, November 5, 2011. Transmitted by memo ENV-DO-14-0319, November 18, 2014.

and operations were discussed in previous Rad-NESHAP annual reports. Since these systems will evaporate treated liquid effluent, the potential off-site dose consequence of these operations is extremely small. A summary[12] of the assessments of these two evaporation systems was delivered to EPA Region 6 in late 2013. This document and several legacy communications regarding evaporation of radioactive liquid waste were included in a response to a Freedom of Information Act (FOIA) request from late 2013; this information was compiled by Rad-NESHAP personnel and delivered to the LANL document office in January 2015 and then onto the requesting non-government organization later in the year.

Construction of new TRU Waste Facility. In August 2014, LANL broke ground on a new transuranic (TRU) waste processing facility. This facility is intended to provide additional waste characterization capability, supplementing and eventually replacing existing LANL operations. The facility will perform headspace gas analysis and radiography of waste drums to characterize drum contents and ensure that waste acceptance criteria established by receiving facilities are met. The LANL Rad-NESHAP program reviewed plans for this facility and its operation, and determined that based on the work scope, neither advance notification to EPA Region 6 nor emissions monitoring are warranted. The potential effective dose equivalent (PEDE) for this facility is less than 0.1 millirem, and no proposed operation represents a source of radionuclide air emissions. Construction continues in 2015, and operations are planned to commence in 2016. When this facility becomes operational, it will be included in the annual EPA report as a “less than 0.1 millirem” exemption. The operations and potential emissions from this facility will be tracked in the annual Radioactive Materials Usage Survey (RMUS).

New sources at TA-53, LANSCE. In 2014, two new sources were identified at the Los Alamos Neutron Science Center (LANSCE) accelerator facility. The first is a diffuse source at the Isotope Production Facility (IPF) building. During testing of an improved air emissions detection system on the IPF stack, LANL workers measured trace radioactive gases in the high bay area around the IPF target and in the equipment aisle and high bay area above the IPF beam tunnel. This radioactive air is the result of migration of beam tunnel air through drains and cable penetrations up into worker occupied spaces, and then vented to the environment as a

[12] LA-UR-13-29271 (Rev. 1), Radionuclide NESHAP Evaluation of Evaporation of Treated Effluent from the Radioactive Liquid Waste Treatment Facility at LANL TA-50. David Fuehne, Marjorie Stockton, and Rebecca Clark, December 11, 2013. Sent via email to EPA Region 6 on December 20, 2013.

diffuse/non-point source. A series of measurements were made late in the run cycle; use of these data points, when extrapolated over the entire run cycle, results in a conservative estimate of air emissions from this source. These emissions are estimated at 99 curies of mixed radioactive gases, corresponding to 0.083 mrem to the maximally exposed off-site receptor. As a result, this building is the dominant emissions source for calendar year 2014, representing about a third of the LANL total off-site dose. We intend to document this source more systematically during the 2015 run cycle for a more realistic assessment. The source, designated 53DIF984 (TA-53, diffuse source from Building 984) is included in the diffuse source assessment in this report.

The second new source at LANSCE is associated with the Weapons Neutron Research facility, Target 4. A portion of the main ion beam line is steered south into Line D; the ion beam can then be delivered to different combinations of the Proton Storage Ring, the 1L Target at the Lujan Neutron Scattering Center, or the WNR facility targets 2 or 4. Air emissions from all these areas are either directly or indirectly vented through the monitored stack at LANSCE Building 7, designated 53000702 (TA-53, Building 7, Exhaust Stack 2). Air from around the WNR Target 4 is normally exhausted by vacuum pump into the WNR Target 2 area, which in turn is exhausted by the ES-2 fan. However, workers discovered a crack in the vacuum pump discharge line in late 2014, so air from Target 4 was being discharged directly to the atmosphere. To account for these emissions, we start with the total ES-2 stack emissions, and scaled them down by a ratio corresponding to the beam delivery to the WNR facility relative to the total beam delivery to all Line D areas targets as measured at 53000702. This is a conservative estimate of emissions, since not all WNR beam is delivered to the Target 4 area. This source is designated 53036899 (TA-53, Building 0368, the WNR Target 4 pump house, no stack number = 99). This is a point source (forced air discharge) and is included in the 2014 Radioactive Materials Usage Survey. In 2014, total emissions from 53036899 are estimated to be 0.67 curies, corresponding to 0.0003 mrem off-site. LANL will continue to track this source in the RMUS until all piping is fixed.

<u>Cessation of stack monitoring at TA-50 Building 37</u>. Building 37 at TA-50 was originally planned to be a radioactive waste incinerator, and stack monitoring was initiated long ago to support this effort. However, the waste incineration program was never started, and other radiological operations never took long-term hold in the building. The only reason for ongoing emissions measurements was a legacy contaminated duct section. In September 2013, this contaminated duct was removed from the building as part of a transition to strictly non-

radiological operations for the building. Emissions sampling continued through the first half of 2014. With no measureable air emissions on the stack sampler, no source term remaining in the building, and no radiological operations to support, stack sampling ceased in September 2014.

Radiological releases at WIPP and subsequent LANL responses. The radiological release at the Waste Isolation Pilot Plant (WIPP) has been described in detail in other reports.[13] Of interest to this document is LANL's response to the incident and the increased air monitoring around TA-54. The WIPP release was traced to a drum of LANL origin containing remediated nitrate-salt-bearing waste, and several other similar drums are still on-site at LANL. These drums were moved into the PermaCon process structure within TA-54 Dome 375, which is equipped with filtered, monitored air exhaust and active fire suppression systems. Drums containing unremediated nitrate-salt-bearing waste were stored in the PermaCon structure within Dome 231, similarly equipped with filtered and monitored air exhaust and active fire suppression systems. The EPA compliance monitor at each dome was supplemented by real-time continuous air monitoring systems, with instruments located in and around these two domes. LANL also operates high-volume air samplers in TA-54, White Rock, and Los Alamos. The real-time monitoring systems and high-volume air samplers are not part of the EPA compliance program, but do represent defense-in-depth to rapidly detect and evaluate any release from waste drums stored at TA-54.

[13] Accident Investigation Report, Phase 2; Radiological Release Event at the Waste Isolation Pilot Plant, February 14, 2014. U. S. Department of Energy, Office of Environmental Management, April 2015.

2014 LANL Radionuclide Air Emissions Report

Abstract

The emissions of radionuclides from Department of Energy Facilities such as Los Alamos National Laboratory (LANL) are regulated by the 1990 Amendments to the Clean Air Act, National Emissions Standards for Hazardous Air Pollutants (40 CFR 61 Subpart H). These regulations established an annual dose limit of 10 mrem to the maximally exposed member of the public attributable to emissions of radionuclides from LANL. This document describes the emissions of radionuclides from LANL and the dose calculations resulting from these emissions for calendar year 2014, meeting reporting requirements established in the regulations. For 2014, the effective dose equivalent received by the maximally exposed individual member of the public was 0.24 millirem.

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 illustrates the Laboratory's location with respect to the nation, state, and county.

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, stockpile stewardship, nonproliferation, magnetic and inertial fusion, nuclear fission, nuclear safeguards and security, isotope production, and laser isotope separation. There is also research in the areas of physics, chemistry, and biology.

The primary facilities involved in the emissions of radioactivity are outlined in this section. The facility locations are designated by technical area and building and shown in Figure 2. For example, the facility designation TA-3-29 is Building 29 at Technical Area (TA-) 3. Potential radionuclide release points are listed in Table 1, with supporting information in later tables and in Section II of this report. Some of the sources described below are characterized as non-point (diffuse and fugitive) emissions. Off-site doses resulting from non-point emissions of radioactive particles and tritium oxide (tritiated water vapor or HTO) are measured and calculated using LANL's ambient air sampling network (Airnet).

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 particulate or vapor activation products (P/VAP).

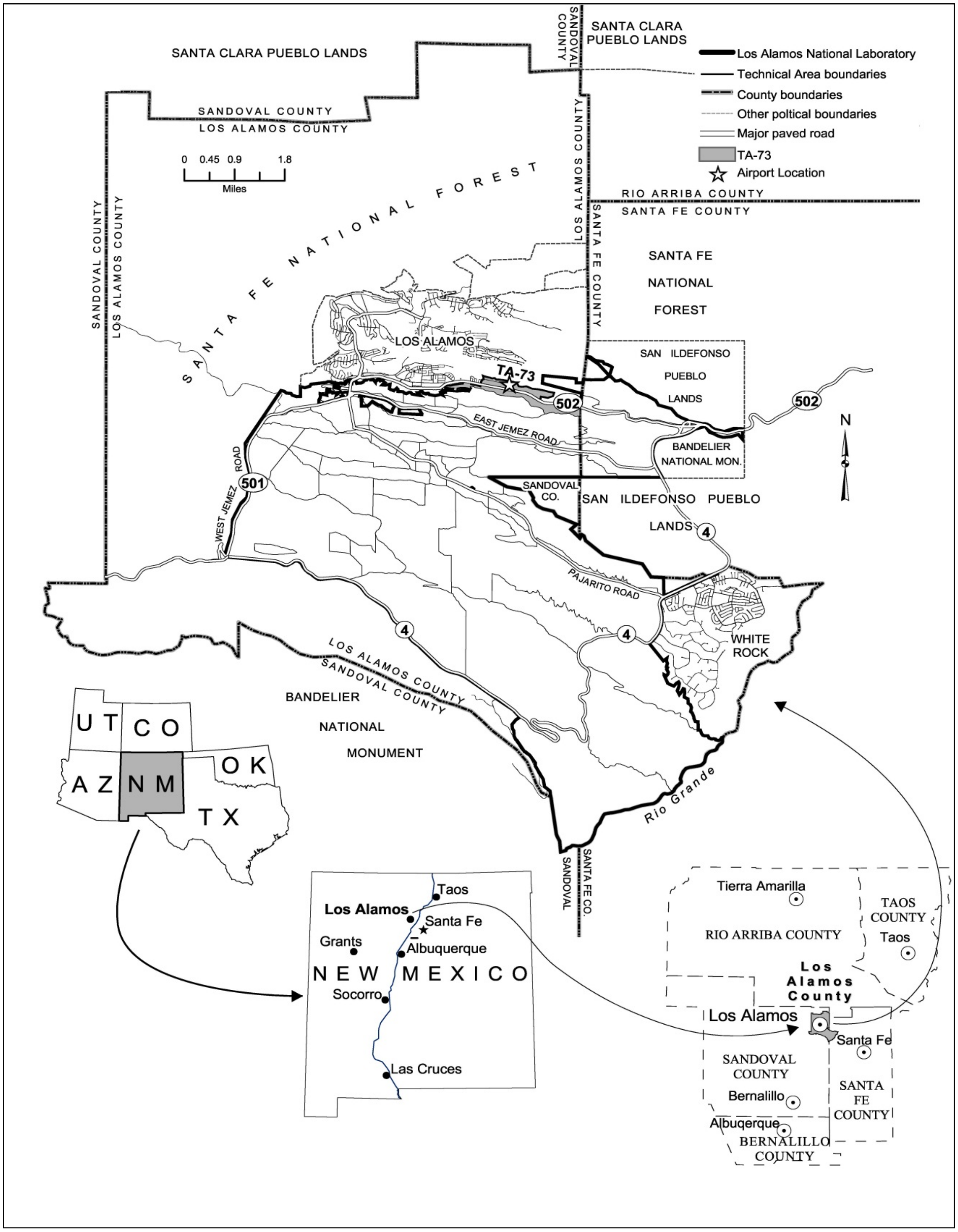

Figure 1. Location of Los Alamos National Laboratory.

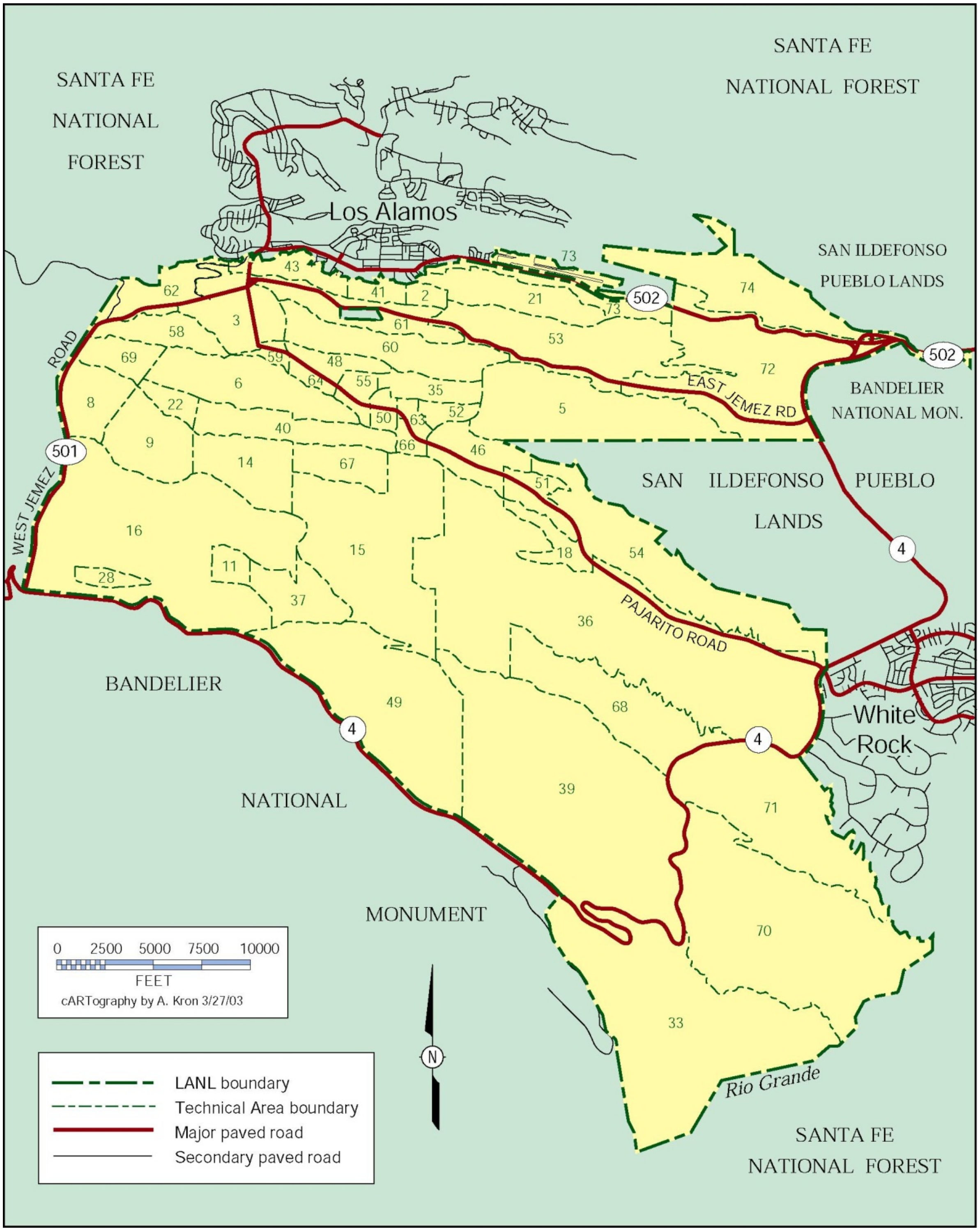

Figure 2. Los Alamos National Laboratory technical areas by number.

