LA-UR-03-3983 **July 2003**

Title **Facility-Wide Air Quality Impact Analysis**

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Summary

Title V of the federal Clean Air Act Amendments of 1990 requires facilities defined as "major stationary sources" to obtain a Title V operating permit. Because Los Alamos National Laboratory (LANL) has the potential to emit more than 100 tons of nitrogen oxides, carbon monoxide, and volatile organic compounds per year, LANL is considered to be a major source of emissions. The intent of the Title V permit program is to enhance compliance by including, in a single permit, all existing air quality construction permit conditions as well as state and federal air quality regulatory requirements. LANL submitted an initial Title V permit application to the New Mexico Environment Department (NMED) in 1995 and an updated application in November 2002. The application is comprehensive and contains, for each permitted emission source, a process description, emission estimates, all applicable air quality requirements, and proposed means of monitoring, recordkeeping, and reporting. The application also requests new facility-wide limits for criteria pollutant and hazardous air pollutant emissions.

On February 21, 2003, NMED requested that LANL provide a facility-wide air quality impact analysis to address nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10}), and total suspended particulates (TSP). The purpose of the request is to ensure that emission limits requested in the Title V permit application do not exceed the New Mexico Ambient Air Quality Standards or the National Ambient Air Quality Standards. NMED requested that the analysis conform to the guidance provided in the New Mexico Air Quality Bureau Dispersion Modeling Guidelines and the Environmental Protection Agency's Guidance on Air Quality Models.

LANL is providing this dispersion modeling analysis to demonstrate that simultaneous operation of the air emission units described in the Title V permit application will not result in any exceedance of the ambient air quality standards. This document describes the air emission units that generate NO_2, CO, SO_2, PM_{10}, and TSP air

emissions, the air emission estimates, the dispersion modeling methodology, and the modeling results. This analysis conforms to the guidance set in the New Mexico Air Quality Bureau Dispersion Modeling Guidelines and the Environmental Protection Agency's Guidance on Air Quality Models. The results demonstrate that the simultaneous operation of LANL's air emission sources at maximum capacity as described in the Title V permit application will not exceed any state or federal ambient air quality standards.

1.0 POLLUTANTS

Nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10}), and total suspended particulates (TSP) have National Ambient Air Quality Standards (NAAQS) and/or New Mexico Ambient Air Quality Standards (NMAAQS) established by the Environmental Protection Agency (EPA) or the New Mexico Environment Department (NMED) and are referred to as criteria pollutants. The NAAQS are found in 40 CFR 50 and the NMAAQS are found in 20.2.3 New Mexico Administrative Code (NMAC).

2.0 AIR EMISSION SOURCES

The air emission sources are briefly described below. Refer to the Title V permit application for a more detailed description.

2.1 Air Curtain Destructors

Los Alamos National Laboratory (LANL) operates three air curtain destructors to burn wood and wood slash harvested from operating areas to support wildfire suppression efforts. There are two types of air curtain destructors at LANL. The T-Series trench burners, powered by 125-horsepower diesel engines, utilize a mobile trailer-mounted burner that is used in combination with an earthen pit or trench made to function as the firebox. The S-Series surface burner, powered by a 76-horsepower diesel engine, is a portable system utilizing a refractory walled enclosure and is completely self-contained and minimizes any set up or tear down. There are two T-Series systems and one S-Series system available for use.

LANL has obtained approval to operate the units on a 24-hour basis. Each unit is capable of burning approximately 10 tons of wood per hour. As proposed in the Title V permit application, fuel loading rates for all three units cumulatively will not exceed 32,000 tons of wood per year, which will require the operation of the engines for approximately 3,200 hours per year. The combustion of wood and the operation of the engines are sources of criteria pollutants.

2.2 Asphalt Production

A BDM Engineering, Model Number TM2000, asphalt plant is being constructed for onsite operation. Moist rock and sand are fed into a rotary dryer for drying and heating using a 25-million-British-thermal-unit-per-hour propane gas burner. The dried aggregate is discharged into a bucket elevator, which discharges onto a vibrating screen that separates the material into different sizes. Material is discharged into a weigh hopper and then into a mixer where liquid asphalt is added. The dust from the dryer is passed through a cyclone and baghouse to clean the gas stream. The plant was permitted under 20.2.72 NMAC in October of 2002.

The BDM Engineering asphalt plant is being constructed to replace an existing small asphalt batch plant that produces hot mix asphalt for minor road patching and paving. The plant, located at TA-3-73, is a Barber-Greene Model No. 892 and was installed at LANL in 1960. Only emissions from the new asphalt plant are modeled in this analysis. Asphalt plants generate criteria pollutants from the combustion in the gas burner and the particulate matter from the aggregate handling.

In the Title V permit application LANL proposed a production limit for asphalt in order to limit criteria pollutant emissions. The proposed asphalt production limit is 13,000 tons per year on a 12-month rolling average. The production limit is based on anticipated demand and actual production rates for recent years. The maximum operating schedule for the BDM Engineering asphalt plant is 10 hours a day, seven days a week for approximately 25 weeks per year with a maximum production rate of 80 tons per hour (160,000 pounds per hour). The actual hours of operation will depend on the production rate.

2.3 Boilers

LANL maintains and operates approximately 200 small boilers that range in size from 0.075 million British thermal units per hour to 14.6 million British thermal units per hour for the maximum nameplate heat input capacity. The majority of boilers are used solely to provide comfort heating and hot water for personal use.

Because LANL is located at a high elevation, the boilers do not operate at nameplate capacity. The maximum heat input capacity, derated for altitude, is referred to as the design rate. For atmospheric boilers, the design rate reflects a 30% decrease in input rating consistent with the LANL Facility Engineering Manual (Chapter 6) specification for this altitude. For forced draft boilers, the design rate reflects a 15% decrease in input rating.

The majority of the boilers at LANL qualify as "insignificant" emissions units under NMED Title V operating permit requirements. However, there are 14 gas-fired boilers that do not meet the insignificant emission unit criteria established by NMED. These boilers are listed in Table 2-1. The combustion of natural gas in the boilers generates criteria pollutants.

