APPENDIX B
NONRADIOLOGICAL AIR QUALITY

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Introduction

This appendix provides additional information about the nonradiological air quality analyses presented in Chapter 5 of this Site-Wide Environmental Impact Statement (SWEIS), including details on the modeling and analysis for criteria pollutants and other chemical emissions.

B.1 Assumptions, Data Sources, Standards, and Models

B.1.1 Applicable Guidelines and Standards and Emission Sources

Criteria Pollutants

The Clean Air Act mandates that the U.S. Environmental Protection Agency (EPA) establish primary and secondary National Ambient Air Quality Standards for pollutants of concern. These pollutants, known as criteria pollutants, are carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, lead, particulate matter less than or equal to 10 microns in aerodynamic diameter (PM_{10}), and particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$).

The State of New Mexico also has established ambient air quality standards for carbon monoxide, sulfur dioxide, nitrogen dioxide, total suspended particulates, hydrogen sulfide, and total reduced sulfur (New Mexico Administrative Code, Title 20, Chapter 2, Part 3). The more restrictive of the State of New Mexico ambient air quality standards and the National Ambient Air Quality Standards, are listed in **Table B–1**.

Criteria pollutants released into the atmosphere from Los Alamos National Laboratory (LANL) operations are emitted primarily from combustion facilities such as boilers, emergency generators, and motor vehicles.

Other Nonradiological Air Pollutants

Chemicals are currently used at LANL in separately located groups of operations or laboratory complexes called “technical areas” (TAs), which comprise large geographic areas. Air pollutants from these TAs may be released into the atmosphere from many ongoing activities, including laboratory, maintenance, and waste management operations. In the 1999 *Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (*1999 SWEIS)* (DOE 1999), two types of toxic air pollutants were considered: noncarcinogenic and carcinogenic. Chemical pollutants are classified as hazardous air pollutants or as toxic air pollutants.

Table B–1 Criteria Pollutant Standards

Pollutant	*Time Period*	*Controlling Ambient Air Quality Standards* [a] *(micrograms per cubic meter)*
Carbon Monoxide	8 hours 1 hour	7,961 [b] 11,987 [b]
Nitrogen Dioxide	Annual 24 hours	75 [b] 150 [b]
Sulfur Dioxide	Annual 24 hours 3 hours	42 [b] 209 [b] 1,046 [c]
Total Suspended Particulates	Annual 30-day 7-day 24 hours	60 [b] 90 [b] 110 [b] 150 [b]
PM_{10}	Annual 24 hours	– [c,d] 150 [c]
$PM_{2.5}$	Annual 24 hours	15 [c] 35 [c,d]
Ozone	8 hours	125 [c]
Lead	Calendar quarter	1.5 [c]
Hydrogen sulfide	1 hour	11.1 [b]

PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers.

[a] Ambient standards for gaseous pollutants are stated in parts per million. These values were converted to micrograms per cubic meter, with appropriate corrections for temperature and pressure (elevation), following New Mexico *Dispersion Modeling Guidelines* (NMED 2003, LANL 2003).

[b] State standard.

[c] Federal standard.

[d] The EPA recently revoked the annual PM_{10} standard and changed the 24-hour $PM_{2.5}$ standard from 65 to 35 micrograms per cubic meter.

Note: The more stringent of the Federal and state standards is presented if both exist for the averaging period. The National Ambient Air Quality Standards (Title 40 *Code of Federal Regulations* [CFR] Part 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic $PM_{2.5}$ mean standard is attained when the expected annual arithmetic mean concentration (3 year average) is less than or equal to the standard. The 24-hour $PM_{2.5}$ standard is met when the 98th percentile over 3 years of 24-hour average concentrations is less than or equal to the standard value. The 24-hour PM_{10} standard is met when the 99th percentile over 3 years of 24-hour concentrations is less than or equal to the standard value.

Sources: NMAC 20.2.3 (New Mexico Administrative Code – Environmental Protection, Air Quality, Ambient Air Quality Standards 2002); 40 CFR Part 50 (National Ambient Air Quality Standards); 71 *Federal Register* (FR) 61143.