The radionuclides emitted from monitored point sources at LANL in calendar year 2014 are listed in Table 2. Tritium is released as either tritiated water vapor (called HTO) or elemental tritium gas (HT). Plutonium-239 can also contain Pu-240; the two isotopes are virtually indistinguishable by alpha spectroscopy, but have similar off-site dose conversions. GMAP emissions include ^{41}Ar, ^{11}C, ^{13}N, and ^{15}O. Various radionuclides such as ^{197m}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

LANL technical areas and operations summaries are listed below. Additional descriptions of LANL technical areas can be found in the annual site Environmental Report for LANL.[14] More thorough descriptions of LANL operations can be found in the Annual Site-Wide Environmental Impact Statement Yearbooks, the most recent being published for 2013.[15] A complete list of non-monitored sources and activities is found in the Radioactive Materials Usage Survey (RMUS), described in the next section.

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 and 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. As mentioned in prior years' reports, work is being consolidated from six wings down to just three wings; these three wings will remain active until approximately 2019, when operations are planned for phase-out in this facility. In late 2012, one stack fan was shut down (ES-37) and the associated sampling system turned off. In the coming year, an operations review of some wings at CMR will be performed to determine the need for ongoing stack sampling from these wings.

TA-3-66: The TA-3-66 Sigma facility is used for a variety of nuclear materials work. Primary materials are metallic and ceramic radionuclides, including depleted uranium. The uranium foundry is located in this building. In recent years research and development work with low-enriched uranium (LEU) fuels used in research reactors has been performed in this facility. The stacks at Sigma are considered "minor" sources under 40 CFR 61 Subpart H and are not monitored.

TA-3-102: This machine shop is used for the metalworking of radioactive materials, primarily depleted uranium. The monitored stack at this facility (ES-22) was shut down in 2011; only minor

[14] Los Alamos National Laboratory, "Environmental Report 2013," ERID-261879, September 2014.
[15] Los Alamos National Laboratory, "SWEIS Yearbook - 2013," LA-UR-15-22755, May 2015.

operations are performed in this facility, and these operations do not meet requirements for a monitored stack.

TA-3-1698: This facility is 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. Small amounts of radioactive materials are used in experiments on materials properties (e.g., stress/strain measurements).

TA-15 and TA-36: These facilities conduct open-air explosive tests involving depleted uranium and weapons development testing. One building, TA-36-99, houses a "gas gun" focused explosive experiment that is ventilated through a non-monitored stack.

TA-15-312: This is the Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility. DARHT conducts high-explosive-driven experiments to investigate weapons functions and behavior during nonnuclear tests using advanced radiography. Starting in 2007, explosive operations at DARHT are conducted in containment vessels. Use of these vessels virtually eliminates air emissions from these operations. Following explosive operations, containment vessels undergo cleanout in building 15-534 and if needed, repair in building 15-285. Both of these latter two buildings are non-monitored point sources, tracked in the RMUS.

TA-16-205 and -450: This is the Weapons Engineering Tritium Facility (WETF). Buildings 205 and 450 were specifically designed and built to process tritium safely. The operations at WETF are divided into two categories: tritium processing and activities that support tritium processing. Examples of tritium-processing operations include repackaging of tritium into different 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. WETF operations have historically been housed in building 205, while building 450 was built for other tritium activities. Expansion of WETF into building 450 began in 2007. As part of this expansion, exhaust ducts were reconfigured so that emissions from TA-16-205 were routed into the TA-16-450 ES-05 stack. Therefore, the TA-16-205 stack ES-04 is discontinued as a point source and TA-16-450 ES-05 is the emissions point source for both buildings. The older emissions sampling system for building 205 is located in the exhaust duct coming out of building 16-205, and this system remains operational and able to measure emissions from that building. The new stack sampling system in stack ES-05 was certified to measure emissions from building 450, whenever that portion of the complex becomes active. This system will also measure emissions from building 205 operations, but was not certified for these operations under ANSI/HPS N13.1-1999 criteria. As discussed in the 2009 emissions report, the ES-05 stack monitor experienced technical problems, and its operations were discontinued in June 2009. Since significant tritium operations have not commenced in 16-450, this stack system is not needed for compliance purposes. Reported emissions for 2014 are measured with the 16-205 duct monitor, but exhausted through and modeled from the 16-450 ES-05 stack.

TA-21: The great majority of buildings at this decommissioned radiochemistry site have been decontaminated and demolished. The tritium operations in TA-21 were relocated in 2006 to other LANL sites, primarily WETF. In 2009, demolition of office and support buildings began. Radiological process buildings were demolished in 2010, and only isolated structures remain at TA-21. Final remediation of these structures, building foundations, subsurface equipment, and legacy disposal areas will take place in coming years. The plans for these operations were discussed with EPA Region 6 during the August 2014 site visit. The MDA-B legacy waste disposal site is also considered part of TA-21. Excavation of MDA-B was completed in 2011; removal of excavation structures was achieved in late 2012.

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

TA-48: The principal activities carried out in this facility are radiochemical separations and hot cell operations supporting the medical radioisotope production program, the Yucca Mountain program, nuclear chemistry experiments, and geochemical and environmental research. These separations involve nanocurie to curie 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. Besides the hot cell operations, the building also houses the Actinide Research Facility and includes the other radiochemical operations described above. Building 1 at TA-48 contains the majority of operations, exhausted through three monitored stacks and several non-monitored stacks. Smaller (non-monitored) operations take place in other buildings around TA-48-1. Building 1 of TA-48 was the first to adopt SD 1027G radionuclide inventory thresholds as described in the 2013 annual report and earlier in this document. While a larger number of isotope processing operations may theoretically result in increased air emissions, this was not noted in 2014.

TA-50-1: This waste management site consists of an industrial low-level radioactive liquid waste treatment facility, RLWTF. Transuranic liquid waste is also treated in this building. The building has one monitored stack (ES-2) and other smaller non-monitored point sources. Two small cooling towers described in the 2010 executive summary had been used for non-radiological purposes in the past. These cooling towers operated briefly to evaporate treated radiological effluent from RLW in 2010 but have not operated since 2010, and that practice has been discontinued. A new fuel-fired evaporator (described in the 2011 report) started radiological operations in 2011 and is being tracked as a non-monitored source. Use of solar evaporative tanks for evaporation of treated effluent have been built but their operations have not commenced.

TA-50-37: Currently there are no operations involving radioactive material in this building; plans for future radiological operations have not come to fruition. Stack sampling took place due to legacy contamination issues. In September 2013, potentially contaminated ventilation duct components were removed to eliminate sources of emissions from this building. Emissions measurements continued through June 2014. With no detectable emissions in the first half of 2014 and no radiological operations or source term present, the monitoring system was shut down in late September 2014. The building is now used exclusively for non-radiological operations.

TA-50-69: This waste management site consists of a waste characterization, reduction, and repackaging facility. Waste drums are repackaged for on-site or off-site disposal. There is one monitored stack, ventilating the primary drum processing glove box, and three non-monitored sources at this building.

TA-53: This technical area houses the Los Alamos Neutron Science Center (LANSCE), a linear particle accelerator complex. There are two monitored stacks (on buildings TA-53-3 and TA-53-7) and several sources tracked in the non-monitored stacks program. 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, the Weapons Neutron Research (WNR) facilities, the Proton Radiography facility, and the high-intensity beam line (Line A). The facility accelerates protons and H- ions to energies 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, but most operations take place at beam currents of 120 microamperes or less. 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.

As a by-product of accelerator operations, cooling water can contain trace amounts of radionuclides. Two solar evaporative tanks were constructed and began operation in 1999 to evaporate this wastewater from the accelerator. Evaporation of water from these open-air tanks can result in a diffuse source of airborne tritium and other particulates. To support other Laboratory operations, these tanks can be used for evaporation of water from other LANL facilities.

In 2004, the Isotope Production Facility (IPF) began operations as part of the LANSCE facility. IPF uses a portion of the LANSCE beam to irradiate a variety of targets for different medical research and treatment uses. After irradiation, targets are processed at LANL hot cells at TA-48 or CMR. IPF has two stacks which are managed as part of the minor (non-monitored) source program.

In 2014, two new sources were identified at the LANSCE facility. The first is a diffuse source at the IPF building. An improvement to the air emissions detection system resulted in measurements of trace radioactive gases in the high bay area around the IPF target and in the equipment aisle above the IPF beam tunnel. This air is the result of migration of beam tunnel air through drains and cable penetrations up into worker occupied spaces, and then vented to the environment as a diffuse/non-point source. A series of measurements were made late in the 2014 run cycle; use of these data points, extrapolated over the entire run cycle, results in a conservative estimate of air emissions from this source.

The second new source is from the WNR facility, Target 4. Air from around the WNR Target 4 is normally exhausted by vacuum pump into the WNR Target 2 area, which in turn is exhausted by the Building 7 stack fan. However, the vacuum pump discharge line was discovered to be cracked in late 2014, so all air from Target 4 was released directly to the atmosphere. To account for these emissions, the total Building 7 stack emissions are scaled down by a ratio corresponding to the relative ion beam delivery to the WNR facility vs the total beam delivery to all Building 7 targets. This is a conservative estimate of emissions, since not all WNR beam is delivered to the Target 4 complex.

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. Waste characterization and processing operations also take place at TA-54 to prepare waste for shipment to the Waste Isolation Pilot Plant (WIPP). Shipments of transuranic waste for disposal at WIPP began in 1999. Characterization work includes analysis of headspace gases and radiography of waste drum contents; processing includes sorting, segregating, size-reduction, and repackaging of waste.

MDA G at TA-54 is also a known source of diffuse emissions of tritium vapor and direct radiation from above-ground storage of radioactive waste. Resuspension of soil contaminated with low levels of plutonium/americium has also created a diffuse source. Point sources at Area G include operations involving characterization, processing, or repackaging of waste containers. Two new monitored point sources came on-line in 2010, at Building 412 and Dome 231. These two sources are waste processing facilities, where drums are repackaged, inspected, and otherwise prepared for off-site disposal. The Dome 231 processing facility was expanded in 2012 to increase throughput capacity of the dome. In March 2014, a new building (Dome 375) began radiological operations to process larger waste containers. Non-monitored (minor) sources of emissions at TA-54 include drum characterization work at Building 33 and Dome 224, and air sample management work outside of Area G in Building 1001.

Note that after the WIPP radiological release in February 2014 was tracked back to a waste drum originating at LANL, air monitoring around TA-54 was increased. Drums which contained waste similar to that in the drum involved in the WIPP release were isolated in Dome 375. Other waste drums of concern were stored at Dome 231. Other waste management and waste processing activities at TA-54 were greatly reduced during 2014, in response to the WIPP event and subsequent operational reviews at LANL.

TA-55-4: Building 4 of the Plutonium Facility (PF-4) provides a pit manufacturing capability and continues the role of providing the capability for research and development applications in chemical and metallurgical processes for recovering, purifying, and converting plutonium and other actinides. A wide range of activities (e.g., heating, dissolution, forming, and welding of special nuclear materials) are also conducted. Additional activities include investigating the means to safely ship, receive, handle, and store nuclear materials and to manage wastes and residues from TA-55. Limited-scope tritium operations also take place in certain areas of TA-55. Building 2 of TA-55 houses associated support facilities for operations in PF-4, including the radiological sample analysis laboratory. Operations from this laboratory are tracked as part of LANL’s non-monitored source program.

TA-55-400. Building 400 at TA-55 is the Radiological Laboratory / Utility / Office Building (RLUOB), the first phase of the project to replace capabilities in TA-3 Building 29. A Congressionally approved line-item project may eventually include a nuclear facility to replace remaining capabilities from TA-3 Building 29. Design of a CMR Replacement (CMRR) nuclear facility was underway but the Administration announced its intent to delay construction for at least five years. RLUOB is designed to perform materials characterization work and actinide chemistry research. While the RLUOB stack became active in November 2012, radiological operations did not commence until late 2014.

Section II. Air Emissions Data

61.94(b)(4) Point Sources

Monitored and non-monitored release points at LANL are listed in Table 1. The point sources are identified using an eight-digit identification number for each exhaust stack (StackID); 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 emissions control systems used on the release points. More information on these emissions control systems appear below.

In addition to the 28 monitored ("major") point sources, 55 non-monitored ("minor") release points in 39 LANL buildings are included in Table 1. Under 40 CFR 61.93(b)(4)(i), sampling of these minor release points is not required because each release point has a potential effective dose equivalent (PEDE) of less than 0.1 mrem/year at the critical receptor. However, in order to verify that emissions from non-monitored point sources remain low, LANL conducts periodic confirmatory measurements in the form of the annual *Radioactive Materials Usage Survey for Unmonitored Point Sources*.[16] The purpose of this survey is to collect and analyze radioactive materials usage and process information for the non-monitored point sources at LANL. In alternate years, the survey is expanded to review monitored sources and ensure proper emissions monitoring is taking place at these facilities. For 2014, the most significant minor sources were analyzed, the evaluated sources were those designated "Tier III" whose potential emissions exceed 0.001 millirem but fall below the 0.1 millirem per year threshold at which continuous monitoring is required. A full description of which sources are analyzed in each year is included in the referenced RMUS report.

The distance between each of the release points and the critical receptor is provided in Table 1. The critical receptor can be a residence, school, business, or office. In this report, the critical receptor is defined as the member of the public (at a fixed structure location) most likely impacted by a given release point. Air dispersion modeling is taken into account to determine the most critical receptor location; the nearest public receptor is not always the critical receptor if the nearest location is upwind from a source.

In compliance with 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 non-monitored point sources. Estimated PEDEs are calculated by modeling these emissions estimates using EPA-approved CAP88 dose modeling software. For 2014, Version 4 of CAP88-PC was used to determine offsite dose consequence from LANL emissions sources. 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.[17]

[16] R. Sturgeon, "2014 Radioactive Materials Usage Survey for Unmonitored Point Sources." ENV-CP internal memo, pending final publication at time of report development.
[17] LANL Procedure, "Air Quality Reviews," P408, January 2014.

Non-point Sources

There are a variety of non-point sources within the 111 km^2 of land (43 square miles) 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, evaporative tanks and basins, 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. Additionally, LANL considers a building to be a non-point source if there is no active process exhaust (e.g., no fume hood, glove box, etc.); no forced air exhaust to the environment; or is equipped with only standard heating/ventilating/air conditioning systems (e.g., occupational comfort cooling or heating).

LANL determines the potential impacts of non-point sources by measuring air concentrations of significant radionuclides at ambient air-sampling sites at locations of public receptors surrounding the Laboratory and at selected locations on Laboratory property. This network of ambient air sampling stations is called Airnet. The LANL Airnet system was originally approved for use in monitoring LANL's non-point radioactive air emission sources in 1996.[18] Based on the original methodology approved by EPA, additional procedures were developed to identify when new Airnet stations were required to assure continued compliance with the Radionuclide NESHAP.[19,20] As described earlier in this document, modifications to LANL's ambient air monitoring program were proposed in 2014, and approved by EPA Region 6 in early 2015. This updates the siting of Airnet stations to reflect current LANL operations and the locations of public receptors, and also updates other operational parameters of the Airnet program. The overall intent and general operational scope of the program remains unchanged, to measure air concentrations of significant LANL radionuclides at public locations.