Table 2-1. Boilers That Are Not Insignificant

Location (Technical Area-Building)	Equipment ID (Manufacturer/ Serial No.)	Design Input Rating (MMBtu/hr)	Air Pollution Control System
TA-16-1484	Sellers/10291	6.35	Low-NO_x*
TA-16-1484	Sellers/10290	6.35	Low-NO_x
TA-16-1485	Sellers/10288	7.84	Low-NO_x
TA-16-1485	Sellers/10289	7.84	Low-NO_x
TA-48-1	Sellers/99017	5.34	None
TA-48-1	Cleaver Brooks/L-62569	5.34	None
TA-48-1	Cleaver Brooks/L-093412	7.14	None
TA-53-365	Sellers/99031-1	7.11	None
TA-53-365	Sellers/99031-2	7.11	None
TA-55-6	Sellers/101319-B	12.4	None
TA-55-6	Sellers/101319-A	12.4	None
TA-59-1	Cleaver Brooks/L-64591	5.34	None
TA-59-1	Cleaver Brooks/L-92957	5.34	None
TA-50-2	Superior-9661	10.7	None

* NO_x = nitrogen oxides

2.4 Carpenter Shops

LANL included two carpenter shops in the Title V permit application. The carpenter shop, located at TA-15-563, under construction in 2002, consists of various saws (band, radial, table, panel), drills, and sanding and shaping equipment. Small wooden structures made in this shop are used to support materials that undergo explosives testing. This shop does not include any equipment for painting, varnishing, staining, or otherwise coating or finishing the wooden structures. Routine operations involve processing soft wood (>90% pine) and, on occasion, other materials such as cardboard, lexan, foam, plastics, and pressure-treated wood. No hardwood is processed in this carpenter shop. A local exhaust ventilation system removes sawdust from TA-15-563. The exhaust system vents to a simple cyclone to capture large wood particles.

The carpenter shop, located at TA-3-38, built before 1960, consists of various saws, drill presses, grinders, and sanders. Activities involve some maintenance activities as well as the fabrication of shipping crates, cabinets and furniture, preparation of framing and plywood for construction sites, preparation of timbers for road crews, and, on occasion, assistance to outside agencies such as the Forest Service on request. The dust generated from these operations is vented through separate regional exhaust systems to one of three cyclones. Woodworking equipment that receives routine use or generates significant dust is connected to the exhaust system. There are no coating operations performed in this shop.

Maximum emissions estimates assume three shifts per day, four hours of operation per shift, seven days per week, and 52 weeks per year, for a maximum physical limitation on the hours of operation of 4,368 hours per year. Carpenter shops are sources of particulate matter emissions.

2.5 Generator at TA-33

LANL operates one stationary generator that is used for process-related activities at TA-33. The unit is a 1500-kilowatt diesel-fired unit (derated for altitude). It will only be used periodically to support experimental research projects. This generator was permitted under 20.2.72 NMAC with restricted operating limits. The operating limits in the permit allow for operating a maximum of 12,000 kilowatt hours per day and

1,350,000 kilowatt hours per year. The generator is also limited to operate at full capacity for eight hours a day between 7:00 a.m. and 5:00 p.m. Diesel combustion in the generator contributes to criteria pollutant emissions.

2.6 Paper Shredder

The paper shredder is located at TA-52-11 and has been in operation since 1991. The shredder is capable of data destruction of paper, microfiche, film, plastic magnetic tape, and compact discs. The shredded material in powder form is vacuumed outside of the building into a container, which is then transported to the county landfill. The maximum capacity of the shredder is 300 pounds of material per hour, 8,760 hours per year for a total of 1,314 tons per year of shredded material. However, the actual operating hours are more accurately characterized by a schedule of 300 pounds of material per hour, six and a half hours per day, and five days per week for a total of 253.5 tons per year of material. The paper shredder is a source of particulate matter emissions.

2.7 Power Plant at TA-3-22

The power plant provides space heating to most of the buildings in TA-3. Steam produced is also used for process needs and to produce electricity in one 10-megawatt and two 5-megawatt steam turbine/generator sets. The plant consists of three dual fuel boilers with natural gas being the primary fuel and No. 2 fuel oil available for use as a standby fuel. Each boiler has a nameplate maximum heat input capacity of 210 million British thermal units per hour. Because LANL is located at a high elevation, the boilers do not operate at nameplate capacity. The maximum heat input capacity, derated for altitude, is calculated to be 178.5 million British thermal units per hour. This reflects a 15% decrease in input rating for this altitude. Two of the boilers were manufactured by Edgemoor Iron Works and installed in 1950. The third boiler was manufactured by Union Iron Works and installed in 1951. The power plant is a source of criteria pollutants that releases from two stacks.

The plant operates 24 hours per day and seven days per week. Normally, only two boilers are operated simultaneously, one of which is on hot standby and the other is running at partial capacity. Under maximum operating conditions, such as during peak generation of electricity, the third boiler can be brought on-line and the plant can operate at maximum capacity.

2.8 Rock Crusher

LANL will utilize a 150-tons-per-hour impact rock crusher to crush concrete and rock removed from buildings as part of the Laboratory's decontamination and decommissioning (D&D) efforts. The crusher will be used intermittently when material is available for crushing and will aid in volume reduction of construction debris. Before crushing, all material is carefully screened and sampled to determine if radioactive contamination is present. If contamination values are above defined release criteria, the material is considered radioactive and properly disposed of as radioactive waste and will not be crushed. The material that is crushed will be used as fill at the sites where the D&D activities occur, thereby eliminating transportation and disposal issues.

The crusher is powered by a 200-horsepower Detroit Diesel engine and is run at 100 horsepower and 1,000 revolutions per minute as per operating specifications. It is portable and will be moved to various D&D sites within LANL's boundaries and will be used to crush concrete and rock at the site where the demolition occurred. The crusher is currently located at TA-21.

LANL obtained construction permit No. 2195 under 20.2.72 NMAC. The permit was issued on June 16, 1999, however NMED has granted an extension of the initial startup date to June 16, 2004. The rock crusher is permitted to operate a maximum of 2,080 hours per year. The processing rate will not exceed 150 tons per hour. The crusher is restricted to operate eight hours per day, six days per week, four weeks per month, and 12 months per year. The crusher may only operate during daylight hours. The rock crusher generates criteria pollutants from the operation of the engine and particulate matter from the crushing and handling activities.