For the purpose of this SWEIS, the estimated chemical emissions during recent years were compared to the emissions evaluated in the *1999 SWEIS*. The total emissions of toxic or hazardous air pollutants and volatile organic compounds showed considerable variation over the period 1999 through 2004. Operation of the air curtain destructors resulted in increases of hazardous air pollutants and volatile organic compounds during 2002 and 2003. The air curtain destructors accounted for 2.1 and 22.9 tons (1.9 and 20.8 metric tons) of hazardous air pollutants and volatile organic compounds, respectively, in 2002. In 2003, they accounted for 3.3 and 36.0 tons (3.0 and 32.7 metric tons) of hazardous air pollutants and volatile organic compounds, respectively (LANL 2004b). With the completion of the Cerro Grande Fire Rehabilitation Project tree thinning and removal, emissions of hazardous air pollutants and volatile organic compounds returned to lower levels more typical of prefire conditions.

Toxic and hazardous air pollutant emissions from LANL activities are released primarily from laboratory, maintenance, and waste management operations. Unlike a production facility with

well-defined operational processes and schedules, LANL is a research and development facility with great fluctuations in both the types of chemicals emitted and their emission rates. LANL has a program to review new operations for their potential to emit chemicals. Toxic air pollutant emissions from the use of chemicals are generally below the levels for which the State would require a permit for a new source under the New Mexico permit regulations for toxic air pollutant emissions (NMAC 20.2.72.400 - 502). The Title V operating permit limits the emissions of hazardous air pollutants such that operations at LANL are below the major source threshold for hazardous air pollutants. Emissions of hazardous air pollutants are monitored and reported annually to the New Mexico Environmental Department as required by the permit. Past actual emissions of hazardous air pollutants have been well below the threshold (LANL 2004a).

The chemical database information system used to estimate emissions in recent years is called ChemLog. It was used to estimate emissions for the annual *SWEIS Yearbooks* for 2002 through 2005 (LANL 2006). ChemLog includes all chemicals purchased at each LANL facility in each calendar year. Prior to 2002, another inventory system was used to estimate emissions based on chemical use. For the *1999 SWEIS*, 51 of the 382 chemicals evaluated were considered to be carcinogenic. For the purpose of the analysis, it was assumed that air emissions could result from the use of any of the 382 chemicals from any of the TAs that purchased them (DOE 1999). In the *SWEIS Yearbooks* chemical usage was summed by facility. It was then estimated that 35 percent of the chemical used was released to the atmosphere. Emission estimates for some metals were based on an emission factor of less than 1 percent because these metal emissions were assumed to result from cutting or melting activities. Fuels such as propane and acetylene were assumed to be completely combusted; therefore, no emissions were reported. A list of chemicals purchased in 2005 are provided in **Table B–2**.

Noncarcinogens

Short-Term Guideline Values. While no national or State of New Mexico standards have been established for noncarcinogens, the New Mexico Environment Department has developed guideline values for determining whether a new or modified source emitting a toxic air pollutant would be issued a construction permit (New Mexico Environment Department, Air Quality Control Regulations, revised November 17, 1994). These guideline values are 8-hour concentrations that are one-hundredth of the Occupational Exposure Limits established by the American Conference of Governmental Industrial Hygienists or the National Institute of Occupational Safety and Health. The State of New Mexico listing was supplemented with information on the lowest values for Occupational Exposure Limits from these sources. These guideline values were used in this analysis in screening for potential short-term impacts of chemical releases from LANL operations.

Annual Average Guideline Values. The guideline values used in the *1999 SWEIS* analysis were the inhalation reference concentrations from EPA's Integrated Risk Information System. Reference concentrations are daily exposure levels to the human population (including sensitive subgroups) during a lifetime (70 years) that could occur without appreciable risk of deleterious effects.

