

General Formation of a Standard

Standards are created to protect a target group from a variety of contaminants in a given exposure pathway for a specific time frame. A target group may refer to the general public, animals, or a sensitive population like adolescents, the elderly, or asthmatics. Contaminants of concern are addressed by a governing body, such as the EPA, which takes into consideration occurrence in the environment, human exposure and risks of adverse health effects, available methods of detection, cost of implementation, geographic location, and public health. After a contaminant of concern has been identified, all exposure pathways are considered to determine the most probable instances and the need for regulation. Pathways of exposure include air, water, soil, biota, and foodstuffs that can be ingested, absorbed, or inhaled. Time of exposure is also an important factor in the formation of standards because prolonged exposure to low levels of a contaminant can have similar health effects as a short exposure to a high level of a contaminant.

Throughout this report, we compare concentrations of radioactive and chemical constituents in air and water samples with pertinent standards and guidelines in regulations of federal and state agencies. Los Alamos National Laboratory (LANL or the Laboratory) operations are conducted in accordance with directives for compliance with environmental standards. These directives are contained in Department of Energy (DOE) Orders 450.1, “Environmental Protection Program;” 5400.5, “Radiation Protection of the Public and the Environment;” and 231.1A, “Environmental Safety and Health Reporting.”

Radiation Standards

DOE regulates radiation exposure to the public and the worker by limiting the radiation dose that can be received during routine Laboratory operations. Because some radionuclides remain in the body and result in exposure long after intake, DOE requires consideration of the dose commitment caused by inhalation, ingestion, or absorption of such radionuclides. This evaluation involves integrating the dose received from radionuclides over a standard period of time. For this report, 50-yr dose commitments were calculated using the EPA dose factors from Federal Guidance Report No. 13 (EPA 1999). The dose factors EPA adopted are based on the recommendations of Publication 30 of the International Commission on Radiological Protection (ICRP 1988).

In 1990, DOE issued Order 5400.5, which finalized the interim radiation protection standard for the public (NCRP 1987). Table A-1 lists currently applicable radiation protection standards, now referred to as public dose limits, for operations at the Laboratory. DOE’s comprehensive public dose limit for radiation exposure limits the effective dose equivalent (EDE) that a member of the public can receive from DOE operations to 100 mrem per year. For one specific activity or pathway, DOE guidance specifies a “dose constraint” of 25 mrem

**Table A-1
DOE Dose Limits
for External and Internal Exposures**

Exposure pathway	Dose Equivalent ^a at Point of Maximum Probable Exposure
Exposure of Any Member of the Public^b	
All Pathways	100 mrem/yr ^c
One Specific Pathway (dose constraint)	25 mrem/yr ^d
Air Pathway Only ^e	10 mrem/yr
Drinking Water	4 mrem/yr
Occupational Exposure^b	
Stochastic Effects	5 rem/yr (TEDE) ^f
Nonstochastic Effects	
Lens of eye	15 rem/yr
Extremity	50 rem/yr
Skin of the whole body	50 rem/yr
Skin of the whole body	50 rem/yr
Embryo/Fetus of Declared Pregnant Worker	0.5 rem/gestation period

^a Note: Refer to Glossary for definition.

^b In keeping with DOE policy, exposures must be limited to as small a fraction of the respective annual dose limits as practicable. DOE’s public dose limit applies to exposures from routine Laboratory operation, excluding contributions from cosmic, terrestrial, and global fallout; self-irradiation; and medical diagnostic sources of radiation. Routine operation means normal, planned operation and does not include actual or potential accidental or unplanned releases. Exposure limits for any member of the general public are taken from DOE Order 5400.5 (DOE 1990). Limits for occupational exposure are taken from 10 CFR 835, Occupational Radiation Protection.

^c Under special circumstances and subject to approval by DOE, this limit on the EDE may be temporarily increased to 500 mrem/yr, provided the dose averaged over a lifetime does not exceed the principal limit of 100 mrem per year.

^d Guidance (DOE 1999.)

^e This level is from EPA’s regulations issued under the Clean Air Act (40 CFR 61, Subpart H) (EPA 1989a).

^f Refer to Glossary for definition.

per year (DOE 1999.) The public dose limits and the DOE occupational dose limits are based on recommendations in ICRP (1988) and the National Council on Radiation Protection and Measurements (NCRP 1987).

The EDE is the hypothetical whole-body dose that would result in the same risk of radiation-induced cancer or genetic disorder as a given exposure to an individual organ. It is the sum of the individual organ doses, weighted to account for the sensitivity of each organ to radiation-induced damage. The weighting factors are taken from the recommendations of the ICRP. The EDE includes doses from both internal and external exposure. External dose factors were obtained from Federal Guidance Report No. 12 (EPA 1993).

Radionuclide concentrations in water are compared with DOE's Derived Concentration Guides (DCGs) to evaluate potential impacts to members of the public. The DCGs for water are those concentrations in water that if consumed at a maximum rate of 730 liters per year, would give a dose of 100 mrem per year.

Table A-2 shows the DCGs. For comparison with drinking-water systems, the DCGs are multiplied by 0.04 to correspond with the EPA limit of 4 mrem per year.

In addition to DOE standards, in 1985 and 1989, the EPA established the National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities, 40 CFR 61, Subpart H. This regulation states that emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr. DOE has adopted this dose limit (Table A-1). This dose is calculated at the location of a residence, school, business, or office. In addition, the regulation requires monitoring of all release points that can produce a dose of 0.1 mrem to a member of the public.

Nonradioactive Air Quality Standards

Table A-3 shows federal and state ambient air quality standards for nonradioactive pollutants.

National Pollutant Discharge Elimination System

The types of monitoring required under National Pollutant Discharge Elimination System (NPDES) and the limits established for sanitary and industrial outfalls can be found at http://int.lanl.gov/environment/h2o/cw_npdes.shtml.

Table A-2
DOE's Derived Concentration Guides for Water^a

Nuclide	DCGs for Water Ingestion in Uncontrolled Areas (pCi/L)	DCGs for Drinking Water Systems (pCi/L) ^b
³ H	2,000,000	80,000
⁷ Be	1,000,000	40,000
⁸⁹ Sr	20,000	800
⁹⁰ Sr	1,000	40
¹³⁷ Cs	3,000	120
²³⁴ U	500	20
²³⁵ U	600	24
²³⁸ U	600	24
²³⁸ Pu	40	1.6
²³⁹ Pu	30	1.2
²⁴⁰ Pu	30	1.2
²⁴¹ Am	30	1.2

^a Guides for uncontrolled areas are based on DOE's public dose limit for the general public (DOE 1990). Guides apply to concentrations in excess of those occurring naturally or that are due to worldwide fallout.

^b Drinking water DCGs are 4% of the DCGs for non-drinking water.

Table A-3
National (40 CFR 50) and New Mexico (20.2.3 NMAC) Ambient Air Quality Standards

Pollutant	Averaging Time	Unit	New Mexico Standard	Federal Standards	
				Primary	Secondary
Sulfur dioxide	Annual	ppm	0.02	0.030	
	24 hours	ppm	0.10	0.14	
	3 hours	ppm			0.5
Hydrogen sulfide	1 hour	ppm	0.010		
Total reduced sulfur	1/2 hour	ppm	0.003		
Total Suspended Particulates	Annual	$\mu\text{g}/\text{m}^3$	60		
	30 days	$\mu\text{g}/\text{m}^3$	90		
	7 days	$\mu\text{g}/\text{m}^3$	110		
	24 hours	$\mu\text{g}/\text{m}^3$	150		
PM-10 ^a	Annual	$\mu\text{g}/\text{m}^3$		50	50
	24 hours	$\mu\text{g}/\text{m}^3$		150	150
PM-2.5 ^b	Annual	$\mu\text{g}/\text{m}^3$		15	15
	24 hours	$\mu\text{g}/\text{m}^3$		65	65
Carbon monoxide	8 hours	ppm	8.7	9	
	1 hour	ppm	13.1	35	
Ozone	1 hour	ppm		0.12	0.12
	8 hours	ppm		0.08	0.08
Nitrogen dioxide	Annual	ppm	0.05	0.053	0.053
	24 hours	ppm	0.10		
Lead and lead compounds	Calendar quarter	$\mu\text{g}/\text{m}^3$		1.5	1.5

^a Particles $\leq 10 \mu\text{m}$ in diameter.