2.9 Steam Plant at TA-21-357

The TA-21-357 steam plant consists of three boilers installed in 1983 and manufactured by the Industrial Boiler Company. The boilers are designed to burn either natural gas or No. 2 fuel oil. Natural gas is the primary fuel. Steam produced in the TA-21-357 steam plant is used to provide space heating for the buildings in TA-21.

Each of the three steam plant boilers has a nameplate maximum heat input capacity of 12 million British thermal units per hour. Because LANL is located at a high elevation, the boilers do not operate at nameplate capacity. The maximum heat input, derated for altitude, is calculated to be 10.2 million British thermal units per hour. This reflects a 15% decrease for this altitude.

In the Title V permit application, LANL proposed a natural gas limit of 60 million cubic feet per year and a fuel oil limit of 10,000 gallons per year . The proposed fuel limits are based on fuel consumption data from previous years and projected steam demand.

2.10 Additional Sources

The Title V permit application includes additional sources that are not summarized or evaluated in this report. These additional sources were not included either because they are not sources of criteria pollutants or because they qualify as insignificant sources. The inclusion of detailed unit-specific information in the Title V permit application is not required for insignificant sources, provided there are no applicable air quality requirements. NMED's Operating Permit Program List of Insignificant Activities, dated September 29, 1995, lists categories of insignificant activities.

However, in an attempt to deliver a conservative and complete analysis of the sources at LANL, the two largest insignificant boilers were modeled. The highest concentrations of the criteria pollutants, from each of the two boilers, were compared to the significance levels found in Table 3 of the New Mexico Air Quality Bureau Dispersion Modeling Guidelines.

The largest insignificant boiler is located at TA-9-282. It is a low NO_x boiler with a design rating of 5.31 million British thermal units per hour. A slightly smaller boiler is located at TA-35-2A. The smaller boiler has a design rating of 4.45 million British thermal units per hour and emissions are uncontrolled. The modeling results indicate that the significance levels are not exceeded.

3.0 EMISSIONS

LANL proposed facility-wide allowable emission limits in the Title V permit application. The application presented emission estimates for each emission unit and source category to demonstrate that the proposed facility-wide allowable emission limits are feasible. However, emission limits were not proposed for individual sources or source categories, except for sources that have allowable emission limits already established in construction permits.

Table 3-1 presents a summary of the annual emissions by source as described in the Title V permit application. Boilers were represented in the application as one source category rather than as individual emission units. Therefore, the application did not present annual emissions for each boiler. Refer to the Title V permit application for a description of the development of the annual emission estimates.

Table 3-1. Emissions Summary (tons/yr) for NO_X, SO_X*, CO, TSP, and PM_{10}

Name and Description	NO_x (tons/yr)	SO_x (tons/yr)	CO (tons/yr)	TSP (tons/yr)	PM_{10} (tons/yr)
Power Plant	99.6	36.9	81.3	15.7	15.7
Air Curtain Destructors	38.2	2.0	23.7	32.4	24.4
TA-33 Diesel Generator	12.20	1.67	10.2	0.43	0.43
TA-21-357 Boilers (3)	3.1	0.3	2.5	0.2	0.2
TA-21 Rock Crusher	6.4	0.4	1.4	1.0	0.7
TA-60 Asphalt Plant	0.16	0.03	2.60	0.06	0.06
TA-3-38 Carpenter Shop	-	-	-	3.07	3.07
TA-15-563 Carpenter Shop	-	-	-	2.81	2.81
TA-52-11 Paper Shredder	-	-	-	13	13

* SO_x = sulfur oxides

Emissions input to the dispersion modeling software is required to be in the units of grams per second. Table 3-2 shows the total emissions input in appropriate units for the source as described under the *Name and Description*. The emissions estimates for the boilers and the TA-21 steam plant were calculated using the sum of the boiler design ratings by location, emission factors described in the Title V permit application, and the appropriate conversions for the units. For the carpenter shops, rock crusher, and paper shredder, the emissions in units of grams per second were derived from the emissions in tons per year by dividing by the annual hours of operation and converting units. The maximum hours of operation for each carpenter shop is 4,368 hours per year, the rock crusher is 2,080 hours per year, and the paper shredder could potentially operate on a continuous basis for 8,760 hours per year. The emissions in grams per second for the TA-33 generator and the power plant are derived from the hourly emission limits, established by 20.2.72 NMAC permit conditions and shown in the Title V permit application, with the appropriate unit conversions. The emissions in grams per second for the asphalt production are calculated with the maximum production rate (80 tons per hour), the emission factors described in the Title V permit application, and the appropriate conversion for the units. The emissions in grams per second were estimated for each air curtain destructor assuming the maximum consumption of wood (10 tons per hour), the engine size, the emission factors described in the Title V permit application, and the appropriate conversion for the units.

The most conservative assumptions were made in the development of emissions in grams per second. In other words, the emissions presented in Table 3-2 are the highest possible emissions. The emission estimates are also very unrealistic. For example, the TA-3 power plant has three boilers. Normally, only two boilers are operated simultaneously, one of which is on hot standby and the other is running at partial capacity. In some cases, all three boilers can operate. The emissions estimates in Table 3-2 account for all three boilers operating at full capacity. In addition, the emissions represent the combustion of the fuel with the highest air emissions. For example, the CO emissions shown in Table 3-2 for the TA-3 power plant are the result of the combustion of natural gas. The remaining air emission estimates are from the combustion of fuel oil. In reality, only one fuel can be burned at a time. This same situation applies to the TA-21 steam plant. For the air curtain destructors, the air emission estimates represent the simultaneous operation of all three units. Under normal operating conditions, only one unit is in operation at any one time. For some locations with more than one boiler, the redundant boiler serves as back up; whereas the emission estimates represent the simultaneous operation of the back up boilers. This approach to the air emissions estimates was taken to deliver a conservative and complete modeling analysis of the air emission sources at LANL.