Table B–2 Chemicals Purchased at Los Alamos National Laboratory – 2005 [a]

Chemical Name	*Key Facility*													
	CMR	***HRL – Biosciences***	***High Explosives Processing***	***High Explosives Testing***	***LANSCE***	***Machine Shops***	***Materials Science Lab***	***Pajarito Site***	***Pu Facility Complex***	***Radio-chemistry Site***	***Sigma Complex***	***Target Fabrication Facility***	***Tritium Operations***	***Waste Management Operations***
1,3,5-Trimethylbenzene					X									
1,4-Dioxane					X					X				
2- Methoxyethanol												X		
2- Nitropropane					X									
Acetic Acid		X								X		X		
Acetic Anhydride										X				
Acetone		X	X	X	X		X		X	X	X	X		
Acetonitrile		X	X		X					X		X		
Acetylene			X						X					
Acrolein			X											
Acrylamide		X												
Aluminum numerous forms											X			
Ammonia										X				
Ammonium Chloride	X								X	X				
Arsenic, El. & inorg, exc. Arsine											X			
Benzene										X		X		
Beryllium											X			
Bromine	X		X							X				
Carbon Tetrachloride	X									X				
Chlorine Trifluoride											X			
Chloroform		X			X							X		
Chromium, Metal & Cr III Compounds, as Cr	X													
Cobalt					X									
Copper	X		X											

Chemical Name	Key Facility													
	CMR	HRL – Biosciences	High Explosives Processing	High Explosives Testing	LANSCE	Machine Shops	Materials Science Lab	Pajarito Site	Pu Facility Complex	Radio-chemistry Site	Sigma Complex	Target Fabrication Facility	Tritium Operations	Waste Management Operations
Cyclohexane					X		X							
Cyclohexene														
Dicyclopentadiene										X				
Diethanolamine										X				
Diethylamine										X				
Diethylene Triamine							X				X			
Diisopropylamine										X				
Dipropylene Glycol Methyl Ether	X													
Ethanol	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ethyl Acetate			X				X			X				
Ethyl Ether					X		X			X		X		
Ethylene Diamine					X					X				
Formamide		X												
Hexane (other isomers) or n-Hexane		X	X		X		X			X		X		
Hydrogen Bromide	X									X				
Hydrogen Chloride	X	X	X		X		X		X	X	X			X
Hydrogen Cyanide												X		
Hydrogen Fluoride, as F		X			X					X	X			
Hydrogen Peroxide	X						X		X	X		X		
Hydroquinone					X					X				
Isobutane	X				X									
Isopropyl Alcohol	X	X			X		X			X	X	X		
Isopropylamine					X									
Kerosene			X			X								
Lead, elemental and inorganic compounds as lead					X									
Magnesium Oxide							X		X	X				

Chemical Name	Key Facility													
	CMR	HRL – Biosciences	High Explosives Processing	High Explosives Testing	LANSCE	Machine Shops	Materials Science Lab	Pajarito Site	Pu Facility Complex	Radio-chemistry Site	Sigma Complex	Target Fabrication Facility	Tritium Operations	Waste Management Operations
Fume														
Manganese Dust & Compounds or Fume					X									
Mercury, numerous forms											X	X		
Methyl Alcohol		X	X	X	X		X		X	X	X	X		
Methyl Ethyl Ketone			X		X							X		
Methyl Iodide										X				
Methyl Methacrylate										X				
Methyl Silicate										X		X		
Methylene Chloride		X	X	X	X					X		X		
Molybdenum	X									X	X			
Morpholine														
n,n-Dimethyl Acetamide or Dimethyl Acetamide			X				X							
n,n-Dimethylformamide		X					X			X		X		
n-Butyl Acetate							X							
Naphtalene										X	X			
n- Heptane										X				
Nitric Acid	X	X	X		X		X		X	X		X	X	
Nitromethane				X										
Oxalic Acid	X								X	X				
Pentane (all isomers)				X						X		X		
Phenol		X												
Phosphoric Acid	X						X			X	X			
Phosphorus											X			
Potassium Hydroxide		X							X	X		X		X
p-Phenylenediamine							X							