^b Particles $\leq 2.5 \mu\text{m}$ in diameter.

Drinking Water Standards

For chemical constituents in drinking water, regulations and standards are issued by the Environmental Protection Agency (EPA) and adopted by the New Mexico Environment Department (NMED) as part of the New Mexico Drinking Water Regulations (NMEIB 1995). To view the New Mexico Drinking Regulations go to http://www.nmenv.state.nm.us/Common/regs_idx.html. EPA's secondary drinking water standards, which are not included in the New Mexico Drinking Water Regulations and are not enforceable, relate to contaminants in drinking water that primarily affect aesthetic qualities associated with public acceptance of drinking water (EPA 1989b). There may be health effects associated with considerably higher concentrations of these contaminants.

Radioactivity in drinking water is regulated by EPA regulations contained in 40 CFR 141 (EPA 1989b) and New Mexico Drinking Water Regulations, Sections 206 and 207 (NMEIB 1995). These regulations provide that combined radium-226 and radium-228 may not exceed 5 pCi per liter. Gross alpha activity (including radium-226, but excluding radon and uranium) may not exceed 15 pCi per liter.

A screening level of 5 pCi per liter for gross alpha is established to determine when analysis specifically for radium isotopes is necessary. In this report, plutonium concentrations are compared with both the EPA gross alpha standard for drinking water and the DOE guides calculated for the DCGs applicable to drinking water (Table A-2).

For man-made beta- and photon-emitting radionuclides, EPA drinking water standards are limited to concentrations that would result in doses not exceeding 4 mrem per year, calculated according to a specified procedure. In addition, DOE Order 5400.5 requires that persons consuming water from DOE-operated

public water supplies do not receive an EDE greater than 4 mrem per year. DCGs for drinking water systems based on this requirement are in Table A-2.

Surface Water Standards

Concentrations of radionuclides in surface water samples may be compared with either the DOE DCGs (Table A-2) or the New Mexico Water Quality Control Commission (NMWQCC) stream standard, which references the state's radiation protection regulations. However, New Mexico radiation levels are in general two orders of magnitude greater than DOE's DCGs for public dose, so only the DCGs will be discussed here. The concentrations of nonradioactive constituents may be compared with the NMWQCC Livestock Watering and Wildlife Habitat stream standards (NMWQCC 1995) (http://www.nmenv.state.nm.us/NMED_regs/swqb/20_6_4_nmac.pdf). The NMWQCC groundwater standards can also be applied in cases where discharges may affect groundwater.

Soils

If contaminant concentrations in soil exceed regional statistical reference levels, the concentrations are first compared to screening levels. The screening level for soils is the concentration that would produce (a) a dose of 15 mrem or greater to an individual, (b) a carcinogen risk of 10^{-5} , or (c) a hazard quotient greater than 1. Screening levels for radionuclides are found in LANL 2005; screening levels for non-radionuclides are found in NMED 2006. If radionuclide concentrations in soil exceed the screening levels, then a dose to a person is calculated using RESRAD and all of the measured radionuclide concentrations available for a given year (these data are presented in [Table S7-1](#)). This calculated dose is compared to the 25-mrem/yr DOE single pathway dose standard (DOE 1999). Doses, risk, or hazard quotients are calculated using a conservative residential scenario given the measured contaminant soil concentration.

Foodstuffs

Federal standards exist for radionuclides and selected non-radionuclides (e.g. mercury and Polychlorinated Biphenyls (PCBs) in foodstuffs. Federal screening levels exist for selected non-radionuclides; LANL has selected screening levels for radionuclides. If contaminant concentrations in foodstuffs exceed regional statistical reference levels, the concentrations are compared to screening levels. LANL has established a screening level of 1 mrem/year for concentrations of individual radionuclides in individual foodstuffs (e.g. fish, crops, etc), assuming a residential scenario. EPA has established screening levels for mercury (EPA 2001) and PCBs (EPA 2007) in fish.

If contaminant concentrations in foodstuffs exceed screening levels, contaminant concentrations are compared against Food and Drug Administration (FDA) standards (FDA 2000). In the case of radionuclides, a dose to a person would be calculated from all the radionuclides measured and compared with the 25 mrem/yr DOE single-pathway dose constraint (DOE 1999).

Biota

If contaminant concentrations in biota exceed regional statistical reference levels, the concentrations are compared to screening levels. For radionuclides in biota, SLs were set at 10% of the standard by LANL to identify the potential contaminants of concern (McNaughton 2006). For chemicals, there are no SLs based on biota tissue concentrations. Instead, if a chemical in biota tissue exceeds the RSRL, then the chemical concentrations in the soil at the place of collection are compared with ecological screening levels (ESLs) (LANL 2008).

Based on the concentrations of radionuclides in biota, we calculate a dose and compare it with the 1-rad/day DOE dose standard for terrestrial plants and aquatic biota and 0.1-rad/day for terrestrial animals (DOE 2002).

References

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- DOE 2003b: US Department of Energy, "Environment, Safety, and Health Reporting," US Department of Energy Order 231.1A (August 19, 2003).
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- EPA 1989a: US Environmental Protection Agency, "40CFR 61, National Emission Standards for Hazardous Air Pollutants, Radionuclides; Final Rule and Notice of Reconsideration," Federal Register 54, 51 653-51 715 (December 15, 1989).
- EPA 1989b: US Environmental Protection Agency, "National Interim Primary Drinking Water Regulations," Code of Federal Regulations, Title 40, Parts 141 and 142 (1989), and "National Secondary Drinking Water Regulations," Part 143 (1989).
- EPA 1993: US Environmental Protection Agency, "External Exposure to Radionuclides in Air, Water, and Soil," Federal Guidance Report No. 12, EPA 402-R-93-081 (September 1993).
- EPA 1999: US Environmental Protection Agency, "Cancer Risk Coefficients for Environmental Exposure to Radionuclides," Federal Guidance Report No. 13, EPA 402-R-90-001 (September 1999).
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- NMWQCC 1995: New Mexico Water Quality Control Commission, "State of New Mexico Water Quality Standards for Interstate and Intrastate Streams," Section 3-101.K (as amended through January 23, 1995).
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- NMED 2006: "Technical Background Document for Development of Soil Screening Levels, Rev. 4.0," New Mexico Environment Department report.

Throughout this report the US Customary (English) system of measurement has generally been used because those are the units in which most data and measurements are collected or measured. For units of radiation activity, exposure, and dose, US Customary Units (that is, curie [Ci], roentgen [R], rad, and rem) are retained as the primary measurement because current standards are written in terms of these units. The equivalent SI units are the becquerel (Bq), coulomb per kilogram (C/kg), gray (Gy), and sievert (Sv), respectively.

Table B-1 presents conversion factors for converting US Customary Units into SI units.

Table B-2 presents prefixes used in this report to define fractions or multiples of the base units of measurements. Scientific notation is used in this report to express very large or very small numbers. Translating from scientific notation to a more traditional number requires moving the decimal point either left or right from the number. If the value given is 2.0×10^3 , the decimal point should be moved three numbers (insert zeros if no numbers are given) to the **right** of its present location. The number would then read 2,000. If the value given is 2.0×10^{-5} , the decimal point should be moved five numbers to the **left** of its present location. The result would be 0.00002.

Table B-3 presents abbreviations for common measurements.

DATA HANDLING OF RADIOCHEMICAL SAMPLES

Measurements of radiochemical samples require that analytical or instrumental backgrounds be subtracted to obtain net values. Thus, net values are sometimes obtained that are lower than the minimum detection limit of the analytical technique. Consequently, individual measurements can result in values of positive or negative numbers. Although a negative value does not represent a physical reality, a valid long-term average of many measurements can be obtained only if the very small and negative values are included in the population calculations (Gilbert 1975).

