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Environment

U.S. Department of Energy Report
1998 LANL Radionuclide Air Emissions

Los Alamos
NATIONAL LABORATORY

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Prepared by
Keith W. Jacobson

Los Alamos
NATIONAL LABORATORY
Los Alamos, New Mexico 87545

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Location: County of Los Alamos, New Mexico

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Compliance Assessment:

1998 EDE: 1.72 mrem

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LIST OF ACRONYMS

CMR	Chemistry and Metallurgy Research (building)
DOE	Department of Energy
EDE	effective dose equivalent
EPA	Environmental Protection Agency
ES	exhaust stack (identification number)
FE	fan exhaust (identification number)
FFCA	Federal Facilities Compliance Agreement
GMAP	gaseous mixed activation products
HEPA	high-efficiency particulate air (filter)
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LSC	liquid scintillation counting
MEI	maximum exposed individual
ND	no detectable (emissions)
PEDE	potential effective dose equivalent
P/VAP	particulate/vapor activation products
TA	technical area (at Los Alamos National Laboratory)

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ABSTRACT

Presented is the Laboratory-wide certified report regarding radioactive effluents released into the air by Los Alamos National Laboratory (LANL) in 1998. This information is required under the Clean Air Act and is being reported to the U.S. Environmental Protection Agency (EPA). The highest effective dose equivalent (EDE) to an off-site member of the public was calculated using procedures specified by the EPA and described in this report. For 1998, the dose was 1.72 mrem. Airborne effluents from a 1 mA, 800 MeV proton accelerator contributed about 80% of the EDE; the majority of the total dose contribution was via the air immersion pathway.

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 (Fig. 1).

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

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

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

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

The radionuclides emitted from point sources at LANL in the calendar year (CY) 1998 are listed in the tables that follow this text. Tritium is released as tritium oxide and elemental tritium. Plutonium contains traces of Am-241, a transformation product of Pu-241. Some of the uranium emissions are from open-air explosive tests involving depleted uranium. GMAP emissions include Ar-41, C-10, C-11, N-13, N-16, O-14, and O-15. Various radionuclides, dominated by Be-7, Br-77, Br-82, and Se-75, make up the majority of the P/VAP emissions.

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

The primary facilities responsible for radiological airborne emissions follow. Additional descriptions of LANL technical areas can be found in the annual site environmental report for LANL.

TA-3-29: Programs conducting chemical and metallurgical research are located in this facility. Principal radionuclides are isotopes of plutonium and uranium.

TA-3-35: The facility houses a 5,000-ton capacity press that has been used in the metalworking of radioactive materials.

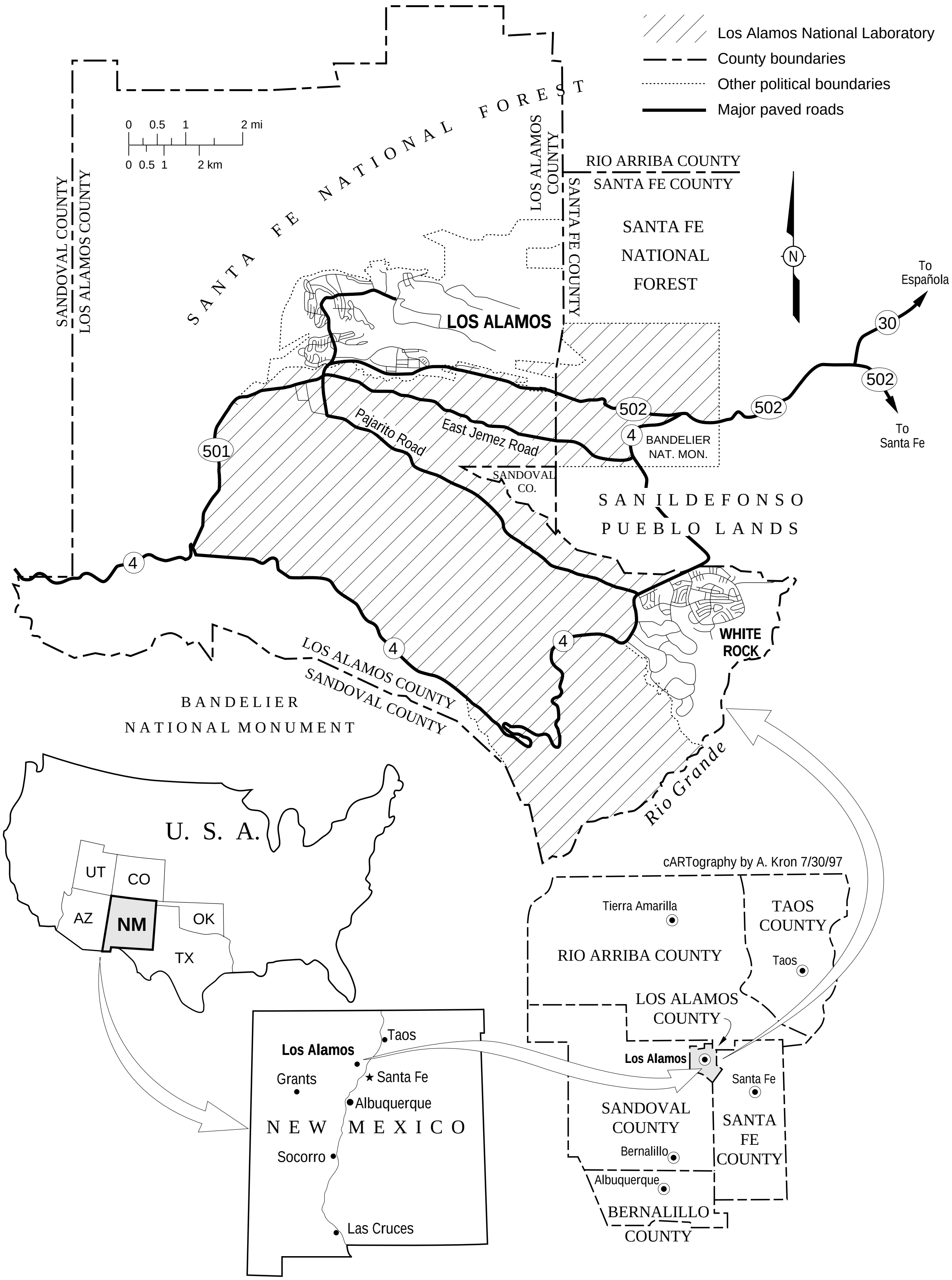

Figure 1. Location of Los Alamos National Laboratory.

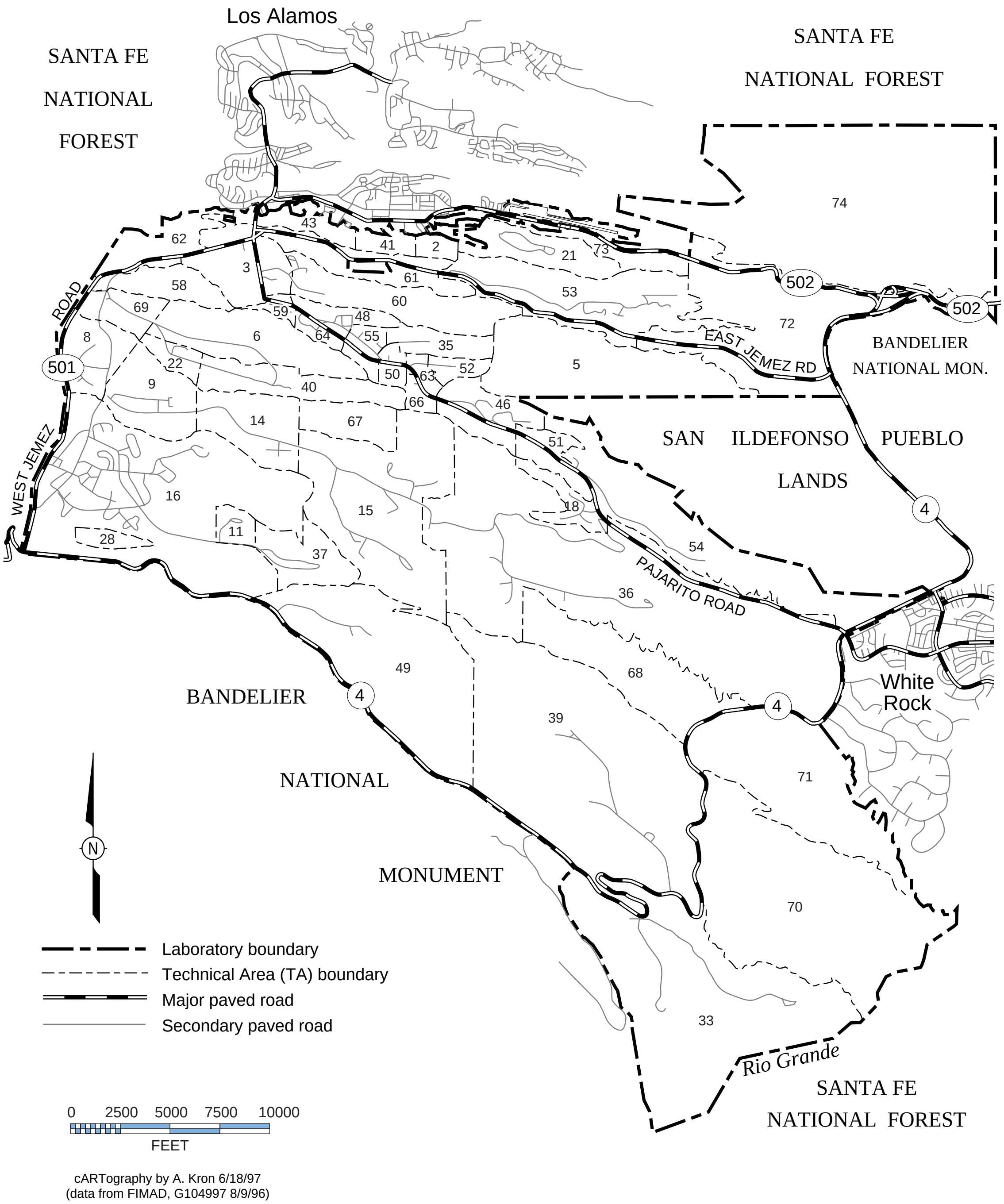

Figure 2. Los Alamos National Laboratory technical areas by number.

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

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

TA-16-205, TA-21-155, and **TA-21-209:** These facilities conduct operations involving tritium. Programs include testing of tritium control systems for the nuclear fusion program (TA-21-155), preparation of targets containing tritium for laser-fusion research, and the handling of tritium for defense programs. Tritium recovery operations from old equipment are being conducted at TA-21-209.

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

TA-21: Many of the facilities at this decommissioned radiochemistry site are undergoing decontamination, demolition, and disposal. Some of these operations may contribute to diffuse releases of uranium and plutonium into the air.

TA-33-86 and TA-41-4: These buildings were formerly used as tritium-handling facilities. All accountable tritium has been removed, and current emissions primarily result from residual tritium contamination and cleanup operations.

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

TA-50-1: This waste management site consists of a low-level liquid waste treatment plant. Also, there is a wastewater outfall from TA-50-1 that results in a diffuse source of airborne tritium.

TA-50-37: This controlled air incinerator was decommissioned in 1996 and is no longer active. It has been remodeled to house the Radioactive Materials Research Operations Demonstration (RAMROD) project.

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

TA-53: This technical area houses the Los Alamos Neutron Science Center (LANSCE), a linear particle accelerator complex. The accelerator is used to conduct research in physics, radiobiology, materials science, and isotope production. The Manual Lujan Neutron Scattering Center and the Proton Storage Ring are part of LANSCE.

The facility accelerates protons to an energy of 800 MeV into target materials such as graphite and tungsten to produce a variety of subatomic particles. The design current of the accelerator is approximately 1 mA. High intensity beam operations were conducted for about three months during 1998. A variety of radioisotopes are produced at LANSCE, by spallation reactions in targets just upstream of the beam stop. The radioisotopes are distributed worldwide for a variety of medical and research procedures.

Airborne radioactive emissions result from the proton beams and secondary particles passing through and activating air in the target cells, beam stop, and surrounding areas. The majority of the emissions are short-lived activation products such as C-11, N-13, and O-15. Most of the activated air is vented through the main stack; however, a fraction of the activated air becomes a fugitive emission from the target areas. In addition, there are three wastewater lagoons at TA-53 that have received radioactive liquid effluents from the accelerator (only one lagoon was active in 1998). Evaporation of water from the lagoons results in a diffuse source of airborne tritium.

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

TA-55-4: As discussed in the January 1999 Site-Wide Environmental Impact Statement for LANL, this plutonium facility is slated for a plutonium pit production mission as well as for continuing in its traditional role of housing research and development applications in chemical and metallurgical processes for recovering, purifying, and converting plutonium and other actinides.[1] A wide range of activities are conducted that included the heating, dissolution, forming, welding, etc., of special nuclear materials. Additional activities include the means to safely ship, receive, handle, and store nuclear materials, as well as manage the wastes and residues produced by TA-55 operations.

Section II. Air Emissions Data

61.94(b)(4) Point Sources

Sampled and unsampled point sources at LANL are listed in Table 1. Each entry is identified by technical area and building. Also listed in Table 1 are the number, type, and efficiency of the effluent controls used on the release points. Each stage of the high-efficiency particulate air (HEPA) exhaust filters is tested at least once every 12 months. The performance criteria for HEPA filter systems are a maximum penetration of 5×10^{-4} for one stage and 2.5×10^{-7} for two stages in series, where penetration equals concentration of aerosol downstream of the air cleaner divided by concentration upstream.

The distance between the point source and the nearest receptor is provided in Table 2. The nearest receptor can be a residence, school, business, or office. The distance to the nearest farm producing milk is 20 km from the Laboratory's eastern boundary; the nearest farms producing meat and vegetables adjoin the Laboratory's eastern boundary, about 4 km from the main exhaust stack at LANSCE. More detailed agricultural information can be found in a supplemental LANL report.[2] At this time, LANL is not using this site-specific agricultural data in the CAP88 model; pre-programmed or default values for New Mexico are utilized for the number of beef and milk cattle and for agricultural productivity.

In addition to 31 monitored release points, approximately 40 unmonitored release points in more than 30 LANL buildings are included in Table 1. Under 40 CFR 61.93(b)(4)(i), sampling of these release points is not required because each release point has a potential effective dose equivalent of less than 0.1 mrem/yr at the critical receptor. However, in order to verify that emissions from unmonitored point sources remain low, LANL conducts "periodic confirmatory measurements" in the form of the Radioactive Materials Usage Survey. The purpose of the usage survey (formerly called the Radionuclide Point Source Inventory) is to collect and analyze radioactive materials usage and process information for the monitored and unmonitored point sources at LANL.

Guidance in Appendix D to 40 CFR 61 and good engineering judgment are used to develop conservative emissions estimates from unmonitored point sources using the data collected from the facilities. Estimated potential effective dose equivalents (PEDEs) are calculated by modeling these emissions estimates using the EPA-approved CAP88 dose modeling software. A comprehensive survey of all of LANL's monitored and unmonitored point sources is conducted annually or biannually.

The cumulative PEDE for all unmonitored point sources at LANL was conservatively estimated (using 1998 Usage Survey data) to be 0.271 mrem/yr. This value is calculated at each building's critical receptor. Because the emissions estimates do not account for pollution control systems, the actual PEDE will be significantly less for these unmonitored point sources. The Laboratory has established administrative requirements to evaluate all potential new sources. These requirements are established for the review of all new Laboratory activities and projects to ensure that air quality regulatory requirements will be met before the activity or project begins.[3]

Nonpoint Sources

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

Beginning in 1995, LANL began summarizing the potential impacts of nonpoint sources by analyzing and reporting air concentration measurements collected at 17 ambient air-sampling sites around the Laboratory. Previously, LANL had estimated emissions from the most significant nonpoint sources and determined the impacts using EPA's dose assessment computer program. The Laboratory and EPA negotiated this new method of assessing nonpoint sources as part of the Federal Facilities Compliance Agreement (FFCA).[4] Results of the air sampling analysis are provided in Section III of this report. With the exception noted below, there were no unusual readings measured at the air sampling stations in 1998.

As mentioned in last year's report, the air quality group recently revised the technique used to calculate tritium concentrations in ambient air. More detailed information on the new analysis technique can be found in a supplemental LANL report.[5] The regional office of the EPA agreed upon the new method in March 1999;[6] however, for completeness, results using both the old and new method are provided in this report as a comparison. Beginning with the 1999 Radionuclide Air Emissions report, only the results from the new method will be used.

Radionuclide Emissions

Radionuclides released from sampled point sources, along with the annual release rate for each radionuclide, are documented in the tables. The point sources are identified using an exhaust stack (ES) eight-digit identification number: the first two digits represent the LANL technical area, the next four digits the building area, and the last two digits the ES number. No detectable emissions are denoted as ND.

Pollution Controls

At Los Alamos National Laboratory the most common type of filtration, for emission control purposes, is the high efficiency particulate air (HEPA) filter. HEPA filters are constructed of sub-micrometer glass fibers that are pressed and glued into a compact, paper-like, pleated media. The paper media is folded alternately over corrugated separators and mounted into a metal or wood frame in eight standard sizes and airflow capacities. A Type I nuclear grade HEPA filter is capable of removing 99.97% of 0.3 μm particles at rated airflow. Other types of filters used in ventilation systems are Aerosol 95, RIGA-FLOW 220, and FARR 30/30. These units are typically used as pre-filters in HEPA filtration systems. These filters are significantly less efficient than HEPA filters and are typically used for collecting particulate matter larger than 5μm. The above mentioned filters are only effective for particles. When the contaminant of concern is in the form of a gas, activated charcoal beds are used. Charcoal beds collect the gas contaminant through an adsorption process in which the gas comes in contact with the charcoal and adheres to the surface of the charcoal. The charcoal can be coated with different types of materials to make the adsorption process more efficient for different types of contaminants. Typically charcoal beds can achieve an efficiency of 98% capture with a resident time of 0.25 seconds.