Table 3-2. Emissions Summary (g/s) for NO_X, SO_X, CO, TSP, and PM_{10}

Name and Description	ID	NO_x (g/s)	SO_x (g/s)	CO (g/s)	TSP (g/s)	PM_{10} (g/s)
Power Plant, 1st Exhaust Stack (two boilers)	TA3_22_1	2.495	17.312	1.865	0.680	0.680
Power Plant, 2nd Exhaust Stack (one boiler)	TA3_22_2	1.247	8.656	0.932	0.340	0.340
Air Curtain Destructor - Trench	ACD1	3.008	0.159	1.869	2.555	1.925
Air Curtain Destructor - Trench	ACD2	3.008	0.159	1.869	2.555	1.925
Air Curtain Destructor - Surface	ACD3	2.817	0.146	1.828	2.541	1.911
TA-33 Diesel Generator	TA33_DG1	5.078	0.693	4.246	0.176	0.176
TA-21-357 Boilers (3)	TA21_B3	0.563	1.380	0.315	0.093	0.093
TA-21 Rock Crusher	TA21_RC1	0.775	0.048	0.170	0.121	0.084
TA-60 Asphalt Plant	TA60_AP1	0.252	0.046	4.032	0.097	0.097
TA-59-1 Boilers (2)	TA59_B2	0.131	0.001	0.110	0.010	0.010
TA-55-6 Boilers (2)	TA55_B2	0.303	0.002	0.255	0.023	0.023
TA-53-365 Boilers (2)	TA53_B2	0.174	0.001	0.146	0.013	0.013
TA-50-2 Boiler	TA50_B1	0.131	0.001	0.110	0.010	0.010
TA-48-1 Boilers (3)	TA48_B	0.218	0.001	0.183	0.017	0.017
TA-16-1484 Boilers (2)	1484_B2	0.058	0.001	0.130	0.012	0.012
TA-16-1485 Boilers (2)	1485_B2	0.071	0.001	0.161	0.015	0.015
TA-3-38 Carpenter Shop	TA3_38C	0.000	0.000	0.000	0.178	0.178
TA-15-563 Carpenter Shop	T15_563C	0.000	0.000	0.000	0.163	0.163
TA-52-11 Paper Shredder	TA52_PS	0.000	0.000	0.000	0.374	0.374

4.0 AIR-DISPERSION MODELING

4.1 Narrative Summary of the Project

This project involves the modeling of air emission units currently in use, or with potential for use at LANL. A total of 19 potential air emission units were modeled. This modeling demonstration reflects the maximum and combined air quality impacts for these sources. That is, the modeling assumed both the simultaneous and continuous operation of all but two of the 19 sources at LANL. The rock crusher at TA-21 and the generator at TA-33 were modeled with limited hours of operation corresponding with permit conditions. Half of the emission units are boilers.

4.2 A List of File Names of the Model Input, Output, and Other Files Used

Tables 4-1 and 4-2 list the file names of the files used in all of the analysis.

Table 4-1. File Names for ISCST3 Modeling

File Name	Size (Kb)	Description
NOX.inp	1,738	Input file for annual and 24-hour evaluation
SOX.inp	3,419	Input file for annual, 24-hour, and 3-hour evaluation
CO.inp	1,738	Input file for 8-hour and 1-hour evaluation
TSP.inp	2,703	Input file for annual and 24-hour evaluation
PM_10.inp	2,703	Input file for annual and 24-hour evaluation
NOX.out	30,969	Output file for NOx evaluation
SOX.out	67,890	Output file for SOx evaluation
CO.out	16,444	Output file for CO evaluation
TSP.out	31,088	Output file for TSP evaluation
PM_10.out	25,449	Output file for PM_{10} evaluation

Table 4-2. Supporting Files Used in the Analysis

File Name	Description
LOSAL94.is2	The meteorological data file used in the modeling analysis. The ISC model-ready file, provided by the Air Quality Bureau (Bureau), consists of hourly surface data from Los Alamos (TA-6) and upper-air data from Albuquerque for the year 1994.
Terrain Files	United States Geological Survey digital elevation model files used to supply terrain heights for sources, receptors, and buildings included in the model analysis. The 7.5-minute files were used to extract terrain elevations.
Fence Line Coordinates	LANL-generated data files for public roads within LANL and other receptor locations along the LANL boundary.

4.3 Discussion of Modeling Approach, Model Options, and Types of Analysis. Models Used and Their Justification, Regulated Pollutants Emitted by Source, and Selection of Terrain Options

The 1998 version of the "New Mexico Air Quality Bureau – Dispersion Modeling Guidelines" (NM Guideline) was reviewed prior to the analysis. The NM Guideline recommends following the procedures given in the EPA's Guideline on Air Quality Models (40 CFR 51, Appendix W) in addition to requirements outlined in the NM Guideline. LANL used Industrial Source Complex Short Term Model Version 3 (ISCST3), an EPA-approved model, for this dispersion analyses. LANL also employed a graphical user interface to ISCST3 produced by Lakes Environmental to more effectively implement ISCST3. Also, the EPA Guideline suggests the use of buoyancy induced dispersion for the modeling of sources involving the combustion of fuel; this is a regulatory default option for ISCST3. The other model options used were the following:

- MSGPRO—the NM Guideline recommends selecting this option when using meteorological data from the Bureau's archive. This option allows the ISCST3 model to continue running in the event missing data are encountered in the meteorological data file. With this option selected, ISCST3 treats missing data similarly to "calms." Although this option was selected, examination of the meteorological data file did not reveal any missing data.
- HE>ZI—this option addresses the potential problem that occurs when the receptor elevation is lower than stack base elevation, which can occur at Los Alamos due to the terrain complexity. In this situation, the mixing layer height (ZI), which is terrain following, may be lower than the effective plume height (HE), which is horizontal. This affects the plume "reflection" calculation in ISCST3, leading to erroneously large concentrations. By selecting this option, the model limits the plume centerline height to be less than the mixing layer height, resulting in realistic concentrations.
- The conservative "simple and complex" terrain option is selected by omitting the NOSMPL and NOCMPL keywords on the model option control pathway. Using this method allows ISCST3 to implement both simple (receptor height below stack height) and

complex (receptor height above plume height) terrain algorithms when calculating concentrations. For intermediate terrain (receptor height between stack height and plume height), ISCST3 will calculate concentrations using both simple and complex terrain algorithms, and the higher of the two concentrations is selected.