Chemical Name	Key Facility													
	CMR	HRL – Biosciences	High Explosives Processing	High Explosives Testing	LANSCE	Machine Shops	Materials Science Lab	Pajarito Site	Pu Facility Complex	Radio-chemistry Site	Sigma Complex	Target Fabrication Facility	Tritium Operations	Waste Management Operations
Propane	X			X	X	X		X	X	X			X	X
Propionic Acid										X				
Propyl Alcohol			X											
Pyridine										X				X
Rhodium Metal	X													
Selenium Compounds				X										
Silver	X													
Sulfur Hexafluoride			X											
Sulfuric Acid	X	X		X	X					X	X	X		X
Tert-Butyl Alcohol	X				X							X		
Tetrahydrofuran			X		X		X			X		X		X
Tin numerous forms					X									
Toluene	X		X							X		X		
Tributyl Phosphate									X					
Trichloroacetic Acid		X												
Tungsten as W insoluble compounds										X		X		
Uranium											X			
Vanadium					X									
VM&P Naphtha										X				
Zinc Chloride Fume								X						
Zinc Oxide Fume					X		X							

CMR = Chemistry and Metallurgy Research Building, HRL = Health Research Laboratory, LANSCE = Los Alamos Neutron Science Center, Pu = plutonium.

[a] These chemicals are representative of those purchased at LANL. Additional chemicals listed in the New Mexico permit regulations on toxic air pollutants and emission (NMAC 20.2.72.502), listed in the EPA list of hazardous air pollutants, and other chemicals could be used and potentially emitted from activities at LANL as needed.

Source: LANL 2006.

Carcinogens

The guideline values used in the *1999 SWEIS* analysis to estimate potential impacts of carcinogenic toxic air pollutants from LANL operations were based on an incremental cancer risk of one in a million (1.0×10^{-6}) (in other words, one person in a population of a million would develop cancer if this population was exposed to this concentration over a lifetime), a level of concern established in the Clean Air Act. This value was used in the screening for the estimated combined incremental cancer risk associated with all of the carcinogenic pollutants emitted from LANL facilities at any location. For the purpose of screening individual carcinogens, a cancer risk of one in one hundred million (1.0×10^{-8}) was established as the guideline value.

B.1.2 Receptors and Receptor Sets

For the purpose of evaluating the impact of criteria pollutant emissions, the analysis prepared for the LANL operating permit was used (LANL 2003). In this analysis, two sets of receptors (locations where air quality levels were estimated) were considered: 1) a regular Cartesian grid with 329 feet (100-meter) grid spacing, and 2) a discrete Cartesian grid that followed actual fence lines, property boundaries, and roads of interest. The discrete Cartesian grid distance was less than 164 feet (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 was fine enough that it could serve as the receptor grid for the refined analysis (LANL 2003).

For the purpose of evaluating the impact of criteria pollutant emissions from construction activities for various projects, a discrete Cartesian grid that followed the fence line, property boundary, and public roads of interest was used, plus a regular Cartesian grid with a 1,600-foot (500-meter) spacing to 6,600 feet (2 kilometers) from the boundary and a 3,300-foot (1,000-meter) spacing beyond 6,600 feet (2 kilometers).

For the purpose of the air pollutant analysis in the *1999 SWEIS*, two sets of receptor locations were used: (1) locations representing actual locations of human activity, and (2) fence line locations to which the public has access (DOE 1999).

The potential impacts of air pollutants on workers employed at LANL facilities were not considered as part of the analysis in the *1999 SWEIS*. Different regulations apply to an occupational setting, and the controlled nature of the work, along with surveillance systems associated with those controls, restricts routine exposures for workers. The analysis focused on exposure to the public and was based on a methodology that initially assumed that chemicals that were purchased were entirely available for release to the atmosphere outside the facility in which the chemicals were used.

Air quality standards have been established by the State of New Mexico and the EPA for criteria pollutants for both short-term (1-hour, 3-hour, 8-hour, and 24-hour) and long-term (30-day, quarterly, and annual) time periods. In addition, guideline values were developed for other air pollutants for both short-term (8-hour) and long-term (annual) time periods. Using these standards and guideline values, the potential impacts of the pollutant emissions from LANL operations on these receptor sets were analyzed as discussed in the following paragraphs.