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

Section III. Dose Assessment

61.94(b)(7) Description of Dose Calculations

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

Development of Source Term

Tritium emissions

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

Tritium emissions from LANSCE (which do not meet the monitoring requirements of 40 CFR 61.93(b)(4)(ii)) are determined using a silica gel sampler. A sample of stack air is pulled through a cartridge containing silica gel. The silica gel collects the water vapor from the air, including any HTO. The water is distilled from the sample, and the amount of HTO is determined by analyzing the water using LSC. Because the primary source for tritium is activated water, sampling for only HTO is appropriate. These results are also corrected using the absolute humidity measured in the stack.

Radioactive particle emissions

Emissions of radioactive particulate matter, generated by operations at facilities such as the Chemistry and Metallurgy Research (CMR) Building and 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 samples for subsequent analysis at an off-site Laboratory. These composited samples are analyzed to determine the total activity of materials such as uranium-234/235/238, plutonium-238/239/240, and americium-241. These data are then combined with estimates of sampling losses and stack and sample flows to calculate emissions. For the case of radionuclides that have short-lived daughters, LANL includes these progeny in the source term. For example, the parent radionuclide U-238 is measured by the analytical laboratory and its short-lived progeny (Pa-234m and Th-234) are assumed to be in equilibrium with the U-238. This allows LANL to more accurately calculate the dose from such radionuclides.

Vapor form emissions

VAP emissions, generated by LANSCE operations and by hot cell activities at CMR and TA-48, are sampled using a charcoal filter or canister. A continuous sample of stack air is pulled through a charcoal filter where vaporous emissions of radionuclides are adsorbed. The amount and identity of the radionuclide(s) present on the filter are determined through the use of gamma spectroscopy. This information is then used to calculate emissions. Radionuclides of this type include As-74, Br-77, and Se-75.

Gaseous mixed activation products (GMAP)

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

Summary of Input Parameters

Effective dose equivalents to potential receptors were calculated for all radioactive air emissions from sampled LANL point sources. Input parameters for these point sources are provided in Tables 3 and 4. The relationships of receptor locations to the individual source release points are provided in Table 5. The nearest receptor location is different for each point source. However, because the majority of the yearly dose is caused by LANSCE emissions, the LANSCE critical receptor location is the maximum dose location for all Laboratory emissions in 1998. This location is a business office approximately 800 meters north-northeast of the LANSCE stack. Emissions and doses from LANSCE are calculated on a monthly basis during beam operations to ensure continued compliance with the 10 mrem standard.

Other site-specific parameters and the source of these data are provided in Table 6. The LANL Air Quality Group operates an on-site network of meteorological monitoring towers. Data gathered by the towers is summarized and formatted for input to the CAP88 program. Copies of the meteorological data files used for the 1998 dose assessment are provided in Table 7.

The Air Quality Group also inputs population array data to the CAP88 program. An example of the population array used for the LANSCE facility is provided in Table 8. For agricultural array input, LANL is currently using the default values in CAP88. Finally, the radionuclide inputs for the point sources monitored in 1998 are provided in Table 9.

Point Source Emissions Modeling

The CAP88 program was used to calculate doses from both the monitored and unmonitored point sources at LANL. The CAP88 program uses on-site meteorological data to calculate atmospheric dispersion and transport of the radioactive effluents. There are a number of radionuclides monitored in LANL effluents that are not included in the dose factor database used by CAP88.[8] For the substantial GMAP effluents such as C-10, N-16, and O-14, LANL uses a revised set of CAP88 database files to which the required dose factors have been added. For other effluents such as As-74, Br-76, Br-77, Hg-197, Se-75, etc., LANL uses the CAP88 code to calculate environmental concentrations of these radionuclides at the receptor locations, then applies an appropriate dose factor to estimate dose.

LANSCE Fugitive Emission Modeling

Some of the gaseous mixed activation products (GMAP) created at the accelerator target cells migrate into room air and into the environment. These fugitive sources are continuously monitored throughout the beam-operating period. In 1998, approximately 413 Ci of C-11 and 17 Ci of Ar-41 were released from LANSCE as fugitive emissions. This source was modeled as an area source, using CAP88 and meteorological data coinciding with the LANSCE run cycle. Fugitive effluents were modeled from three areas at LANSCE; additional source information is provided in Table 10.

TA-18 Nonpoint Emission Modeling

This site consists of a variety of nuclear assemblies that are operated at near-critical conditions. During the near-critical operations, neutrons are generated that in turn activate argon atoms in the air surrounding the assembly. Operations conducted in 1998 were evaluated for their potential to create Ar-41 gas. In 1998, approximately 0.18 Ci of Ar-41 was generated and the dose evaluated with CAP88. Additional source information is provided in Table 10.

Radionuclides Not Included in CAP88

Some of the radionuclides detected in LANL air effluents are not included in the CAP88 library of exposure-to-dose conversion factors. As previously mentioned, LANL added dose coefficients to the CAP88 data files for three routinely emitted radionuclides: C-10, N-16, and O-14. Because of the unique emissions from LANSCE and other facilities, other radionuclides not included in CAP88 are emitted on an infrequent basis. Although these emissions are minor in comparison, a dose evaluation is still considered necessary to demonstrate that the actual contribution is small. Examples of such radionuclides detected in LANL air effluents during 1998 are included in Table 9 and are listed separately in Table 11.

To calculate the dose from these particular radionuclides, LANL uses several methods. LANL uses the mainframe version of CAP88 to calculate the air concentration at the receptor location of interest. In most cases the air concentration can be then converted into a dose by applying the conversions given in Table 2 of Appendix E of 40 CFR 61, which has a more extensive list of radionuclides than CAP88.[9] In some cases, LANL obtains exposure-to-dose conversion factors from other sources, such as EPA's Federal Guidance Reports.[10,11] Dose conversion factors used for radionuclides not included in CAP88 but found in LANL air effluents during 1998 are provided in Table 12.

At the LANL wide maximum dose location for 1998, the total estimated dose arising from emissions of radionuclides not included in the CAP88 library, was about 0.02 mrem. This number is included in the total annual dose. The LANL Air Quality Group has informed the Regional Office of the U.S. EPA of the various steps and methods used to calculate the doses from such radionuclides.[12]

Environmental Data

The net annual average ambient concentration of important airborne radionuclides, measured at 17 air sampling stations (Fig. 3), is calculated by subtracting an appropriate background concentration value. The net concentration is converted to an annual effective dose equivalent (EDE) using Table 2 of Appendix E of 40 CFR 61 and applying the valid assumption that each table value is equivalent to 10 mrem/yr from all appropriate exposure pathways (100% occupancy assumed at the respective location).[9] Results from each air sampler are given in Table 12. The operational performance of each air sampler is provided in Table 13. Dose estimates from a previously used procedure, discussed in the FFCA and since discontinued, are given in Table 14.

61.92 Compliance Assessment

The highest effective dose equivalent to any member of the public at any off-site point where there is a residence, school, or business office was 1.72 mrem, for radioactive effluents released by LANL in 1998. This dose was calculated by adding up the doses for each of the point sources at LANL, the diffuse and fugitive gaseous activation products from LANSCE and TA-18, and the dose measured by the ambient air sampler in the vicinity of the critical receptor location (Table 16). This dose also includes an approximate 0.02 mrem contribution from radionuclides not included in CAP88. The location of the off-site point of highest impact is a business office approximately 800 meters north-northeast of TA-53.

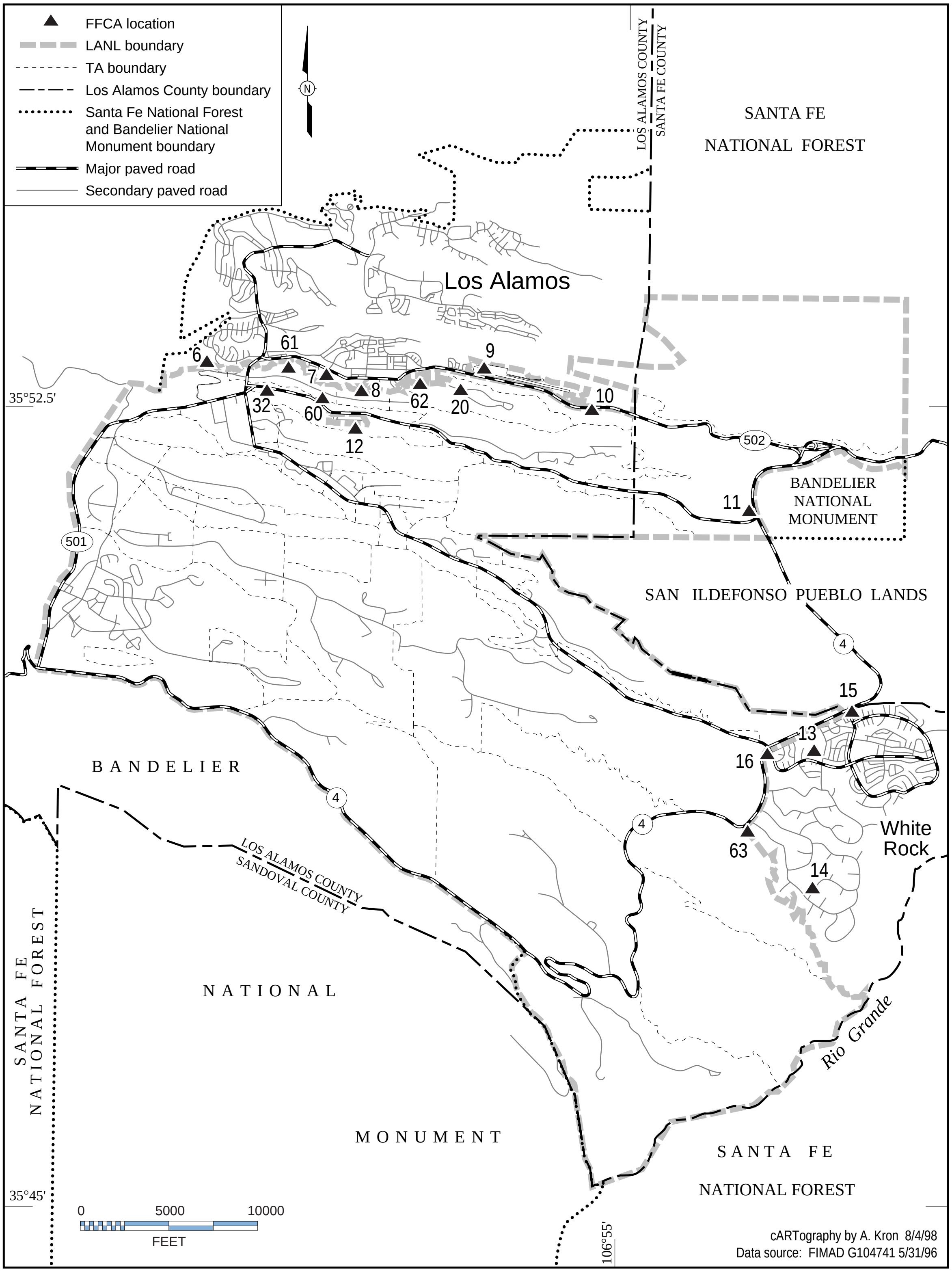

Figure 3. Location of air sampling stations used for nonpoint source compliance.

Section IV. Constructions and Modifications

61.94(b)(8) Constructions and Modifications

A brief description of constructions and modifications that were completed and/or reviewed in 1998, but for which the requirement to apply for approval to construct or modify was waived under 61.96, is provided in Table 17. The Air Quality Group for LANL/DOE maintains the documentation developed to support the waiver.

Section V. Additional Information

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

Unplanned Releases

When compared to a previous effluent release rate of about 0.5 Ci per day (1997 data), there were two events in 1998 in which unanticipated releases of tritium occurred. During the time period from January 31 to February 2, approximately 60 Ci of tritium was released via the exhaust stack at TA-21-209. Also, over the period from Oct 7 to Oct 9, approximately 23 Ci of tritium was released from the same stack.

Environmental Monitoring

The Air LANL Quality Group operates an extensive environmental monitoring network that includes several environmental monitoring stations located near the LANSCE boundary inhabited by the public. Measurement systems at these stations include LiF thermoluminescent dosimeters, continuously operated air samplers, and an in situ high-pressure ion chamber. The combination of these measurement systems allows for monitoring of radionuclide air concentrations and the radiation exposure rate. Results showed the total measured dose is less than the modeled dose given in this report. Results are published here and in the Annual Site Environmental Surveillance Report for DOE Order compliance.

Other Supplemental Information

- Collective effective dose equivalent for 1998 airborne releases: 0.8 person-rem.
- Compliance with Subparts Q and T of 40 CFR 61 – Radon-222 Emissions.
  These regulations apply to Rn-222 emissions from DOE storage/disposal facilities that contain byproduct material. “Byproduct 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 byproduct material used in experiments in the TA-54 low-level waste facility, Area G, making the Laboratory subject to this regulation. Subject facilities cannot exceed an emissions rate of 20 pCi/m^2 s of Rn-222. In 1993 and 1994, LANL conducted a study to characterize emissions from the Area G disposal site.[13] This study showed an average emission rate of 0.14 pCi/m^2 s for Area G. The performance assessment for Area G has determined that there will not be a significant increase in Rn-222 emissions in the future.[14]
- Potential to exceed 0.1 mrem from LANL sources of Rn-222 or Rn-220 emissions: not applicable at LANL.
- Status of compliance with EPA effluent monitoring requirements: As of June 3, 1996, LANL came into compliance with EPA effluent monitoring requirements.

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

ESIDNUM*	Location	Control Description	Number of Effluent Controls	Control Efficiency	Monitored
03001608	TA-03-16	none	0	0%	☐
03001609	TA-03-16	none	0	0%	☐
03001614	TA-03-16	none	0	0%	☐
03001616	TA-03-16	none	0	0%	☐
03001621	TA-03-16	none	0	0%	☐
03001641	TA-03-16	none	0	0%	☐
03002913	TA-03-29-1	unknown	0	0%	☐
03002914	TA-03-29-2	HEPA	2	99.95% each	☑
03002915	TA-03-29-2	HEPA	2	99.95% each	☑
03002919	TA-03-29-3	Aerosol 95	1	80%	☑
03002920	TA-03-29-3	Aerosol 95	1	80%	☑
03002923	TA-03-29-4	FARR 30/30	1	~ 20%	☑
03002924	TA-03-29-4	FARR 30/30	1	~ 20%	☑
03002928	TA-03-29-5	HEPA	2	99.95% each	☑
03002929	TA-03-29-5	HEPA	2	99.95% each	☑
03002932	TA-03-29-7	HEPA	2	99.95% each	☑
03002933	TA-03-29-7	HEPA	2	99.95% each	☑
03002937	TA-03-29-V	HEPA	2	99.95% each	☑
03002944	TA-03-29-9	RIGA-Flow 220	1	80%	☑
03002945	TA-03-29-9	RIGA-Flow 220	1	80%	☑
03002946	TA-03-29-9	RIGA-Flow 220	1	80%	☑
03003401	TA-03-34	none	0	0%	☐
03003435	TA-03-34	none	0	0%	☐
03003501	TA-03-35	HEPA	1	99.95%	☑

*The point sources are identified using an exhaust stack (ES) eight-digit identification number: the first two digits represent the LANL technical area, the next four digits the building area, and the last two digits the ES number.

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

ESIDNUM	Location	Control Description	Number of Effluent Controls	Control Efficiency	Monitored
03004025	TA-03-40	HEPA	1	99.95%	☐
03006601	TA-03-66	none	0	0%	☐
03006602	TA-03-66	none	0	0%	☐
03006603	TA-03-66	none	0	0%	☐
03006604	TA-03-66	none	0	0%	☐
03006605	TA-03-66	none	0	0%	☐
03006626	TA-03-66	HEPA	1	99.95%	☐
03006643	TA-03-66	none	0	0%	☐
03010222	TA-03-102	HEPA	1	99.95%	☑
03010225	TA-03-102	HEPA	1	99.95%	☐
03014110	TA-03-141	none	0	0%	☐
03169801	TA-03-1698	none	0	0%	☐
09002103	TA-09-21	none	0	0%	☐
09003201	TA-09-32	none	0	0%	☐
16020504	TA-16-205	CR/MS	1	>99%	☑
16024801	TA-16-248	none	0	0%	☐
18012701	TA-18-127	none	0	0%	☐
18016801	TA-18-168	none	0	0%	☐
21000507	TA-21-5	HEPA	2	99.95% each	☐
21002S00	TA-21-2S	HEPA	1	99.95%	☐
21015001	TA-21-150	HEPA	1	99.95%	☐
21015505	TA-21-155	CR/MS	1	>99%	☑
21020901	TA-21-209	CR/MS	1	>99%	☑
21021301	TA-21-213	none	0	0%	☐
21025704	TA-21-257	none	0	0%	☐
33008606	TA-33-86	none	0	0%	☑

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

ESIDNUM	Location	Control Description	Number of Effluent Controls	Control Efficiency	Monitored
35021305	TA-35-213	none	0	0%	☐
35021308	TA-35-213	none	0	0%	☐
41000104	TA-41-1	HEPA	2	99.95% each	☐
41000417	TA-41-4	none	0	0%	☑
43000102	TA-43-1	none	0	0%	☐
43000109	TA-43-1	none	0	0%	☐
43000110	TA-43-1	none	0	0%	☐
43000112	TA-43-1	none	0	0%	☐
43000113	TA-43-1	none	0	0%	☐
43000134	TA-43-1	none	0	0%	☐
46002401	TA-46-24	none	0	0%	☐
46003101	TA-46-31	none	0	0%	☐
46003125	TA-46-31	none	0	0%	☐
46003141	TA-46-31	none	0	0%	☐
46004106	TA-46-41	none	0	0%	☐
46015405	TA-46-154	none	0	0%	☐
46015810	TA-46-158	none	0	0%	☐
48000107	TA-48-1	HEPA/Charcoal Bed	2	99.95% each	☑
48000111	TA-48-1	none	0	0%	☐
48000115	TA-48-1	none	0	0%	☐
48000135	TA-48-1	none	0	0%	☐
48000145	TA-48-1	none	0	0%	☐
48000154	TA-48-1	HEPA	2	99.95% each	☑
48000160	TA-48-1	HEPA	1	99.95%	☑
48004501	TA-48-45	none	0	0%	☐
50000102	TA-50-1	HEPA	1	99.95% each	☑