- LANL modeled PM_{10} as "other" and named it "PM_10," which ISCST3 does not recognize as PM_{10}, to avoid having to choose between the two default options provided for particulate matter and allows for the highest 24-hour and annual average to be calculated by ISCST3.
- LANL used the building downwash option and supplied building profile input for some of the emission units.

There was no screening per se: the only receptor arrangement used for modeling includes 1) a regular Cartesian grid with 100-meter grid spacing and 2) a discrete Cartesian grid that follows actual fence lines, property boundaries, and roads of interest. The discrete Cartesian grid distance is less than 50 meters between receptor points. The regular Cartesian grid was created large enough to show the full extent of the areas of significant impact, and the grid spacing is fine enough that it can serve as the receptor grid for the refined analysis.

In all cases, except for the TA-3 power plant, LANL modeled emissions from multiple boilers (at a given Technical Area) as one release point; emissions from the TA-3 power plant were divided into two exhaust stacks. The model also allows for hourly variable emissions rates. LANL used this option for the TA-21 rock crusher and the TA-33 generator that are currently limited to restricted hours of operation by their existing air quality permits. Table 4-3 lists each source along with its source identification name used in the input file.

Except for three, all of the emission units generate criteria pollutants from combustion. The three exceptions are the two carpenter shops and the paper shredder, which are only sources of particulate matter emissions. In addition to the emissions generated from combustion, the rock crusher and the asphalt plant are also sources of particulate matter emissions.

Table 4-3. Air Emission Units Modeled with ISCST3

#	Name and Description	ISCST3 ID
1	Power Plant, 1st Exhaust Stack	TA3_22_1
2	Power Plant, 2nd Exhaust Stack	TA3_22_2
3	Air Curtain Destructor - Trench	ACD1
4	Air Curtain Destructor - Trench	ACD2
5	Air Curtain Destructor - Box	ACD3
6	TA-33 Diesel Generator	TA33_DG1
7	TA-21-357 Boilers (3)	TA21_B3
8	TA-21 Rock Crusher	TA21_RC1
9	TA-60 Asphalt Plant	TA60_AP1
10	TA-59-1 Boilers (2)	TA59_B2
11	TA-55-6 Boilers (2)	TA55_B2
12	TA-53-365 Boilers (2)	TA53_B2
13	TA-50-2 Boiler	TA50_B1
14	TA-48-1 Boilers (3)	TA48_B3
15	TA-16-1484 Boilers (2)	1484_B2
16	TA-16-1485 Boilers (2)	1485_B2
17	TA-3-38 Carpenter Shop	TA3_38C
18	TA-15-563 Carpenter Shop	T15_563C
19	TA-52-11 Paper Shredder	TA52_PS

4.4 A Discussion of the Meteorological Data, Including Identification of the Source

LANL used the 1994 meteorological data set provided by the NMED’s Air Quality Bureau retrieved from the WWW at: http://www.nmenv.state.nm.us/aqb/met_data.html#METDATA (LOSAL94.ZIP).

4.5 Map Showing the Location of the Facility

LANL understands that electronic files containing the topographical data will be acceptable, and these are provided to NMED on a CD. A map showing the location of the emission units at LANL is included as Appendix A.

4.6 A Description of the Site, Building Dimensions and a Plot Plan and a Discussion of Building Downwash

LANL is located in north-central New Mexico, approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe. The 40-square-mile site is situated on the Pajarito Plateau, which slopes downward toward the east. Altitudes at LANL range from about 7,500 feet on the west end down to about 6,500 feet on the east end. The Plateau is broken by canyons, some broad and some narrow, up to about 300 feet in depth. The canyons drain east-southeastward into the Rio Grande.

All of the emissions units are located on the Pajarito Plateau, a map showing most of these sources is included in Appendix A. LANL ran the EPA building downwash program, Building Profile Input Program (BPIP), for 13 sources affected by building downwash. Output from the BPIP was supplied to each ISCST3 input file. LANL reduced the flow rate of certain stacks, from their actual stack flow rate, to account for a reduced vertical motion due to the presence of rain-hats on the stacks.

4.7 A Description of the Receptor Grids, Including the Fence Line Coordinates, and Any Receptors on the Property Boundary

Two receptor grids are used, a regular Cartesian grid and a discrete Cartesian grid. The regular Cartesian grid was arbitrarily chosen to be 20 kilometers by 20 kilometers in size with 100-meter grid spacing. The fine grid spacing allows this to be used as the “refined” analysis grid. When it is found that the level of significant impact goes beyond the 20-kilometer by 20-kilometer boundary, the grid is enlarged. When running the SO_x analysis, for example, the grid was made 23 kilometers by 36 kilometers to completely enclose the area of significant impact. The second receptor grid is a discrete Cartesian grid that follows some fence lines, some territory boundaries (such as where LANL meets the San Ildefonso reservation), and some roads that can be used by the general public. The grid spacing of the discrete Cartesian is always less than 50 meters.

4.8 A Copy of the Surrounding Sources of Emissions and Those Used in the Modeling/Any Adjacent Sources Modeled

LANL focused the modeling analysis on the air emission sources presented in the 2002 Operating Permit Application. Surrounding sources were not included. Dispersion modeling under the New Mexico Title V regulation, 20.2.70 NMAC, specifically does not require modeling of surrounding sources.

4.9 A Cross-Reference Between the Sources Listed in the Permit and Their Names Used in the Modeling

The names of the sources used in the modeling are provided in Table 4-3.

4.10 If Standards are Exceeded Because of Surrounding Sources, a Culpability Analysis for the Source is Needed

Surrounding sources were not included in this modeling analysis. Dispersion modeling under the New Mexico Title V regulation, 20.2.70 NMAC, specifically does not require modeling of surrounding sources.

4.11 Discuss How the Radius of Impact was Determined/the Radius and Significance of Impact

LANL allowed the “refined” analysis grid to completely enclose all areas of significant impact.