For individual measurements, uncertainties are reported as one standard deviation. The standard deviation is estimated from the propagated sources of analytical error.

**Table B-1
Approximate Conversion
Factors for Selected US Customary Units**

Multiply US Customary units	by	to Obtain SI (Metric) Unit
Fahrenheit (°F)	5/9 - 32	Celsius (°C)
inches (in.)	2.54	centimeters (cm)
cubic feet (ft ³)	0.028	cubic meters (m ³)
acres	.4047	hectares (ha)
ounces (oz)	28.3	grams (g)
pounds (lb)	0.453	kilograms (kg)
miles (mi)	1.61	kilometers (km)
gallons (gal.)	3.785	liters (L)
feet (ft)	0.305	meters (m)
parts per million (ppm)	1	micrograms per gram (µg/g)
parts per million (ppm)	1	milligrams per liter (mg/L)
square miles (mi ²)	2.59	square kilometers (km ²)
picocurie (pCi)	37	millibecquerel (mBq)
rad	0.01	gray (Gy)
millirem (mrem)	0.01	millisievert (mSv)

**Table B-2
Prefixes Used with SI (Metric) Units**

Prefix	Factor	Symbol
mega	1 000 000 or 10 ⁶	M
kilo	1 000 or 10 ³	k
centi	0.01 or 10 ⁻²	c
milli	0.001 or 10 ⁻³	m
micro	0.000001 or 10 ⁻⁶	µ
nano	0.000000001 or 10 ⁻⁹	n
pico	0.000000000001 or 10 ⁻¹²	p
femto	0.000000000000001 or 10 ⁻¹⁵	f
atto	0.000000000000000001 or 10 ⁻¹⁸	a

**Table B-3
Common Measurement Abbreviations and Measurement Symbols**

Symbol	Abbreviation	Symbol	Abbreviation
aCi	attocurie	mrem	millirem
Bq	becquerel	mSv	millisievert
Btu	British thermal unit	nCi	nanocurie
Ci	curie	nCi/dry g	nanocurie per dry gram
cm ³ /s	cubic centimeters per second	nCi/L	nanocurie per liter
cpm/L	counts per minute per liter	ng/m ³	nanogram per cubic meter
fCi/g	femtocurie per gram	pCi/dry g	picocurie per dry gram
ft	foot or feet	pCi/g	picocurie per gram
ft ³ /min	cubic feet per minute	pCi/L	picocurie per liter
ft ³ /s	cubic feet per second	pCi/m ³	picocurie per cubic meter
kg	kilogram	pCi/mL	picocurie per milliliter
kg/h	kilogram per hour	pg/g	picogram per gram
m ³ /s	cubic meter per second	pg/m ³	picogram per cubic meter
μCi/L	microcurie per liter	PM ₁₀	small particulate matter (less than 10 μm diameter)
μCi/mL	microcurie per milliliter	PM _{2.5}	small particulate matter (less than 2.5 μm diameter)
μg/g	microgram per gram	R	roentgen
μg/m ³	microgram per cubic meter	s, SD, or σ	standard deviation
mL	milliliter	sq ft (ft ²)	square feet
mm	millimeter	>	greater than
μm	micrometer	<	less than
μmho/cm	micro mho per centimeter	≥	greater than or equal to
mCi	millicurie	≤	less than or equal to
mg	milligram	±	plus or minus
mR	milliroentgen	~	approximately
mrad	millirad		

Standard deviations for the AIRNET station and group (off-site regional, off-site perimeter, and on-site) means are calculated using the standard equation:

$$s = (\sum (c_i - \bar{c})^2 / (N - 1))^{1/2}$$

where

c_i = sample i ,

\bar{c} = mean of samples from a given station or group, and

N = number of samples in the station or group.

This value is reported as one standard deviation (1s) for the station and group means.

REFERENCE

Gilbert 1975: R. O. Gilbert, "Recommendations Concerning the Computation and Reporting of Counting Statistics for the Nevada Applied Ecology Group," Battelle Pacific Northwest Laboratories report BNWL-B-368 (September 1975).

APPENDIX C – DESCRIPTION OF TECHNICAL AREAS AND THEIR ASSOCIATED PROGRAMS

Locations of the technical areas (TAs) operated by the Laboratory in Los Alamos County are shown in Figure 1-2. The main programs conducted at each of the areas are listed in this Appendix.

Technical Area	Activities
TA-0 (Offsite Facilities)	This TA designation is assigned to structures leased by DOE that are located outside LANL's boundaries in the Los Alamos townsite and White Rock.
TA-2 (Omega Site or Omega West Reactor)	Omega West Reactor, an 8-MW nuclear research reactor, was located here. It was placed into a safe shutdown condition in 1993 and was removed from the nuclear facilities list. The reactor was decontaminated and decommissioned in 2002.
TA-3 (Core Area or South Mesa Site)	This TA is LANL's core scientific and administrative area, with approximately half of LANL's employees and total floor space. It is the location of a number of the LANL's Key Facilities, including the Chemistry and Metallurgy Research Building, the Sigma Complex, the Machine Shops, the Material Sciences Laboratory, and the Nicholas C. Metropolis Center for Modeling and Simulation.
TA-5 (Beta Site)	This TA is largely undeveloped. Located between East Jemez Road and the San Ildefonso Pueblo, it contains physical support facilities, an electrical substation, and test wells.
TA-6 (Two-Mile Mesa Site)	This TA, located in the northwestern part of LANL, is mostly undeveloped. It contains a meteorological tower, gas-cylinder-staging buildings, and aging vacant buildings that are awaiting demolition.
TA-8 (GT-Site [Anchor Site West])	This TA, located along West Jemez Road, is a testing site where nondestructive dynamic testing techniques are used for the purpose of ensuring the quality of materials in items ranging from test weapons components to high-pressure dies and molds. Techniques used include radiography, radioisotope techniques, ultrasonic and penetrant testing, and electromagnetic test methods.
TA-9 (Anchor Site East)	This TA is located on the western edge of LANL. Fabrication feasibility and the physical properties of explosives are explored at this TA, and new organic compounds are investigated for possible use as explosives.
TA-11 (K-Site)	This TA is used for testing explosives components and systems, including vibration analysis and drop-testing materials and components under a variety of extreme physical environments. Facilities are arranged so that testing may be controlled and observed remotely, allowing devices that contain explosives, radioactive materials, and nonhazardous materials to be safely tested and observed.
TA-14 (Q-Site)	This TA, located in the northwestern part of LANL, is one of 14 firing areas. Most operations are remotely controlled and involve detonations, certain types of high explosives machining, and permitted burning.
TA-15 (R-Site)	This TA, located in the central portion of LANL, is used for high explosives research, development, and testing, mainly through hydrodynamic testing and dynamic experimentation. TA-15 is the location of two firing sites, the Dual Axis Radiographic Hydrodynamic Test Facility, which has an intense high-resolution, dual-machine radiographic capability, and Building 306, a multipurpose facility where primary diagnostics are performed.
TA-16 (S-Site)	TA-16, in the western part of LANL, is the location of the Weapons Engineering Tritium Facility, a state-of-the-art tritium processing facility. The TA is also the location of high explosives research, development, and testing, and the High Explosives Wastewater Treatment Facility.
TA-18 (Pajarito Site)	This TA, located in Pajarito Canyon, is the location of the Los Alamos Critical Experiment Facility, a general-purpose nuclear experiments facility. It is the location of the Solution High-Energy Burst Assembly and is also used for teaching and training related to criticality safety and applications of radiation detection and instrumentation. All Security Category I and II materials and activities have been relocated to the Nevada Test Site.
TA-21 (DP-Site)	TA-21 is on the northern border of LANL, next to the Los Alamos townsite. In the western part of the TA is the former radioactive materials (including plutonium) processing facility that has been partially decontaminated and decommissioned. In the eastern part of the TA are the Tritium Systems Test Assembly and the Tritium Science and Fabrication Facility. Operations from both facilities have been transferred elsewhere as of the end of 2006.
TA-22 (TD-Site)	This TA, located in the northwestern portion of LANL, houses the Los Alamos Detonator Facility. Construction of a new Detonator Production Facility began in 2003. Research, development, and fabrication of high-energy detonators and related devices are conducted at this facility.
TA-28 (Magazine Area A)	TA-28, located near the southern edge of LANL, was an explosives storage area. The TA contains five empty storage magazines that are being decontaminated and decommissioned.
TA-33 (HP-Site)	TA-33 is a remotely-located TA at the southeastern boundary of LANL. The TA is used for experiments that require isolation, but do not require daily oversight. The National Radioastronomy Observatory's Very Long Baseline Array telescope is located at this TA.