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

ESIDNUM	Location	Control Description	Number of Effluent Controls	Control Efficiency	Monitored
50000201	TA-50-2	none	0	0%	☐
50003701	TA-50-37	HEPA	2	99.95% each	☑
50006901	TA-50-69	HEPA	1	99.95%	☐
50006902	TA-50-69	HEPA	1	99.95%	☐
50006903	TA-50-69	HEPA	2	99.95% each	☑
50018500	TA-50-185	HEPA	1	99.95%	☐
53000303	TA-53-3	HEPA	1	99.95%	☑
53000702	TA-53-7	HEPA	1	99.95%	☑
53109010	TA-53-1090	none	0	0%	☐
54003300	TA-54-33	HEPA	1	99.95%	☐
54003601	TA-54-36	HEPA	1	99.95%	☐
54022601	TA-54-226	none	0	0%	☐
54028101	TA-54-281	HEPA	1	99.95%	☐
54100110	TA-54-1001	none	0	0%	☐
55000415	TA-55-4	HEPA	4	99.95% each	☑
55000416	TA-55-4	HEPA	4	99.95% each	☑
59000104	TA-59-1	none	0	0%	☐
59000114	TA-59-1	none	0	0%	☐
59000121	TA-59-1	none	0	0%	☐
59000122	TA-59-1	none	0	0%	☐
59000123	TA-59-1	none	0	0%	☐
59000124	TA-59-1	none	0	0%	☐
59000125	TA-59-1	none	0	0%	☐
59000126	TA-59-1	none	0	0%	☐
59000127	TA-59-1	none	0	0%	☐
59000130	TA-59-1	none	0	0%	☐

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

ESIDNUM	Nearest Receptor (m)	Receptor Direction
03002914	999	N
03002915	999	N
03002919	1139	N
03002920	1139	N
03002923	1010	N
03002924	1010	N
03002928	1149	N
03002929	1149	N
03002932	1165	N
03002933	1165	N
03002937	1113	N
03002944	1197	N
03002945	1197	N
03002946	1197	N
03003501	1129	N
03010222	1205	N
16020504	710	S
21015505	668	NNW
21020901	700	NNW
33008606	2301	WNW
41000417	215	NNE
48000107	753	N
48000154	751	N
48000160	766	N
50000102	1175	N
50003701	1161	N
50006903	1176	N
53000303	800	NNE
53000702	944	NNE
55000415	1004	N
55000416	1056	N

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

ESIDNUM	Height (m)	Diameter (m)
03002914	15.9	1.07
03002915	15.9	1.07
03002919	15.9	1.07
03002920	15.9	1.07
03002923	15.9	1.07
03002924	15.9	1.07
03002928	15.9	1.07
03002929	15.9	1.07
03002932	15.9	1.07
03002933	15.9	1.07
03002937	16.8	0.20
03002944	16.5	1.40
03002945	16.5	1.40
03002946	16.5	1.80
03003501	12.0	0.86
03010222	13.4	0.91
16020504	18.3	0.46
21015505	29.9	0.81
21020901	22.9	1.22
33008606	23.4	0.56
41000417	30.8	1.50
48000107	13.4	0.30
48000154	13.1	0.91
48000160	12.4	0.38
50000102	15.5	1.83
50003701	12.4	0.91
50006903	10.5	0.34
53000303	33.5	0.91
53000702	13.1	0.91
55000415	9.5	0.93
55000416	9.5	0.93

Table 4. 61.94(b)(7) User Supplied Data—Monitored Stack Parameters

ESIDNUM	stack exit velocity (m/s)
03002914	5.8
03002915	20.3
03002919	23.0
03002920	19.2
03002923	20.5
03002924	14.4
03002928	20.3
03002929	19.0
03002932	12.2
03002933	17.8
03002937	22.0
03002944	11.3
03002945	6.9
03002946	5.9
03003501	5.3
03010222	1.0
16020504	16.4
21015505	8.3
21020901	11.5
33008606	8.4
41000417	2.7
48000107	19.1
48000154	6.8
48000160	9.8
50000102	12.5
50003701	7.0
50006903	5.0
53000303	11.9
53000702	9.5
55000415	9.6
55000416	13.2

Table 5. 61.94(b)(7) User Supplied Data—Receptor Locations for Monitored Release Points

ESIDNUM	Nearest Receptor	Direction	LANL Maximum Dose Location	Direction
03002914	999	N	5,981	E
03002915	999	N	5,983	E
03002919	1,139	N	5,969	E
03002920	1,139	N	5,967	E
03002923	1,010	N	6,130	E
03002924	1,010	N	6,132	E
03002928	1,149	N	6,116	E
03002929	1,149	N	6,118	E
03002932	1,165	N	5,966	E
03002933	1,165	N	5,965	E
03002937	1,113	N	6,054	E
03002944	1,197	N	6,055	E
03002945	1,197	N	6,057	E
03002946	1,197	N	6,057	E
03003501	1,129	N	5,751	E
03010222	1,205	N	6,249	E
16020504	710	S	9,799	ENE
21015505	668	NNW	1,525	E
21020901	700	NNW	1,453	E
33008606	2,301	WNW	10,362	N
41000417	215	NNE	3,832	E
48000107	753	N	4,730	ENE
48000154	751	N	4,694	ENE
48000160	766	N	4,733	ENE
50000102	1,175	N	4,131	ENE
50003701	1,161	N	4,242	ENE
50006903	1,176	N	4,297	ENE
53000303	800	NNE	800	NNE
53000702	944	NNE	944	NNE
55000415	1,004	N	4,434	ENE
55000416	1,056	N	4,508	ENE

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

Description	value	units	CAP88 variable name	reference
annual rainfall rate	45.3	cm/y	RR	Bowen (1990)
lid height	1525	m	LIPO	Holzworth (1972)
annual median temp	281.9	K	TA	Bowen (1990)
E-vertical temperature gradient	0.02	K/m	TG	EPA (1995)
F-vertical temperature gradient	0.035	K/m	TG	EPA (1995)
G-vertical temperature gradient	0.035	K/m	TG	EPA (1995)
food supply fraction - local vegetables	0.076		F1V	EPA (1989)
food supply fraction - vegetable regional	0.924		F2V	EPA (1989)
food supply fraction - vegetable imported	0		F3V	EPA (1989)
food supply fraction - meat local	0.008		F1B	EPA (1989)
food supply fraction - meat regional	0.992		F2B	EPA (1989)
food supply fraction - meat imported	0		F3B	EPA (1989)
food supply fraction - milk local	0		F1M	EPA (1989)
food supply fraction - milk regional	1		F2M	EPA (1989)
food supply fraction - milk imported	0		F3M	EPA (1989)
ground surface roughness factor	0.5		GSCFAC	EPA (1989)

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays

CAP88 Input Data For 1998 TA-6 Meteorological Tower

```
1  1  0.001740.001030.000030.000000.000000.00000
1  2  0.002310.000970.000030.000000.000000.00000
1  3  0.003860.002400.000000.000000.000000.00000
1  4  0.006860.004860.000000.000000.000000.00000
1  5  0.009600.006340.000000.000000.000000.00000
1  6  0.009000.009660.000030.000000.000000.00000
1  7  0.010290.012570.000030.000000.000000.00000
1  8  0.008290.013000.000460.000000.000000.00000
1  9  0.004030.010290.000460.000000.000000.00000
1 10  0.002600.004170.000830.000000.000000.00000
1 11  0.001740.002140.000490.000000.000000.00000
1 12  0.001060.001260.000290.000000.000000.00000
1 13  0.000710.001230.000230.000000.000000.00000
1 14  0.001030.000910.000060.000000.000000.00000
1 15  0.000740.001110.000090.000000.000000.00000
1 16  0.000740.000770.000110.000000.000000.00000
2  1  0.000200.000860.000260.000000.000000.00000
2  2  0.000600.001400.000400.000000.000000.00000
2  3  0.000490.002430.000140.000000.000000.00000
2  4  0.001690.003460.000030.000000.000000.00000
2  5  0.001860.004260.000000.000000.000000.00000
2  6  0.001370.002660.000030.000000.000000.00000
2  7  0.001110.002570.000060.000000.000000.00000
2  8  0.001660.007770.000800.000000.000000.00000
2  9  0.001230.010030.003690.000000.000000.00000
2 10  0.000710.005140.004600.000110.000000.00000
2 11  0.000570.002570.005230.000290.000000.00000
2 12  0.000230.001460.002400.000110.000000.00000
2 13  0.000110.001000.000710.000000.000000.00000
2 14  0.000260.001060.000460.000000.000000.00000
2 15  0.000260.000860.000600.000030.000000.00000
2 16  0.000170.001370.000310.000000.000000.00000
3  1  0.000510.001510.000770.000000.000000.00000
3  2  0.001310.004110.002030.000060.000000.00000
3  3  0.001290.005910.001370.000000.000000.00000
3  4  0.001740.005260.000460.000000.000000.00000
3  5  0.001660.003710.000090.000000.000000.00000
3  6  0.000970.001570.000110.000000.000000.00000
3  7  0.000910.000800.000000.000000.000000.00000
3  8  0.001630.005310.001000.000000.000000.00000
3  9  0.002490.016370.011510.000140.000000.00000
3 10  0.001830.009630.011890.001200.000000.00000
3 11  0.000910.005430.008630.000710.000000.00000
3 12  0.000630.003630.009490.000910.000000.00000
3 13  0.000290.002430.006290.000510.000000.00000
3 14  0.000430.001660.002690.000140.000000.00000
3 15  0.000370.002740.003460.000060.000000.00000
3 16  0.000260.001260.001030.000030.000000.00000
4  1  0.005830.009400.000460.000030.000000.00000
4  2  0.005460.008290.001340.000060.000000.00000
4  3  0.004290.004660.000310.000000.000000.00000
4  4  0.003510.002260.000140.000030.000000.00000
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4  5  0.002600.000830.000000.000000.000000.00000
4  6  0.002740.000600.000030.000000.000000.00000
4  7  0.002770.000800.000000.000000.000000.00000
4  8  0.003290.001890.000030.000000.000000.00000
4  9  0.007630.010200.000800.000290.000030.00000
4 10  0.006740.019030.004260.003060.000090.00000
4 11  0.005000.019060.006570.003060.000000.00000
4 12  0.004170.017140.007030.002940.000170.00000
4 13  0.003400.007890.016570.008460.000490.00006
4 14  0.003260.008340.016340.011260.002600.00034
4 15  0.003770.013910.008630.001630.000200.00000
4 16  0.005170.008540.000860.000060.000000.00000
5  1  0.004830.001890.000000.000000.000000.00000
5  2  0.003290.000740.000000.000000.000000.00000
5  3  0.002090.000540.000000.000000.000000.00000
5  4  0.001460.000170.000000.000000.000000.00000
5  5  0.000710.000000.000000.000000.000000.00000
5  6  0.000600.000000.000000.000000.000000.00000
5  7  0.000630.000000.000000.000000.000000.00000
5  8  0.001400.000060.000000.000000.000000.00000
5  9  0.003400.000800.000000.000000.000000.00000
5 10  0.005030.003460.000000.000000.000000.00000
5 11  0.005400.009230.000000.000000.000000.00000
5 12  0.006540.019740.000110.000000.000000.00000
5 13  0.006690.033510.003030.000030.000000.00000
5 14  0.005030.016060.004290.000140.000000.00000
5 15  0.006000.029890.000260.000000.000000.00000
5 16  0.006830.009030.000000.000000.000000.00000
6  1  0.003630.000630.000000.000000.000000.00000
6  2  0.001970.000140.000000.000000.000000.00000
6  3  0.001570.000090.000000.000000.000000.00000
6  4  0.000690.000000.000000.000000.000000.00000
6  5  0.000540.000000.000000.000000.000000.00000
6  6  0.000460.000000.000000.000000.000000.00000
6  7  0.000340.000000.000000.000000.000000.00000
6  8  0.000600.000000.000000.000000.000000.00000
6  9  0.001060.000030.000000.000000.000000.00000
6 10  0.002340.000260.000000.000000.000000.00000
6 11  0.003540.001090.000000.000000.000000.00000
6 12  0.004630.005110.000000.000000.000000.00000
6 13  0.007140.026970.000290.000000.000000.00000
6 14  0.006800.037000.001910.000000.000000.00000
6 15  0.007540.008510.000000.000000.000000.00000
6 16  0.004540.001800.000000.000000.000000.00000
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Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

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   CAP88 Input Data For 1998 TA-49 Meteorological Tower

1  1  0.000370.000090.000000.000000.000000.00000
1  2  0.000460.000000.000000.000000.000000.00000
1  3  0.000660.000030.000000.000000.000000.00000
1  4  0.001340.000110.000000.000000.000000.00000
1  5  0.002120.000370.000000.000000.000000.00000
1  6  0.001890.000460.000000.000000.000000.00000
1  7  0.001370.000630.000000.000000.000000.00000
1  8  0.001030.000400.000000.000000.000000.00000
1  9  0.000970.000230.000000.000000.000000.00000
1 10  0.000430.000170.000000.000000.000000.00000
1 11  0.000460.000200.000000.000000.000000.00000
1 12  0.000370.000090.000000.000000.000000.00000
1 13  0.000370.000060.000000.000000.000000.00000
1 14  0.000370.000060.000000.000000.000000.00000
1 15  0.000340.000090.000000.000000.000000.00000
1 16  0.000400.000090.000000.000000.000000.00000
2  1  0.000090.000060.000000.000000.000000.00000
2  2  0.000260.000090.000000.000000.000000.00000
2  3  0.000290.000260.000000.000000.000000.00000
2  4  0.000460.000230.000000.000000.000000.00000
2  5  0.000920.000890.000000.000000.000000.00000
2  6  0.000740.000890.000000.000000.000000.00000
2  7  0.000510.000860.000000.000000.000000.00000
2  8  0.000400.000800.000000.000000.000000.00000
2  9  0.000600.000540.000030.000000.000000.00000
2 10  0.000140.000230.000000.000000.000000.00000
2 11  0.000170.000200.000000.000000.000000.00000
2 12  0.000090.000090.000030.000000.000000.00000
2 13  0.000140.000000.000000.000000.000000.00000
2 14  0.000170.000090.000000.000000.000000.00000
2 15  0.000090.000110.000000.000000.000000.00000
2 16  0.000140.000030.000030.000000.000000.00000
3  1  0.000200.000140.000060.000000.000000.00000
3  2  0.000340.000230.000030.000000.000000.00000
3  3  0.000490.000510.000000.000000.000000.00000
3  4  0.001340.001890.000000.000000.000000.00000
3  5  0.001770.003320.000060.000000.000000.00000
3  6  0.000970.004210.000000.000000.000000.00000
3  7  0.000940.003520.000090.000000.000000.00000
3  8  0.000460.002860.000000.000000.000000.00000
3  9  0.000800.003260.000090.000000.000000.00000
3 10  0.000370.001170.000000.000000.000000.00000
3 11  0.000290.000570.000060.000000.000000.00000
3 12  0.000060.000370.000140.000000.000000.00000
3 13  0.000260.000370.000200.000000.000000.00000
3 14  0.000200.000400.000110.000000.000000.00000
3 15  0.000090.000230.000030.000000.000000.00000
3 16  0.000090.000170.000030.000000.000000.00000
4  1  0.001540.001520.001120.001000.000060.00006
4  2  0.001490.001860.000370.001000.000000.00000
4  3  0.001690.003350.000430.000260.000030.00000
4  4  0.001630.007100.000540.000260.000000.00000
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 4  5  0.002260.009610.000570.000000.000000.00000
 4  6  0.001660.006640.000370.000060.000000.00000
 4  7  0.001660.007550.000690.000000.000000.00000
 4  8  0.001490.010560.002690.000630.000000.00000
 4  9  0.001400.016050.011300.014560.001090.00017
 4 10  0.001630.007180.007810.013880.002780.00060
 4 11  0.001370.003630.006010.013300.003380.00034
 4 12  0.001430.003520.007010.009300.001800.00003
 4 13  0.001400.003380.010530.010270.001090.00000
 4 14  0.001060.003030.009210.004350.000740.00006
 4 15  0.001460.001800.005010.003430.000170.00000
 4 16  0.001260.001490.001860.002550.000400.00000
 5  1  0.003230.014820.009810.000110.000000.00000
 5  2  0.003460.009640.005380.000200.000000.00000
 5  3  0.002780.011530.006320.000290.000000.00000
 5  4  0.002830.008350.003090.000110.000000.00000
 5  5  0.002170.004030.000940.000030.000000.00000
 5  6  0.001770.002920.000570.000000.000000.00000
 5  7  0.001570.002980.001090.000030.000000.00000
 5  8  0.001750.006380.007040.000570.000000.00000
 5  9  0.002570.022260.039230.004550.000000.00000
 5 10  0.003290.024290.021740.002890.000000.00000
 5 11  0.002980.017650.013790.001490.000000.00000
 5 12  0.002630.011270.010530.001230.000000.00000
 5 13  0.002690.009560.009960.001140.000000.00000
 5 14  0.002570.010990.013700.000260.000000.00000
 5 15  0.002690.011840.007780.000340.000000.00000
 5 16  0.002860.008210.005640.000460.000000.00000
 6  1  0.007930.013730.002370.000030.000000.00000
 6  2  0.005010.002830.000060.000000.000000.00000
 6  3  0.003780.001460.000060.000000.000000.00000
 6  4  0.002550.000430.000000.000000.000000.00000
 6  5  0.001770.000170.000000.000000.000000.00000
 6  6  0.001340.000170.000000.000000.000000.00000
 6  7  0.001540.000740.000030.000000.000000.00000
 6  8  0.001630.000970.000090.000000.000000.00000
 6  9  0.002170.003180.000140.000000.000000.00000
 6 10  0.003810.007300.000260.000000.000000.00000
 6 11  0.004580.010330.000430.000000.000000.00000
 6 12  0.004840.020340.003090.000000.000000.00000
 6 13  0.005320.036020.007210.000000.000000.00000
 6 14  0.004460.023860.013330.000000.000000.00000
 6 15  0.006640.020030.005410.000030.000000.00000
 6 16  0.006980.031190.016080.000090.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