4.12 A Cross-Reference to the Output Files in Which Report Table Values (of Ambient Impacts) Were Taken From. Pollutant Averaging Time, Applicability of Regulations, Increment and Cumulative Impacts of the Source

The first highest concentration values were obtained from the output files listed in Table 4-1. As provided by the NM Guideline document, the NO_x concentrations were multiplied by 0.40 to determine the 24-hour maximum NO_2 concentrations. The annual values for NO_x were multiplied by 0.75 to determine the annual average NO_2 concentrations. Pollutant averaging times used were annual, 30 days, 24 hour, 8 hour, 3 hour, and 1 hour. The air concentrations determined from the modeling were compared to the national and state ambient air quality standards established in 40 CFR 50 and

20.2.3 NMAC. The modeling analysis showed that none of the air quality standards would be exceeded at any point outside the LANL boundary for these sources.

4.13 Tables of Standards Corrected for the Site Elevation

The air quality standards were adjusted for site elevation following the procedure given on page 25 of the NM Dispersion Modeling Guidelines. Table 4-4 gives the standards in parts per million and micrograms per cubic meter. Table 4-5 provides the conversions between parts per million and micrograms per cubic meter. LANL used 7,300 feet as the site elevation and 514 °Rankin (285.6 K) as the Los Alamos average summer morning temperature for the conversions.

Table 4-4. Ambient Air Quality Standards in ppm and µg/m³

	NO_2	**SO_2**	**CO**		
	ppm	**ppm**	**ppm**		
1-hour average			13.1		
3-hour average		0.50			
8-hour-average			8.7		
24-hour average	0.10	0.10			
7-day average					
30-day average					
Annual Geometric Mean					
Annual Arithmetic Average	0.05	0.02			
		conversions			
	NO_2	**SO_2**	**CO**	**PM_{10}**	**TSP**
	µg/m^3	**µg/m^3**	**µg/m^3**	**µg/m^3**	**µg/m^3**
1-hour average			11987		
3-hour average		1046			
8-hour average			7961		
24-hour average	150	209		150	150
7-day average					110
30-day average					90
Annual Geometric Mean					60
Annual Arithmetic Mean	75	42		50	

Shaded values represent the published standards.

Table 4-5. Concentration Conversions

Pollutant	ppm	µg/m^3
NO_2	1.0	1503
SO_2	1.0	2093
CO	1.0	915

4.14 A Summary of the Modeling Results Including the Maximum Concentrations and Where They Occurred as Compared to the Standards

4.14.1. Summary

The results demonstrate that the simultaneous operation of LANL's air emission sources at maximum capacity as described in the Title V permit application will not exceed any state or federal ambient air quality standards. A summary of the modeling results for off-site receptors is included in Table 4-6. The table presents the impact as a percent of the standard at the location offsite with the highest impact. A more complete presentation of results is given in Appendix B, which also lists the Easting and Northing[1] grid point where the maximum offsite concentrations occurred.

Table 4-6. Comparison of Modeling Results Offsite to Air Quality Standards

Averaging Period	Percent of NO_2 Standard	Percent of SO_2 Standard	Percent of CO Standard	Percent of PM_{10} Standard	Amount of TSP Standard
1-hour average	na*	na	8.9	na	na
3-hour average	na	38.0	na	na	na
8-hour average	na	na	2.4	na	na
24-hour average	26.8	39.9	na	67.7	90.0
7-day average	na	na	na	na	na
30-day average	na	na	na	na	12.7
Annual Arithmetic Mean	9.4	24.4	na	10.5	9.5

*na = not applicable

The maximum offsite NO_2 concentration for the 24-hour averaging period was about 40 micrograms per cubic meter. This occurred on Santa Fe National Forest property near TA-16, near the western boundary of LANL, about 580 meters to the north-southwest of where the air curtain destructors are operated. There were no exceedances of the 24-hour NO_2 standard for the air curtain destructors, which combined, have the highest NOx emission rate.

The highest value of the maximum annual NO_2 concentration was about 7 micrograms per cubic meter, which occurred along the LANL boundary with the Los Alamos town site near TA-21. There were no exceedances of the NO_2 standards at TA-21, which is located especially close to the Los Alamos town site. The highest 24-hour

[1] All coordinates used in the modeling analysis were Universal Transverse Mercator, North American Datum 1927, in meters.

concentration onsite at TA-21 was about 87 micrograms per cubic meter, which occurred about 400 meters from the nearest off-site receptor location. The maximum 24-hour NO_2 concentration along the LANL fence line of TA-21 was about 31 micrograms per cubic meter.

The maximum offsite SO_2 concentration for the 3-hour averaging period was about 400 micrograms per cubic meter, or less than one-half of the standard. This occurred in the Los Alamos town site near TA-3, or about 2 kilometers west-northwest of the TA-3 power plant, the most significant source of SO_2 emissions for LANL. For the 24-hour averaging period, the maximum offsite concentration of SO_2 was about 83 micrograms per cubic meter, which occurred along the LANL boundary with the Los Alamos town site near TA-21; and the highest offsite annual SO_2 concentration was about 10 micrograms per cubic meter (at this same location).

There were no exceedances of the 24-hour SO_2 standard at TA-21, which is located especially close to the Los Alamos town site. The highest concentration in this area was about 143 micrograms per cubic meter.

The 1-hour average and the 8-hour average impact from CO emissions were well below the applicable CO standards.