DESCRIPTION OF TECHNICAL AREAS AND THEIR ASSOCIATED PROGRAMS

Technical Area	Activities
TA-35 (Ten Site)	This TA, located in the north central portion of LANL, is used for nuclear safeguards research and development, primarily in the areas of lasers, physics, fusion, materials development, and biochemistry and physical chemistry research and development. The Target Fabrication Facility, located at this TA, conducts precision machining and target fabrication, polymer synthesis, and chemical and physical vapor deposition. Additional activities at TA-35 include research in reactor safety, optical science, and pulsed-power systems, as well as metallurgy, ceramic technology, and chemical plating. Additionally, there are some Biosafety Level 1 and 2 laboratories at TA-35.
TA-36 (Kappa-Site)	TA-36, a remotely-located area in the eastern portion of LANL, has four active firing sites that support explosives testing. The sites are used for a wide variety of nonnuclear ordnance tests.
TA-37 (Magazine Area C)	This TA is used as an explosives storage area. It is located at the eastern perimeter of TA-16.
TA-39 (Ancho Canyon Site)	TA-39 is located at the bottom of Ancho Canyon. This TA is used to study the behavior of nonnuclear weapons (primarily by photographic techniques) and various phenomenological aspects of explosives.
TA-40 (DF-Site)	TA-40, centrally located within LANL, is used for general testing of explosives or other materials and development of special detonators for initiating high explosives systems.
TA-41 (W-Site)	TA-41, located in Los Alamos Canyon, is no longer actively used. Many buildings have been decontaminated and decommissioned; the remaining structures include historic properties.
TA-43 (the Bioscience Facilities, formerly called the Health Research Laboratory)	TA-43 is adjacent to the Los Alamos Medical Center at the northern border of LANL. Two facilities are located within this TA: the Bioscience Facilities (formerly called the Health Research Laboratory) and NNSA's local Site Office. The Bioscience Facilities have Biosafety Level 1 and 2 laboratories and are the focal point of bioscience and biotechnology at LANL. Research performed at the Bioscience Facilities includes structural, molecular, and cellular radiobiology; biophysics; radiobiology; biochemistry; and genetics.
TA-46 (WA-Site)	TA-46, located between Pajarito Road and the San Ildefonso Pueblo, is one of LANL's basic research sites. Activities have focused on applied photochemistry operations and have included development of technologies for laser isotope separation and laser enhancement of chemical processes. The Sanitary Wastewater Systems Plant is also located within this TA.
TA-48 (Radiochemistry Site)	TA-48, located in the north central portion of LANL, supports research and development in nuclear and radiochemistry, geochemistry, production of medical radioisotopes, and chemical synthesis. Hot cells are used to produce medical radioisotopes.
TA-49 (Frijoles Mesa Site)	TA-49, located near Bandelier National Monument, is used as a training area and for outdoor tests on materials and equipment components that involve generating and receiving short bursts of high-energy, broad-spectrum microwaves. A fire support building and helipad located near the entrance to the TA are operated by the U.S. Forest Service.
TA-50 (Waste Management Site)	TA-50, located near the center of LANL, is the location of waste management facilities including the Radioactive Liquid Waste Treatment Facility and the Waste Characterization, Reduction, and Repackaging Facility. The Actinide Research and Technology Instruction Center is also located in this TA.
TA-51 (Environmental Research Site)	TA-51, located on Pajarito Road in the eastern portion of LANL, is used for research and experimental studies on the long-term impacts of radioactive materials on the environment. Various types of waste storage and coverings are studied at this TA.
TA-52 (Reactor Development Site)	TA-52 is located in the north central portion of LANL. A wide variety of theoretical and computational research and development activities related to nuclear reactor performance and safety, as well as to several environmental, safety, and health activities, are carried out at this TA.
TA-53 (Los Alamos Neutron Science Center)	TA-53, located in the northern portion of LANL, includes the LANSCE. LANSCE houses one of the largest research linear accelerators in the world and supports both basic and applied research programs. Basic research includes studies of subatomic and particle physics, atomic physics, neutrinos, and the chemistry of subatomic interactions. Applied research includes materials science studies that use neutron spallation and contributes to defense programs. LANSCE has also produced medical isotopes for the past 20 years.
TA-54 (Waste Disposal Site)	TA-54, located on the eastern border of LANL, is one of the largest TAs at LANL. Its primary function is management of solid radioactive and hazardous chemical wastes, including storage, treatment, decontamination, and disposal operations.
TA-55 (Plutonium Facility Complex Site)	TA-55, located in the center of LANL, is the location of the Plutonium Facility Complex and is the chosen location for the Chemistry and Metallurgy Research Building Replacement. The Plutonium Facility provides chemical and metallurgical processes for recovering, purifying, and converting plutonium and other actinides into many compounds and forms. The Chemistry and Metallurgy Research Building Replacement, currently under construction, will provide chemistry and metallurgy research, actinide chemistry, and materials characterization capabilities.

Technical Area	Activities
TA-57 (Fenton Hill Site)	TA-57 is located about 20 miles (32 kilometers) west of LANL on land administered by the U.S. Forest Service. The primary purpose of the TA is observation of astronomical events. TA-57 houses the Milagro Gamma Ray Observatory and a suite of optical telescopes. Drilling technology research is also performed in this TA.
TA-58 (Twomile North Site)	TA-58, located near LANL's northwest border on Twomile Mesa North, is a forested area reserved for future use because of its proximity to TA-3. The TA houses a few LANL-owned storage trailers and a temporary storage area.
TA-59 (Occupational Health Site)	This TA is located on the south side of Pajarito Road adjacent to TA-3. This is the location of staff who provide support services in health physics, risk management, industrial hygiene and safety, policy and program analysis, air quality, water quality and hydrology, hazardous and solid waste analysis, and radiation protection. The Medical Facility at TA-59 includes a clinical laboratory and provides bioassay sample analytical support.
TA-60 (Sigma Mesa)	TA-60 is located southeast of TA-3. The TA is primarily used for physical support and infrastructure activities. The Nevada Test Site Test Fabrication Facility and a test tower are also located here. Due to the moratorium on testing, these buildings have been placed in indefinite safe shutdown mode.
TA-61 (East Jemez Site)	TA-61, located in the northern portion of LANL, contains physical support and infrastructure facilities, including a sanitary landfill operated by Los Alamos County and sewer pump stations.
TA-62 (Northwest Site)	TA-62, located next to TA-3 and West Jemez Road in the northwest corner of LANL, serves as a forested buffer zone. This TA is reserved for future use.
TA-63 (Pajarito Service Area)	TA-63, located in the north central portion of LANL, contains physical support and infrastructure facilities. The facilities at this TA serve as localized storage and office space.
TA-64 (Central Guard Site)	This TA is located in the north central portion of LANL and provides offices and storage space.
TA-66 (Central Technical Support Site)	TA-66 is located on the southeast side of Pajarito Road in the center of LANL. The Advanced Technology Assessment Center, the only facility at this TA, provides office and technical space for technology transfer and other industrial partnership activities.
TA-67 (Pajarito Mesa Site)	TA-67 is a forested buffer zone located in the north central portion of LANL. No operations or facilities are currently located at the TA.
TA-68 (Water Canyon Site)	TA-68, located in the southern portion of LANL, is a testing area for dynamic experiments that also contains environmental study areas.
TA-69 (Anchor North Site)	TA-69, located in the northwestern corner of LANL, serves as a forested buffer area. The new Emergency Operations Center, completed in 2003, is located here.
TA-70 (Rio Grande Site)	TA-70 is located on the southeastern boundary of LANL and borders the Santa Fe National Forest. It is a forested TA that serves as a buffer zone.
TA-71 (Southeast Site)	TA-71 is located on the southeastern boundary of LANL and is adjacent to White Rock to the northeast. It is an undeveloped TA that serves as a buffer zone for the High Explosives Test Area.
TA-72 (East Entry Site)	TA-72, located along East Jemez Road on the northeastern boundary of LANL, is used by protective force personnel for required firearms training and practice purposes.
TA-73 (Airport Site)	TA-73 is located along the northern boundary of LANL, adjacent to Highway 502. The County of Los Alamos manages, operates, and maintains the community airport under a leasing arrangement with DOE. Use of the airport by private individuals is permitted with special restrictions.
TA-74 (Otowi Tract)	TA-74 is a forested area in the northeastern corner of LANL. A large portion of this TA has been conveyed to Los Alamos County or transferred to the Department of the Interior in trust for the Pueblo of San Ildefonso and is no longer part of LANL.