[18] U.S. Environmental Protection Agency, *Federal Register*, Vol. 60, No. 107, June 5, 1995.
[19] LANL Procedure ESH-17-238, R0, "Evaluating New Diffuse Sources and New Receptors for AIRNET Coverage," December 2001.
[20] Letter to Mr. George Brozowski, Radiation Program Manager, Environmental Protection Agency from Mr. Steve Fong, Office of Environment, Department of Energy, May 11, 2001.

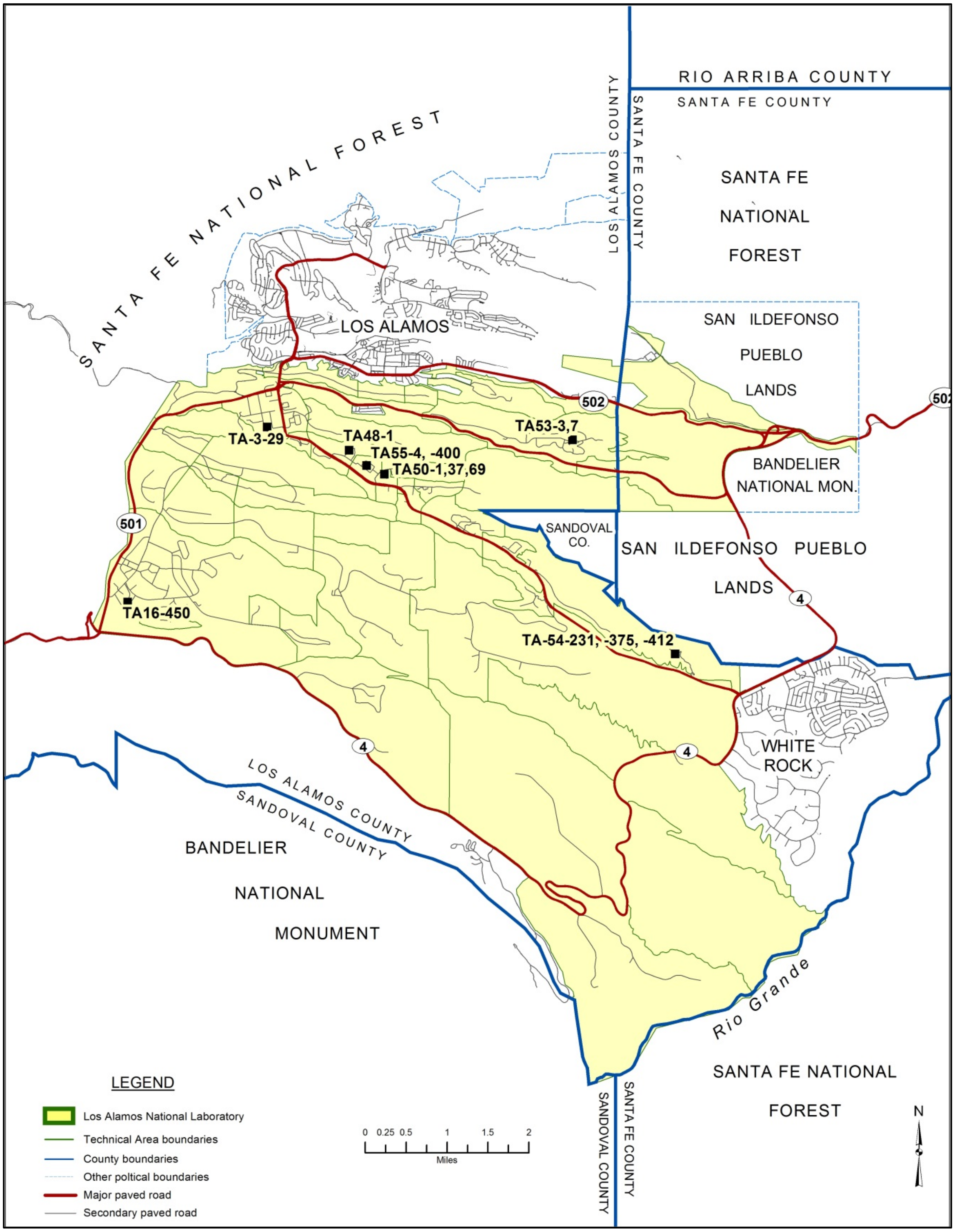

Figure 3. Location of facilities with continuously operated stack-sampling systems for airborne radionuclide emissions.

Radionuclide Emissions

Table 2 lists the radionuclides released from monitored point sources, along with the annual emissions in curies for each radionuclide. For a source with no detectable emissions, the term "none" appears in the radionuclide column. Extensive notes appear at the end of the source term table. A map showing the general locations of the facilities continuously monitored for radionuclide emissions is shown in Figure 3.

Emission Controls

The most common type of filtration for emission control purposes at LANL is the high-efficiency particulate air (HEPA) filter, as noted in Table 1. HEPA filters are constructed of sub-micrometer glass fibers that are pressed and glued into a compact, paper-like, pleated media.

At LANL, each HEPA filter system on active operational sources is tested at least once every 12 months. The nominal performance criteria for HEPA filter systems are a maximum penetration of 5×10^{-4} for one stage (99.95% removal) and maximum penetration of 2.5×10^{-7} for two stages in series (99.999925% removal). In these quoted values, filter penetration and percent removal are defined below.

$$\text{Penetration} = (\text{downstream concentration}) / (\text{upstream concentration})$$

$$\text{Removal} = [1 - (\text{penetration})] * 100\%$$

Note that in recent years, changes to HEPA filter testing methods and equipment at LANL have resulted in limitations in the ability to certify very high levels of aerosol removal. Therefore, LANL is now only certifying filters at the "single stage" penetration & removal criteria, regardless of the number of filter bank stages installed at the facility. Table 1 lists the number of filter banks installed at the facility and the <u>nominal</u> removal efficiency, not the certified tested removal efficiency.

Other types of filters used in ventilation systems are Aerosol 95; RIGA-Flow 220, 221, and 222; 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 removing gross 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 or vapors, 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 directly to the surface of the charcoal. The charcoal can be coated with different types of materials to make the adsorption process more efficient for specific types of contaminants. Typically, charcoal beds achieve an efficiency of 98% capture. Efficiency of a charcoal filter can vary with different chemical pollutants in the exhaust air stream.

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 gas-phase or elemental tritium (HT) into tritiated water vapor (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 a concentrated source of activated gas (the off-gas system for the 1L target cooling system) are directed into a long transport line. The transit time through this system allows short-lived gaseous radionuclides to decay before being emitted from the stack. This delay system is used to provide a reduction in radionuclide emissions from the 1L target area exhausted through stack 53000702.

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

The 2003 revisions to 40 CFR 61 Subpart H established several inspection and maintenance requirements for monitored stacks. These requirements are based on American National Standards Institute/Health Physics Society N13.1-1999, *Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities*. Annual visual inspection of particulate monitoring systems is a component of the Laboratory's program to comply with these requirements. In 2014, we performed stack inspections and/or cleaning operations on 25 monitored stacks. Two stacks do not meet EPA requirements as "major" sources, and no inpsections were conducted on these systems (53000303 and 50003701, the latter of which was shut down in September). For the one tritium-only stack at TA-16 (as well as the tritium sampling system at TA-55-4), the annual in-place performance test serves as the annual inspection, per EPA alternative method approval. [Note that per EPA approval discussed earlier in the document, 2014 is the final year for which in-place performance tests will be conducted. For 2015 and beyond, the stack will be subject to visual inspection and offline performance testing, similar to other LANL sources.] This accounts for the 28 monitored stacks at LANL.

Cleaning activities were performed on 15 of these systems in 2014 to remove trace particulate within the sample systems. Of the inspections performed in 2014, sample systems on 6 stacks showed evidence of particulate deposition in the sampler or transport line. These systems will be addressed as part of the current year's sampler inspection cycle. In 2014, no radiological material was measured on inspection or cleaning equipment. Therefore, no additions to the source term are required from this pathway for this year.

Section III. Dose Assessment

61.94(b)(7) Description of Dose Calculations

Effective dose equivalent (EDE or dose) calculations for point sources, unmonitored point sources, and non-point gaseous activation products from LANSCE were performed with the CAP88 code. LANL had used the original mainframe version of CAP88 (version 0) through the 2005 report; CAP88 version 3 was used for 2006-2012 reports; and CAP88 version 4 adopted for use in the 2013 annual report and again used for this 2014 report. Verification of the CAP88 code is performed by running the EPA test case before performing the dose calculations.

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 if it is in the chemical form of elemental tritium (HT) or tritiated water vapor (HTO). 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 water vapor (including HTO) is removed from the air, leaving elemental tritium, or HT. The sample air stream 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. Since different chemical forms are collected in different vials, the system will discriminate HTO vapor from HT gas, allowing separate dose assessment with CAP88-PC versions 3 and 4. Bubblers are in use to measure tritium emissions from TA-16 (WETF) and TA-55 PF-4's south stack, 55000416.

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. Tritium emissions for 2014 continue to be calculated based on the rate of generation measured in 2001, using representative parameters.

In past years, very low-level tritium operations also took place from TA-55 Building 4, in the northern portion of the building exhausted through ES-15. While the southern stack ES-16 is monitored for tritium emissions, at ES-15, tritium is not a pollutant of concern and falls well below the ten percent of the PEDE criteria at which monitoring is required. Similarly, the WCRR waste repackaging facility at TA-50-69 occasionally process waste drums containing trace amounts of tritium. No tritium operations took place in either of these facilities in 2014. If tritium operations had occurred at these facilities, the potential upper bound limit of emissions would be included in the Table 2 source term. Calculations and user estimations would be used to determine this upper bound, adequate for a non-significant radionuclide at these sources.

Radioactive particulate emissions

Emissions of radioactive particulate matter, generated by operations at facilities such as the CMR facility (TA-3-29) 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 semiannual composite data are then combined with estimates of sampling losses and stack and sample flows to calculate emissions. Short-lived progeny are assumed to be emitted in secular equilibrium with their long-lived parent nuclides. For example, we measure for the presence of ^{90}Sr and assume that an equal amount of the progeny ^{90}Y is emitted as well.

Vapor form emissions

Vapor emissions, generated by LANSCE operations and by hot-cell activities at TA-3-29 and TA-48, are sampled using an activated charcoal filter cartridge. 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. These analytical results are used in conjunction with facility information 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 real-time monitoring data. A continuously-operating air flow-through ionization chamber is operated in series with a high-purity germanium (HPGe) detector and data acquisition system. A sample of stack air is pulled through the ionization chamber to measure the total amount of radioactivity in the sample, while specific radioisotopes are identified through the use of gamma spectroscopy and decay curve analysis with the HPGe system. This information is then used to calculate emissions. Radionuclides of this type include ^{11}C, ^{13}N, and ^{15}O.

Summary of Input Parameters

EDE to potential receptors was calculated for all radioactive air emissions from sampled LANL point sources. The radionuclide releases for the point sources monitored in 2014 are provided in Table 2. Input parameters for these point sources are provided in Table 3. The geographic locations of the release points, given in New Mexico State Plane coordinates, are provided in Table 4. Table 5 shows the distance and direction from each of the LANL monitored stacks to the LANL-wide highest receptor location for this report year. Other site-specific parameters used in CAP88 and the sources of these data are provided in Table 6.

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 2014, data from three different towers were used for the air-dispersion modeling; the tower data that are most representative of the release point are applied. Copies of the meteorological data files used for the annual 2014 dose assessments are provided in Table 7. Note that due to the extent of the data in Table 7, that table has been moved to Appendix 1. There are three files included in Table 7, detailing wind speed and direction information from TA-6, TA-53, and TA-54 meteorology towers.

The Laboratory also enters 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, and the population files used at LANL were updated in late

2012 using 2010 census data[21], Different population files are used depending on where the dominant LANL source is located in a given year. For 2014, LANL's dominant emitter was sources at TA-53, the LANSCE accelerator. Therefore, the "LANL TA-53 source" array is used for population dose assessment. This array appears in Table 8. For agricultural array input, LANL is currently using the default values in CAP88 for the state of New Mexico.

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. The Laboratory routinely evaluates public areas to assure that any new residence, school, business, or office is identified for the EDE calculation. As per EPA guidance,[22] personnel that work in leased space within the boundaries of the Laboratory are not considered members of the public for the EDE determination. Personnel of this type are considered to be subcontractors to DOE, similar to security guards and maintenance workers.

Point Source Emissions Modeling

The CAP88 version 4 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. CAP88 version 4 includes all radionuclides for which there are dose conversion factors in the EPA's Federal Guidance Reports.[23,24,25] In 2014, all monitored radionuclides were included in CAP88 for the monitored stacks source term. Some minor sources (non-monitored stacks) used exotic radionuclides (usually very short-lived) not in

[21] LA-UR-12-22801, "Population Files for use with CAP88 at Los Alamos. M. McNaughton and B. Brock. January 2012.

[22] Frank Marcinowski, Acting Director, Radiation Protection Division, "Criteria to Determine Whether a Leased Facility at Department of Energy (DOE) is Subject to Subpart H," Office of Radiation and Indoor Air, U. S. Environmental Protection Agency, March 26, 2001.

[23] K. F. Eckerman, A. B. Wolbarst, and A. C. B. Richardson, Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," Office of Radiation Programs, U.S. Environmental Protection Agency, Washington, D.C., 1988.

[24] K. F. Eckerman and J. C. Ryman, Federal Guidance Report No. 12, "External Exposures to Radionuclides in Air, Water, and Soil Exposure-to-Dose Coefficients for General Application," U.S. Environmental Protection Agency, Washington, D.C., 1993

[25] K. F. Eckerman, R. W. Leggett, C. B. Nelson, J. S. Puskin, and A. C. B. Richardson, Federal Guidance Report No. 13, "Cancer Risk Coefficients for Environmental Exposure to Radionuclides," U.S. Environmental Protection Agency, Washington, D.C., 1999

the CAP88 version 4 library; these were addressed per procedure.[26] Updates of "non-CAP88 nuclides" for monitored and non-monitored point sources were described in previous memos to EPA Region 6, most recently in a 2011 memo.[27]

LANSCE Diffuse / Fugitive Emission Modeling

Some of the GMAP created at the accelerator target cells or at other accelerator beam line locations migrate into room air and into the environment. These diffuse or fugitive sources are continuously monitored throughout the beam-operating period. In 2014, approximately 25 Ci of ^{11}C and 85 Ci of ^{41}Ar were released from LANSCE as fugitive emissions.[28] These sources were modeled as area sources using CAP88 version 4, and the specific input parameters are provided in Table 9. The dominant fugitive emissions source was the Building 984 source, newly identified in 2014. The source is described in the Executive Summary of this document.