```
   CAP88 Input Data For 1998 TA-53 Meteorological Tower

 1  1  0.001010.000350.000030.000000.000000.00000
 1  2  0.002620.000580.000000.000000.000000.00000
 1  3  0.004840.001530.000000.000000.000000.00000
 1  4  0.008490.003830.000000.000000.000000.00000
 1  5  0.006560.005120.000000.000000.000000.00000
 1  6  0.004780.004640.000000.000000.000000.00000
 1  7  0.004200.003340.000000.000000.000000.00000
 1  8  0.003200.002530.000000.000000.000000.00000
 1  9  0.001990.001550.000000.000000.000000.00000
 1 10  0.001150.000980.000000.000000.000000.00000
 1 11  0.000980.000660.000030.000000.000000.00000
 1 12  0.000600.000690.000090.000000.000000.00000
 1 13  0.000370.000750.000030.000000.000000.00000
 1 14  0.000550.000550.000030.000000.000000.00000
 1 15  0.000400.000260.000000.000000.000000.00000
 1 16  0.000600.000290.000000.000000.000000.00000
 2  1  0.000290.000200.000000.000000.000000.00000
 2  2  0.000520.000550.000000.000000.000000.00000
 2  3  0.001070.001780.000030.000000.000000.00000
 2  4  0.001350.003340.000000.000000.000000.00000
 2  5  0.001070.004550.000000.000000.000000.00000
 2  6  0.000720.003430.000000.000000.000000.00000
 2  7  0.000630.002420.000000.000000.000000.00000
 2  8  0.000660.001760.000000.000000.000000.00000
 2  9  0.000350.001760.000030.000000.000000.00000
 2 10  0.000230.000950.000030.000000.000000.00000
 2 11  0.000140.000630.000000.000000.000000.00000
 2 12  0.000060.000580.000060.000000.000000.00000
 2 13  0.000060.000660.000140.000000.000000.00000
 2 14  0.000090.000490.000140.000000.000000.00000
 2 15  0.000030.000320.000060.000000.000000.00000
 2 16  0.000200.000200.000090.000000.000000.00000
 3  1  0.000580.000460.000290.000000.000000.00000
 3  2  0.000950.001640.000400.000000.000000.00000
 3  3  0.001550.004350.000370.000000.000000.00000
 3  4  0.001670.006650.000350.000000.000000.00000
 3  5  0.001180.007000.000490.000000.000000.00000
 3  6  0.000750.004520.000140.000000.000000.00000
 3  7  0.000750.004320.000090.000000.000000.00000
 3  8  0.001070.005960.000200.000000.000000.00000
 3  9  0.000720.006360.001010.000000.000000.00000
 3 10  0.000460.003570.000950.000030.000000.00000
 3 11  0.000290.001780.000890.000030.000000.00000
 3 12  0.000200.001670.001990.000060.000000.00000
 3 13  0.000260.001870.002850.000090.000000.00000
 3 14  0.000140.001300.002040.000030.000000.00000
 3 15  0.000200.000660.000690.000000.000000.00000
 3 16  0.000260.000460.000370.000000.000000.00000
 4  1  0.005010.007920.009180.002420.000230.00000
 4  2  0.004660.008290.006680.001840.000000.00000
 4  3  0.003830.007140.003600.000460.000000.00000
 4  4  0.002760.005760.001350.000090.000000.00000
```

```
4  5  0.002620.005900.001210.000030.000000.00000
4  6  0.001840.003280.000550.000030.000000.00000
4  7  0.002190.005010.000980.000060.000000.00000
4  8  0.001840.008720.007740.001440.000000.00000
4  9  0.002130.013530.024790.009360.000350.00000
4 10  0.002100.014480.029310.018540.002970.00040
4 11  0.002190.014110.020840.011370.002940.00020
4 12  0.001870.006070.016550.010880.001010.00003
4 13  0.002250.006510.016870.007310.000950.00000
4 14  0.002070.005790.010280.002680.000350.00009
4 15  0.002680.004030.004030.002760.000290.00003
4 16  0.004660.004640.003940.001610.000120.00006
5  1  0.006910.011000.002790.000030.000000.00000
5  2  0.006100.008000.002500.000000.000000.00000
5  3  0.004780.004870.000950.000030.000000.00000
5  4  0.003280.003370.000400.000000.000000.00000
5  5  0.002760.002070.000030.000000.000000.00000
5  6  0.002480.001240.000120.000000.000000.00000
5  7  0.002130.002040.000170.000000.000000.00000
5  8  0.002220.004720.003510.000290.000000.00000
5  9  0.003050.010740.004350.000140.000000.00000
5 10  0.003430.023230.019120.000400.000000.00000
5 11  0.004840.026080.009210.000120.000000.00000
5 12  0.003890.020990.017560.000140.000000.00000
5 13  0.004230.022660.021130.000090.000000.00000
5 14  0.004320.014860.003450.000000.000000.00000
5 15  0.005610.008490.003110.000030.000000.00000
5 16  0.007260.009790.002990.000060.000000.00000
6  1  0.003400.000830.000000.000000.000000.00000
6  2  0.003600.000860.000000.000000.000000.00000
6  3  0.002990.000490.000000.000000.000000.00000
6  4  0.002590.000630.000000.000000.000000.00000
6  5  0.002680.000090.000000.000000.000000.00000
6  6  0.002420.000230.000000.000000.000000.00000
6  7  0.002040.000720.000000.000000.000000.00000
6  8  0.003050.001470.000090.000000.000000.00000
6  9  0.003830.003310.000030.000000.000000.00000
6 10  0.004460.004150.000230.000000.000000.00000
6 11  0.003170.001500.000000.000000.000000.00000
6 12  0.002560.005530.000720.000000.000000.00000
6 13  0.002250.005870.000630.000000.000000.00000
6 14  0.002620.004380.000430.000000.000000.00000
6 15  0.002130.001410.000030.000000.000000.00000
6 16  0.004060.000890.000000.000000.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

```
   CAP88 Input Data For 1998 TA-54 Meteorological Tower

 1  1  0.000940.000370.000000.000000.000000.00000
 1  2  0.002230.001230.000000.000000.000000.00000
 1  3  0.003010.002200.000000.000000.000000.00000
 1  4  0.005980.005240.000000.000000.000000.00000
 1  5  0.010620.008590.000030.000000.000000.00000
 1  6  0.009650.006960.000000.000000.000000.00000
 1  7  0.006840.004070.000000.000000.000000.00000
 1  8  0.003690.003950.000000.000000.000000.00000
 1  9  0.001890.003380.000000.000000.000000.00000
 1 10  0.001150.001660.000030.000000.000000.00000
 1 11  0.000920.000860.000030.000000.000000.00000
 1 12  0.000830.000770.000000.000000.000000.00000
 1 13  0.000460.000370.000030.000000.000000.00000
 1 14  0.000660.000310.000000.000000.000000.00000
 1 15  0.000660.000260.000030.000000.000000.00000
 1 16  0.000860.000340.000000.000000.000000.00000
 2  1  0.000170.000260.000030.000000.000000.00000
 2  2  0.000290.001000.000000.000000.000000.00000
 2  3  0.000720.002460.000060.000000.000000.00000
 2  4  0.001170.003180.000000.000000.000000.00000
 2  5  0.001000.002750.000090.000000.000000.00000
 2  6  0.000690.001460.000030.000000.000000.00000
 2  7  0.000490.001400.000000.000000.000000.00000
 2  8  0.000540.002580.000030.000000.000000.00000
 2  9  0.000460.002950.000030.000000.000000.00000
 2 10  0.000340.001860.000060.000000.000000.00000
 2 11  0.000170.001000.000030.000000.000000.00000
 2 12  0.000140.000540.000090.000000.000000.00000
 2 13  0.000090.000540.000260.000000.000000.00000
 2 14  0.000060.000600.000290.000000.000000.00000
 2 15  0.000200.000170.000030.000000.000000.00000
 2 16  0.000030.000000.000000.000000.000000.00000
 3  1  0.000430.000460.000060.000000.000000.00000
 3  2  0.000540.002610.000060.000000.000000.00000
 3  3  0.000890.007530.000340.000000.000000.00000
 3  4  0.001350.004290.000630.000000.000000.00000
 3  5  0.000830.002060.000140.000000.000000.00000
 3  6  0.001000.001000.000030.000000.000000.00000
 3  7  0.000660.001550.000140.000000.000000.00000
 3  8  0.000660.003980.000830.000000.000000.00000
 3  9  0.000570.007990.003150.000060.000000.00000
 3 10  0.000290.005500.002090.000000.000000.00000
 3 11  0.000370.002200.001400.000030.000000.00000
 3 12  0.000370.001780.002580.000170.000000.00000
 3 13  0.000140.001520.004380.000140.000000.00000
 3 14  0.000200.001000.002200.000110.000000.00000
 3 15  0.000170.000600.000520.000000.000000.00000
 3 16  0.000230.000230.000090.000000.000000.00000
 4  1  0.002090.002830.003550.001200.000060.00000
 4  2  0.002120.008450.007760.001570.000000.00000
 4  3  0.002980.013660.005180.000230.000000.00000
 4  4  0.002780.003640.000800.000000.000000.00000
```

```
4  5  0.001830.001030.000110.000000.000000.00000
4  6  0.002000.000770.000000.000000.000000.00000
4  7  0.001520.001550.000460.000030.000000.00000
4  8  0.001430.003640.005120.000630.000000.00000
4  9  0.001750.009280.022560.009590.000290.00003
4 10  0.002380.012050.038820.023820.003180.00014
4 11  0.001950.008470.015290.008880.001800.00003
4 12  0.002350.004900.009280.005240.000260.00000
4 13  0.001800.005210.008700.003520.000110.00000
4 14  0.001550.004520.006010.000830.000110.00000
4 15  0.001720.002580.004010.000600.000000.00000
4 16  0.001660.002200.001720.000690.000030.00000
5  1  0.005840.008760.004270.000060.000000.00000
5  2  0.004440.007330.004900.000140.000000.00000
5  3  0.003060.004410.000540.000030.000000.00000
5  4  0.002580.000660.000030.000000.000000.00000
5  5  0.001150.000230.000000.000000.000000.00000
5  6  0.000860.000000.000000.000000.000000.00000
5  7  0.001370.000290.000000.000000.000000.00000
5  8  0.000970.000520.000030.000000.000000.00000
5  9  0.001490.003550.000600.000000.000000.00000
5 10  0.002200.014570.014290.000740.000000.00000
5 11  0.002490.016630.013170.000170.000000.00000
5 12  0.003290.012850.003150.000000.000000.00000
5 13  0.004950.019240.001370.000000.000000.00000
5 14  0.008650.019930.001030.000000.000000.00000
5 15  0.007530.023160.001030.000000.000000.00000
5 16  0.009080.010540.001460.000090.000000.00000
6  1  0.008880.007300.000460.000000.000000.00000
6  2  0.005610.003520.000090.000000.000000.00000
6  3  0.003840.001400.000000.000000.000000.00000
6  4  0.001150.000200.000000.000000.000000.00000
6  5  0.000430.000030.000000.000000.000000.00000
6  6  0.000430.000000.000000.000000.000000.00000
6  7  0.000340.000060.000000.000000.000000.00000
6  8  0.000970.000090.000000.000000.000000.00000
6  9  0.001170.000860.000030.000000.000000.00000
6 10  0.002430.004090.000520.000000.000000.00000
6 11  0.003660.013230.002230.000000.000000.00000
6 12  0.005840.020470.002260.000000.000000.00000
6 13  0.010480.024450.001320.000000.000000.00000
6 14  0.017320.024760.000000.000000.000000.00000
6 15  0.016060.035190.000370.000000.000000.00000
6 16  0.009250.015630.001400.000000.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data For May 1998 TA-53 Meteorological Tower

```
1  1  0.000890.001190.000000.000000.000000.00000
1  2  0.002380.000600.000000.000000.000000.00000
1  3  0.002680.001190.000000.000000.000000.00000
1  4  0.004170.005950.000000.000000.000000.00000
1  5  0.004170.006250.000000.000000.000000.00000
1  6  0.003570.007740.000000.000000.000000.00000
1  7  0.002980.004760.000000.000000.000000.00000
1  8  0.002080.001490.000000.000000.000000.00000
1  9  0.000600.000890.000000.000000.000000.00000
1 10  0.001190.000600.000000.000000.000000.00000
1 11  0.000600.000300.000000.000000.000000.00000
1 12  0.000300.000890.000000.000000.000000.00000
1 13  0.000000.000300.000000.000000.000000.00000
1 14  0.000600.001490.000000.000000.000000.00000
1 15  0.000890.000000.000000.000000.000000.00000
1 16  0.000600.000000.000000.000000.000000.00000
2  1  0.000000.000000.000000.000000.000000.00000
2  2  0.000600.000000.000000.000000.000000.00000
2  3  0.001190.002380.000000.000000.000000.00000
2  4  0.000890.001790.000000.000000.000000.00000
2  5  0.000600.003570.000000.000000.000000.00000
2  6  0.000600.003270.000000.000000.000000.00000
2  7  0.000000.002980.000000.000000.000000.00000
2  8  0.000000.001490.000000.000000.000000.00000
2  9  0.000300.001490.000300.000000.000000.00000
2 10  0.000000.000300.000000.000000.000000.00000
2 11  0.000000.000300.000000.000000.000000.00000
2 12  0.000300.000890.000300.000000.000000.00000
2 13  0.000000.001490.000600.000000.000000.00000
2 14  0.000000.000300.000600.000000.000000.00000
2 15  0.000000.000300.000000.000000.000000.00000
2 16  0.000300.000000.000000.000000.000000.00000
3  1  0.000600.000000.000000.000000.000000.00000
3  2  0.000300.000890.000300.000000.000000.00000
3  3  0.000600.001190.000300.000000.000000.00000
3  4  0.000300.003870.000890.000000.000000.00000
3  5  0.000300.004170.000890.000000.000000.00000
3  6  0.000000.004760.000000.000000.000000.00000
3  7  0.000600.006840.000600.000000.000000.00000
3  8  0.000000.003270.000600.000000.000000.00000
3  9  0.000000.003570.001190.000000.000000.00000
3 10  0.000300.002080.002980.000000.000000.00000
3 11  0.000000.001490.001190.000000.000000.00000
3 12  0.000600.002380.005060.000000.000000.00000
3 13  0.000600.002080.008030.000300.000000.00000
3 14  0.000000.001790.005950.000000.000000.00000
3 15  0.000300.001190.002380.000000.000000.00000
3 16  0.000000.000000.000600.000000.000000.00000
4  1  0.002380.003570.008630.000600.000000.00000
4  2  0.002380.002680.004170.002080.000000.00000
4  3  0.001490.002680.001190.000600.000000.00000
4  4  0.001790.004170.000890.000600.000000.00000
```