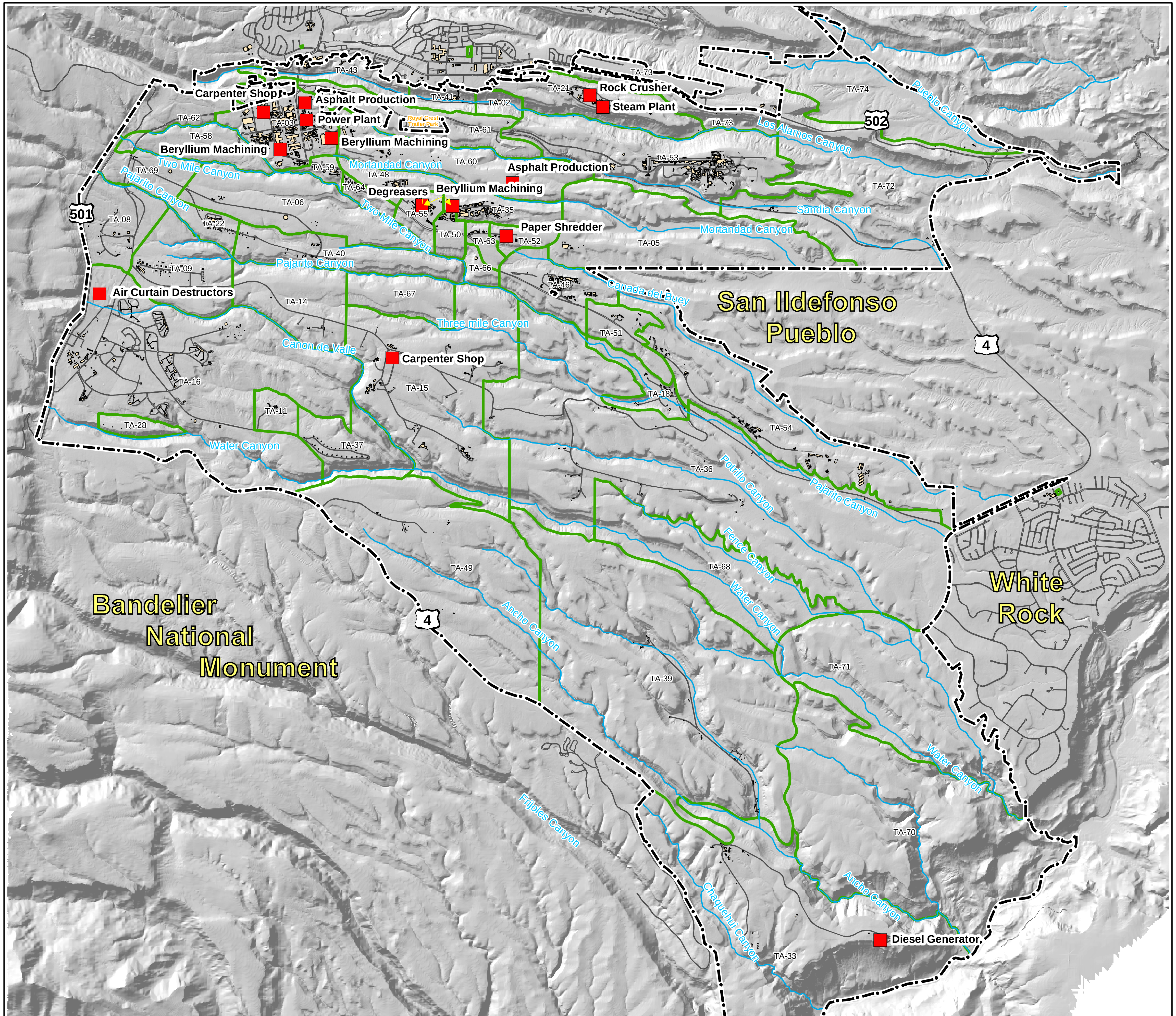
The maximum offsite TSP concentrations for the 24-hour averaging period were 135 micrograms per cubic meter, or about 90% of the applicable standards. This occurred on Santa Fe National Forest property near TA-16, near the western boundary of LANL. This was also the location of the highest offsite impact for PM_{10}. The primary sources creating this offsite impact are the three air curtain destructors currently located about 450 meters away at TA-16. The annual average concentrations for TSP and PM_{10} were well below the applicable standards.

4.14.2. Insignificant Sources

Appendix C profiles the analysis for representative insignificant sources. The modeling results indicate that the significance levels are not exceeded.

Appendix A. Location of Air Emission Units at LANL

Location of Air Emission Units at LANL



Legend

- Emission Unit
- LANL Boundary
- Paved, Road
- Drainage
- Technical Area
- Buildings

N S W E

0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

New Mexico State Plane Coordinates, Central Zone, North American Datum 1983

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Map Reference No. 03-003-1. Produced by Winters Red Star.
Created February 5, 2003

Appendix B. Dispersion Modeling Results

NO_2 averaging pd.	maximum value of NO_x (μg/m³)	location of maximum value UTM X (m)	Y (m)	NO_x fraction converted to NO_2	maximum value of NO_2 (μg/m³)	more stringent of NAAQS or NMAAQS (μg/m³)
24-hour	100.6	377600	3968000	0.40	40.2	150
Annual mean (arithmetic)	9.4	384800	3971200	0.75	7.0	75

SO_2 averaging pd.	maximum value of SO_x (μg/m³)	location of maximum value UTM X (m)	Y (m)	SO_x fraction converted to SO_2	maximum value of SO_2 (μg/m³)	more stringent of NAAQS or NMAAQS (μg/m³)
3-hour	397.3	379300	3971400	1.0	397.3	1046
24-hour	83.5	385200.69	3971127.5	1.0	83.5	209
Annual mean (arithmetic)	10.2	385029.5	3971163.25	1.0	10.2	42

CO averaging pd.	maximum value of CO (μg/m³)	location of maximum value UTM X (m)	Y (m)	more stringent of NAAQS or NMAAQS (μg/m³)
1-hour	1071	377700	3968400	11987
8-hour	192.4	377600	3968000	7961

TSP averaging pd.	maximum value of TSP (μg/m³)	location of maximum value UTM X (m)	Y (m)	more stringent of NAAQS or NMAAQS (μg/m³)
24-hour	135.0	377700	3968500	150
30-day	11.4	377700	3968500	
Annual mean (arithmetic)	5.7	377700	3968400	60*

*(geometric mean)

PM_{10} averaging pd.	maximum value of PM_{10} (μg/m³)	location of maximum value UTM X (m)	Y (m)	more stringent of NAAQS or NMAAQS (μg/m³)
24-hour	101.6	377700	3968500	150
Annual mean (arithmetic)	5.24	380320.19	3970865.0	50

Arithmetic mean is greater than or equal to geometric mean for positive elements so the value of "9" is an upper bound on the observed geometric mean.

Appendix C. Air Dispersion Analysis of Insignificant Boilers

Another modeling analysis was conducted for two boilers. The purpose of the analysis was to demonstrate that the impacts from numerous but minor emissions units (similar to the two cases evaluated here) are insignificant. The two cases used in the analysis were, boiler stack emissions from TA-35-2A and boiler stack emissions from TA-9-282 (a medium sized Laboratory and office building).