Environmental Data Used for Non-point Source Emission Estimation

The net annual average ambient concentration of airborne radionuclides measured at 22 air sampling stations (Figure 4) is calculated by subtracting an appropriate background concentration value.[29] The net concentration at each air sampler is converted to the annual effective dose equivalent (EDE) using Table 2 of Appendix E of 40 CFR 61 and applying the valid assumption that each Table 2 value is equivalent to 10 mrem/year from all appropriate exposure pathways (100% occupancy assumed at the respective location). Dose assessment results from each air sampler are given in Table 10. The operational performance and analytical completeness of each air sampler is provided in Table 11.

Note that for 2014, some stations not designated as historical compliance stations did not have tritium (H-3) measured at that location. For these stations, it is known that tritium is not a pollutant of concern for these locations. These stations are noted in the tritium dose and the analytical completeness columns.

As described in the Executive Summary, some stations were relocated, some shut down, and some new stations started for calendar year 2015. The new 2015 maps are shown in Figure 5 (Los Alamos County only) and Figure 6 (Los Alamos and Northern New Mexico). These stations represent compliance stations and some LANL facility surveillance stations.

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[26] LANL procedure ENV-EAQ-512, R2, "Dose Factors for Non-CAP88 Radionuclides," November 2009.
[27] WES-EDA-11-0023, "Documentation of Dose Calculation Methods for Radionuclides Not Included in CAP88 Version 3." M. McNaughton memo to G. Brozowski, December 21, 2011.
[28] ENV-ES:15-0135, "2014 Annual Source Term for Radionuclide Air Emissions,", May 27, 2015.
[29] LANL procedure ENV-ES-QP-502.4, "Air Pathway Dose Assessment," November 2011.

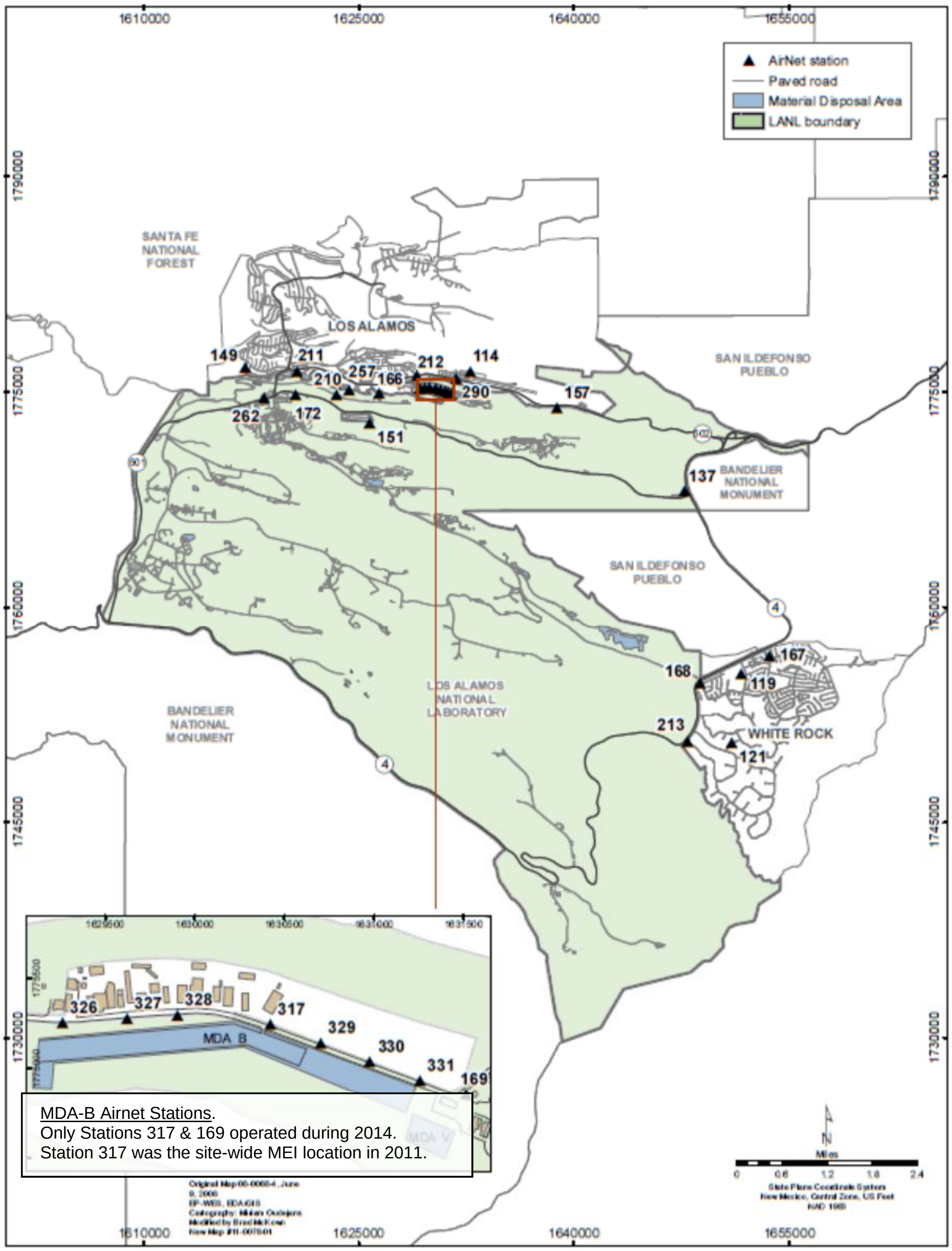

Figure 4. Locations of air sampling stations used for non-point source emissions compliance.

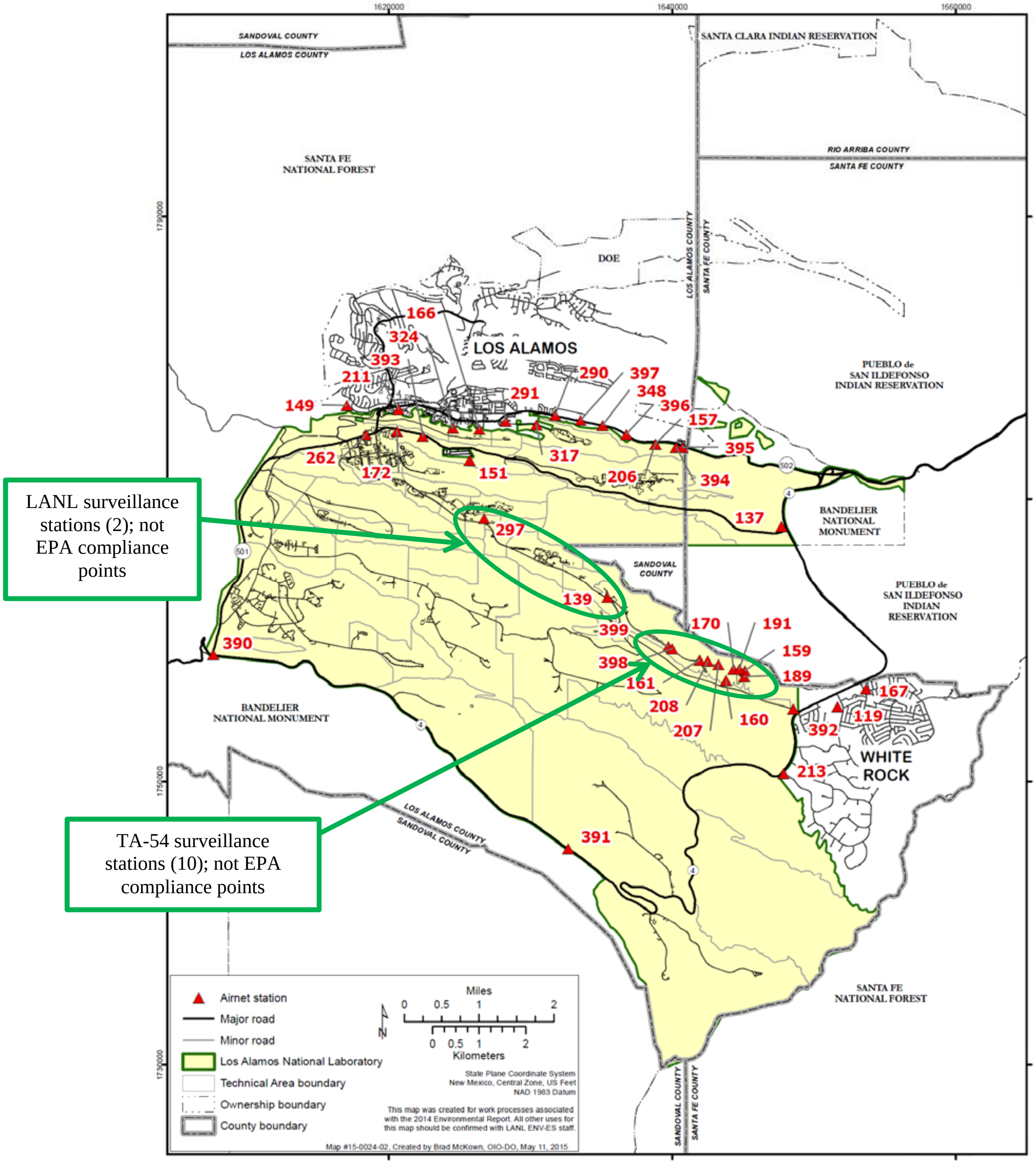

Figure 5. Locations of air sampling stations in operation for Calendar Year 2015. Stations that are not EPA Compliance points are indicated.

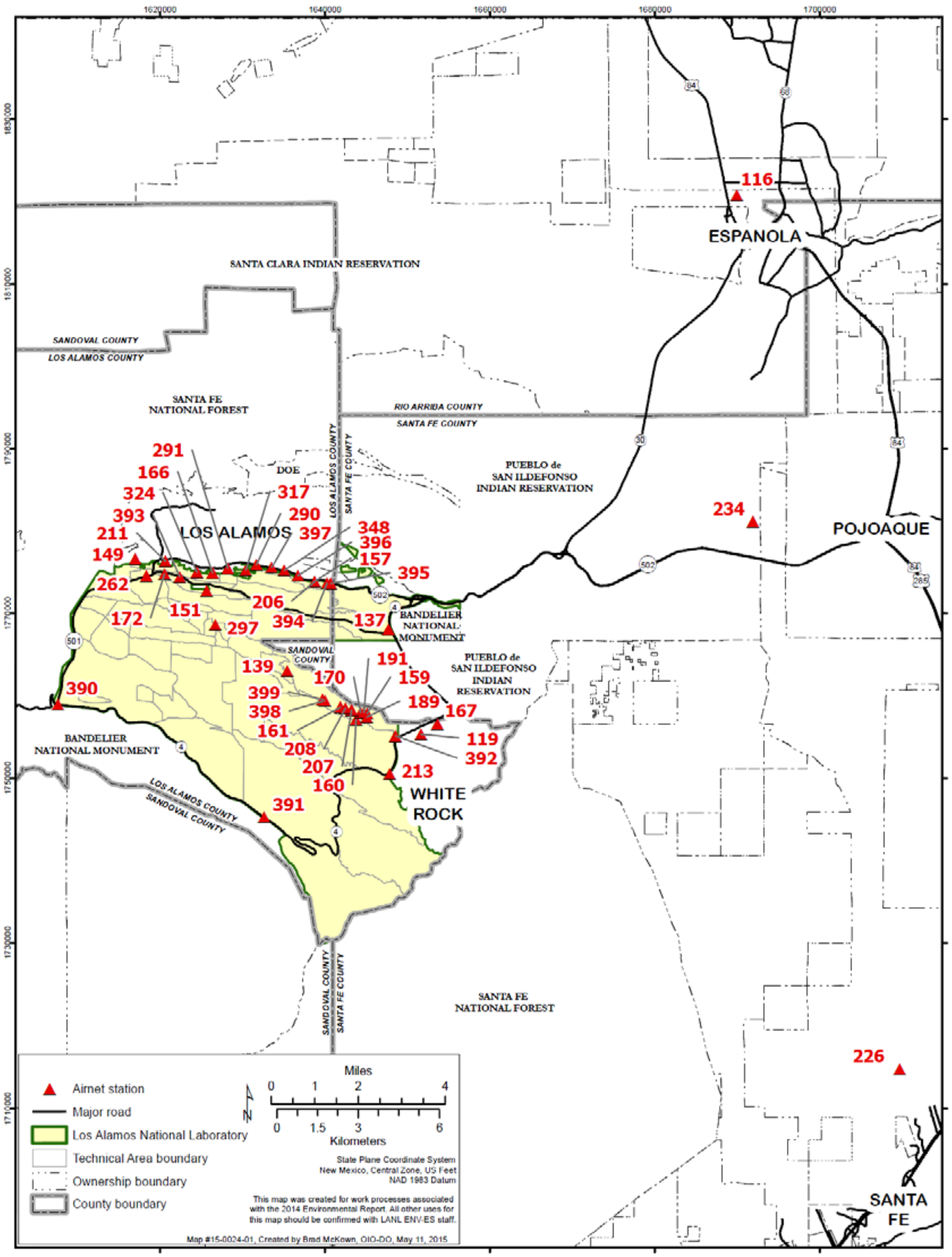

Figure 6. Locations of air sampling stations around Los Alamos County and also regional Northern New Mexico stations, effective for Calendar Year 2015. Not all are EPA Compliance points; some are for facility environmental surveillance. See Figure 5 for detail.

LANSCE Monthly Assessments

The Laboratory evaluates and reports the dose from short-lived radioactive gases released from LANSCE exhaust stack 53000702 on a monthly basis. This is performed to track and trend the emissions throughout the year and identify any issues that need addressing. The doses from these monthly emissions are calculated with CAP88 using actual meteorology for the month and are shown in Table 12. For 2014 the Laboratory also evaluated this stack's total gaseous emissions for the year in a single CAP88 run and compared the results to the sum of monthly values. When evaluated to the LANSCE facility critical receptor, the sum of monthly doses is a dose of 0.0158 mrem, and the annual total single analysis result is 0.0205 millirem, a difference of 26%. This same comparison, when emissions are modeled to the LANL site-wide MEI for 2014, results in a sum of monthly analyses equal to 0.00639 millirem and a single annual analysis equal to 0.00587 millirem. This difference is 8.4%. (see Table 12 for details). These differences are due to meteorological parameters modeled by monthly runs (e.g., wind speed and direction, atmospheric mixing height) for the specific months of interest as opposed to those factors representing the entire calendar year. For conservatism, LANL uses the maximum value of either the annual evaluation or the sum of the monthly doses for EPA reported doses.

Aside from these monthly GMAP runs from 53000702, all other CAP88 assessments are performed using annual source term and annual meteorological inputs. The summary of off-site dose analyses from the LANSCE facility is included in Table 12.

Highest EDE Determination

Historically, the maximally exposed individual (MEI) location has been at 2470 East Road, usually referred to as "East Gate." The dose was primarily a result of LANSCE stack emissions. Emissions reduction efforts in place at LANSCE since 2005 have resulted in very low off-site doses from these stacks. Emissions were further reduced by improvements made in the new beam Target/Moderator/Reflector System (TMRS) that was installed in early 2010. Because the LANSCE emissions are so low in recent years, the location of the MEI is not as readily apparent as in the past and requires more detailed evaluation, as follows.