```
 4  5  0.002680.002380.000890.000300.000000.00000
 4  6  0.000600.002380.000000.000000.000000.00000
 4  7  0.001790.004760.000890.000000.000000.00000
 4  8  0.001190.007140.010410.002980.000000.00000
 4  9  0.001190.005360.026480.030940.002080.00000
 4 10  0.000890.008030.038680.057720.002680.00000
 4 11  0.000890.008630.027970.014880.002080.00000
 4 12  0.001490.005950.027670.014880.002080.00000
 4 13  0.001190.010710.044930.012790.000300.00000
 4 14  0.001790.011600.025890.008930.000300.00000
 4 15  0.001490.002680.007440.005650.000300.00000
 4 16  0.002680.003270.002680.001190.000000.00000
 5  1  0.002680.005650.001490.000000.000000.00000
 5  2  0.001790.005650.002080.000000.000000.00000
 5  3  0.002080.002980.000890.000300.000000.00000
 5  4  0.000300.001490.000000.000000.000000.00000
 5  5  0.001790.002380.000000.000000.000000.00000
 5  6  0.000890.000300.000000.000000.000000.00000
 5  7  0.001190.002380.000300.000000.000000.00000
 5  8  0.001490.002980.002980.000600.000000.00000
 5  9  0.001790.007740.002680.000300.000000.00000
 5 10  0.000890.014280.021120.000300.000000.00000
 5 11  0.002080.013690.010410.000000.000000.00000
 5 12  0.001790.013690.024990.000300.000000.00000
 5 13  0.001790.022610.038080.000000.000000.00000
 5 14  0.001490.018450.008330.000000.000000.00000
 5 15  0.001190.006550.005360.000000.000000.00000
 5 16  0.003870.006840.002380.000000.000000.00000
 6  1  0.000890.000600.000000.000000.000000.00000
 6  2  0.002980.000300.000000.000000.000000.00000
 6  3  0.000600.000000.000000.000000.000000.00000
 6  4  0.000600.000300.000000.000000.000000.00000
 6  5  0.002080.000000.000000.000000.000000.00000
 6  6  0.000600.000600.000000.000000.000000.00000
 6  7  0.001490.001190.000000.000000.000000.00000
 6  8  0.001490.001490.000300.000000.000000.00000
 6  9  0.002080.002080.000000.000000.000000.00000
 6 10  0.001790.002980.001790.000000.000000.00000
 6 11  0.001490.001190.000000.000000.000000.00000
 6 12  0.000600.006250.000890.000000.000000.00000
 6 13  0.000600.007140.000600.000000.000000.00000
 6 14  0.000300.004760.001790.000000.000000.00000
 6 15  0.000600.000300.000000.000000.000000.00000
 6 16  0.001190.000300.000000.000000.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data For June 1998 TA-53 Meteorological Tower

```
1  1  0.000370.000370.000370.000000.000000.00000
1  2  0.001120.000000.000000.000000.000000.00000
1  3  0.000000.001120.000000.000000.000000.00000
1  4  0.003350.004090.000000.000000.000000.00000
1  5  0.002600.005210.000000.000000.000000.00000
1  6  0.000370.002230.000000.000000.000000.00000
1  7  0.000740.001490.000000.000000.000000.00000
1  8  0.001490.001120.000000.000000.000000.00000
1  9  0.000000.001120.000000.000000.000000.00000
1 10  0.001120.000370.000000.000000.000000.00000
1 11  0.001120.000370.000370.000000.000000.00000
1 12  0.000740.001490.000000.000000.000000.00000
1 13  0.000000.001120.000370.000000.000000.00000
1 14  0.000370.001120.000000.000000.000000.00000
1 15  0.000000.000370.000000.000000.000000.00000
1 16  0.000000.000370.000000.000000.000000.00000
2  1  0.000740.000370.000000.000000.000000.00000
2  2  0.000000.000000.000000.000000.000000.00000
2  3  0.000370.001120.000000.000000.000000.00000
2  4  0.000370.002980.000000.000000.000000.00000
2  5  0.000370.004460.000000.000000.000000.00000
2  6  0.000370.004830.000000.000000.000000.00000
2  7  0.000000.001490.000000.000000.000000.00000
2  8  0.000370.000740.000000.000000.000000.00000
2  9  0.000000.000370.000000.000000.000000.00000
2 10  0.000000.000000.000000.000000.000000.00000
2 11  0.000370.000370.000000.000000.000000.00000
2 12  0.000000.001860.000370.000000.000000.00000
2 13  0.000000.002230.000740.000000.000000.00000
2 14  0.000000.001120.000370.000000.000000.00000
2 15  0.000000.000740.000000.000000.000000.00000
2 16  0.000000.000000.000000.000000.000000.00000
3  1  0.000370.000000.000000.000000.000000.00000
3  2  0.001860.001120.000370.000000.000000.00000
3  3  0.000370.003720.000000.000000.000000.00000
3  4  0.001120.004830.000370.000000.000000.00000
3  5  0.000000.004460.001490.000000.000000.00000
3  6  0.000740.005210.000370.000000.000000.00000
3  7  0.000000.004460.000000.000000.000000.00000
3  8  0.000370.003350.001120.000000.000000.00000
3  9  0.000000.004460.002600.000000.000000.00000
3 10  0.000000.002230.002600.000370.000000.00000
3 11  0.000000.001860.004830.000370.000000.00000
3 12  0.000370.003720.010410.000000.000000.00000
3 13  0.000370.002600.014130.000370.000000.00000
3 14  0.000370.002230.006320.000000.000000.00000
3 15  0.000370.001120.001860.000000.000000.00000
3 16  0.000370.000000.000740.000000.000000.00000
4  1  0.003720.003720.001490.000000.000000.00000
4  2  0.002230.005210.003350.000370.000000.00000
4  3  0.001490.004460.001120.000000.000000.00000
4  4  0.001120.003720.001860.000000.000000.00000
```

```
4  5  0.001860.001120.000000.000000.000000.00000
4  6  0.000740.001860.000740.000000.000000.00000
4  7  0.001120.003720.000740.000000.000000.00000
4  8  0.001860.004090.006320.002600.000000.00000
4  9  0.003720.004830.022310.022690.000740.00000
4 10  0.000000.006320.038680.032730.007070.00000
4 11  0.002600.007070.031980.038680.004460.00000
4 12  0.002230.008180.047230.058010.006320.00037
4 13  0.001490.011160.046490.034960.004090.00000
4 14  0.000370.006690.024920.004090.000000.00000
4 15  0.002230.004830.003720.002230.000000.00000
4 16  0.004090.005210.001120.000000.000000.00000
5  1  0.000740.003350.000370.000000.000000.00000
5  2  0.001490.003350.000740.000000.000000.00000
5  3  0.001490.001860.000740.000000.000000.00000
5  4  0.001490.001490.000000.000000.000000.00000
5  5  0.002600.000740.000000.000000.000000.00000
5  6  0.000740.001490.000000.000000.000000.00000
5  7  0.001120.001490.000000.000000.000000.00000
5  8  0.001490.004090.003720.000000.000000.00000
5  9  0.000740.004460.002600.000000.000000.00000
5 10  0.000740.009670.020450.000370.000000.00000
5 11  0.001860.016730.011160.000000.000000.00000
5 12  0.002230.013390.016360.000740.000000.00000
5 13  0.001490.026030.031240.000370.000000.00000
5 14  0.001860.017480.005950.000000.000000.00000
5 15  0.002980.009300.004830.000000.000000.00000
5 16  0.001860.007070.000740.000000.000000.00000
6  1  0.000000.000740.000000.000000.000000.00000
6  2  0.001120.000000.000000.000000.000000.00000
6  3  0.000000.000000.000000.000000.000000.00000
6  4  0.000000.000000.000000.000000.000000.00000
6  5  0.001120.000000.000000.000000.000000.00000
6  6  0.000370.000000.000000.000000.000000.00000
6  7  0.001120.000000.000000.000000.000000.00000
6  8  0.000000.001490.000370.000000.000000.00000
6  9  0.001120.001120.000000.000000.000000.00000
6 10  0.000370.001860.000370.000000.000000.00000
6 11  0.000000.000370.000000.000000.000000.00000
6 12  0.000000.002980.001490.000000.000000.00000
6 13  0.000000.002980.000370.000000.000000.00000
6 14  0.000000.002980.000000.000000.000000.00000
6 15  0.000000.000370.000000.000000.000000.00000
6 16  0.001490.000000.000000.000000.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

```
CAP88 Input Data For July 1998 TA-53 Meteorological Tower
```

```
1  1  0.002380.000600.000000.000000.000000.00000
1  2  0.004460.001490.000000.000000.000000.00000
1  3  0.008930.001790.000000.000000.000000.00000
1  4  0.010410.004460.000000.000000.000000.00000
1  5  0.006550.004170.000000.000000.000000.00000
1  6  0.007140.003570.000000.000000.000000.00000
1  7  0.007140.001790.000000.000000.000000.00000
1  8  0.005950.002680.000000.000000.000000.00000
1  9  0.005060.002980.000000.000000.000000.00000
1 10  0.002980.001190.000000.000000.000000.00000
1 11  0.000600.000890.000000.000000.000000.00000
1 12  0.000600.000300.000000.000000.000000.00000
1 13  0.000890.001190.000000.000000.000000.00000
1 14  0.000300.000000.000000.000000.000000.00000
1 15  0.000300.000300.000000.000000.000000.00000
1 16  0.000300.000300.000000.000000.000000.00000
2  1  0.000000.000300.000000.000000.000000.00000
2  2  0.001490.000600.000000.000000.000000.00000
2  3  0.003270.003570.000000.000000.000000.00000
2  4  0.000600.003570.000000.000000.000000.00000
2  5  0.001190.002980.000000.000000.000000.00000
2  6  0.000890.000890.000000.000000.000000.00000
2  7  0.000300.000890.000000.000000.000000.00000
2  8  0.000890.000600.000000.000000.000000.00000
2  9  0.000600.004460.000000.000000.000000.00000
2 10  0.000600.002980.000000.000000.000000.00000
2 11  0.000300.001490.000000.000000.000000.00000
2 12  0.000000.000000.000000.000000.000000.00000
2 13  0.000300.000600.000000.000000.000000.00000
2 14  0.000300.000300.000300.000000.000000.00000
2 15  0.000300.000300.000000.000000.000000.00000
2 16  0.000300.000300.000000.000000.000000.00000
3  1  0.001790.000890.000000.000000.000000.00000
3  2  0.001790.002680.000000.000000.000000.00000
3  3  0.003570.008630.000300.000000.000000.00000
3  4  0.002680.007440.000600.000000.000000.00000
3  5  0.002080.004170.000600.000000.000000.00000
3  6  0.000600.003270.000300.000000.000000.00000
3  7  0.001190.002980.000300.000000.000000.00000
3  8  0.000600.006550.000000.000000.000000.00000
3  9  0.000890.010410.001790.000000.000000.00000
3 10  0.000000.007740.001190.000000.000000.00000
3 11  0.000000.003270.000890.000000.000000.00000
3 12  0.000000.001190.000600.000000.000000.00000
3 13  0.000300.001790.000000.000000.000000.00000
3 14  0.000300.000890.000600.000000.000000.00000
3 15  0.000300.000600.000600.000000.000000.00000
3 16  0.000300.000890.000000.000000.000000.00000
4  1  0.002380.006840.006840.002380.001190.00000
4  2  0.003270.011900.007740.001490.000000.00000
4  3  0.001790.007440.002080.000890.000000.00000
4  4  0.002080.005060.001190.000000.000000.00000
```

```
 4  5  0.002080.004760.002380.000000.000000.00000
 4  6  0.002380.006250.000300.000000.000000.00000
 4  7  0.000600.004170.001790.000300.000000.00000
 4  8  0.001490.008030.006550.001790.000000.00000
 4  9  0.002380.014280.029460.007440.000000.00000
 4 10  0.001190.014280.036000.008030.000300.00000
 4 11  0.001490.019930.021120.003870.000600.00000
 4 12  0.000890.005060.012200.002080.000000.00000
 4 13  0.001490.003570.006550.002080.000000.00000
 4 14  0.001190.004460.005060.001190.000000.00000
 4 15  0.001790.002380.001190.002080.000300.00030
 4 16  0.002980.002680.004460.002980.000600.00060
 5  1  0.008330.014280.004760.000300.000000.00000
 5  2  0.005950.010710.002680.000000.000000.00000
 5  3  0.004170.003570.001790.000000.000000.00000
 5  4  0.002680.004170.000890.000000.000000.00000
 5  5  0.001790.002080.000000.000000.000000.00000
 5  6  0.002080.000600.000600.000000.000000.00000
 5  7  0.002080.001490.000300.000000.000000.00000
 5  8  0.000890.003270.003570.000000.000000.00000
 5  9  0.001190.007740.002980.000600.000000.00000
 5 10  0.002380.020830.015770.000300.000000.00000
 5 11  0.004460.026780.010710.000000.000000.00000
 5 12  0.003570.028270.026780.000000.000000.00000
 5 13  0.004460.025590.025590.000600.000000.00000
 5 14  0.003870.014880.006250.000000.000000.00000
 5 15  0.004760.010410.002680.000300.000000.00000
 5 16  0.007740.017550.004760.000300.000000.00000
 6  1  0.003570.000890.000000.000000.000000.00000
 6  2  0.002980.000000.000000.000000.000000.00000
 6  3  0.003570.000600.000000.000000.000000.00000
 6  4  0.002080.000890.000000.000000.000000.00000
 6  5  0.001190.000300.000000.000000.000000.00000
 6  6  0.000890.000300.000000.000000.000000.00000
 6  7  0.002080.000000.000000.000000.000000.00000
 6  8  0.001190.001790.000000.000000.000000.00000
 6  9  0.000890.002380.000000.000000.000000.00000
 6 10  0.005060.002080.000000.000000.000000.00000
 6 11  0.002380.002080.000000.000000.000000.00000
 6 12  0.002380.007740.000300.000000.000000.00000
 6 13  0.004460.007140.002680.000000.000000.00000
 6 14  0.004760.006250.000300.000000.000000.00000
 6 15  0.002380.002980.000300.000000.000000.00000
 6 16  0.004460.001190.000000.000000.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data For August 1998 TA-53 Meteorological Tower

1	1	0.003350.000370.000000.000000.000000.00000
1	2	0.007440.001120.000000.000000.000000.00000
1	3	0.012270.002980.000000.000000.000000.00000
1	4	0.016360.007810.000000.000000.000000.00000
1	5	0.005950.003720.000000.000000.000000.00000
1	6	0.004460.004460.000000.000000.000000.00000
1	7	0.004090.003720.000000.000000.000000.00000
1	8	0.005950.005210.000000.000000.000000.00000
1	9	0.004830.004090.000000.000000.000000.00000
1	10	0.001490.001490.000000.000000.000000.00000
1	11	0.002980.001120.000000.000000.000000.00000
1	12	0.000740.000740.000000.000000.000000.00000
1	13	0.000370.000740.000000.000000.000000.00000
1	14	0.001120.000370.000000.000000.000000.00000
1	15	0.000740.000000.000000.000000.000000.00000
1	16	0.000740.000370.000000.000000.000000.00000
2	1	0.001490.000740.000000.000000.000000.00000
2	2	0.002230.000370.000000.000000.000000.00000
2	3	0.002980.002230.000000.000000.000000.00000
2	4	0.002230.007440.000000.000000.000000.00000
2	5	0.000000.004090.000000.000000.000000.00000
2	6	0.000740.001490.000000.000000.000000.00000
2	7	0.000370.004090.000000.000000.000000.00000
2	8	0.000000.002600.000000.000000.000000.00000
2	9	0.000000.002230.000000.000000.000000.00000
2	10	0.000000.002230.000000.000000.000000.00000
2	11	0.000000.001860.000000.000000.000000.00000
2	12	0.000370.000740.000000.000000.000000.00000
2	13	0.000370.001120.000000.000000.000000.00000
2	14	0.000370.000000.000000.000000.000000.00000
2	15	0.000000.000370.000000.000000.000000.00000
2	16	0.000370.000370.000000.000000.000000.00000
3	1	0.000370.000740.000000.000000.000000.00000
3	2	0.001120.003720.001120.000000.000000.00000
3	3	0.002600.005950.000740.000000.000000.00000
3	4	0.002230.007810.000370.000000.000000.00000
3	5	0.000370.003720.000000.000000.000000.00000
3	6	0.000000.001860.000000.000000.000000.00000
3	7	0.000370.002600.000000.000000.000000.00000
3	8	0.000370.007070.000000.000000.000000.00000
3	9	0.000000.007070.000740.000000.000000.00000
3	10	0.000370.009300.000740.000000.000000.00000
3	11	0.001490.005950.000740.000000.000000.00000
3	12	0.000370.003720.000000.000000.000000.00000
3	13	0.000000.002230.001120.000000.000000.00000
3	14	0.000370.001490.000000.000000.000000.00000
3	15	0.000000.000000.000370.000000.000000.00000
3	16	0.000740.001120.000370.000000.000000.00000
4	1	0.002980.007810.012640.001120.000000.00000
4	2	0.004460.007070.004830.000740.000000.00000
4	3	0.002980.002980.004090.000370.000000.00000
4	4	0.002600.001860.002230.000000.000000.00000

```
 4  5  0.000740.001860.003350.000000.000000.00000
 4  6  0.002230.001490.001860.000000.000000.00000
 4  7  0.000740.002600.001120.000370.000000.00000
 4  8  0.000370.007810.002600.000370.000000.00000
 4  9  0.001120.011530.020830.000740.000000.00000
 4 10  0.002230.018970.023060.001490.000000.00000
 4 11  0.001860.033840.020080.000000.000000.00000
 4 12  0.000740.011900.013390.001120.000000.00000
 4 13  0.001860.010780.010780.001490.000000.00000
 4 14  0.001490.006690.008930.002980.000000.00000
 4 15  0.001120.004090.004090.004090.001120.00000
 4 16  0.002230.003720.006320.004090.000370.00000
 5  1  0.006690.011900.003350.000000.000000.00000
 5  2  0.002600.010040.002600.000000.000000.00000
 5  3  0.002980.002980.001490.000000.000000.00000
 5  4  0.003350.001120.000000.000000.000000.00000
 5  5  0.001120.001490.000370.000000.000000.00000
 5  6  0.003720.000740.000370.000000.000000.00000
 5  7  0.001120.001120.000000.000000.000000.00000
 5  8  0.001120.002230.003350.000370.000000.00000
 5  9  0.002230.003720.003720.000000.000000.00000
 5 10  0.001490.030490.015250.000000.000000.00000
 5 11  0.004830.039050.011160.000370.000000.00000
 5 12  0.003720.045370.029750.000370.000000.00000
 5 13  0.001860.034590.015990.000000.000000.00000
 5 14  0.004460.012640.001490.000000.000000.00000
 5 15  0.005950.012270.004460.000000.000000.00000
 5 16  0.004460.013020.005210.000370.000000.00000
 6  1  0.003350.000370.000000.000000.000000.00000
 6  2  0.002600.000740.000000.000000.000000.00000
 6  3  0.003350.000000.000000.000000.000000.00000
 6  4  0.001490.000000.000000.000000.000000.00000
 6  5  0.002230.000000.000000.000000.000000.00000
 6  6  0.000370.000370.000000.000000.000000.00000
 6  7  0.001490.000740.000000.000000.000000.00000
 6  8  0.000740.000370.000000.000000.000000.00000
 6  9  0.001120.001860.000000.000000.000000.00000
 6 10  0.002980.002230.000000.000000.000000.00000
 6 11  0.002600.001490.000000.000000.000000.00000
 6 12  0.003350.006320.000370.000000.000000.00000
 6 13  0.000740.005580.000370.000000.000000.00000
 6 14  0.002980.004090.000000.000000.000000.00000
 6 15  0.001860.002600.000000.000000.000000.00000
 6 16  0.004090.001120.000000.000000.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data For September 1998 TA-53 Meteorological Tower

```
1  1  0.001120.000370.000000.000000.000000.00000
1  2  0.001490.000370.000000.000000.000000.00000
1  3  0.005210.003350.000000.000000.000000.00000
1  4  0.007440.007440.000000.000000.000000.00000
1  5  0.001860.010410.000000.000000.000000.00000
1  6  0.003350.005580.000000.000000.000000.00000
1  7  0.001860.003720.000000.000000.000000.00000
1  8  0.002230.005580.000000.000000.000000.00000
1  9  0.002600.000000.000000.000000.000000.00000
1 10  0.000370.001120.000000.000000.000000.00000
1 11  0.000740.001120.000000.000000.000000.00000
1 12  0.000740.000370.000370.000000.000000.00000
1 13  0.000740.001490.000000.000000.000000.00000
1 14  0.000000.001120.000000.000000.000000.00000
1 15  0.000000.000370.000000.000000.000000.00000
1 16  0.000740.000000.000000.000000.000000.00000
2  1  0.000000.000000.000000.000000.000000.00000
2  2  0.000740.000740.000000.000000.000000.00000
2  3  0.001860.002230.000000.000000.000000.00000
2  4  0.001490.006320.000000.000000.000000.00000
2  5  0.000370.007070.000000.000000.000000.00000
2  6  0.000370.003720.000000.000000.000000.00000
2  7  0.000370.003350.000000.000000.000000.00000
2  8  0.001490.003350.000000.000000.000000.00000
2  9  0.000370.003720.000000.000000.000000.00000
2 10  0.000000.001860.000000.000000.000000.00000
2 11  0.000000.000000.000000.000000.000000.00000
2 12  0.000000.000370.000000.000000.000000.00000
2 13  0.000000.000370.000370.000000.000000.00000
2 14  0.000370.001120.000000.000000.000000.00000
2 15  0.000000.000370.000000.000000.000000.00000
2 16  0.000000.000370.000000.000000.000000.00000
3  1  0.000370.000370.000000.000000.000000.00000
3  2  0.001120.001120.000000.000000.000000.00000
3  3  0.002980.005210.000000.000000.000000.00000
3  4  0.001120.006690.000000.000000.000000.00000
3  5  0.000000.007810.000370.000000.000000.00000
3  6  0.001120.002230.000370.000000.000000.00000
3  7  0.000000.003350.000000.000000.000000.00000
3  8  0.000370.006690.000000.000000.000000.00000
3  9  0.000000.008180.001860.000000.000000.00000
3 10  0.000000.004460.001120.000000.000000.00000
3 11  0.000370.001860.000740.000000.000000.00000
3 12  0.000000.001860.002230.000000.000000.00000
3 13  0.000370.001860.003350.000000.000000.00000
3 14  0.000000.002600.002980.000000.000000.00000
3 15  0.000000.001120.001120.000000.000000.00000
3 16  0.000000.000740.000370.000000.000000.00000
4  1  0.003350.007440.005950.001490.000370.00000
4  2  0.003720.008550.009670.001860.000000.00000
4  3  0.006320.007070.001490.000000.000000.00000
4  4  0.001490.005580.000370.000000.000000.00000
```