For more information on environmental topics at Los Alamos National Laboratory, access the following websites:

Environmental Surveillance reports and supplemental data tables	http://www.lanl.gov/environment/all/esr.shtml
Los Alamos National Laboratory web site	http://www.lanl.gov/
DOE/NNSA Los Alamos Site Office web site	http://www.doeal.gov/laso/default.aspx
Department of Energy web site	http://www.energy.gov/
LANL's air quality pages	http://www.lanl.gov/environment/air/index.shtml
LANL's water quality pages	http://www.lanl.gov/environment/h2o/index.shtml
LANL's waste pages	http://www.lanl.gov/environment/waste/index.shtml
LANL's biological resources pages	http://www.lanl.gov/environment/bio/index.shtml
LANL's risk reduction pages	http://www.lanl.gov/environment/risk/index.shtml
LANL's clean-up pages	http://www.lanl.gov/environment/cleanup/index.shtml
LANL's environmental database	http://www.lanl.gov/environment/all/racer.shtml
Comments and suggestions on this document	http://www.lanl.gov/environment/all/esr.shtml

activation products	Radioactive products generated as a result of neutrons and other subatomic particles interacting with materials such as air, construction materials, or impurities in cooling water. These activation products are usually distinguished, for reporting purposes, from fission products.
alpha particle	A positively charged particle (identical to the helium nucleus) composed of two protons and two neutrons that are emitted during decay of certain radioactive atoms. Alpha particles are stopped by several centimeters of air or a sheet of paper
ambient air	The surrounding atmosphere as it exists around people, plants, and structures. It is not considered to include the air immediately adjacent to emission sources.
AOC	Area of concern
aquifer	A saturated layer of rock or soil below the ground surface that can supply usable quantities of groundwater to wells and springs. Aquifers can be a source of water for domestic, agricultural, and industrial uses.
artesian well	A well in which the water rises above the top of the water-bearing bed.
background radiation	Ionizing radiation from sources other than the Laboratory. This radiation may include cosmic radiation; external radiation from naturally occurring radioactivity in the earth (terrestrial radiation), air, and water; internal radiation from naturally occurring radioactive elements in the human body; worldwide fallout; and radiation from medical diagnostic procedures.
beta particle	A negatively charged particle (identical to the electron) that is emitted during decay of certain radioactive atoms. Most beta particles are stopped by 0.6 cm of aluminum.
biota	The types of animal and plant life found in an area.
blank sample	A control sample that is identical, in principle, to the sample of interest, except that the substance being analyzed is absent. The measured value or signals in blanks for the analyte is believed to be caused by artifacts and should be subtracted from the measured value. This process yields a net amount of the substance in the sample.
blind sample	A control sample of known concentration in which the expected values of the constituent are unknown to the analyst.
CAA	Clean Air Act. The federal law that authorizes the Environmental Protection Agency (EPA) to set air quality standards and to assist state and local governments to develop and execute air pollution prevention and control programs.

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980. Also known as Superfund, this law authorizes the federal government to respond directly to releases of hazardous substances that may endanger health or the environment. The EPA is responsible for managing Superfund.
CFR	Code of Federal Regulations. A codification of all regulations developed and finalized by federal agencies in the Federal Register.
contamination	(1) Substances introduced into the environment as a result of people's activities, regardless of whether the concentration is a threat to health (see pollution). (2) The deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or personnel.
controlled area	Any Laboratory area to which access is controlled to protect individuals from exposure to radiation and radioactive materials.
Ci	Curie. Unit of radioactivity. One Ci equals 3.70×10^{10} nuclear transformations per second.
cosmic radiation	High-energy particulate and electromagnetic radiations that originate outside the earth's atmosphere. Cosmic radiation is part of natural background radiation.
CWA	Clean Water Act. The federal law that authorizes the EPA to set standards designed to restore and maintain the chemical, physical, and biological integrity of the nation's waters.
DCG	Derived Concentration Guides. The concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation), would result in an effective dose equivalent of 100 mrem. DCGs do not consider decay products when the parent radionuclide is the cause of the exposure (DCG values are presented in DOE Order 5400.5).
DOE	US Department of Energy. The federal agency that sponsors energy research and regulates nuclear materials used for weapons production. Los Alamos National Laboratory is managed by the NNSA, an agency within the DOE.
dose	A term denoting the quantity of radiation energy absorbed.
absorbed dose	The energy absorbed by matter from ionizing radiation per unit mass of irradiated material at the place of interest in that material. The absorbed dose is expressed in units of rad (or gray) (1 rad = 0.01 gray).
dose equivalent	The product of absorbed dose in rad (or gray) in tissue, a quality factor, and other modifying factors. Dose equivalent is expressed in units of rem (or sievert) (1 rem = 0.01 sievert).

TEDE	Total effective dose equivalent. The hypothetical whole-body dose that would give the same risk of cancer mortality and serious genetic disorder as a given exposure but that may be limited to a few organs. The effective dose equivalent is equal to the sum of individual organ doses, each weighted by degree of risk that the organ dose carries. For example, a 100-mrem dose to the lung, which has a weighting factor of 0.12, gives an effective dose that is equivalent to $100 \times 0.12 = 12$ mrem.
Maximum individual dose	The greatest dose commitment, considering all potential routes of exposure from a facility's operation, to an individual at or outside the Laboratory boundary where the highest dose rate occurs. It takes into account shielding and occupancy factors that would apply to a real individual.
population dose	The sum of the radiation doses to individuals of a population. It is expressed in units of person-rem. (For example, if 1,000 people each received a radiation dose of 1 rem, their population dose would be 1,000 person-rem.)
whole body dose	A radiation dose commitment that involves exposure of the entire body (as opposed to an organ dose that involves exposure to a single organ or set of organs).
effluent	A liquid waste discharged to the environment.
EIS	Environmental Impact Statement. A detailed report, required by federal law, on the significant environmental impacts that a proposed major federal action would have on the environment. An EIS must be prepared by a government agency when a major federal action that will have significant environmental impacts is planned.
emission	A gaseous waste discharged to the environment.
environmental compliance	The documentation that the Laboratory complies with the multiple federal and state environmental statutes, regulations, and permits that are designed to ensure environmental protection. This documentation is based on the results of the Laboratory's environmental monitoring and surveillance programs.
environmental monitoring	The sampling of contaminants in liquid effluents and gaseous emissions from Laboratory facilities, either by directly measuring or by collecting and analyzing samples in a laboratory.
environmental surveillance	The sampling of contaminants in air, water, sediments, soils, foodstuffs, and plants and animals, either by directly measuring or by collecting and analyzing samples in a laboratory.