The dose from LANSCE emissions can be a significant contributor at its facility critical receptor location (East Gate), but much less so at other possible MEI locations. To evaluate different MEI locations, the doses from LANSCE stack and diffuse emissions at the East Gate are calculated. This sum is then combined with the Airnet measurements at East Gate to determine a comparison point. The doses measured at other Airnet locations are examined to see if there are any sites which can match or exceed this comparison point at East Gate. CAP88 is used to model the LANSCE facility emissions and other significant stack sources to these locations. The Airnet measured dose is added to the stack modeled doses to determine the total LANL dose consequence at each location, keeping in mind that the MEI location must be a school, business, residence, or office.

In 2014, there was no dominant Airnet measured dose location, so several sites were evaluated for their MEI potential. The Airnet dose locations were ranked for subsequent analysis. There were also relatively high emissions from sources at LANSCE and from the WETF tritium stack (16045005), in comparison to recent years. The newly-identified LANSCE diffuse source at TA-53 Building 984 (53DIF984) must also be considered. The critical receptor for this source is not East Gate as other LANSCE sources, but a business on Entrada Drive in eastern Los Alamos town site. The elevated emissions from 53DIF984 modeled to Entrada Drive resulted in a higher dose (0.083 mrem) than any other single source or Airnet measurement in 2014. As a result, the closest Airnet station to this Entrada Drive location (Station 311, Airport Runway) was added to the list of Airnet locations to be evaluated. Emissions from all of the LANSCE facility sources (monitored stacks and diffuse sources) and the WETF stack emissions were then modeled with CAP88 to the Airnet locations identified earlier. The sum of the Airnet measured dose and the modeled stack and diffuse source doses at each location resulted in a list of doses from which the MEI location is selected. The evaluated locations are (values in millirem):

- Entrada Drive: LANSCE=0.0957 WETF=0.0052 Airnet=0.0207 total = 0.1216 mrem
- Hillside 138: LANSCE=0.0027 WETF=0.0055 Airnet=0.0743 total = 0.0825 mrem
- West Gate/TA-16: LANSCE=0.0007 WETF=0.0260 Airnet=0.0527 total = 0.0794 mrem
- County Landfill: LANSCE=0.0018 WETF=0.0084 Airnet=0.0458 total = 0.0560 mrem
- DP Road: LANSCE=0.0086 WETF=0.0055 Airnet=0.0395 total = 0.0536 mrem

Based on the list above, the Entrada Drive location is the MEI for 2014. Emissions from the remaining monitored stacks were modeled from their sources to the Entrada Drive location. The total MEI dose at this location results from sum of the following sources, with full details in Table 13.

- emissions from all LANL stacks, modeled by CAP88 to this location;
- emissions from LANSCE diffuse sources, modeled by CAP88 to this location;
- the dose measured at the nearby Airnet sampler, Station 311; and
- the sum of all non-monitored sources potential emissions, modeled by CAP88 to each source’s critical receptor.

61.92 Compliance Assessment

The highest EDE to any member of the public at any off-site point where there is a residence, school, or business was 0.24 mrem for radionuclides released by LANL in 2014. This dose was calculated by adding up (1) the dose contributions for each of the monitored point sources at LANL, modeled to the MEI location; (2) the diffuse/fugitive gaseous activation products from LANSCE modeled to this MEI location; (3) the dose measured by the ambient air sampler in the vicinity of the public receptor location; and (4) the potential dose contribution of 0.121 mrem from non-monitored stacks. Because the emissions estimates from non-monitored stacks do not account for pollution control systems, the actual dose from these minor sources is significantly less than the reported potential dose value. Table 13 of this report provides the compliance assessment summary, broken down by stack. The location of the Maximally Exposed Individual (MEI) from LANL operations is a business at 95 Entrada Drive, close to Airnet Station 311. The EDE of 0.24 millirem is well below the EPA limit of 10 millirem per year.

Section IV. Construction and Modifications

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

A brief description of construction and modifications that were completed in 2014 for which the requirement to apply for approval to construct or modify was waived under section 61.96 is given below:

<u>PR-ID: 09P-0042 – TA-48-1 Room 426 Perchlorate Hood</u>

Installation of new perchlorate hoods in TA-48-1, Room 426 and installation of a new stack to exhaust these hoods was completed in 2013. Operational readiness and testing activities were completed by the end of 2013. Radioactive operations in the new hoods and stack began the week of March 17, 2014. This is a relocation of an existing operation from TA-48, Building 1, Room 430, to TA-48, Building1, Room 426. The existing operations were tracked in RMUS and have historically been well below 0.1 mrem. The total emissions from the relocated operations into Room 426 were 0.0001 mrem in 2014. This source will continue to be tracked in the annual RMUS.

<u>PR-ID 11P-0049 – TA-55-4 Plutonium Assay and Radiochemistry Gloveboxes</u>

Three new gloveboxes were installed in TA-55-4 in 2013. The purpose of this equipment is to support capabilities to characterize heat source plutonium during production of fuel clads as well as capabilities to verify and characterize newly received heat source plutonium. These capabilities are being relocated from CMR (TA-3-29) to TA-55-4. Radioactive materials were introduced into these new gloveboxes in April 2014 to qualify operations. The operations were fully qualified and Procedure Qualification Records (PQRs) were completed in 2014, and the system became fully operational in 2015. This equipment is exhausted through an existing monitored stack at TA-55, 55000415, and therefore no separate dose calculations were needed. This is considered a relocation of existing operations.

PR-ID 11A-0006 – TA-3-2322 SIMS Lab Renovation

As part of an overall renovation of the TA-3-2322 laboratory space a new secondary ion mass spectrometer (SIMS) was installed. Some of the sample analysis work that takes place in this laboratory now includes very small quantities of radioactive particulates or solids. Radioactive materials were first introduced in this equipment in 2014. All radioactive material is in contained, sealed sources. There is no forced air exhaust point for this laboratory, therefore this is considered a diffuse source and any radioactive air emissions will be measured by our ambient monitoring network, Airnet. Initial analysis of this source resulted in a maximum potential off-site dose estimate of 3.0E-05 mrem/yr.

PR-ID 14A-0006 – TA-59-1 Radioactive Gold Research

A new research activity started operation at TA-59-1 in December 2014. The project involves electroplating nickel alloy plates with radioactive gold. The electroplating process is performed at room temperature with an aqueous solution that contained 0.005 molar HAuCl4 (chloroauric acid) plus 0.5 molar HCl (hydrochloric acid), so the process takes dissolved gold ions in solution and deposits a solid layer of gold onto the nickel plate. The gold is a mixture of isotopes with the vast majority as the stable Au-197 isotope and only a few parts per million as the radioactive Au-198 isotope and even less as radioactive Au-199. Initial analysis of this source resulted in a maximum potential off-site dose estimate of 7.7E-03 mrem/yr. Based on the limited operations that occurred in late 2014, the actual potential off-site dose from this source was 1.03E-11 mrem.

Section V. Additional Information

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

Unplanned Releases

While not specifically unplanned releases, there were two newly identified sources of radionuclide air emissions in 2014. These two sources, both at LANSCE, are discussed at length in the Executive Summary and in subsequent sections of this document. Off-site doses form these sources result in 0.083 millirem in 2014. These sources will be carefully tracked in 2015 and following years.

Environmental Monitoring

In addition to the Airnet monitors identified in this report, additional environmental monitoring stations are operated at LANL and include 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 associated with NESHAP compliance are included in this document, while results for all monitoring data are published in the Annual Site Environmental Report for compliance with DOE Orders.

Other Supplemental Information

The following information is included for completeness, but not directly required under 40 CFR 61 Subpart H regulations.

- 80-km collective effective (population) dose for 2014 airborne releases: **0.284 person-rem**.
  To calculate this dose, the total source term (Table 2) from all Laboratory monitored stacks and LANSCE diffuse sources was modeled in a single CAP88 file from the dominant emissions source. For 2014, this dominant source was the diffuse source at TA-53 Building 984. The population array for a TA-53 source was used; all other parameters were identical to the 53DIF984 individual dose calculations.
- 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, MDA G; this practice makes the Laboratory subject to this regulation. Subject facilities cannot exceed an emissions rate of 20 pCi/m2 s of ^{222}Rn. In 1993 and 1994, LANL conducted a study to characterize emissions from the MDA G disposal site.[30] This study showed an average emission rate of 0.14 pCi/m2 s for MDA G. The performance assessment for MDA G has determined that there will not be a significant increase in ^{222}Rn emissions in the future.[31]

- 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 is in compliance with these requirements.

[30] Bart Eklund, "Measurements of Emission Fluxes from Technical Area 54, Areas G and L," Radian Corporation report, Austin, Texas, 1995

[31] Los Alamos National Laboratory, "Performance Assessment and Composite Analysis for Los Alamos National Laboratory Materials Disposal Area G," LA-UR-97-85, 1997.

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

Stack ID	Location TA-Bldg	Effluent Controls	# of Effluent Controls*	Control Efficiency*	Monitored Stack?	Nearest Receptor (m)	Receptor Direction
03001600	TA-03-16	None	0	0%		968	N
03002913	TA-03-29-1	unknown	0	0%		859	NNE
03002914	TA-03-29-2	HEPA	2*	99.95% each*	X	733	NE
03002915	TA-03-29-2	HEPA	2*	99.95% each*	X	734	NE
03002919	TA-03-29-3	Aerosol 95	1	80%	X	838	NNE
03002920	TA-03-29-3	Aerosol 95	1	80%	X	837	NNE
03002923	TA-03-29-4	FARR 30/30	1	20%	X	618	NNW
03002924	TA-03-29-4	FARR 30/30	1	20%	X	618	NNW
03002928	TA-03-29-5	HEPA	2*	99.95% each*	X	938	NE
03002929	TA-03-29-5	HEPA	2*	99.95% each*	X	939	NE
03002932	TA-03-29-7	HEPA	2*	99.95% each*	X	858	NNE
03002933	TA-03-29-7	HEPA	2*	99.95% each*	X	857	NNE
03002944	TA-03-29-9	RIGA-Flow	1	80%	X	939	NNE
03002945	TA-03-29-9	RIGA-Flow	1	80%	X	941	NNE
03002946	TA-03-29-9	RIGA-Flow	1	80%	X	940	NNE
03003299	TA-03-32	unknown	0	0%		641	NNE
03003400	TA-03-34	none	0	0%		668	NNE
03003501	TA-03-35	HEPA	1	99.95%		683	NNE
03006601	TA-03-66	none	0	0%		695	N
03006602	TA-03-66	none	0	0%		709	N
03006603	TA-03-66	none	0	0%		708	N
03006604	TA-03-66	none	0	0%		708	N
03006605	TA-03-66	none	0	0%		714	N
03006606	TA-03-66	none	0	0%		670	N
03006626	TA-03-66	HEPA	1	99.95%		618	N
03006654	TA-03-66	HEPA	1	99.95%		665	N
03006699	TA-03-66	none	0	0%		669	N
03010225	TA-03-102	HEPA	1	99.95%		772	N
03169800	TA-03-1698	none	0	0%		717	NNE
09002103	TA-09-21	none	0	0%		3044	NE
09003499	TA-09-34	none	0	0%		2879	NE

Table 1 (Continued) Release Point Data

Stack ID	Location TA-Bldg	Effluent Controls	# of Effluent Controls	Control Efficiency*	Monitored Stack?	Nearest Receptor (m)	Receptor Direction
15028599	TA-15-285	HEPA	1	99.95%		3719	NNE
15053401	TA-15-534	HEPA	1	99.95%		3282	NNE
16020299	TA-16-202	none	0	0%		1185	S
16020599	TA-16-205	none	0	0%		752	SSW
16045005	TA-16-450	none	0	0%	X	772	S
35000200	TA-35-2	none	0	0%		1294	NNW
35021305	TA-35-213	none	0	0%		1010	N
35045599	TA-35-455	Unknown	0	0%		1055	N
36000104	TA-36-1	unknown	0	0%		5379	SE
39006999	TA-39-69	unknown	0	0%		3071	ENE
43000100	TA-43-1	none	0	0%		122	NNE
46002499	TA-46-24	none	0	0%		2887	N
46003100	TA-46-31	none	0	0%		2792	N
46004106	TA-46-41	none	0	0%		2890	N
46015405	TA-46-154	none	0	0%		2769	N
46015899	TA-46-158	none	0	0%		3053	N
46020099	TA-46-200	none	0	0%		2743	N
48000107	TA-48-1	HEPA/Charco	2*	99.95% each*	X	754	NNE
48000111	TA-48-1	none	0	0%		874	NNE
48000115	TA-48-1	none	0	0%		764	NNE
48000135	TA-48-1	none	0	0%		797	NNE
48000145	TA-48-1	none	0	0%		893	NNE
48000154	TA-48-1	HEPA	2*	99.95% each*	X	756	NNE
48000160	TA-48-1	HEPA	1	99.95%	X	769	NNE
48000166	TA-48-1	HEPA	2*	99.95% each*		867	NNE
48000167	TA-48-1	HEPA	2*	99.95% each*		897	NNE
48000168	TA-48-1	none	0	0%		874	NNE
48004500	TA-48-45	none	0	0%		742	N

Table 1 (Continued)

Stack ID	Location TA-Bldg	Effluent Controls	# of Effluent Controls	Control Efficiency*	Monitored Stack?	Nearest Receptor (m)	Receptor Direction
50000102	TA-50-1	HEPA	1	99.95% each*	X	1185	N
50000299	TA-50-2	none	0	0%		1215	N
50003701	TA-50-37	HEPA	2*	99.95% each*	X	1171	N
50006901	TA-50-69	HEPA	1	99.95%		1199	N
50006902	TA-50-69	HEPA	1	99.95%		1188	N
50006903	TA-50-69	HEPA	2*	99.95% each*	X	1187	N
50006999	TA-50-69	unknown	0	0%		1190	N
50025799	TA-50-257	none	0	0%		1201	N
53000116	TA-53-1	unknown	0	0%		1443	ENE
53000303	TA-53-3	HEPA	1	99.95%	X	806	NNE
53000702	TA-53-7	HEPA	1	99.95%	X	957	NNE
53001599	TA-53-15	none	0	0%		1096	NNE
53001899	TA-53-18	none	0	0%		1019	NNE
53036899	TA-53-368	none	0	0%		1000	NNE
53098401	TA-53-984	none	0	0%		1049	NE
53109099	TA-53-1090	none	0	0%		1009	NNE
54003399	TA-54-33	None	0	0%		2058	ESE
54022499	TA-54-224	None	0	0%		2246	ESE
54023199	TA-54-231	HEPA	1	99.95%	X	1480	SE
54037599	TA-54-375	HEPA	1	99.95%	X	1783	SE
54041299	TA-54-412	HEPA	1	99.95%	X	1660	SE
54100199	TA-54-1001	None	0	0%		4999	ESE
54100999	TA-54-1009	None	0	0%		4781	ESE
55000201	TA-55-2	None	0	0%		1111	NNE
55000415	TA-55-4	HEPA	4*	99.95% each*	X	1018	NNE
55000416	TA-55-4	HEPA	4*	99.95% each*	X	1091	NNE
55040099	TA-55-400	HEPA	1	99.95%	X	1318	NNE

Notes: * As described in the main text, LANL only tests HEPA filter banks down to 0.0005 penetration & 99.95% removal. This table reports the actual number of installed HEPA bank stages and nominal/design removal efficiencies, not tested efficiencies.