```
4  5  0.000740.001490.001120.000000.000000.00000
4  6  0.000740.001120.000000.000000.000000.00000
4  7  0.002230.002980.002600.000000.000000.00000
4  8  0.000370.007440.020080.001860.000000.00000
4  9  0.001860.019340.047230.008550.000000.00000
4 10  0.001490.014130.030120.020450.001490.00000
4 11  0.001120.017480.026030.001860.000000.00000
4 12  0.001860.004830.012640.001120.000000.00000
4 13  0.001120.005580.010780.000000.000000.00000
4 14  0.000740.004090.008550.000370.000000.00000
4 15  0.000740.003720.003720.005950.000370.00000
4 16  0.001860.004090.002230.000370.000370.00000
5  1  0.004830.007070.001120.000000.000000.00000
5  2  0.004090.004460.002980.000000.000000.00000
5  3  0.003720.004830.001120.000000.000000.00000
5  4  0.001490.001490.000000.000000.000000.00000
5  5  0.000740.001490.000000.000000.000000.00000
5  6  0.000740.001120.000000.000000.000000.00000
5  7  0.001120.000000.000370.000000.000000.00000
5  8  0.000370.007070.015250.001490.000000.00000
5  9  0.001120.015250.009300.000370.000000.00000
5 10  0.002230.026400.020450.000370.000000.00000
5 11  0.002600.050950.013020.000000.000000.00000
5 12  0.004090.046110.017850.000000.000000.00000
5 13  0.004090.029750.030120.000000.000000.00000
5 14  0.001120.005210.001490.000000.000000.00000
5 15  0.003350.002230.007440.000000.000000.00000
5 16  0.002600.006690.002600.000000.000000.00000
6  1  0.001490.000740.000000.000000.000000.00000
6  2  0.002230.000370.000000.000000.000000.00000
6  3  0.002230.000000.000000.000000.000000.00000
6  4  0.001120.000370.000000.000000.000000.00000
6  5  0.001490.000000.000000.000000.000000.00000
6  6  0.000740.000000.000000.000000.000000.00000
6  7  0.000000.000000.000000.000000.000000.00000
6  8  0.001860.000740.000000.000000.000000.00000
6  9  0.000740.002600.000000.000000.000000.00000
6 10  0.002980.004830.000000.000000.000000.00000
6 11  0.003350.001120.000000.000000.000000.00000
6 12  0.003350.008930.000370.000000.000000.00000
6 13  0.001860.007070.000000.000000.000000.00000
6 14  0.000000.003350.000000.000000.000000.00000
6 15  0.000740.000740.000000.000000.000000.00000
6 16  0.002230.000370.000000.000000.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data For October 1998 TA-53 Meteorological Tower

```
1  1  0.000370.000000.000000.000000.000000.00000
1  2  0.001860.000000.000000.000000.000000.00000
1  3  0.001490.000740.000000.000000.000000.00000
1  4  0.008930.001490.000000.000000.000000.00000
1  5  0.005580.004460.000000.000000.000000.00000
1  6  0.003350.004830.000000.000000.000000.00000
1  7  0.002980.003720.000000.000000.000000.00000
1  8  0.003350.001490.000000.000000.000000.00000
1  9  0.001490.001120.000000.000000.000000.00000
1 10  0.001120.000740.000000.000000.000000.00000
1 11  0.000000.000000.000000.000000.000000.00000
1 12  0.000000.000000.000000.000000.000000.00000
1 13  0.000370.000000.000000.000000.000000.00000
1 14  0.000000.000000.000000.000000.000000.00000
1 15  0.000000.000000.000000.000000.000000.00000
1 16  0.000370.000000.000000.000000.000000.00000
2  1  0.000000.000000.000000.000000.000000.00000
2  2  0.000000.000740.000000.000000.000000.00000
2  3  0.000370.000740.000000.000000.000000.00000
2  4  0.002230.001490.000000.000000.000000.00000
2  5  0.001860.003350.000000.000000.000000.00000
2  6  0.001120.002600.000000.000000.000000.00000
2  7  0.000740.002230.000000.000000.000000.00000
2  8  0.000370.000740.000000.000000.000000.00000
2  9  0.000740.000370.000000.000000.000000.00000
2 10  0.000000.000370.000000.000000.000000.00000
2 11  0.000000.000000.000000.000000.000000.00000
2 12  0.000000.000000.000000.000000.000000.00000
2 13  0.000000.000000.000000.000000.000000.00000
2 14  0.000000.000370.000000.000000.000000.00000
2 15  0.000000.000000.000000.000000.000000.00000
2 16  0.000000.000740.000370.000000.000000.00000
3  1  0.000740.000000.000740.000000.000000.00000
3  2  0.000000.001120.001120.000000.000000.00000
3  3  0.001120.000370.000000.000000.000000.00000
3  4  0.002230.005950.000740.000000.000000.00000
3  5  0.001120.006690.001120.000000.000000.00000
3  6  0.001120.005210.000740.000000.000000.00000
3  7  0.000370.004460.000000.000000.000000.00000
3  8  0.001490.005210.000000.000000.000000.00000
3  9  0.000740.004090.000000.000000.000000.00000
3 10  0.001860.001860.000000.000000.000000.00000
3 11  0.000370.000740.000000.000000.000000.00000
3 12  0.000000.001120.000370.000000.000000.00000
3 13  0.000000.000740.000740.000000.000000.00000
3 14  0.000370.000740.000000.000000.000000.00000
3 15  0.000370.000370.000000.000000.000000.00000
3 16  0.000000.000370.000370.000000.000000.00000
4  1  0.004090.002230.012640.001490.000000.00000
4  2  0.003720.002600.008180.002230.000000.00000
4  3  0.003720.004090.001860.001860.000000.00000
4  4  0.004460.004830.001490.000370.000000.00000
```

```
4  5  0.001120.006690.001120.000000.000000.00000
4  6  0.001860.001860.000370.000370.000000.00000
4  7  0.001490.005580.000370.000000.000000.00000
4  8  0.001120.005950.010410.001120.000000.00000
4  9  0.002980.020450.046110.008930.000000.00000
4 10  0.004090.026780.030490.014500.002230.00000
4 11  0.002980.023430.034960.013390.000370.00000
4 12  0.002230.006320.019340.008930.000740.00000
4 13  0.001490.002980.008550.002230.000740.00000
4 14  0.002600.002600.005950.001120.000000.00000
4 15  0.001860.003720.001860.000370.000000.00000
4 16  0.004090.003350.007810.001120.000000.00000
5  1  0.005210.003350.001120.000000.000000.00000
5  2  0.006690.003350.001120.000000.000000.00000
5  3  0.004090.002230.000370.000000.000000.00000
5  4  0.002980.001120.000740.000000.000000.00000
5  5  0.002230.001860.000000.000000.000000.00000
5  6  0.001120.000740.000000.000000.000000.00000
5  7  0.002980.001490.000000.000000.000000.00000
5  8  0.001490.004830.005950.000740.000000.00000
5  9  0.004090.015620.004830.000000.000000.00000
5 10  0.005210.030120.016360.000370.000000.00000
5 11  0.003350.028260.015990.000740.000000.00000
5 12  0.001860.031610.039050.000000.000000.00000
5 13  0.005210.030120.037190.000000.000000.00000
5 14  0.004090.013020.004090.000000.000000.00000
5 15  0.003720.002600.001860.000000.000000.00000
5 16  0.005580.003350.002230.000000.000000.00000
6  1  0.003720.000000.000000.000000.000000.00000
6  2  0.004090.000740.000000.000000.000000.00000
6  3  0.004090.000740.000000.000000.000000.00000
6  4  0.001860.000000.000000.000000.000000.00000
6  5  0.003350.000000.000000.000000.000000.00000
6  6  0.002980.000000.000000.000000.000000.00000
6  7  0.001860.000000.000000.000000.000000.00000
6  8  0.002980.002230.000000.000000.000000.00000
6  9  0.004830.002230.000000.000000.000000.00000
6 10  0.005950.004830.000000.000000.000000.00000
6 11  0.003350.001490.000000.000000.000000.00000
6 12  0.002230.007810.000370.000000.000000.00000
6 13  0.001490.009670.000370.000000.000000.00000
6 14  0.001860.002600.000740.000000.000000.00000
6 15  0.001490.000370.000000.000000.000000.00000
6 16  0.003720.000370.000000.000000.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data For November 1998 TA-53 Meteorological Tower

```
1  1  0.000830.000000.000000.000000.000000.00000
1  2  0.001250.000420.000000.000000.000000.00000
1  3  0.002080.000000.000000.000000.000000.00000
1  4  0.003330.000830.000000.000000.000000.00000
1  5  0.009560.002080.000000.000000.000000.00000
1  6  0.006650.002490.000000.000000.000000.00000
1  7  0.004990.001660.000000.000000.000000.00000
1  8  0.001250.001250.000000.000000.000000.00000
1  9  0.000000.000420.000000.000000.000000.00000
1 10  0.000000.000420.000000.000000.000000.00000
1 11  0.000000.000000.000000.000000.000000.00000
1 12  0.000420.000000.000000.000000.000000.00000
1 13  0.000000.000000.000000.000000.000000.00000
1 14  0.000000.000000.000000.000000.000000.00000
1 15  0.000420.000420.000000.000000.000000.00000
1 16  0.000000.000000.000000.000000.000000.00000
2  1  0.000000.000000.000000.000000.000000.00000
2  2  0.000000.000420.000000.000000.000000.00000
2  3  0.000420.002080.000000.000000.000000.00000
2  4  0.003330.002080.000000.000000.000000.00000
2  5  0.001250.009150.000000.000000.000000.00000
2  6  0.000830.002490.000000.000000.000000.00000
2  7  0.000420.002080.000000.000000.000000.00000
2  8  0.001250.002080.000000.000000.000000.00000
2  9  0.000420.000000.000000.000000.000000.00000
2 10  0.000000.000420.000000.000000.000000.00000
2 11  0.000420.000000.000000.000000.000000.00000
2 12  0.000000.000420.000000.000000.000000.00000
2 13  0.000000.000420.000000.000000.000000.00000
2 14  0.000000.001660.000000.000000.000000.00000
2 15  0.000000.000420.000000.000000.000000.00000
2 16  0.000000.000000.000000.000000.000000.00000
3  1  0.000000.000420.000420.000000.000000.00000
3  2  0.001250.000830.000420.000000.000000.00000
3  3  0.000000.001660.000420.000000.000000.00000
3  4  0.002490.006240.000420.000000.000000.00000
3  5  0.002080.016630.000420.000000.000000.00000
3  6  0.000420.007070.000000.000000.000000.00000
3  7  0.000830.003330.000000.000000.000000.00000
3  8  0.001250.003330.000000.000000.000000.00000
3  9  0.001250.006650.000420.000000.000000.00000
3 10  0.000420.001660.000420.000000.000000.00000
3 11  0.000000.000830.000000.000000.000000.00000
3 12  0.000000.000830.000000.000000.000000.00000
3 13  0.000000.001250.000000.000000.000000.00000
3 14  0.000000.000420.000420.000420.000000.00000
3 15  0.000000.000420.000000.000000.000000.00000
3 16  0.000000.000000.000000.000000.000000.00000
4  1  0.004160.012060.011230.000830.000000.00000
4  2  0.004160.009150.006240.000420.000000.00000
4  3  0.003740.006650.003330.000000.000000.00000
4  4  0.004570.010810.003330.000000.000000.00000
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 4  5  0.004160.017050.003740.000000.000000.00000
 4  6  0.001660.007900.001660.000000.000000.00000
 4  7  0.002490.004990.000420.000000.000000.00000
 4  8  0.003740.009560.003740.000420.000000.00000
 4  9  0.002910.019960.019540.003740.000000.00000
 4 10  0.002080.017460.029110.007480.001250.00000
 4 11  0.002910.012060.010810.009980.006650.00166
 4 12  0.002080.004160.004160.005410.000830.00000
 4 13  0.002490.004160.007070.004570.002080.00000
 4 14  0.001660.004990.009980.005410.002490.00083
 4 15  0.004160.003740.000420.002080.001250.00000
 4 16  0.003330.006650.000420.000000.000000.00000
 5  1  0.007900.013720.006240.000000.000000.00000
 5  2  0.007070.014140.006650.000000.000000.00000
 5  3  0.006650.008730.001250.000000.000000.00000
 5  4  0.005410.005820.000830.000000.000000.00000
 5  5  0.006240.005410.000000.000000.000000.00000
 5  6  0.002080.002490.000420.000000.000000.00000
 5  7  0.002490.001660.000000.000000.000000.00000
 5  8  0.002080.007480.001250.000000.000000.00000
 5  9  0.006650.014140.009980.000000.000000.00000
 5 10  0.001660.037840.027860.000000.000000.00000
 5 11  0.002910.024120.005410.000000.000000.00000
 5 12  0.002490.017460.007070.000000.000000.00000
 5 13  0.005410.019540.012890.000000.000000.00000
 5 14  0.004990.023700.002490.000000.000000.00000
 5 15  0.007480.012060.001250.000000.000000.00000
 5 16  0.010400.010810.002490.000000.000000.00000
 6  1  0.004570.002080.000000.000000.000000.00000
 6  2  0.007900.002080.000000.000000.000000.00000
 6  3  0.004160.002080.000000.000000.000000.00000
 6  4  0.004570.000420.000000.000000.000000.00000
 6  5  0.002910.000000.000000.000000.000000.00000
 6  6  0.002080.000420.000000.000000.000000.00000
 6  7  0.001660.000420.000000.000000.000000.00000
 6  8  0.002910.000830.000000.000000.000000.00000
 6  9  0.002910.002910.000000.000000.000000.00000
 6 10  0.004570.002080.000000.000000.000000.00000
 6 11  0.002490.002080.000000.000000.000000.00000
 6 12  0.001660.001660.000420.000000.000000.00000
 6 13  0.003740.005410.000830.000000.000000.00000
 6 14  0.004570.006650.001660.000000.000000.00000
 6 15  0.002910.004160.000000.000000.000000.00000
 6 16  0.009150.001660.000000.000000.000000.00000
```

Table 7. 61.94(b)(7) User Supplied Data—Wind Frequency Arrays (Cont.)

CAP88 Input Data For December 1998 TA-53 Meteorological Tower

```
1  1  0.001040.000000.000000.000000.000000.00000
1  2  0.001740.000350.000000.000000.000000.00000
1  3  0.007640.002080.000000.000000.000000.00000
1  4  0.011110.002780.000000.000000.000000.00000
1  5  0.010420.000350.000000.000000.000000.00000
1  6  0.003820.001740.000000.000000.000000.00000
1  7  0.003130.002080.000000.000000.000000.00000
1  8  0.002780.000690.000000.000000.000000.00000
1  9  0.000690.000000.000000.000000.000000.00000
1 10  0.000000.000350.000000.000000.000000.00000
1 11  0.001040.000000.000000.000000.000000.00000
1 12  0.000690.000000.000000.000000.000000.00000
1 13  0.000350.000000.000000.000000.000000.00000
1 14  0.000000.000000.000000.000000.000000.00000
1 15  0.000350.000000.000000.000000.000000.00000
1 16  0.000690.000000.000000.000000.000000.00000
2  1  0.000000.000000.000000.000000.000000.00000
2  2  0.000000.000000.000000.000000.000000.00000
2  3  0.000690.000350.000000.000000.000000.00000
2  4  0.001740.003470.000000.000000.000000.00000
2  5  0.001740.002430.000000.000000.000000.00000
2  6  0.000000.003470.000000.000000.000000.00000
2  7  0.001040.001740.000000.000000.000000.00000
2  8  0.000000.000690.000000.000000.000000.00000
2  9  0.000000.001040.000000.000000.000000.00000
2 10  0.000000.000000.000000.000000.000000.00000
2 11  0.000350.000000.000000.000000.000000.00000
2 12  0.000000.000000.000000.000000.000000.00000
2 13  0.000000.000000.000000.000000.000000.00000
2 14  0.000000.000000.000000.000000.000000.00000
2 15  0.000000.000350.000000.000000.000000.00000
2 16  0.000350.000000.000690.000000.000000.00000
3  1  0.000350.000690.000350.000000.000000.00000
3  2  0.000690.002080.000000.000000.000000.00000
3  3  0.002430.006600.000350.000000.000000.00000
3  4  0.001390.006940.000000.000000.000000.00000
3  5  0.002080.005210.000350.000000.000000.00000
3  6  0.002080.002080.000000.000000.000000.00000
3  7  0.002430.001740.000000.000000.000000.00000
3  8  0.000690.007640.000000.000000.000000.00000
3  9  0.000000.006250.000000.000000.000000.00000
3 10  0.000000.002780.000000.000000.000000.00000
3 11  0.000350.000000.000000.000000.000000.00000
3 12  0.000000.000000.000350.000000.000000.00000
3 13  0.000350.000690.000000.000350.000000.00000
3 14  0.000350.000350.000350.000000.000000.00000
3 15  0.000000.000350.000000.000000.000000.00000
3 16  0.000000.000690.000000.000000.000000.00000
4  1  0.007990.011460.013190.009030.000000.00000
4  2  0.004170.011110.009380.003820.000000.00000
4  3  0.003470.014930.003470.000690.000000.00000
4  4  0.002430.006250.001740.000000.000000.00000
```