EPA	Environmental Protection Agency. The federal agency responsible for enforcing environmental laws. Although state regulatory agencies may be authorized to administer some of this responsibility, EPA retains oversight authority to ensure protection of human health and the environment.
exposure	A measure of the ionization produced in air by x-ray or gamma ray radiation. (The unit of exposure is the roentgen.)
external radiation	Radiation originating from a source outside the body.
gallery	An underground collection basin for spring discharges.
gamma radiation	Short-wavelength electromagnetic radiation of nuclear origin that has no mass or charge. Because of its short wavelength (high energy), gamma radiation can cause ionization. Other electromagnetic radiation (such as microwaves, visible light, and radiowaves) has longer wavelengths (lower energy) and cannot cause ionization.
gross alpha	The total amount of measured alpha activity without identification of specific radionuclides.
gross beta	The total amount of measured beta activity without identification of specific radionuclides.
groundwater	Water found beneath the surface of the ground. Groundwater usually refers to a zone of complete water saturation containing no air.
half-life, radioactive	The time required for the activity of a radioactive substance to decrease to half its value by inherent radioactive decay. After two half-lives, one-fourth of the original activity remains ($1/2 \times 1/2$), after three half-lives, one-eighth ($1/2 \times 1/2 \times 1/2$), and so on.
hazardous waste	Wastes exhibiting any of the following characteristics: ignitability, corrosivity, reactivity, or yielding toxic constituents in a leaching test. In addition, EPA has listed as hazardous other wastes that do not necessarily exhibit these characteristics. Although the legal definition of hazardous waste is complex, the term generally refers to any waste that EPA believes could pose a threat to human health and the environment if managed improperly. Resource Conservation and Recovery Act (RCRA) regulations set strict controls on the management of hazardous wastes.
hazardous waste constituent	The specific substance in a hazardous waste that makes it constituent hazardous and therefore subject to regulation under Subtitle C of RCRA.

HSWA	Hazardous and Solid Waste Amendments of 1984 to RCRA. These amendments to RCRA greatly expanded the scope of hazardous waste regulation. In HSWA, Congress directed EPA to take measures to further reduce the risks to human health and the environment caused by hazardous wastes.
hydrology	The science dealing with the properties, distribution, and circulation of natural water systems.
internal radiation	Radiation from a source within the body as a result of deposition of radionuclides in body tissues by processes such as ingestion, inhalation, or implantation. Potassium-40, a naturally occurring radionuclide, is a major source of internal radiation in living organisms. Also called self-irradiation.
ionizing radiation	Radiation possessing enough energy to remove electrons from the substances through which it passes. The primary contributors to ionizing radiation are radon, cosmic and terrestrial sources, and medical sources such as x-rays and other diagnostic exposures.
isotopes	Forms of an element having the same number of protons in their nuclei but differing in the number of neutrons. Isotopes of an element have similar chemical behaviors but can have different nuclear behaviors.
long-lived isotope	A radionuclide that decays at such a slow rate that a quantity of it will exist for an extended period (half-life is greater than three years).
short-lived isotope	A radionuclide that decays so rapidly that a given quantity is transformed almost completely into decay products within a short period (half-life is two days or less).
LANS	Los Alamos National Security. The limited liability corporation that took over management of LANL in June 2006.
LASO	Los Alamos Site Office. The Los Alamos office of the DOE's NNSA.
LLW	Low-level radioactive waste. Radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e.(2) of the <i>Atomic Energy Act of 1954</i> , as amended), or naturally occurring radioactive material.
MCL	Maximum contaminant level. Maximum permissible level of a contaminant in water that is delivered to the free-flowing outlet of the ultimate user of a public water system (see Appendix A and Table A-6). The MCLs are specified by the EPA.
MDA	Material disposal area.

MEI	Maximally exposed individual. The average exposure to the population in general will always be less than to one person or subset of persons because of where they live, what they do, and their individual habits. To try to estimate the dose to the MEI, one tries to find that population subgroup (and more specifically, the one individual) that potentially has the highest exposure, intake, etc. This becomes the MEI.
mixed waste	Waste that contains a hazardous waste component regulated under Subtitle C of the RCRA and a radioactive component consisting of source, special nuclear, or byproduct material regulated under the federal Atomic Energy Act (AEA).
mrem	Millirem. See definition of rem. The dose equivalent that is one-thousandth of a rem.
NEPA	National Environmental Policy Act. This federal legislation, passed in 1969, requires federal agencies to evaluate the impacts of their proposed actions on the environment before decision making. One provision of NEPA requires the preparation of an EIS by federal agencies when major actions significantly affecting the quality of the human environment are proposed.
NESHAP	National Emission Standards for Hazardous Air Pollutants. These standards are found in the CAA; they set limits for such pollutants as beryllium and radionuclides.
NNSA	National Nuclear Security Agency. An agency within the DOE that is responsible for national security through the military application of nuclear energy.
nonhazardous waste	Chemical waste regulated under the Solid Waste Act, Toxic Substances Control Act, and other regulations, including asbestos, PCB, infectious wastes, and other materials that are controlled for reasons of health, safety, and security.
NPDES	National Pollutant Discharge Elimination System. This federal program, under the Clean Water Act, requires permits for discharges into surface waterways.
nuclide	A species of atom characterized by the constitution of its nucleus. The nuclear constitution is specified by the number of protons, number of neutrons, and energy content—or alternately, by the atomic number, mass number, and atomic mass. To be a distinct nuclide, the atom must be capable of existing for a measurable length of time.
outfall	The location where wastewater is released from a point source into a receiving body of water.

PCB	Polychlorinated biphenyls. A family of organic compounds used since 1926 in electric transformers, lubricants, carbonless copy paper, adhesives, and caulking compounds. PCBs are extremely persistent in the environment because they do not break down into new and less harmful chemicals. PCBs are stored in the fatty tissues of humans and animals through the bioaccumulation process. EPA banned the use of PCBs, with limited exceptions, in 1976.
PDL	Public Dose Limit. The new term for Radiation Protection Standards, a standard for external and internal exposure to radioactivity as defined in DOE Order 5400.5 (see Appendix A and Table A-1).
PE Curie	One PE curie is the quantity of transuranic material that has the same radiation inhalation hazard as one curie of Pu-239. The PE curie is described in Appendix B of http://www.wipp.energy.gov/library/wac/CH-WAC.pdf .
perched groundwater	A groundwater body above a slow-permeability rock or soil layer that is separated from an underlying main body of groundwater by a vadose zone.
person-rem	A quantity used to describe the radiological dose to a population. Population doses are calculated according to sectors, and all people in a sector are assumed to get the same dose. The number of person-rem is calculated by summing the modeled dose to all receptors in all sectors. Therefore, person-rem is the sum of the number of people times the dose they receive.
pH	A measure of the hydrogen ion concentration in an aqueous solution. Acidic solutions have a pH less than 7, basic solutions have a pH greater than 7, and neutral solutions have a pH of 7.
pollution	Levels of contamination that may be objectionable (perhaps because of a threat to health [see contamination]).
point source	An identifiable and confined discharge point for one or more water pollutants, such as a pipe, channel, vessel, or ditch.
ppb	Parts per billion. A unit measure of concentration equivalent to the weight/volume ratio expressed as $\mu\text{g/L}$ or ng/mL . Also used to express the weight/weight ratio as ng/g or $\mu\text{g/kg}$.
ppm	Parts per million. A unit measure of concentration equivalent to the weight/volume ratio expressed as mg/L . Also used to express the weight/weight ratio as $\mu\text{g/g}$ or mg/kg .
QA	Quality assurance. Any action in environmental monitoring to ensure the reliability of monitoring and measurement data. Aspects of quality assurance include procedures, interlaboratory comparison studies, evaluations, and documentation.