Table 2. 40-61.94(b)(7) User Supplied Data—Radionuclide Emissions

StackID	Nuclide	Annual Emission (Ci)
03002914	Pu-238	6.54E-09
03002914	Pu-239	3.96E-09
03002914	U-234	5.58E-08
03002914	U-235	1.61E-08
03002915	Th-230	1.40E-07
03002919	Am-241	5.24E-07
03002919	Pu-238	2.21E-07
03002919	Pu-239	1.40E-06
03002919	U-234	3.87E-08
03002919	U-235	1.91E-08
03002920	Pu-238	1.85E-09
03002920	Pu-239	7.74E-09
03002923	Pu-238	6.77E-09
03002923	U-234	4.95E-07
03002923	U-235	3.47E-08
03002923	U-238	4.86E-08
03002923	Pa-234m (p)	4.86E-08
03002923	Th-234 (p)	4.86E-08
03002924	Am-241	6.10E-09
03002924	Pu-238	8.80E-08
03002924	Pu-239	3.15E-08
03002924	Th-228	3.95E-08
03002924	U-234	1.88E-06
03002924	U-235	1.36E-08
03002928	Pu-238	6.19E-09
03002928	Pu-239	3.13E-08
03002928	U-234	4.90E-08
03002929	U-234	5.27E-08
03002932	U-234	5.25E-08
03002933	U-234	4.54E-08
03002944	Pu-242	2.09E-06
03002944	U-234	4.57E-08
03002945	None	0.00E+00
03002946	None	0.00E+00
16045005	H-3(Gas)	2.11E+01
16045005	H-3(HTO)	2.57E+02
48000107	As-73	5.57E-06
48000107	As-74	4.64E-05
48000107	Br-77	2.87E-04

StackID	Nuclide	Annual Emission (Ci)
48000107	Ge-68	1.95E-03
48000107	Ga-68 (p)	1.95E-03
48000107	Hg-197m	1.38E-02
48000107	Hg-197 (p)	1.38E-02
48000107	Se-75	1.01E-04
48000154	U-234	1.20E-08
48000154	U-238	6.04E-09
48000154	Pa-234m (p)	6.04E-09
48000154	Th-234 (p)	6.04E-09
48000160	As-73	9.62E-08
48000160	Se-75	1.29E-07
50000102	Pu-238	4.73E-08
50000102	Pu-239	1.22E-08
50000102	U-234	5.89E-08
50003701	None	0.00E+00
50006903	Pu-238	8.55E-10
53000303	Ar-41	1.18E+00
53000303	Be-7	2.04E-05
53000303	Br-77	1.47E-06
53000303	Br-82	2.17E-05
53000303	C-11	2.83E+01
53000303	H-3(HTO)	1.01E+01
53000702	Ar-41	4.72E+00
53000702	C-10	1.17E-01
53000702	C-11	3.33E+01
53000702	N-13	1.05E+01
53000702	N-16	2.26E-01
53000702	O-14	2.38E-01
53000702	O-15	1.13E+01
53000702	H-3(HTO)	2.01E+00
53000702	Br-76	4.35E-05
53000702	Br-77	1.59E-05
53000702	Br-82	8.65E-04
53000702	Hg-197m	1.55E-04
53000702	Hg-197 (p)	1.55E-04
53000702	Na-24	6.56E-07
53000702	Se-75	8.71E-06
54023199	None	0.00E+00
54037599	U-234	7.08E-09

StackID	Nuclide	Annual Emission (Ci)
54041299	U-234	1.73E-09
55000415	Pu-238	1.23E-09
55000415	U-234	9.85E-09
55000416	Pu-238	1.54E-09
55000416	Pu-239	1.40E-09
55000416	U-234	2.27E-08
55000416	U-235	6.83E-09
55000416	H-3(Gas)	2.30E-01
55000416	H-3(HTO)	3.55E+00

StackID	Nuclide	Annual Emission (Ci)
55040099	None	0.00E+00
Diffuse Sources from TA-53 LANSCE		
53DIF1LS	Ar-41	9.37E-02
53DIF1LS	C-11	2.25E+00
53DIF3SY	Ar-41	3.15E-01
53DIF3SY	C-11	7.56E+00
53DIF984	Ar-41	8.41E+01
53DIF984	C-11	1.48E+01

Table 2 Notes:

Stacks at the Chemistry & Metallurgy Research (CMR) facility identified as 03002914 through 03002933 are recorded in the RADAIR database as N3002914 through N3002933, to indicate measurements made with the New sampling systems, effective 2001.

Starting in 2006, particulate emissions from TA-55 stacks 55000415 and 55000416 are measured from new sample systems, which consist of four independent sample systems on each stack. The four samplers are identified as 5500415A, -B, -C, and -D; and 5500416A, -B, -C, and -D. Stack emissions data reported in this table represent average emission values measured from these four samplers. In the RADAIR database, these average emissions are given the stack ID 5500415X and 5500416X, with the "X" indicating the calculated average value from the four samples. The emissions of tritium (H-3, both HT and HTO forms) from the ES-16 stack use a different sample system, and references remain unchanged in the database.

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

The term "None" in the Nuclide column indicates that there were no detectable emissions from this source for this calendar year.

Stack 16045005 (ES-5) exhausts buildings TA-16-450 and TA-16-205. The ES-5 stack sampler was not operational, so reported emissions are measured by the sampler in the exhaust duct from 16-205, designated 16020504. That sampler captures all emissions from the facility, as 16-450 operations have not commenced. A full explanation is in Attachment B.

Non-point emissions sources 53DIF3SY, 53DIF1LS, and 53DIF984 are separated from the main source term table because they are addressed in different sections of the annual emissions report.

Emissions of Pu-242 from stack 03002944 were hand-calculated to account for alpha emitting radionuclides measured on stack composite filter sample in excess the amount that can be attributed to monitored isotopes. Pu-242 is a conservative estimate, based on radioactive material usage at that facility.

Table 3. 40-61.94(b)(7) User-Supplied Data—Monitored Stack Parameters

StackID	Height (m)	Diameter (m)	Exit Velocity (m/s)	Nearest Meteorological Tower
03002914	15.9	1.07	18.0	TA-6
03002915	15.9	1.05	23.6	TA-6
03002919	15.9	1.07	20.3	TA-6
03002920	15.9	1.07	5.3	TA-6
03002923	15.9	1.07	16.4	TA-6
03002924	15.9	1.06	7.1	TA-6
03002928	15.9	1.05	17.9	TA-6
03002929	15.9	1.07	16.3	TA-6
03002932	15.9	1.07	14.5	TA-6
03002933	15.9	1.06	16.1	TA-6
03002944	16.5	1.52	2.7	TA-6
03002945	16.5	1.52	12.4	TA-6
03002946	16.5	1.88	8.2	TA-6
16045005	18.3	1.18	17.4	TA-6
48000107	13.4	0.30	18.4	TA-6
48000154	13.1	0.91	5.5	TA-6
48000160	12.4	0.38	10.9	TA-6
50000102	15.5	1.82	7.8	TA-6
50003701	12.4	0.91	4.2	TA-6
50006903	10.5	0.31	6.3	TA-6
53000303	33.5	0.91	10.1	TA-53
53000702	13.1	0.91	8.1	TA-53
54023199	0.61	0.61	0 vertical 9.9 horizontal	TA-54
54037599	0.76	0.90	0 vertical 10.6 horizontal	TA-54
54041299	0.61	0.61	0 vertical 4.4 horizontal	TA-54
55000415	9.5	0.93	7.5	TA-6
55000416	9.5	0.94	9.9	TA-6
55040099	26.0	1.88	12.6	TA-6

Table 4. 61.94(b)(7) User-Supplied Data—Monitored Stack Parameters—NM State Plane Coordinates (NAD '83)

StackID	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
16045005	1,609,426	1,760,910
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	1,769,111
50006903	1,625,579	1,769,065
53000303	1,638,133	1,771,546
53000702	1,638,057	1,771,054
54023199	1,644,758	1,757,255
54037599	1,644,020	1,757,838
54041299	1,644,568	1,757,946
55000415	1,624,870	1,769,742
55000416	1,624,675	1,769,550
55040099	1,624,983	1,768,754

Table 5. 40-61.94(b)(7) User-Supplied Data—Highest Off-Site Dose Location for Monitored Release Points

StackID	Associated Meteorological Tower	Distance to LANL Highest Dose Location (m)	Direction to LANL Highest Dose Location
03002914	TA-06	5511	E
03002915	TA-06	5509	E
03002919	TA-06	5498	E
03002920	TA-06	5500	E
03002923	TA-06	5660	E
03002924	TA-06	5663	E
03002928	TA-06	5650	E
03002929	TA-06	5652	E
03002932	TA-06	5498	E
03002933	TA-06	5497	E
03002944	TA-06	5589	E
03002945	TA-06	5593	E
03002946	TA-06	5591	E
16045005	TA-06	9415	ENE
48000107	TA-06	4293	ENE
48000154	TA-06	4255	ENE
48000160	TA-06	4292	ENE
50000102	TA-06	3738	ENE
50003701	TA-06	3844	ENE
50006903	TA-06	3899	ENE
53000303	TA-53	922	NNW
53000702	TA-53	1056	NNW
54023199	TA-54	5714	NNW
54037599	TA-54	5465	NNW
54041299	TA-54	5494	NNW
55000415	TA-06	4010	ENE
55000416	TA-06	4089	ENE
55040099	TA-06	4088	ENE

Table 6. 40-61.94(b)(7) User-Supplied Data—Other Input Parameters

Description	Value	Units	CAP88 Variable Name (source code/V0 identifiers)
Annual rainfall rate	45	cm/y	RR
Lid height	1600	m	LIPO
Annual ambient temperature	9	deg C	TA
Absolute humidity	5.5	g/m^3	
E-vertical temperature gradient	0.02	K/m	TG
F-vertical temperature gradient	0.035	K/m	TG
G-vertical temperature gradient	0.035	K/m	TG
Food supply fraction - local vegetables	1		F1V
Food supply fraction - vegetable regional	0		F2V
Food supply fraction - vegetable imported	0		F3V
Food supply fraction - meat local	1		F1B
Food supply fraction - meat regional	0		F2B
Food supply fraction - meat imported	0		F3B
Food supply fraction - milk local	1		F1M
Food supply fraction - milk regional	0		F2M
Food supply fraction - milk imported	0		F3M
Ground surface roughness factor	0.5		GSCFAC

Table 7: 40-61.94(b)(7) User-Supplied Data—Wind Frequency Array

Due to the extent of data reported in Table 7, this table has been moved to Appendix 1.

Table 8. 40-61.94(b)(7) User-Supplied Data—Population Array

Estimated 2010 Population within 80 km of Los Alamos National Laboratory (revised 2012)

	Distances from Los Alamos – "TA-53 Source"												
Direction (sector)	250	750	1500	2500	3500	4500	7500	15000	25000	35000	45000	55000	70000
N	0	50	0	157	184	183	0	16	103	1077	0	945	641
NNW	0	0	0	566	276	397	50	7	22	291	0	0	528
NW	0	0	0	312	647	786	1336	2	27	56	821	0	1153
WNW	0	0	0	38	959	1047	5063	0	35	41	0	0	3305
W	0	0	0	0	161	169	15	14	119	575	0	135	257
WSW	0	0	0	0	0	0	2	14	1	696	0	4673	0
SW	0	0	0	0	0	0	5	5	0	0	0	3965	0
SSW	0	0	0	0	0	0	36	6	1766	2392	5674	4591	100236
S	0	0	0	0	0	0	20	9	31	274	0	0	6060
SSE	0	0	0	0	0	0	765	51	406	6811	3328	0	0
SE	0	0	0	0	0	0	5764	1	1318	88346	9870	218	6
ESE	0	0	0	0	0	0	36	14	868	10461	0	803	2430
E	0	0	0	0	0	0	3	1915	5002	511	588	1	598
ENE	0	0	0	0	0	0	0	2600	5419	4317	194	1128	1752
NE	0	0	0	0	0	0	0	1314	17067	2878	1604	1597	3527
NNE	0	0	0	0	0	0	0	15	2739	479	3483	0	58

Table 9. 40-61.94(b)(7) User-Supplied Data Modeling Parameters for LANL Non-Point Sources

Non-Point Source	Area of Source (m^2)	Radionuclide	Emission (Ci)
TA-53 Beam Switchyard StackID = 53DIF3SY	484	^{41}Ar	3.15E-01
		^{11}C	7.56E+00
TA-53-1L Service Area Stack ID = 53DIF1LS	1.0	^{41}Ar	9.37E-02
		^{11}C	2.25E+00
TA-53 Building 984 Stack ID = 53DIF984	200	^{41}Ar	8.41E+01
		^{11}C	1.48E+01

Non-Point Source	Distance to Nearest Receptor Location [Critical receptor] (meters)	Direction to Nearest Receptor Location [Critical Receptor]
TA-53 Beam Switchyard StackID = 53DIF3SY	774	NNE
TA-53-1L Service Area Stack ID = 53DIF1LS	943	NNE
TA-53 Building 984 Stack ID = 53DIF984	973	NNE

Non-Point Source	Distance to LANL Maximum Dose Location (m)	Direction to LANL Maximum Dose Location
TA-53 Beam Switchyard StackID = 53DIF3SY	890	NNW
TA-53-1L Service Area Stack ID = 53DIF1LS	1068	NNW
TA-53 Building 984 Stack ID = 53DIF984	973	NNE

Table 10. Environmental Data—Compliance Stations

2014 Effective Dose Equivalent measured at air sampling locations around LANL (net millirem)

Site	Site Name	H-3	Am-241	Pu-238	Pu-239	U-234	U-235	U-238	Total (mrem)
114	Los Alamos Airport	0.001	0.001	0.002	0.000	0.003	0.000	0.002	0.0090
119	Rocket Park	0.010	-0.001	0.004	0.003	0.004	0.001	0.005	0.0270
121	Pajarito Acres	0.013	0.000	0.001	0.002	0.005	0.001	0.002	0.0243
133	Bandelier Fire Lookout	0.001	0.000	0.002	0.000	0.002	0.001	0.004	0.0101
137	Well PM-1 (E. Jemez Road)	0.002	0.001	0.002	-0.001	0.007	0.001	0.006	0.0188
149	48th Street (Twin Tanks Complex)	0.008	0.000	0.002	0.003	0.000	0.001	0.000	0.0145
151	Royal Crest Trailer Court	0.009	-0.001	0.000	0.001	0.006	0.002	0.003	0.0201
157	East Gate	0.005	-0.003	0.001	0.001	0.009	0.001	0.007	0.0200
166	McDonalds	0.009	-0.001	0.002	-0.004	0.005	0.001	0.006	0.0177
167	White Rock Fire Station	0.011	-0.001	-0.002	0.001	0.004	0.001	0.002	0.0160
168	White Rock Nazarene Church	0.012	-0.002	0.003	-0.001	0.005	0.002	0.002	0.0210
169	TA-21 Area B*	-0.002	0.005	0.002	0.010	0.007	0.003	0.008	0.0331
172	Los Alamos County Landfill	0.004	0.002	0.001	0.000	0.019	0.003	0.017	0.0458
206	East Gate – Backup	0.003	-0.002	0.001	0.005	0.005	0.001	0.006	0.0189
210	LA Canyon	0.004	-0.001	0.000	0.003	0.002	0.001	0.003	0.0118
211	LA Hospital	0.003	0.000	0.001	-0.004	0.005	0.001	0.003	0.0080
212	Crossroads Church	0.004	-0.001	0.000	0.003	0.009	0.001	0.008	0.0234
213	Monte Rey South	0.015	-0.001	0.003	0.001	0.001	0.002	0.004	0.0248
262	TA-3 Research Park	0.005	0.002	0.002	0.003	0.005	0.002	0.003	0.0211
290	Los Alamos Airport Road	0.008	0.000	-0.003	0.001	0.007	0.001	0.004	0.0187
307	TA-16 / S-Site Cafeteria	0.044	0.000	0.001	0.001	0.004	0.001	0.002	0.0527
311	LA Airport Runway	***	-0.001	0.001	0.003	0.007	0.001	0.010	0.0207
317	DP Road (A15-West End)	***	0.005	0.001	0.018	0.007	0.001	0.009	0.0395
324	Hill Side 138**	0.003	0.001	0.000	0.058	0.007	0.001	0.005	0.0743
348	State Road 502 / Mid-Runway	***	-0.001	0.004	0.001	0.006	0.001	0.004	0.0162

* Station 169 was shut down in May 2014, with notification to and approval by EPA Region 6.
** As discussed in the 2012 Annual Report, Station 324 replaced Station 257 as a compliance measurement point in November 2012.
*** These stations are not compliance points under the 1996 FFCA; tritium is not a significant pollutant at these sites & sampling is not required.
Note that negative numbers indicate measured air concentrations were below background measurements.
Highlights indicate the LANL MEI location for 2014 (Station 311) and prior year's MEI location (Station 324).