The files used in the analysis were:

TA35NOx.inp	TA35NOx.out
TA35SOx.inp	TA35SOx.out
TA35TSP.inp	TA35TSP.out
TA35PM10.inp	TA35PM10.out
TA35CO.inp	TA35CO.out
TA9_NOx.inp	TA9NOx.out
TA9_SOx.inp	TA9SOx.out
TA9_TSP.inp	TA9TSP.out
TA9_PM10.inp	TA9PM10.out
TA9_CO.inp	TA9CO.out

LANL used the same modeling options, assumptions, and meteorological data as used in the combined analysis presented in this report. LANL used a uniform 2-kilometer by 2-kilometer Cartesian grid with a grid point spacing of 100 meters. Figure C-1 shows the locations of the two boilers that were modeled. For both emission units, LANL used the building downwash option and supplied building profile information as calculated by the BPIP. LANL did not supply actual receptors to the model.

Table C-1 lists the calculated criteria pollutant emissions from the two case sources. The stack parameters supplied to the ISCST3 model are presented in Table C-2.

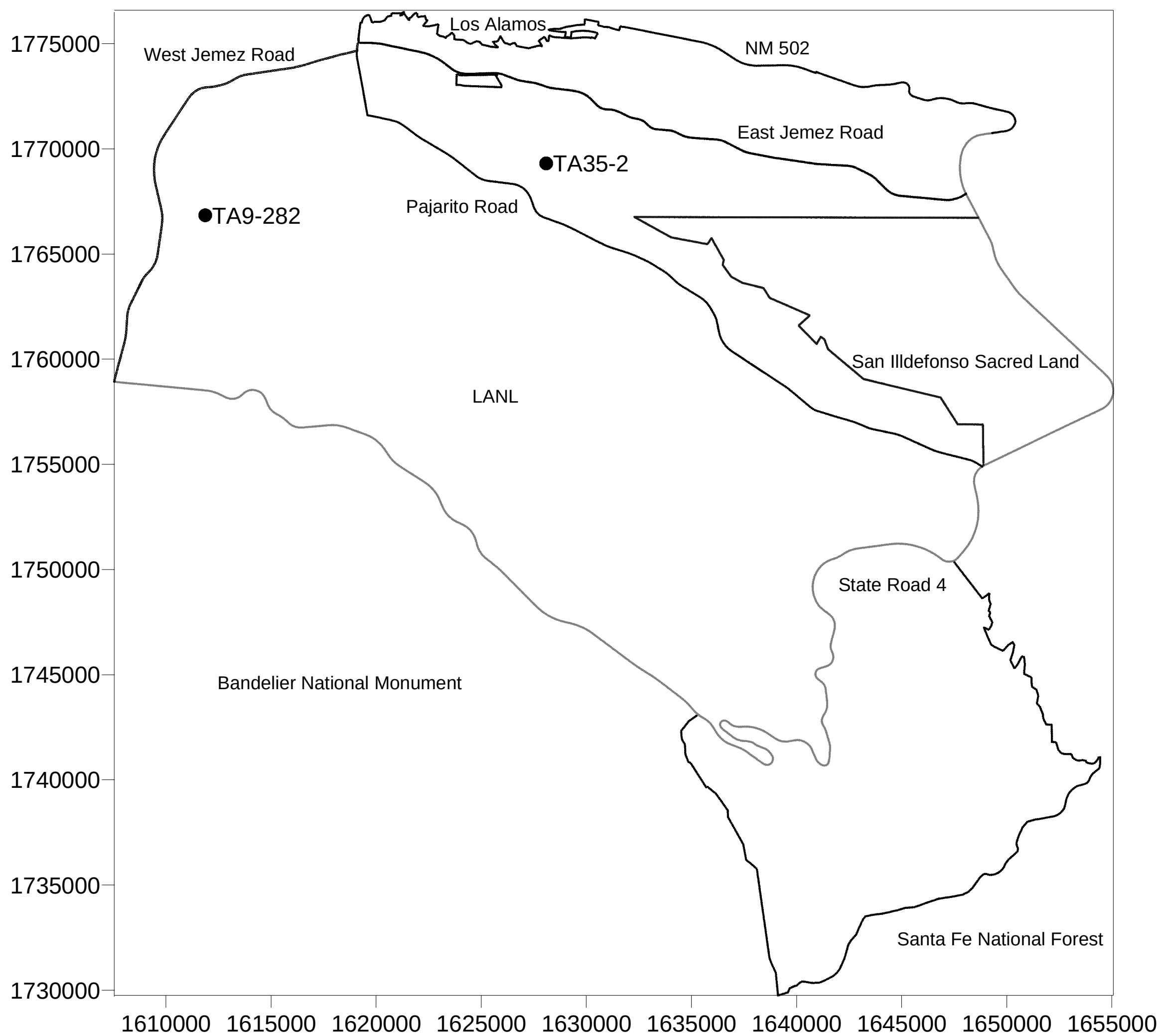

Figure C-1. Locations of Two Emissions Units for Insignificant Boiler Modeling Demonstration

Table C-1. Calculated Emissions from Two Insignificant Boilers

Pollutant	TA-35-2 Emissions (g/s)	TA-9-282 Emissions (g/s)
SO_x	0.0003	0.0004
NO_x	0.0544	0.0241
CO	0.0457	0.0546
Particulate Matter	0.0041	0.0049
PM_{10}	0.0041	0.0049
Volatile Organic Compounds	0.0030	0.0036

Table C-2. Stack Parameters

	TA-35-2A	TA-9-282
Height	18.3 m	4.0 m
Diameter	0.3 m	0.3 m
Temperature	422 K	422 K
Exit Velocity	1 m/s	1 m/s

LANL modeled all criteria pollutants for each source with the appropriate averaging times. The significance levels were not exceeded at the nearest offsite locations for each boiler. For the TA-9-282 boiler, the highest 24-hour NO_2 concentration at the nearest offsite receptor, along West Jemez Road, was about 0.15 micrograms per cubic meter. The highest annual average concentration along West Jemez Road was about 0.02 micrograms per cubic meter. For the TA-35-2A boiler, the highest 24-hour NO_2 concentration at the nearest offsite receptor, along Pajarito Road was about 1.3 micrograms per cubic meter. The highest annual average concentration along Pajarito Road was about 0.10 micrograms per cubic meter. The modeling demonstration for the two cases presented in this appendix demonstrated that the impacts from these types of sources are insignificant.

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