QC	Quality control. The routine application of procedures within environmental monitoring to obtain the required standards of performance in monitoring and measurement processes. QC procedures include calibration of instruments, control charts, and analysis of replicate and duplicate samples.
rad	Radiation absorbed dose. The rad is a unit for measuring energy absorbed in any material. Absorbed dose results from energy being deposited by the radiation. It is defined for any material. It applies to all types of radiation and does not take into account the potential effect that different types of radiation have on the body. $1 \text{ rad} = 1,000 \text{ millirad (mrad)}$
radionuclide	An unstable nuclide capable of spontaneous transformation into other nuclides through changes in its nuclear configuration or energy level. This transformation is accompanied by the emission of photons or particles.
RCRA	Resource Conservation and Recovery Act of 1976. RCRA is an amendment to the first federal solid waste legislation, the Solid Waste Disposal Act of 1965. In RCRA, Congress established initial directives and guidelines for EPA to regulate hazardous wastes.
release	Any discharge to the environment. Environment is broadly defined as water, land, or ambient air.
rem	Roentgen equivalent man. The rem is a unit for measuring dose equivalence. It is the most commonly used unit and pertains only to people. The rem takes into account the energy absorbed (dose) and the biological effect on the body (quality factor) from the different types of radiation. $\text{rem} = \text{rad} \times \text{quality factor}$ $1 \text{ rem} = 1,000 \text{ millirem (mrem)}$
SAL	Screening Action Level. A defined contaminant level that if exceeded in a sample requires further action.
SARA	Superfund Amendments and Reauthorization Act of 1986. This act modifies and reauthorizes CERCLA. Title III of this act is known as the Emergency Planning and Community Right-to-Know Act of 1986.
saturated zone	Rock or soil where the pores are completely filled with water, and no air is present.

SWMU	Solid waste management unit. Any discernible site at which solid wastes have been placed at any time, regardless of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at or around a facility at which solid wastes have been routinely and systematically released, such as waste tanks, septic tanks, firing sites, burn pits, sumps, landfills (material disposal areas), outfall areas, canyons around LANL, and contaminated areas resulting from leaking product storage tanks (including petroleum).
terrestrial radiation	Radiation emitted by naturally occurring radionuclides such as internal radiation source; the natural decay chains of uranium-235, uranium-238, or thorium-232; or cosmic-ray-induced radionuclides in the soil.
TLD	Thermoluminescent dosimeter. A material (the Laboratory uses lithium fluoride) that emits a light signal when heated to approximately 300°C. This light is proportional to the amount of radiation (dose) to which the dosimeter was exposed.
TRU	Transuranic waste. Waste contaminated with long-lived transuranic elements in concentrations within a specified range established by DOE, EPA, and Nuclear Regulatory Agency. These are elements shown above uranium on the chemistry periodic table, such as plutonium, americium, and neptunium, that have activities greater than 100 nanocuries per gram.
TSCA	Toxic Substances Control Act. TSCA is intended to provide protection from substances manufactured, processed, distributed, or used in the United States. A mechanism is required by the act for screening new substances before they enter the marketplace and for testing existing substances that are suspected of creating health hazards. Specific regulations may also be promulgated under this act for controlling substances found to be detrimental to human health or to the environment.
tuff	Rock formed from compacted volcanic ash fragments.
uncontrolled area	An area beyond the boundaries of a controlled area (see controlled area in this glossary).
unsaturated zone	See vadose zone in this glossary.
UST	Underground storage tank. A stationary device, constructed primarily of nonearthen material, designed to contain petroleum products or hazardous materials. In a UST, 10% or more of the volume of the tank system is below the surface of the ground.
vadose zone	The partially saturated or unsaturated region above the water table that does not yield water for wells. Water in the vadose zone is held to rock or soil particles by capillary forces and much of the pore space is filled with air.

water table	The water level surface below the ground at which the unsaturated zone ends and the saturated zone begins. It is the level to which a well that is screened in the unconfined aquifer would fill with water.
watershed	The region draining into a river, a river system, or a body of water.
wetland	A lowland area, such as a marsh or swamp, that is inundated or saturated by surface water or groundwater sufficient to support hydrophytic vegetation typically adapted for life in saturated soils.
wind rose	A diagram that shows the frequency and intensity of wind from different directions at a particular place.
worldwide fallout	Radioactive debris from atmospheric weapons tests that has been deposited on the earth's surface after being airborne and cycling around the earth.

APPENDIX F – ACRONYMS AND ABBREVIATIONS

Ac-ft	acre-feet
ACA	accelerated corrective action
AIRNET	Ambient Air Monitoring Network
ALARA	as low as reasonably achievable
AOC	area of concern
AQA	Analytical Quality Associates
ARRA	American Recovery and Reinvestment Act
AST	aboveground storage tank
BCG	Biota Concentration Guides
BDD	Buckman Direct Diversion Project
BMP	Best Management Practice
BOD	biological oxygen demand
BSRL	baseline statistical reference level
C&T	(Land) Conveyance and Transfer Project
CAA	Clean Air Act
CEM	Certified Energy Manager
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGP	Construction General Permit
Ci	curie
CME	corrective measure evaluation
CMI	corrective measure implementation
CMR	Chemistry and Metallurgy Research Facility
CMRR	Chemistry and Metallurgy Research Replacement Facility
COE	United States Army Corps of Engineers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Consent Order	New Mexico Environment Department Compliance Order on Consent
COPC	chemical of potential concern
CWA	Clean Water Act
CY	calendar year
D&D	decontamination and decommissioning
DAC	derived air concentration

DARHT	Dual Axis Radiographic Hydrotest Facility
DCG	derived concentration guide
DOE	Department of Energy
DOECAP	Department of Energy Contract Analytical Program
DP	Delta Prime site
DPA	Data Package Assessment
DRO	diesel-range organic compound
DPRNET	Direct Penetrating Radiation Monitoring Network
DU	depleted uranium
EDE	effective dose equivalent
EIS	Environmental Impact Statement
EMS	Environmental Management System
EP	Environmental Programs Directorate
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ES&H	environment, safety, & health
ESH&Q	Environment, Safety, Health, and Quality Directorate
ESL	ecological screening level
ESPC	Energy Savings Performance Contract
EU	enriched uranium
FCRS	Flood Control Retention Structure
FDA	Food and Drug Administration
FFCA	Federal Facility Compliance Agreement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOD	Facility Operations Directorate
FY	fiscal year
GEL	General Environmental Laboratory
GHG	greenhouse gas
GMAP	gaseous mixed air activation products
GSAF	Generator Set-Aside Fee
GSA	General Services Administration

HAP	hazardous air pollutant
HE	high explosive
HEWTF	High Explosive Wastewater Treatment Facility
HPSB	High Performance Sustainable Building
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
HT	elemental tritium
HTO	tritium oxide
IFWGMP	Interim Facility-Wide Groundwater Monitoring Plan
IP	Individual Permit
ISL	industrial screening level
ISM	Integrated Safety Management
ISO	International Standards Organization
JIT	just in time
LACW	Los Alamos Canyon Weir
LANL	Los Alamos National Laboratory (or the Laboratory)
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center (TA-53)
LASO	Los Alamos Site Office
LC/MS/MS	liquid chromatography/mass spectrometry/mass spectrometry
LCS	laboratory control sample
LEED	Leadership in Energy and Environmental Design
LLW	low-level waste
MAP	Mitigation Action Plan
MAPEP	Mixed-Analyte Performance Evaluation Program
MCL	maximum contaminant level
MDA	material disposal area
MDL	method detection limit
MEI	maximally exposed individual
MLLW	mixed low-level waste

ACRONYMS AND ABBREVIATIONS

MOU	memorandum of understanding
MREM	millirem
MS	matrix spike
MSGP	Multi-Sector General Permit
NCRP	National Council on Radiation Protection
NELAP	National Environmental Laboratory Accreditation Program
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NISC	Nonproliferation and International Security Center
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NNSA	National Nuclear Security Administration
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NRDA	natural resources damage assessment
NSSB	National Security Sciences Building
NSR	New Source Review
NTS	Nevada Test Site
NTU	nephelometric turbidity units
ODS	Ozone-depleting substances
ORP	oxidation-reduction potential
P2	Pollution Prevention Program
PA/CA	performance assessment/composite analysis
PCB	polychlorinated biphenyls
PCFRS	Pajarito Canyon Flood Retention Structure
PE	performance evaluation
PM	particulate matter
ppb	parts per billion
PQL	Practical Quantitation Limit