Table 11. Environmental Data—Compliance Stations

2014 Sampler Operational Completeness and Analytical Completeness									
Site #	**Site Name**	**Station % Run Time**	**Am-241**	**H-3**	**Pu-238**	**Pu-239**	**U-234**	**U-235**	**U-238**
114	Los Alamos Airport	99.59	100.00	100.00	100.00	100.00	100.00	100.00	100.00
119	Rocket Park	99.30	100.00	100.00	100.00	100.00	100.00	100.00	100.00
121	Pajarito Acres	98.28	100.00	100.00	100.00	100.00	100.00	100.00	100.00
133	Bandelier Fire Lookout (near park entrance)	99.33	100.00	96.00	100.00	100.00	100.00	100.00	100.00
137	Well PM-1 (E. Jemez Road)	99.22	100.00	100.00	100.00	100.00	100.00	100.00	100.00
149	48th Street (Twin Tanks Complex)	98.32	100.00	100.00	100.00	100.00	100.00	100.00	100.00
151	Royal Crest Trailer Court	99.49	100.00	92.00	100.00	100.00	100.00	100.00	100.00
157	East Gate	99.28	100.00	96.00	100.00	100.00	100.00	100.00	100.00
166	McDonalds	96.89	100.00	96.00	100.00	100.00	100.00	100.00	100.00
167	White Rock Fire Station	99.42	100.00	100.00	100.00	100.00	100.00	100.00	100.00
168	White Rock Nazarene Church	98.61	100.00	100.00	100.00	100.00	100.00	100.00	100.00
169	TA-21 Area B*	99.22	100.00	90.91	15.38	15.38	100.00	100.00	100.00
172	Los Alamos County Landfill	96.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
206	East Gate – Backup	99.32	100.00	100.00	100.00	100.00	100.00	100.00	100.00
210	LA Canyon	99.59	100.00	100.00	100.00	100.00	100.00	100.00	100.00
211	LA Hospital	99.39	100.00	100.00	100.00	100.00	100.00	100.00	100.00
212	Crossroads Church	99.57	100.00	100.00	100.00	100.00	100.00	100.00	100.00
213	Monte Rey South	97.93	100.00	100.00	100.00	100.00	100.00	100.00	100.00
262	TA-3 Research Park	99.32	100.00	100.00	100.00	100.00	100.00	100.00	100.00
290	Los Alamos Airport Road	99.58	100.00	100.00	100.00	100.00	100.00	100.00	100.00
307	TA-16 / S-Site Cafeteria	99.42	100.00	100.00	100.00	100.00	100.00	100.00	100.00
311	LA Airport Runway	99.58	100.00	***	100.00	100.00	100.00	100.00	100.00
317	DP Road (A15-West End)	99.54	100.00	***	10.34	10.34	100.00	100.00	100.00
324	Hill Side 138**	99.14	100.00	100.00	100.00	100.00	100.00	100.00	100.00
348	State Road 502 / Mid-Runway	99.58	100.00	***	100.00	100.00	100.00	100.00	100.00
	Average:	**99.00**	**100.0**	**98.68**	**93.03**	**93.03**	**100.0**	**100.0**	**100.0**

* Station 169 was shut down in May 2014, with notification to and approval by EPA Region 6.

** As discussed in the 2012 Annual Report, Station 324 replaced Station 257 as a compliance measurement point in November 2012.

*** These stations are not compliance points under the 1996 FFCA; tritium is not a significant pollutant at these sites & sampling is not required.

Table 12. LANSCE Monthly Assessments, Comparison with Annual Analyses, and Facility Dose Summary

Description	StackID	Dose at @ East Gate (mrem)	Dose at @ Entrada Drive (mrem)
LANSCE stack January GMAP	53000702	5.71E-03	2.97E-03
LANSCE stack February GMAP	53000702	1.48E-04	7.27E-05
LANSCE stack March GMAP	53000702	None	None
LANSCE stack April GMAP	53000702	None	None
LANSCE stack May GMAP	53000702	None	None
LANSCE stack June GMAP	53000702	None	None
LANSCE stack July GMAP	53000702	None	None
LANSCE stack August GMAP	53000702	2.31E-04	3.62E-05
LANSCE stack September GMAP	53000702	2.25E-03	6.75E-04
LANSCE stack October GMAP	53000702	3.66E-03	9.43E-04
LANSCE stack November GMAP	53000702	3.78E-03	1.69E-03
LANSCE stack December GMAP	53000702	2.31E-04	3.62E-05
Sum of monthly GMAP runs for this stack	53000702	1.58E-02	6.39E-03
GMAP single annual analysis for this stack	53000702	2.05E-02	5.87E-03
Difference, sum of monthly vs. annual analyses:		*26%*	*8.4%*

To be conservative, the **maximum value** of the two above methods will be used for all further reporting of GMAP emissions from the main LANSCE stack 53000702. Values are highlighted above for each receptor location.

SUMMARY OF LANSCE FACILITY DOSE		Dose at @ East Gate (mrem)	Dose at @ Entrada Drive (mrem)
LANSCE stack	53000303	8.20E-03	3.48E-03
LANSCE stack GMAP (see above)	53000702	2.05E-02	6.39E-03
LANSCE stack PVAP	53000702	8.58E-04	3.00E-04
LANSCE Diffuse/Fugitive Emissions – Beam Switchyard	53DIF3SY	7.18E-03	2.09E-03
LANSCE Diffuse/Fugitive Emissions – 1L Service Area	53DIF1LS	1.43E-03	4.19E-04
LANSCE Diffuse/Fugitive Emissions – Building 984 ***(new in 2014)***	53DIF984	4.32E-02	8.30E-02
2014 LANSCE facility summary:		8.14E-02	9.57E-02

GMAP = Gaseous Mixed Activation products; short-lived radioactive gases (e.g., C-11, O-15, Ar-41).

PVAP = Particulate & Vapor Activation Products (e.g., Na-24, Br-76).

Note: All CAP88 analyses above are annual assessments, with the exception of the monthly GMAP analyses for stack 53000702, as described.

Note: For completeness, the "Summary" portion of this table is reproduced in Table 13, next page, for both the facility critical receptor (usually East Gate) and the LANL Maximally Exposed Individual (MEI) receptor.

Note: 53DIF984 is about 750 meters west of the other sources at TA-53. As such, the critical receptor for Building 984 is not the East Gate complex, but rather a business on Entrada Drive. Doses in the above table are shown to each location.

Table 13. 40-61.92 Highest Effective Dose Equivalent Summary All LANL Sources

Description	StackID	Dose for Site Critical Receptor (mrem)	Dose at Entrada Drive receptor (mrem)
CMR Stack – Wing 2	03002914	8.31E-07	9.64E-08
CMR Stack – Wing 2	03002915	2.15E-06	2.54E-07
CMR Stack – Wing 3	03002919	1.22E-04	1.30E-05
CMR Stack – Wing 3	03002920	7.72E-07	6.94E-08
CMR Stack – Wing 4	03002923	2.62E-06	2.78E-07
CMR Stack – Wing 4	03002924	1.94E-05	1.83E-06
CMR Stack – Wing 5	03002928	1.92E-06	2.54E-07
CMR Stack – Wing 5	03002929	1.62E-07	2.10E-08
CMR Stack – Wing 7	03002932	2.10E-07	2.21E-08
CMR Stack – Wing 7	03002933	1.77E-07	1.89E-08
CMR Stack – Wing 9	03002944	1.44E-04	1.43E-05
CMR Stack – Wing 9	03002945	0.00E+00	0.00E+00
CMR Stack – Wing 9	03002946	0.00E+00	0.00E+00
WETF Stack – new	16045005	2.55E-02	5.21E-03
Radiochemistry Stack	48000107	2.12E-03	2.56E-04
Radiochemistry Stack	48000154	1.23E-07	1.44E-08
Radiochemistry Stack	48000160	6.22E-08	7.28E-09
Waste Management Stack	50000102	2.51E-06	7.62E-07
Waste Management Stack	50003701	0.00E+00	0.00E+00
Waste Management Stack	50006903	4.27E-08	1.12E-08
LANSCE-Stack	53000303	8.20E-03	3.48E-03
LANSCE-Stack – GMAP (See Note 1 below)	53000702	2.05E-02	6.39E-03
LANSCE- Annual – Partic/Vapor	53000702	8.58E-04	3.00E-04
LANSCE Fugitive - Beam Switch Yard	53DIF3SY	7.18E-03	2.09E-03
LANSCE Fugitive - 1L Service Area	53DIF1LS	1.43E-03	4.19E-04
LANSCE Fugitive – Building 984	53DIF984	8.30E-02	8.30E-02
Waste Processing Stack	54023199	0.00E+00	0.00E+00
Waste Processing Stack	54037599	2.53E-08	4.65E-10
Waste Processing Stack	54041299	6.99E-09	1.13E-10
Plutonium Facility Stack	55000415	1.31E-07	2.35E-08
Plutonium Facility Stack	55000416	1.21E-03	2.59E-04
Radiological Lab/Utility/Office Bldg	55040099	0.00E+00	0.00E+00
Unmonitored Stacks - No credit for controls	99000000	1.20E-01	1.20E-01
Air Sampler Net Dose @ this location	99000010	N/A (Various Locations)	2.07E-02
Total dose to off-site maximally exposed individual (mrem)			**= 0.24 mrem**

Note 1: As described in Table 12, the reporting value for GMAP emissions from 53000702 is the maximum value of either the annual GMAP dose assessment or the sum of monthly GMAP dose assessments. Data for TA-53 stacks here is reproduced from Table 12, with the exception of 53DIF984. This source's critical receptor is the same as the LANL MEI location.

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: *<Signature on file>* Date: *19 June 2015*
Owner: Kimberly Davis Lebak
Manager
Los Alamos Field Office, NA-00-LA
National Nuclear Security Administration
U. S. Department of Energy

Signature: *<Signature on file>* Date: *11 June 2015*
Operator: Michael T. Brandt
Associate Director
Environment, Safety, and Health
Los Alamos National Security, LLC
Los Alamos National Laboratory

Appendix 1 – Meteorology Data

Due to the extent of data reported in Table 7, that table has been moved to this appendix.

Table 7: 40-61.94(b)(7) User-Supplied Data—Wind Frequency Arrays

Table 7a: CAP88 Input Data for 2014 TA-6 Meteorological Tower (93.30% Data Completeness)

N	A	0.000950.000210.000000.000000.000000.00000
NNE	A	0.000920.000310.000000.000000.000000.00000
NE	A	0.001840.000490.000000.000000.000000.00000
ENE	A	0.002750.000700.000000.000000.000000.00000
E	A	0.003120.000760.000000.000000.000000.00000
ESE	A	0.003580.002290.000000.000000.000000.00000
SE	A	0.003700.002360.000000.000000.000000.00000
SSE	A	0.002420.002170.000000.000000.000000.00000
S	A	0.001930.001010.000000.000000.000000.00000
SSW	A	0.000760.000640.000000.000000.000000.00000
SW	A	0.000610.000150.000000.000000.000000.00000
WSW	A	0.000430.000180.000000.000000.000000.00000
W	A	0.000370.000240.000000.000000.000000.00000
WNW	A	0.000240.000180.000030.000000.000000.00000
NW	A	0.000370.000310.000030.000000.000000.00000
NNW	A	0.000370.000180.000060.000000.000000.00000
N	B	0.000240.000210.000030.000000.000000.00000
NNE	B	0.000310.000240.000000.000000.000000.00000
NE	B	0.000310.000670.000000.000000.000000.00000
ENE	B	0.000860.001220.000000.000000.000000.00000
E	B	0.001250.001280.000000.000000.000000.00000
ESE	B	0.001380.002420.000000.000000.000000.00000
SE	B	0.001250.003400.000000.000000.000000.00000
SSE	B	0.000860.002910.000000.000000.000000.00000
S	B	0.000460.001840.000030.000000.000000.00000
SSW	B	0.000310.000700.000060.000000.000000.00000
SW	B	0.000120.000280.000000.000000.000000.00000
WSW	B	0.000090.000310.000030.000000.000000.00000
W	B	0.000000.000210.000030.000000.000000.00000
WNW	B	0.000060.000120.000000.000000.000000.00000
NW	B	0.000090.000310.000120.000030.000000.00000
NNW	B	0.000060.000240.000120.000000.000000.00000
N	C	0.000240.000240.000060.000030.000000.00000
NNE	C	0.000800.000670.000060.000000.000000.00000
NE	C	0.000490.002390.000090.000000.000000.00000
ENE	C	0.001530.002970.000060.000000.000000.00000
E	C	0.001650.003400.000000.000000.000000.00000
ESE	C	0.001250.006270.000090.000000.000000.00000
SE	C	0.001220.009080.000150.000000.000000.00000
SSE	C	0.001010.011320.000460.000000.000000.00000
S	C	0.001160.007770.000890.000000.000000.00000
SSW	C	0.000400.002320.000920.000030.000000.00000
SW	C	0.000280.000890.000400.000000.000000.00000
WSW	C	0.000180.000860.000400.000000.000000.00000
W	C	0.000180.000860.000670.000000.000000.00000
WNW	C	0.000060.000730.000610.000030.000000.00000
NW	C	0.000030.000890.000760.000060.000000.00000
NNW	C	0.000180.000580.000310.000000.000000.00000