```
4  5  0.003470.007640.000350.000000.000000.00000
4  6  0.001040.001040.000000.000000.000000.00000
4  7  0.003130.005210.000350.000000.000000.00000
4  8  0.001740.008680.002430.000000.000000.00000
4  9  0.001390.014240.016670.003470.000000.00000
4 10  0.003130.011810.029860.017010.003130.00000
4 11  0.001040.011460.011810.020490.017010.00069
4 12  0.001390.001740.006600.002430.000350.00000
4 13  0.001740.004860.003820.002430.000000.00000
4 14  0.000350.005210.000690.000350.000000.00000
4 15  0.001740.001040.002080.000000.000000.00000
4 16  0.007290.002780.003820.000350.000000.00000
5  1  0.009720.024310.007290.000000.000000.00000
5  2  0.010760.017010.004510.000000.000000.00000
5  3  0.005560.008330.000350.000000.000000.00000
5  4  0.003130.005210.000350.000000.000000.00000
5  5  0.002780.001740.000000.000000.000000.00000
5  6  0.002430.000350.000000.000000.000000.00000
5  7  0.001040.002430.000000.000000.000000.00000
5  8  0.001390.004860.002430.000000.000000.00000
5  9  0.001390.013190.003470.000350.000000.00000
5 10  0.003470.025350.030210.001390.000000.00000
5 11  0.005900.038540.018750.000000.000000.00000
5 12  0.004170.010760.007990.000350.000000.00000
5 13  0.003820.012500.004860.000000.000000.00000
5 14  0.005560.008330.000350.000000.000000.00000
5 15  0.006250.009720.001040.000000.000000.00000
5 16  0.013540.016670.002780.000000.000000.00000
6  1  0.007990.002780.000000.000000.000000.00000
6  2  0.009380.004510.000000.000000.000000.00000
6  3  0.006250.001740.000000.000000.000000.00000
6  4  0.004860.001040.000000.000000.000000.00000
6  5  0.004510.000350.000000.000000.000000.00000
6  6  0.002780.000350.000000.000000.000000.00000
6  7  0.003470.000350.000000.000000.000000.00000
6  8  0.005560.002080.000000.000000.000000.00000
6  9  0.006250.006940.000000.000000.000000.00000
6 10  0.007290.006600.000000.000000.000000.00000
6 11  0.004860.004860.000000.000000.000000.00000
6 12  0.004510.006600.003820.000000.000000.00000
6 13  0.003130.005560.000350.000000.000000.00000
6 14  0.004510.003820.000350.000000.000000.00000
6 15  0.004510.001740.000000.000000.000000.00000
6 16  0.009030.002780.000000.000000.000000.00000
```

Table 8. 40.94(b)(7) User Supplied Data—Population Array

Projected 1996/1997 Population within 80 km of Los Alamos National Laboratory[1]

Distance from TA-53 (km)

Direction	0-0.8	0.8-1.0	1-2	2-4	4-8	8-15	15-20	20-30	30-40	40-60	60-80
N	0	7	87	234	131	0	13	90	950	811	587
NNE	0	6	64	93	23	2	10	2,338	395	671	313
NE	0	3	11	0	0	1	1,181	14,743	2,536	2,457	3,591
ENE	0	1	0	0	0	559	1,499	4,546	3,585	1,416	1,601
E	0	0	0	0	1	316	1,332	4,096	386	22	413
ESE	0	0	0	0	0	9	10	669	8,017	727	2,240
SE	0	0	2	0	4,468	565	0	984	72,724	7,485	664
SSE	0	0	3	0	510	341	0	293	5,656	2,577	110
S	0	0	4	0	0	21	0	16	148	399	3,056
SSW	0	0	6	0	0	30	1	794	1,316	6,974	53,789
SW	0	0	13	0	1	4	1	0	0	2,249	188
WSW	0	0	17	27	0	7	0	32	387	2,474	5
W	0	0	3	119	173	0	7	66	291	64	72
WNW	0	2	14	1,007	5,839	0	0	26	30	63	2,622
NW	0	5	29	886	1,431	0	2	24	49	0	577
NNW	0	6	59	681	282	0	6	19	259	161	283
Total	0	42	303	3,047	12,859	1,855	4,062	28,736	96,729	28,550	70,111

Total population within 80 km of Los Alamos National Laboratory is over 246,000.

[1] Jacobson et al. (1998)

Table 9. 61.94(b)(7) User Supplied Data—Radionuclide Effluents

ESIDNUM	Nuclide	Emission (Ci)
03002914	AM-241	2.2E-08
03002914	Pu-239	1.0E-08
03002914	TH-228	1.4E-08
03002914	TH-232	1.2E-08
03002914	U-234	2.0E-08
03002914	U-235	1.7E-09
03002914	Th-231	1.7E-09
03002915	U-234	3.9E-08
03002915	AM-241	4.6E-08
03002915	Pu-239	3.1E-08
03002915	TH-230	2.9E-08
03002919	Th-231	4.9E-09
03002919	U-235	4.9E-09
03002919	TH-230	4.1E-08
03002919	Pu-239	7.2E-06
03002919	AM-241	1.5E-06
03002919	PU-238	2.4E-06
03002920	AM-241	1.3E-08
03002920	Pu-239	2.8E-08
03002920	TH-230	2.0E-08
03002923	U-234	1.0E-05
03002923	Th-234	4.8E-07
03002923	Pa-234m	4.8E-07
03002923	U-238	4.8E-07
03002923	Th-231	4.2E-07
03002923	U-235	4.2E-07
03002923	Pu-239	1.2E-08
03002923	PU-238	1.9E-08
03002923	AM-241	1.2E-08
03002923	TH-230	2.2E-08
03002924	Pu-239	1.7E-08

Table 9. 61.94(b)(7) User Supplied Data—Radionuclide Effluents (Cont.)

ESIDNUM	Nuclide	Emission (Ci)
03002924	Pa-234m	2.0E-08
03002924	Th-234	2.0E-08
03002924	U-238	2.0E-08
03002924	Th-231	8.3E-09
03002924	U-235	8.3E-09
03002924	TH-228	7.2E-08
03002924	PU-238	1.6E-07
03002924	AM-241	1.6E-08
03002924	U-234	2.3E-06
03002928	PU-238	6.8E-07
03002928	U-235	6.5E-09
03002928	Th-231	6.5E-09
03002928	Pu-239	1.5E-07
03002928	U-234	1.2E-07
03002928	AM-241	2.1E-08
03002929	PU-238	3.8E-09
03002929	Pu-239	6.5E-09
03002932	None	
03002933	TH-228	4.6E-08
03002933	TH-230	2.3E-08
03002933	AM-241	3.0E-09
03002937	PU-238	7.5E-11
03002937	TH-230	7.2E-10
03002937	AM-241	1.1E-10
03002944	SE-75	6.7E-06
03002945	TH-230	7.4E-08
03002945	Pa-234m	3.7E-08
03002945	PU-238	2.7E-08
03002945	TH-232	5.4E-08
03002945	U-238	3.7E-08
03002945	Th-234	3.7E-08

Table 9. 61.94(b)(7) User Supplied Data—Radionuclide Effluents (Cont.)

ESIDNUM	Nuclide	Emission (Ci)
03002945	AM-241	2.9E-09
03002946	None	
03003501	Th-231	6.2E-09
03003501	U-235	6.2E-09
03003501	U-234	1.3E-07
03003501	AM-241	9.3E-09
03010222	Th-231	5.8E-07
03010222	TH-228	2.3E-09
03010222	Pa-234m	3.6E-08
03010222	Th-234	3.6E-08
03010222	U-238	3.6E-08
03010222	PU-238	2.0E-10
03010222	U-235	5.8E-07
03010222	U-234	1.7E-05
03010222	TH-232	1.4E-09
03010222	TH-230	6.8E-09
16020504	H-3(GAS)	2.3E+01
16020504	H-3(HTO)	2.2E+02
21015505	H-3(GAS)	1.3E+01
21015505	H-3(HTO)	6.9E+01
21020901	H-3(HTO)	3.1E+02
21020901	H-3(GAS)	7.3E+01
33008606	H-3(HTO)	3.0E+01
33008606	H-3(GAS)	3.5E+01
41000417	H-3(HTO)	3.5E+01
41000417	H-3(GAS)	1.3E+00
48000107	U-234	9.2E-09
48000107	AS-74	9.5E-07
48000107	BR-77	8.7E-05
48000107	SE-75	1.9E-05
48000107	U-235	3.5E-10

Table 9. 61.94(b)(7) User Supplied Data—Radionuclide Effluents (Cont.)

ESIDNUM	Nuclide	Emission (Ci)
48000107	Th-231	3.5E-10
48000154	Th-231	4.0E-09
48000154	U-235	4.0E-09
48000154	U-234	1.1E-07
48000160	SE-75	5.4E-06
48000160	U-235	6.5E-10
48000160	Th-231	6.5E-10
48000160	U-234	1.6E-08
48000160	AM-241	3.7E-10
50000102	PU-238	1.4E-08
50000102	U-234	1.8E-07
50000102	TH-230	7.7E-08
50000102	AM-241	6.5E-09
50003701	U-234	1.1E-08
50006903	U-234	4.2E-10
50006903	TH-230	3.1E-10
50006903	PU-238	1.3E-09
53000303	SC-44M	5.8E-07
53000303	BR-77	3.5E-02
53000303	H-3(HTO)	3.5E+00
53000303	V-48	5.3E-06
53000303	N-13	1.3E+03
53000303	AR-41	1.5E+02
53000303	BE-7	1.2E-04
53000303	BR-76	3.6E-02
53000303	BR-82	6.7E-03
53000303	C-11	3.3E+03
53000303	CL-39	3.3E+00
53000303	C-10	1.9E+02
53000303	HG-197	1.7E-03
53000303	O-15	2.7E+03

Table 9. 61.94(b)(7) User Supplied Data—Radionuclide Effluents (Cont.)

ESIDNUM	Nuclide	Emission (Ci)
53000303	N-16	1.5E+02
53000303	O-14	5.8E+01
53000303	NA-24	1.8E-04
53000702	BR-77	7.4E-06
53000702	AR-41	4.1E+00
53000702	AS-73	1.3E-04
53000702	H-3(HTO)	2.7E-01
53000702	BR-76	3.9E-04
53000702	BR-82	9.6E-04
53000702	C-10	5.0E-02
53000702	C-11	1.1E+02
53000702	HG-197	4.4E-03
53000702	O-15	1.4E+01
53000702	O-14	1.2E+00
53000702	N-13	7.2E+00
53000702	K-40	7.6E-05
53DIFFUS	Ar-41	1.7E+01
53DIFFUS	C-11	4.1E+02
55000415	TH-230	3.0E-08
55000415	Pu-239	1.7E-08
55000416	AM-241	3.8E-09
55000416	Pu-239	4.5E-08
55000416	H-3(GAS)	1.4E+00
55000416	H-3(HTO)	4.8E-01

Table 10. 40.94(b)(7) User Supplied Data—Modeling Parameters for LANL Nonpoint Sources

LANL Air Activation Sources

Source	Radionuclide	#Ci	Area of source (m^2)	Distance to LANL Maximum Dose Location (m)	Direction to LANL Maximum Dose Location
TA-53-Switchyard	Ar-41	2.1	484	774	NNE
	C-11	50.3	‖	‖	
TA-53-Isotope Production	Ar-41	7.0	37	740	N
	C-11	167.0	‖	‖	
TA-53-Area A East	Ar-41	10.0	1,423	756	N
	C-11	246.0	‖	‖	
TA-18-116	Ar-41	0.04	31,400	4,261	NNE
TA-18-168	Ar-41	0.14	31,400	3,894	NNE

Table 11. 40.94(b)(7) User Supplied Data—Radionuclide Effluents Radionuclides Not Included in CAP88

Source	ESID#	Radionuclide	Emissions (Ci)	Dose at LANL Receptor (mrem)	Dose at Facility Receptor (mrem)
TA-3-29-44	03002944	Se-75	6.66e-06	3.26e-06	1.18e-05
TA-48-1-7	48000107	As-74	9.46e-07	3.41e-08	3.18e-07
		Br-77	8.68e-05	1.61e-07	1.52e-06
		Se-75	1.87e-05	9.52e-06	8.24e-05
TA-48-1-60	48000160	Se-75	5.36e-06	2.53e-06	2.47e-05
TA-53-3-3	53000303	C-10	1.87e+02	1.65e-05	1.65e-05
		N-16	1.50e+02	8.88e-08	8.88e-08
		O-14	5.75e+01	6.41e-03	6.41e-03
		Cl-39	3.25e+00	1.31e-02	1.31e-02
		Br-76	3.61e-02	1.14e-04	1.14e-04
		Br-77	3.55e-02	3.10e-03	3.10e-03
		Hg-197	1.73e-03	7.83e-06	7.83e-06
		Sc-44m	5.81e-07	4.64e-09	4.64e-09
		V-48	5.29e-06	2.00e-06	2.00e-06
TA-53-7-2	53000702	C-10	5.00e-02	2.96e-08	2.96e-08
		O-14	1.20e+00	1.82e-04	1.82e-04
		As-73	1.26e-04	1.00e-05	1.00e-05
		Br-76	3.93e-04	2.68e-06	2.68e-06
		Br-77	7.43e-06	1.48e-07	1.48e-07
		Hg-197	4.39e-03	4.46e-05	4.46e-05

Table 12. (FFCA) Environmental Data

1998 Effective Dose Equivalent (net in mrem) at Air Sampling Locations Around

Site # and Name		AM-241	H-3	PU-238	PU-239	U-234	U-235	U-238	Rounded Total
06	48th Street	-0.001	0.004	0.000	0.001	0.001	0.001	0.000	0.01
07	Gulf/Exxon/Shell Station	0.001	0.010	0.002	0.017	0.009	0.001	0.011	0.06
08	McDonalds	0.003	0.022	0.000	0.000	0.004	0.001	0.005	0.05
09	Los Alamos Airport	0.000	0.027	0.002	0.011	0.005	0.001	0.006	0.07
10	Eastgate	0.001	0.026	0.000	0.000	0.008	0.001	0.008	0.06
11	Well PM-1 (E. Jemez Road)	0.000	0.011	0.002	0.001	0.002	0.000	0.004	0.03
12	Royal Crest Trailer Court	0.001	0.012	0.002	0.000	0.003	0.001	0.004	0.03
13	Pinon School	0.000	0.018	0.002	-0.002	0.004	0.003	0.006	0.04
14	Pajarito Acres	0.002	0.007	0.001	0.002	0.000	0.000	0.002	0.02
15	White Rock Fire Station	-0.002	0.012	0.000	0.004	0.005	0.002	0.006	0.03
16	White Rock Nazarene Church	0.005	0.021	0.002	0.000	0.001	0.000	0.003	0.04
20	TA-21 Area B	0.001	0.056	0.001	0.001	0.003	0.000	0.004	0.09
32	County Landfill (TA-48)	0.002	0.010	0.000	0.023	0.062	0.005	0.063	0.17
60	LA Canyon	0.005	0.014	-0.001	0.000	0.008	0.000	0.009	0.05
61	LA Hospital	0.004	0.008	0.000	0.005	0.014	0.000	0.014	0.05
62	Trinity Bible Church	0.003	0.026	0.000	0.003	0.004	0.001	0.005	0.05
63	Monte Rey South	0.003	0.009	0.000	0.001	0.001	0.001	0.004	0.02

Table 13. (FFCA) Analytical Completeness Summary—Air Sampler Operation

Site #	Site Name	% Run Time	Analysis	% Analytical Completeness
06	48th Street	99.8		
			PU-239	100.0
			U-238	100.0
			AM-241	100.0
			H-3	100.0
			PU-238	100.0
			U-234	100.0
			U-235	100.0
07	Gulf/Exxon/Shell Station	97.9		
			U-235	100.0
			AM-241	100.0
			H-3	100.0
			PU-239	100.0
			PU-238	100.0
			U-234	100.0
			U-238	100.0
08	McDonalds	99.3		
			U-235	100.0
			PU-239	100.0
			AM-241	100.0
			U-238	100.0
			H-3	100.0
			PU-238	100.0
			U-234	100.0
09	Los Alamos Airport	99.9		
			H-3	96.0
			U-235	100.0
			U-234	100.0
			U-238	100.0
			PU-239	100.0
			PU-238	100.0
			AM-241	100.0
10	Eastgate	97.8		
			H-3	100.0
			PU-239	100.0
			U-238	100.0
			U-235	100.0
			AM-241	100.0
			U-234	100.0
			PU-238	100.0

Table 13. (FFCA) Analytical Completeness Summary—Air Sampler Operation (Cont.)

Site #	Site Name	% Run Time	Analysis	% Analytical Completeness
11	Well PM-1 (E. Jemez Road)	99.8		
			H-3	100.0
			PU-239	100.0
			PU-238	100.0
			U-234	100.0
			U-238	100.0
			U-235	100.0
			AM-241	100.0
12	Royal Crest Trailer Court	98.2		
			AM-241	100.0
			U-234	100.0
			U-238	100.0
			PU-238	100.0
			H-3	100.0
			U-235	100.0
			PU-239	100.0
13	Pinon School	99.4		
			PU-239	100.0
			PU-238	100.0
			U-234	100.0
			AM-241	100.0
			U-238	100.0
			H-3	96.0
			U-235	100.0
14	Pajarito Acres	99.3		
			PU-238	100.0
			U-238	100.0
			H-3	96.0
			U-235	100.0
			AM-241	100.0
			U-234	100.0
			PU-239	100.0
15	White Rock Fire Station	99.6		
			U-238	100.0
			PU-238	100.0
			AM-241	100.0
			U-235	100.0
			U-234	100.0
			H-3	100.0
			PU-239	100.0

Table 13. (FFCA) Analytical Completeness Summary—Air Sampler Operation (Cont.)

Site #	Site Name	% Run Time	Analysis	% Analytical Completeness
16	White Rock Nazarene Church	99.8		
			PU-238	100.0
			H-3	100.0
			U-234	100.0
			U-238	100.0
			U-235	100.0
			AM-241	100.0
			PU-239	100.0
20	TA-21 Area B	99.0		
			U-235	100.0
			U-234	100.0
			AM-241	100.0
			H-3	96.0
			PU-238	100.0
			PU-239	100.0
			U-238	100.0
32	County Landfill (TA-48)	99.8		
			U-235	100.0
			PU-239	100.0
			AM-241	100.0
			U-234	100.0
			H-3	100.0
			U-238	100.0
			PU-238	100.0
	LA Canyon	98.5	60	
			AM-241	100.0
			PU-238	100.0
			U-238	100.0
			PU-239	100.0
			H-3	100.0
			U-235	100.0
			U-234	100.0
61	LA Hospital	99.9		
			AM-241	100.0
			U-238	100.0
			H-3	100.0
			PU-239	100.0
			U-235	100.0
			U-234	100.0
			PU-238	100.0

Table 13. (FFCA) Analytical Completeness Summary—Air Sampler Operation (Cont.)

Site #	Site Name	% Run Time	Analysis	% Analytical Completeness
62	Trinity Bible Church	99.9		
			H-3	100.0
			U-238	100.0
			AM-241	100.0
			U-234	100.0
			U-235	100.0
			PU-239	100.0
			PU-238	100.0
63	Monte Rey South	98.8		
			U-238	100.0
			PU-239	100.0
			PU-238	100.0
			U-234	100.0
			H-3	100.0
			AM-241	100.0
			U-235	100.0

Table 14. Environmental Data—Change

1998 Effective Dose Equivalent (net in mrem) at Air Sampling Locations Around LANL for Tritium – Using Procedure Given in FFCA* (changed)

Site # and Name		(mrem)
06	48th Street	0.001
07	Gulf/Exxon/Shell	0.005
08	McDonalds	0.013
09	Los Alamos Airport	0.013
10	Eastgate	0.012
11	Well PM-1 (E. Jemez	0.005
12	Royal Crest Trailer	0.007
13	Pinon School	0.010
14	Pajarito Acres	0.002
15	White Rock Fire Station	0.005
16	White Rock Nazarene	0.005
20	TA-21 Area B	0.024
32	County Landfill	0.005
60	LA Canyon	0.011
61	LA Hospital	0.005
62	Trinity Bible Church	0.011
63	Monte Rey South	0.002

*EPA, 1995

Table 15. 40.94(b)(7) User Supplied Data—Supplemental Dose Factors

Radionuclide	Ci per m^3 per 10 mrem	reference
As-72	2.40E-11	EPA (1989)
As-73	1.10E-11	EPA (1989)
As-74	2.20E-12	EPA (1989)
Br-76	1.23E-10	LANL (1999)
Br-77	4.20E-11	EPA (1989)
C-10	1.13E-11	LANL (1998)
Cl-39	9.17E-10	LANL (1999)
Hg-197	8.30E-11	EPA (1989)
N-16	3.43E-12	LANL (1998)
O-14	5.29E-12	LANL (1998)
Sc-44m	4.74E-11	LANL (1999)
Se-75	1.70E-13	EPA (1989)
V-48	1.00E-12	EPA (1989)

Table 16. 61.92 Effective Dose Equivalent

ESIDNUM	Description	Dose at LANL Receptor	Dose for release site Receptor
03002914	CMR Stack	1.92E-06	9.60E-06
03002915	CMR Stack	3.14E-06	1.30E-05
03002919	CMR Stack	2.60E-04	9.10E-04
03002920	CMR Stack	1.45E-06	5.20E-06
03002923	CMR Stack	9.23E-05	4.00E-04
03002924	CMR Stack	2.62E-05	1.20E-04
03002928	CMR Stack	1.89E-05	6.90E-05
03002929	CMR Stack	2.22E-07	8.20E-07
03002932	CMR Stack	0.00E+00	0.00E+00
03002933	CMR Stack	1.29E-06	4.50E-06
03002937	CMR Stack	1.92E-08	8.40E-08
03002944	CMR Stack	0.00E+00	0.00E+00
03002944	TA-3-29-44/non-CAP88 radionuclides	3.29E-06	1.18E-05
03002945	CMR Stack	3.72E-06	1.40E-05
03003501	Press Building Stack	1.85E-06	7.60E-06
03010222	Shops Addition Stack	1.66E-04	7.30E-04
16020504	WETF Stack	1.10E-03	1.20E-02
18011600	Godiva Diffuse	2.11E-06	2.11E-06
18016800	SHEBA Diffuse	8.63E-06	8.63E-06
21015505	TSTA Stack	3.30E-03	3.30E-03
21020901	TSFF Stack	1.77E-02	1.77E-02
33008601	HP-Site Stack	2.56E-04	4.70E-04
41000417	W-Site Stack	6.43E-04	3.20E-03