PRS	Potential Release Site
PSTB	Petroleum Storage Tank Bureau
P/VAP	particulate/vapor activation products
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
R&D	research and development
RAMP	Roof Assessment Management Program
RCRA	Resource Conservation and Recovery Act
RDX	research department explosive (cyclonite)
RLUOB	Radiological Laboratory/Utility/Office Building
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	Record of Decision
RSL	residential screening level
RSRL	regional statistical reference level
RWMB	Radioactive Waste Management Basis
SAL	screening action level
SDPPP	Site Discharge Pollution Prevention Plan
SDWA	Safe Drinking Water Act
SERF	Sanitary Effluent Reclamation Facility
SFB	soil, foodstuffs, and biota
SL	screening level
SMA	Site Monitoring Area
SMO	Sample Management Office
SOP	standard operating procedure
SOW	statement of work
SPCC	Spill Prevention Control and Countermeasures
SR	State Road
SSL	soil screening level
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWEIS	Site-Wide Environmental Impact Statement

SWPPP	Storm Water Pollution Prevention Plan
SWMU	solid waste management unit
SWWS	Sanitary Wastewater Systems Plant
TA	Technical Area
TAL	target analyte list
TCDD	tetrachlorodibenzodioxin
TCDF	tetrachlorodibenzofuran
TCE	trichloroethylene
TDS	total dissolved solids
TEQ	toxicity equivalent quotient
TLD	thermoluminescent dosimeter
TNT	trinitrotoluene
TOC	total organic carbon
TRC	total residual chlorine
TRU	transuranic
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, or disposal facility
UI	Utilities and Infrastructure Facilities
USFS	United States Forest Service
USGS	United States Geological Survey
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Project
WWTP	wastewater treatment plant
WY	water year
ZLD	Zero Liquid Discharge

APPENDIX G – ELEMENTAL AND CHEMICAL NONEMCLATURE

Actinium	Ac	Erbium	Er
Aluminum	Al	Europium	Eu
Americium	Am	Fermium	Fm
Argon	Ar	Fluorine	F
Antimony	Sb	Francium	Fr
Arsenic	As	Gadolinium	Gd
Astatine	At	Gallium	Ga
Barium	Ba	Germanium	Ge
Berkelium	Bk	Gold	Au
Beryllium	Be	Hafnium	Hf
Bicarbonate	HCO ₃	Helium	He
Bismuth	Bi	Holmium	Ho
Boron	B	Hydrogen	H
Bromine	Br	Hydrogen oxide	H ₂ O
Cadmium	Cd	Indium	In
Calcium	Ca	Iodine	I
Californium	Cf	Iridium	Ir
Carbon	C	Iron	Fe
Cerium	Ce	Krypton	Kr
Cesium	Cs	Lanthanum	La
Chlorine	Cl	Lawrencium	Lr (Lw)
Chromium	Cr	Lead	Pb
Cobalt	Co	Lithium	Li
Copper	Cu	Lithium fluoride	LiF
Curium	Cm	Lutetium	Lu
Cyanide	CN	Magnesium	Mg
Carbonate	CO ₃	Manganese	Mn
Dysprosium	Dy	Mendelevium	Md
Einsteinium	Es	Mercury	Hg

Molybdenum	Mo	Samarium	Sm
Neodymium	Nd	Scandium	Sc
Neon	Ne	Selenium	Se
Neptunium	Np	Silicon	Si
Nickel	Ni	Silver	Ag
Niobium	Nb	Sodium	Na
Nitrate (as Nitrogen)	NO ₃ -N	Strontium	Sr
Nitrite (as Nitrogen)	NO ₂ -N	Sulfate	SO ₄
Nitrogen	N	Sulfite	SO ₃
Nitrogen dioxide	NO ₂	Sulfur	S
Nobelium	No	Tantalum	Ta
Osmium	Os	Technetium	Tc
Oxygen	O	Tellurium	Te
Palladium	Pd	Terbium	Tb
Phosphorus	P	Thallium	Tl
Phosphate (as Phosphorus)	PO ₄ -P	Thorium	Th
Platinum	Pt	Thulium	Tm
Plutonium	Pu	Tin	Sn
Polonium	Po	Titanium	Ti
Potassium	K	Tritiated water	HTO
Praseodymium	Pr	Tritium	³ H
Promethium	Pm	Tungsten	W
Protactinium	Pa	Uranium	U
Radium	Ra	Vanadium	V
Radon	Rn	Xenon	Xe
Rhenium	Re	Ytterbium	Yb
Rhodium	Rh	Yttrium	Y
Rubidium	Rb	Zinc	Zn
Ruthenium	Ru	Zirconium	Zr

In the Report “Environmental Surveillance at Los Alamos During 2009,” a number of errors were introduced during the final compositing of the report. These errors have been corrected in the on-line version <http://int.lanl.gov/environment/all/esr.shtml>. In the printed copies of the report, the following errors are found.

1. Chapter 1, page 40, Table 1-2, 2 corrections – both in the middle column: 1,6057 should be 1,605, and 4,882 should be 5,551.
2. Chapter 3, page 87 Figure 3-3: The caption of the figure should be “Los Alamos County radiation background compared with average US background. Los Alamos County-specific background doses have not been determined for potassium-40, medical/dental exposures, man-made radiation, and global fallout and are assumed to be the same as the US average in this figure.”
3. Chapter 5, page 148, Figure 5-10 should read, “Bis(2-ethylhexyl)phthalate concentration history for intermediate well MCOI-6. Nondetects are reported at the practical quantitation limit (PQL) of about 11 µg/L; the MDL is about 2.2 µg/L. The EPA MCL is 6 µg/L.”
Chapter 5, page 150, Figure 5-16 should read, “Figure 5-16. Bis(2-ethylhexyl)phthalate concentration history for intermediate groundwater well TA-53i. The EPA MCL is 6 µg/L.”
4. Chapter 6, pages 214 and 215, D.1 heading should be “On-Site and Perimeter Monitoring Locations,” and D.2 should be “Regional Monitoring Locations.”
5. Chapter 8, page 281, Table 8-1 should read, “Standards and Other Reference Levels Applied to Foodstuffs”
Chapter 8, page 288, Table 8-2 should read, “Standards and Other Reference Levels Applied to Biota”
Chapter 8, page 291, Figure 8-9, The unit measurements should read “Uranium-238 (pCi/g ash)”
Chapter 8, page 292, Figure 8-10, The unit measurements should read “Uranium-238 (pCi/g ash)”

The following Los Alamos National Laboratory organizations perform environmental surveillance, ensure environmental compliance, and provide environmental data for this report:

Waste and Environment Support Services Division (Jean Dewart, Coordinator)

Water Quality and RCRA Group (Luciana Vigil-Holterman and Robert Beers, Coordinators)

Air Quality and Ecology Group (Sonja Salzman, Coordinator)

Previous reports in this series are LA-14427-ENV, LA-13775-ENV, LA 13861 ENV, LA-13979-ENV, LA-14085 ENV, LA-14162-ENV, LA 14239 ENV, LA-14304-ENV, LA-14341-ENV, LA-14369-ENV, LA 14407 ENV, and LA-14427-ENV.

Technical coordination by Jean Dewart, Waste and Environmental Services, Environmental Data & Analysis

Edited by Caroline Spaeth, Information Resource Management, Communication Arts and Services

Composited by Elaine Forbes, Business and Project Services, Communications

Production Support provided by Business and Project Services, Deliverables Production: Sandra Martinez, Pamela Maestas, Julie Marquez, Vanessa Troncoso

An on-line survey form for providing comments, suggestions, and other input on this report is available at <http://www.lanl.gov/environment/all/esr.shtml>

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