(Table continued next page)

Table 7a (continued)

```
  N D 0.004040.005900.002170.000760.000030.00000
NNE D 0.003180.006580.002810.001070.000150.00000
 NE D 0.002260.004800.001620.000090.000000.00000
ENE D 0.002570.003640.000800.000000.000000.00000
  E D 0.002690.003400.000340.000030.000000.00000
ESE D 0.003330.006970.000550.000000.000000.00000
 SE D 0.003760.009880.002660.000120.000000.00000
SSE D 0.004310.019360.011870.001650.000000.00000
  S D 0.005540.024410.035360.007860.000120.00000
SSW D 0.005050.022180.029330.008900.000610.00000
 SW D 0.004130.012820.015880.009180.002230.00006
WSW D 0.004710.010090.014190.012720.003430.00015
  W D 0.004280.008690.017920.014620.003030.00028
WNW D 0.003300.007680.018200.016920.006610.00251
 NW D 0.003330.008750.011620.008260.003060.00043
NNW D 0.004710.007000.004920.001960.000060.00000
  N E 0.002480.004590.001990.000000.000000.00000
NNE E 0.001130.003760.000950.000000.000000.00000
 NE E 0.000860.000920.000210.000000.000000.00000
ENE E 0.000640.000370.000090.000000.000000.00000
  E E 0.000550.000060.000030.000000.000000.00000
ESE E 0.001250.000670.000030.000000.000000.00000
 SE E 0.001250.000760.000060.000000.000000.00000
SSE E 0.001990.002480.000150.000000.000000.00000
  S E 0.002540.007520.001250.000000.000000.00000
SSW E 0.002750.017710.003460.000000.000000.00000
 SW E 0.002720.017280.009790.000000.000000.00000
WSW E 0.002540.005780.005290.000000.000000.00000
  W E 0.002780.004470.001740.000000.000000.00000
WNW E 0.002630.006090.005480.000000.000000.00000
 NW E 0.002080.009360.005020.000000.000000.00000
NNW E 0.002450.006120.001650.000000.000000.00000
  N F 0.007000.007980.000430.000000.000000.00000
NNE F 0.002420.001440.000060.000000.000000.00000
 NE F 0.001250.000180.000000.000000.000000.00000
ENE F 0.000800.000000.000000.000000.000000.00000
  E F 0.000760.000030.000000.000000.000000.00000
ESE F 0.001130.000180.000030.000000.000000.00000
 SE F 0.001130.000120.000000.000000.000000.00000
SSE F 0.001680.000280.000000.000000.000000.00000
  S F 0.002260.000730.000000.000000.000000.00000
SSW F 0.004100.002910.000000.000000.000000.00000
 SW F 0.006180.011650.000340.000000.000000.00000
WSW F 0.008110.025600.003640.000000.000000.00000
  W F 0.006910.024010.001280.000000.000000.00000
WNW F 0.006120.021410.001440.000000.000000.00000
 NW F 0.006910.026950.001380.000000.000000.00000
NNW F 0.008040.016980.000670.000000.000000.00000
```

(Table continued next page)

Table 7 (continued)

```
Table 7b:     CAP88 Input Data for 2014 TA-53 Meteorological Tower
              (99.90% Data Completeness)
       N A 0.000970.000290.000000.000000.000000.00000
     NNE A 0.001800.000340.000030.000000.000000.00000
      NE A 0.002770.000860.000000.000000.000000.00000
     ENE A 0.004280.001890.000000.000000.000000.00000
       E A 0.003860.001910.000000.000000.000000.00000
     ESE A 0.003370.002110.000000.000000.000000.00000
      SE A 0.002460.002430.000000.000000.000000.00000
     SSE A 0.002600.002110.000000.000000.000000.00000
       S A 0.001740.001340.000000.000000.000000.00000
     SSW A 0.000940.000540.000000.000000.000000.00000
      SW A 0.000340.000460.000000.000000.000000.00000
     WSW A 0.000340.000200.000000.000000.000000.00000
       W A 0.000310.000140.000030.000000.000000.00000
     WNW A 0.000230.000260.000000.000000.000000.00000
      NW A 0.000400.000200.000000.000000.000000.00000
     NNW A 0.000510.000200.000000.000000.000000.00000
       N B 0.000370.000140.000030.000000.000000.00000
     NNE B 0.000660.000290.000000.000000.000000.00000
      NE B 0.000800.001090.000030.000000.000000.00000
     ENE B 0.001970.001910.000000.000000.000000.00000
       E B 0.001310.002430.000000.000000.000000.00000
     ESE B 0.001340.002770.000000.000000.000000.00000
      SE B 0.000890.001860.000000.000000.000000.00000
     SSE B 0.000570.002230.000000.000000.000000.00000
       S B 0.000400.001740.000000.000000.000000.00000
     SSW B 0.000200.000630.000030.000000.000000.00000
      SW B 0.000170.000260.000000.000000.000000.00000
     WSW B 0.000090.000230.000000.000000.000000.00000
       W B 0.000090.000110.000030.000000.000000.00000
     WNW B 0.000110.000340.000000.000000.000000.00000
      NW B 0.000140.000200.000140.000000.000000.00000
     NNW B 0.000140.000110.000060.000000.000000.00000
       N C 0.000340.000510.000400.000000.000000.00000
     NNE C 0.000660.001540.000370.000000.000000.00000
      NE C 0.001460.003510.000510.000000.000000.00000
     ENE C 0.002200.006060.000260.000000.000000.00000
       E C 0.001910.006970.000200.000000.000000.00000
     ESE C 0.001140.005830.000060.000000.000000.00000
      SE C 0.000890.005660.000060.000000.000000.00000
     SSE C 0.001030.006140.000400.000000.000000.00000
       S C 0.000690.005310.000490.000000.000000.00000
     SSW C 0.000310.002200.000430.000000.000000.00000
      SW C 0.000030.001060.000230.000000.000000.00000
     WSW C 0.000200.000830.000540.000000.000000.00000
       W C 0.000060.000740.000660.000000.000000.00000
     WNW C 0.000090.000310.000570.000030.000000.00000
      NW C 0.000030.000430.000540.000060.000000.00000
     NNW C 0.000170.000260.000230.000000.000000.00000
```

(Table continued next page)

Table 7b (continued)

```
  N D 0.004740.009080.008340.002830.000230.00000
NNE D 0.005340.011540.008680.003770.000600.00003
 NE D 0.005400.009830.004740.001170.000000.00000
ENE D 0.005570.010650.003280.000140.000000.00000
  E D 0.005170.010830.001800.000060.000000.00000
ESE D 0.003630.005910.000690.000030.000000.00000
 SE D 0.003110.006280.001370.000340.000000.00000
SSE D 0.003400.010370.008860.002310.000260.00000
  S D 0.003400.017400.027940.016220.000540.00000
SSW D 0.003260.014450.038510.025910.002970.00029
 SW D 0.002770.011280.021280.013940.003090.00023
WSW D 0.001710.007570.013140.011570.003630.00040
  W D 0.001830.007060.015370.010680.002370.00046
WNW D 0.002660.005030.011400.009260.002710.00049
 NW D 0.003110.003400.006170.005260.001910.00074
NNW D 0.003680.003800.004940.003460.000600.00006
  N E 0.004570.008910.001600.000000.000000.00000
NNE E 0.004400.007110.002310.000000.000000.00000
 NE E 0.002570.004200.001510.000000.000000.00000
ENE E 0.001540.002540.000370.000000.000000.00000
  E E 0.001860.001570.000090.000000.000000.00000
ESE E 0.001340.001310.000030.000000.000000.00000
 SE E 0.001140.001230.000060.000000.000000.00000
SSE E 0.001230.001800.000430.000000.000000.00000
  S E 0.001310.006110.004570.000000.000000.00000
SSW E 0.001340.014800.028250.000000.000000.00000
 SW E 0.001910.018050.015430.000000.000000.00000
WSW E 0.001460.011050.010680.000000.000000.00000
  W E 0.001710.007880.010030.000000.000000.00000
WNW E 0.002140.008230.006310.000000.000000.00000
 NW E 0.003400.005660.002540.000000.000000.00000
NNW E 0.003770.007000.003830.000000.000000.00000
  N F 0.005600.002290.000030.000000.000000.00000
NNE F 0.005660.001940.000030.000000.000000.00000
 NE F 0.004940.001400.000090.000000.000000.00000
ENE F 0.004260.000890.000000.000000.000000.00000
  E F 0.003340.000310.000000.000000.000000.00000
ESE F 0.002600.000370.000000.000000.000000.00000
 SE F 0.002630.000940.000000.000000.000000.00000
SSE F 0.003430.001200.000060.000000.000000.00000
  S F 0.004260.003540.000230.000000.000000.00000
SSW F 0.004600.007710.001110.000000.000000.00000
 SW F 0.004140.004200.000400.000000.000000.00000
WSW F 0.003030.007060.001860.000000.000000.00000
  W F 0.003260.008540.003940.000000.000000.00000
WNW F 0.004200.006480.000340.000000.000000.00000
 NW F 0.004370.003200.000860.000000.000000.00000
NNW F 0.004940.002910.000540.000000.000000.00000
```

(Table continued next page)

Table 7 (continued)

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Table 7c:     CAP88 Input Data for 2014 TA-54 Meteorological Tower
              (91.45% Data Completeness)
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```
   N A 0.000590.000340.000000.000000.000000.00000
 NNE A 0.001150.000410.000000.000000.000000.00000
  NE A 0.002590.001090.000000.000000.000000.00000
 ENE A 0.003990.001780.000000.000000.000000.00000
   E A 0.004770.002750.000000.000000.000000.00000
 ESE A 0.004530.002720.000030.000000.000000.00000
  SE A 0.004710.002090.000000.000000.000000.00000
 SSE A 0.002720.001750.000000.000000.000000.00000
   S A 0.002000.001400.000000.000000.000000.00000
 SSW A 0.001220.001060.000000.000000.000000.00000
  SW A 0.000910.000560.000000.000000.000000.00000
 WSW A 0.000690.000190.000000.000000.000000.00000
   W A 0.000370.000370.000000.000000.000000.00000
 WNW A 0.000340.000090.000000.000000.000000.00000
  NW A 0.000250.000120.000000.000000.000000.00000
 NNW A 0.000340.000120.000000.000000.000000.00000
   N B 0.000160.000250.000000.000000.000000.00000
 NNE B 0.000530.000720.000000.000000.000000.00000
  NE B 0.000530.001440.000030.000000.000000.00000
 ENE B 0.001030.001970.000000.000000.000000.00000
   E B 0.001150.002720.000000.000000.000000.00000
 ESE B 0.001060.001810.000030.000000.000000.00000
  SE B 0.000690.001720.000000.000000.000000.00000
 SSE B 0.000120.001470.000000.000000.000000.00000
   S B 0.000340.001470.000000.000000.000000.00000
 SSW B 0.000190.000750.000030.000000.000000.00000
  SW B 0.000120.000590.000000.000000.000000.00000
 WSW B 0.000060.000370.000030.000000.000000.00000
   W B 0.000030.000250.000000.000000.000000.00000
 WNW B 0.000000.000060.000030.000000.000000.00000
  NW B 0.000000.000160.000000.000000.000000.00000
 NNW B 0.000030.000120.000000.000000.000000.00000
   N C 0.000190.000440.000000.000000.000000.00000
 NNE C 0.000410.001840.000060.000000.000000.00000
  NE C 0.000910.005120.000120.000000.000000.00000
 ENE C 0.001250.005870.000090.000000.000000.00000
   E C 0.001280.005650.000030.000000.000000.00000
 ESE C 0.001190.002930.000000.000000.000000.00000
  SE C 0.000410.002680.000030.000000.000000.00000
 SSE C 0.000470.003620.000060.000000.000000.00000
   S C 0.000250.004460.000340.000000.000000.00000
 SSW C 0.000340.003710.000470.000000.000000.00000
  SW C 0.000280.001530.000340.000000.000000.00000
 WSW C 0.000190.000620.000280.000000.000000.00000
   W C 0.000120.000750.000870.000030.000000.00000
 WNW C 0.000090.000470.000660.000060.000000.00000
  NW C 0.000030.000340.000280.000030.000000.00000
 NNW C 0.000120.000370.000410.000000.000000.00000
```

(Table continued next page)

Table 7c (continued)

```
  N D 0.003990.005400.003310.002220.000160.00003
NNE D 0.004930.011020.010420.003620.000910.00012
 NE D 0.004990.018290.012360.001190.000030.00000
ENE D 0.004810.011420.002840.000090.000000.00000
  E D 0.002780.005960.000660.000030.000000.00000
ESE D 0.001840.002280.000190.000030.000000.00000
 SE D 0.001250.002650.000840.000370.000030.00000
SSE D 0.001370.004240.003030.002900.000470.00000
  S D 0.002370.010110.015420.016630.002720.00003
SSW D 0.002310.014570.039410.039730.005340.00009
 SW D 0.003210.011520.023500.015880.003180.00053
WSW D 0.003310.006870.008990.008210.002120.00016
  W D 0.003340.007080.009610.006150.000910.00000
WNW D 0.004030.004240.006870.004960.000750.00006
 NW D 0.003930.005120.004960.003120.000280.00003
NNW D 0.003930.004560.002780.002150.000310.00000
  N E 0.003680.004310.003960.000000.000000.00000
NNE E 0.002120.004620.004370.000000.000000.00000
 NE E 0.001560.002620.001470.000000.000000.00000
ENE E 0.000970.001150.000310.000000.000000.00000
  E E 0.000810.000590.000030.000000.000000.00000
ESE E 0.000690.000690.000030.000000.000000.00000
 SE E 0.000810.000660.000030.000000.000000.00000
SSE E 0.000590.001310.000660.000000.000000.00000
  S E 0.000780.002310.003340.000000.000000.00000
SSW E 0.001650.008330.013540.000000.000000.00000
 SW E 0.001560.011580.015320.000000.000000.00000
WSW E 0.002030.006830.003900.000000.000000.00000
  W E 0.003280.008300.002560.000000.000000.00000
WNW E 0.003030.008710.003060.000000.000000.00000
 NW E 0.004430.007610.001900.000000.000000.00000
NNW E 0.003590.005400.001530.000000.000000.00000
  N F 0.007800.014510.002250.000000.000000.00000
NNE F 0.005180.007860.000870.000000.000000.00000
 NE F 0.003370.002900.000370.000000.000000.00000
ENE F 0.001400.000720.000000.000000.000000.00000
  E F 0.000810.000160.000000.000000.000000.00000
ESE F 0.000720.000000.000000.000000.000000.00000
 SE F 0.000340.000190.000030.000000.000000.00000
SSE F 0.000750.000250.000060.000000.000000.00000
  S F 0.000970.001060.000220.000000.000000.00000
SSW F 0.002090.005840.001440.000000.000000.00000
 SW F 0.002960.014950.006370.000000.000000.00000
WSW F 0.004180.023030.006680.000000.000000.00000
  W F 0.006770.024870.004560.000000.000000.00000
WNW F 0.007900.017880.000720.000000.000000.00000
 NW F 0.010950.038510.001620.000000.000000.00000
NNW F 0.009210.019500.003870.000000.000000.00000
```