48000107	Radiochemistry Stack	8.02E-08	7.50E-07
48000107	TA48-1-7/non-CAP88 radionuclides	9.72E-06	8.42E-05
48000154	Radiochemistry Stack	9.67E-07	9.00E-06
48000160	Radiochemistry Stack	1.54E-07	1.50E-06
48000160	TA-48-1-60/non-CAP88 radionuclides	2.53E-06	2.47E-05
50000102	Waste Management Stack	3.31E-06	1.10E-05

Table 16. 61.92 Effective Dose Equivalent (Cont.)

ESIDNUM	Description	Dose at LANL Receptor	Dose for release site Receptor
50003701	Waste Management Stack	1.09E-07	4.40E-07
50006903	Waste Management Stack	4.11E-08	1.80E-07
53000303	May LANSCE Stack	6.63E-04	6.63E-04
53000303	LANSCE Stack-June	4.39E-05	4.39E-05
53000303	LANSCE Stack-July	6.27E-05	6.27E-05
53000303	LANSCE Stack-August	7.06E-05	7.06E-05
53000303	LANSCE Stack-September	3.27E-05	3.27E-05
53000303	LANSCE Stack-October	8.53E-02	8.53E-02
53000303	LANSCE Stack-November	2.11E-01	2.11E-01
53000303	LANSCE Stack-December	6.95E-01	6.95E-01
53000303	TA-53-3-3/non-CAP88 radionuclides	1.63E-02	1.63E-02
53000303	LANSCE Annual P/VAP	1.83E-04	1.83E-04
5300033a	LANSCE Fugitive-Area-A	1.52E-01	1.52E-01
530003ip	LANSCE Fugitive-Isotope Prod.	1.34E-01	1.34E-01
530003sy	LANSCE Fugitive-Switch Yard	4.08E-02	4.08E-02
53000702	LANSCE Annual P/VAP	3.75E-05	3.75E-05
53000702	LANSCE Stack-July	1.29E-04	1.29E-04
53000702	LANSCE Stack-August	8.27E-04	8.27E-04
53000702	LANSCE Stack-September	1.82E-03	1.82E-03
53000702	LANSCE Stack-October	1.78E-02	1.78E-02
53000702	LANSCE Stack-November	1.06E-02	1.06E-02
53000702	LANSCE Stack-December	2.09E-02	2.09E-02
53000702	TA-53-7-2/non-CAP88 radionuclides	5.74E-05	5.74E-05
55000415	Plutonium Facility Stack	9.41E-07	5.10E-06
55000416	Plutonium Facility Stack	2.42E-05	1.00E-04
98000000	Unmonitored Stacks-gross	2.71E-01	2.71E-01
98000010	Air Sampler-net	4.40E-02	4.40E-02

Table 17. 40.95(b)(8) Constructions and Modifications Reviewed

96-127 Metallography Studies of Tritium-Contaminated Reservoirs

This project at TA-35, Building 213, involves the analysis of empty reservoirs (from DOE's Savannah River Site) that have known tritium contamination. Each study may involve up to one mCi of tritium, and a total of three studies per year may be conducted. Studies began in April of 1998.

97-0018 Analysis of Fluorescent Microspheres in Tritiated Water Samples

This project involves the analysis of fluorescent microspheres in tritiated water samples using a flow cytometer. Water samples will be obtained from the Nevada Test Site. The water samples are expected to contain between 0 and 170,000 pCi/l of tritium. Operations began in 1998, however, no emissions have been detected.

97-0034 Laser Spark Analysis of Soil

This project involved the measurement of radioactive and metal contamination in soil using laser spark spectroscopy. Approximately one gram of contaminated soil was transferred to and sealed in a glass vial in a hood. Laser pulses were focused through the vial to form a laser spark inside the vial. The resulting spark light was collected and analyzed to determine the contaminant composition using atomic emission spectroscopy. A maximum of six experiments were conducted in TA-46, Building 41. The radioactive contamination included U-238, Th-234, U-235, Th-231, Co-60, and Cs-137. Operations began and were completed in 1998.

97-0065 Metallography and Analysis of Contaminated Parts

This project is a continuation of metallographic studies previously conducted at the Savannah River Site (SRS). Although this work is conducted using existing laboratories and equipment at TA-35, Building 213, it is a new potential tritium source for this facility. Each study may involve up to one mCi of tritium, and a total of three runs per year May be conducted. Operations began after April of 1998.

98-0011 Measurement of U and Pu Isotopes in Bioassay and Environmental Samples

This project will involve the development and implementation of procedures for U and Pu isotopic measurement. Samples will be digested, traced with radioactive isotopes, chemically separated, and analyzed. Samples will be digested using strong acids and hot plates or microwaves. Chemical separation will be accomplished using ion exchange columns. Samples will be analyzed in ICP mass spectrometer. The sample preparation activities are ongoing at TA-59-1; the new element of the project is the analysis by alpha spectrometer.

Uranium and plutonium will be used in liquid form as tracers. The total amount used in one year will not exceed 100 nanoCuries for each isotope. Each sample will require less than 10 picoCuries of tracer. No more than 1000 samples will be processed in a year.

Dose assessments were calculated using CAP88, an EPA-approved dispersion-modeling program. Based on the modeling results, the potential effective dose equivalent from the point source at the nearest receptor is 9E-04 mrem/yr. The estimated dose is significantly lower than the estimated dose, 1.15E-02 mrem/yr, from other activities at TA-59-1.

This project did not start up in 1998 as anticipated.

98-0014 TA-49 Remedial Action

The objective of this project is to limit the vertical migration of water and contaminants at MDA-2. Expected contaminants include beryllium, lead, uranium, plutonium, and americium. Activities include removing the asphalt cap, replacing and underlining the fill, recovering the surface with uncontaminated tuff an engineered cover, and restoring the area. The activities will be on going for 7 months.

In order to re-evaluate the applicability of NESHAP requirements for pre-construction approval, dose assessments were calculated using CAP88, an EPA-approved dispersion-modeling program. The modeling takes into account the tritium emissions and the previously estimated Pu-239 emissions (7.3E-05 Ci/yr). Based on the modeling results, the potential effective dose equivalent from the source at the nearest off-site receptor (3370 m to the SSE) remains at 4E-03 mrem/yr and is well below the permitting threshold of 0.1 mrem/yr specified in 40 CFR 61, Subpart H (Rad NESHAP). Therefore, the project does not require EPA pre-approval.

In addition, ESH-17 plans to have three air monitoring stations. The stations will be capable of detecting tritium, plutonium, uranium, americium, and gross alpha and gross beta radioactivity. Operations began in 1998.

98-0021 ABB E02

TA-35-2 will receive 100 kg of granulated free flowing or powder D-38, packaged in a 30-gallon container and shipped from Sweden. Samples of the material will be taken and repacked into 4.3 liter poly bottles and shipped to TA-55. A tent equipped with HEPA filters will be set up for this project.

Uncontrolled rad air emissions are estimated by applying the particulate reduction factor, 1E-03, from Appendix D of 40 CFR 61, Subpart H (Rad NESHAP). The resulting air emissions are as follows:

(100,000 g D-38) * (4.38E-07 Ci/g) * (1E-03) = 4.4E-05 Ci

In order to determine the applicability of NESHAP requirements, dose assessments were calculated using CAP88, an EPA-approved dispersion-modeling program. Based on the modeling results, the potential effective dose equivalent from the point source at the nearest off-site receptor 1228 m away is 6.2E-03 mrem/yr and is well below the monitoring and permitting threshold of 0.1mrem/yr specified in 40 CFR 61, Subpart H (NESHAP). Therefore, the project does not require EPA pre-approval or emissions monitoring. Operations began at the end of May, 1998.

98-0031 Thermal Ionization Cavity/Mass Spectroscopy

The aim of this project is to develop more efficient methods for ionizing samples. Different approaches will be used at TA-59 and at TA-50. At TA-59, the approach is to design instruments and develop methods for pulsed-glow discharge time-of-flight mass spectrometry. Solid samples of metals (aluminum, copper, iron, and tantalum) will be used.

At TA-50, the approach is to build and test thermal ionization mass specs which utilize a thermal ionization cavity type source. Work at TA-50 will involve small (microgram or less) quantities of radionuclides (U, Th, Pu, Np, Am) in solution. Less than 1 gram (total of all nuclides) will be stored in the lab at one time. The instrumentation routinely involves the use of high voltages, RF, high temperatures, ultra-high vacuum systems, organic solvents, and acids.

It is estimated that no more than 200 samples will be processed in one year. Some samples may have up to picogram or nanogram levels of radionuclides. For a conservative estimate, assume that 200 samples with 1 nanogram of Np-237 are processed. Uncontrolled rad air emissions from the heating process to 2200 degree Celsius are estimated by applying the gas reduction factor, 1, from Appendix D of 40 CFR 61, Subpart H (Rad NESHAP). The resulting air emissions are as follows:

(200 samples) * (1E-09g/sample) * (7.1E-04 Ci/g) * (1) = 1.4E-10 Ci/yr

The estimated air emissions from this project are below the 1996 measured uncontrolled emissions from the stack, 4.2E-08 Ci. In order to determine the applicability of NESHAP requirements, dose assessments were calculated using CAP88, an EPA-approved dispersion modeling program. Based on the modeling results, the potential effective dose equivalent from the point source at the nearest off-site receptor, 1153 m away is 5E-08 mrem/yr and is well below the monitoring and permitting threshold of 0.1 mrem/yr specified in 40 CFR 61, Subpart H (NESHAP). Therefore, the project does not require EPA pre-approval or air emissions monitoring. Operations began in 1998.

98-0115 Neptunium Sphere

The objective of this project is to build a doubly clad, 7.3 kg neptunium-237 sphere in Wing 9 of the Chemistry and Metallurgy Research (CMR) Building, for physics measurements at TA-18. Neptunium feed material will be shipped from TA-18 to CMR. The process will be performed in an alpha box in a hot cell in Wing 9 of CMR. The alpha box will be equipped with a furnace, a grinding machine, welding equipment, a lathe, sphere measurement instrumentation, crucible/mold temperature instrumentation, alpha box oxygen concentration instrumentation, a weigh scale, and other necessary utilities. The process will be performed in a constant nitrogen-inert atmosphere purged through HEPA filters to the atmosphere. The neptunium feedstock will be introduced into the alpha box and weighed. The ~7.3 kg of neptunium feedstock will be loaded into a carbon crucible/mold. The furnace will melt the neptunium at about 640ºC in a crucible/mold within a vacuum container. After the neptunium is cast into the mold section, a directional cool-down sequence will be performed and monitored. The mold will then be opened in the inerted alpha box to retrieve the shape. The shape will be measured for sphericity, then ground on the grinding machine with a nonhazardous lubricant to a spherical shape, and then measured. The sphere will be ground only the minimum extent required for shape, since the spherical neptunium mass is to be maximized. The neptunium contaminated lubricant will be captured in the alpha box for disposal.

At another location, two nickel hemispheres will be machined to fit the neptunium sphere dimension. The nickel hemispheres will be introduced into the alpha box, fitted onto the neptunium sphere, and welded closed to complete the first cladding layer. The nickel surface will be dressed and measured. At another location, the two tungsten hemispheres will be machined to fit the nickel sphere dimension. The tungsten hemispheres will be introduced into the alpha box, fitted onto the nickel sphere, and welded closed to complete the second cladding layer. The installed lathe will be used as a welding fixture and as a contingency fixture if the cladding needs to be opened due to a bad weld, to recover the neptunium. This process is expected to take about one week.

Neptunium Grinding

The neptunium sphere will be ground only to the extent required for shape. The grinding will be performed on the grinding machine with a non-hazardous lubricant in the alpha box. Since the grinding will be a wet process and performed in a controlled alpha box, minimal air emissions are expected.

Neptunium Melting and Casting

Emissions were estimated with an Appendix D (40 CFR61) release factor for liquids and particulate solids of 0.001 and a control factor for HEPA filtration of 0.01. These factors were applied to 10,000 g of neptunium-237. With a specific activity of 7.1E-04 Ci/g, the emissions are 7.1E-05 Ci/yr. In order to determine the applicability of NESHAP requirements, dose assessments were calculated using CAP88, an EPA-approved dispersion modeling program. Based on modeling results, the potential effective dose equivalent from the project's estimated controlled emissions at the nearest receptor is 0.02 mrem/yr and is below the permitting threshold of 0.1 mrem/yr specified in 40 CFR 61, Subpart H (NESHAP). Also based on the modeling results, the combined potential effective dose equivalent from the controlled point source at the receptor is 2.7E-03 mrem/yr and is well below the permitting threshold of 0.1 mrem/yr specified in 40 CFR 61, Subpart H (NESHAP). In addition, the Np-237 emissions will be released though a stack that is monitored. The existing particulate monitor will capture the Np-237 particulates, and if necessary, Np-237 analysis will be performed.

The anticipated start-up date for this project is July 1999.

98-9967 CMR Tritium

ESH-17 has reviewed the activities required to open 5 canisters each containing 4 Ci of tritium in a CMR hotcell. It is estimated that the maximum air emissions vented to the stack would be 20 Ci. In order to determine the applicability of the rad NESHAP (40 CFR 61, Subpart H) requirements, dose assessments were calculated using CAP88, an EPA-approved dispersion-modeling program. Based on the modeling results, the potential effective dose equivalent from the point source at the nearest off-site receptor is 8.43E-03 mrem/yr and is well below the monitoring and permitting threshold of 0.1 mrem/yr specified in the rad NESHAP. This project is on hold and there is currently no anticipated start-up date.

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 USC., 001).

Signature: David A. Gurulé Date: 6/17/99

David A. Gurulé, P.E., Owner
Area Manager, Los Alamos Area Office
U.S. Department of Energy

Signature: [signature] Date: June 15, 1999

Dennis J. Erickson, Operator
Director, Environment, Safety and Health Division
Los Alamos National Laboratory

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1997 LANL Radionuclide Emissions Report Errata as noted by K.W. Jacobson

Page 9: The endnote reference was omitted from the second sentence in the section entitled “Environmental Data.” A superscripted 7 to refer the reader to item number 7 in the reference list should have been included.

Table 1, page 1: An incorrect building number was given for the release point with the ESIDNUM of 03003435. The correct location is TA-3-34, not TA-03-035.

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