Criteria Pollutants

Short-term and long-term impacts for carbon monoxide, nitrogen dioxide, sulfur dioxide, total suspended particulates, and PM_{10} were estimated at the receptor locations, and the results were compared with applicable air quality standards. Both time frames were analyzed to address the potential short-term (acute) and long-term (chronic) impacts of these pollutants at locations where the public could have both short-term and long-term exposure to emissions from LANL facilities. Hydrogen sulfide and total reduced sulfur emissions are associated mostly with oil and gas industry; therefore, analysis for these pollutants was not necessary at LANL.

Other Air Pollutants

Noncarcinogens. The potential short-term (acute) and long-term (chronic) impacts of these pollutants at locations where the public could have both short-term and long-term exposure to emissions from LANL facilities were considered.

Short-term impacts were analyzed for fence line receptors. Long-term impacts were not considered at these receptor locations because, although it is possible that the public could have access to fence line areas for short periods of time, these locations would not be inhabited or visited on a regular (long-term) basis.

Carcinogens. The annual impacts from the emissions of carcinogenic air pollutants were analyzed for sensitive receptors. Although guideline values for short-term exposure were used in the screening steps, the more meaningful comparisons were to long-term guideline values for sensitive receptors.

B.1.3 Air Quality Dispersion

Models

The EPA's Industrial Source Complex Air Quality Dispersion Model (ISCST3) was used for the nonradiological air pollutant analyses in this SWEIS and the *1999 SWEIS*. ISCST3 is a versatile model that is often used to predict pollutant concentrations from continuous point, area, volume, and open disposal cell sources (EPA 1995, 2002). This versatile model is often used because of the many features that enable the user to estimate concentrations from nearly any type of source emitting nonreactive pollutants.

EPA's PUFF computer model was used for a screening level analysis of emissions from LANL's High Explosive Firing Sites at TA-14, TA-15, TA-36, TA-39, and TA-40. The PUFF model was designed to estimate downwind concentrations from instantaneous releases of pollutants (DOE 1999). The HOTSPOT computer code was used in combination with the ISCST3 computer model for a detailed analysis of emissions from the high explosive firing sites in order to provide a more readily usable input data file than that provided by PUFF for the health effects analysis in the *1999 SWEIS*. The HOTSPOT code was designed for detonation of high explosives, and was used specifically to provide input data to the ISCST3 model (DOE 1999).

B.2 Criteria Pollutants – General Approach

The combustion sources that were evaluated in the facility-wide analysis of criteria pollutants included each permitted emission source, and, for completeness, two of the largest insignificant sources[1]. These sources included boilers, TA-3 and TA-15 carpenter shops, TA-33 generators, TA-52 paper shredder, TA-60 asphalt plant, TA-3 power plant, TA-21 rock crusher, TA-21 steam plant, boilers at TA-9 and TA-35, and air curtain destructors. An atmospheric dispersion modeling analysis was conducted to estimate the combined potential air quality impacts of the emissions from each of these emission sources (DOE 1999).

No quantitative analysis of vehicular-related emissions was performed as part of the analysis for the *1999 SWEIS*, but these emissions were assumed to be included in the background (DOE 1999). The alternatives considered in this SWEIS may have different effects on the travel patterns in the study area as a result of changes in the number of LANL employees and the future population of Los Alamos. Therefore, changes in regional emissions from traffic were considered for each alternative.

B.2.1 Criteria Pollutants – Methodology

The analysis of combustion-related pollutants used standard analytical modeling techniques based on atmospheric dispersion modeling and emissions estimated under the peak and actual annual average operating conditions of each major combustion unit. Estimates of emission rates were based on the potential emissions from each source. For the purpose of the site-wide analysis, it was assumed that all three TA-3 boilers were operating at full capacity, using the fuel with highest air emissions. This approach was taken to obtain a conservative and complete modeling analysis of these emission sources. Emission rates used in the modeling are presented in **Table B–3**. Other details of the modeling are summarized in the *Facility-Wide Air Quality Impact Analysis* report (LANL 2003). With respect to emission rates from the combustion sources, the analysis bounds the air quality impacts from all the alternatives because the analysis is based on the maximum potential emission from the sources.

B.2.2 Results of Criteria Pollutant Analysis

The results of the analysis of criteria pollutants from LANL's combustion sources are presented in Chapter 5, Table 5–8 of this SWEIS. As shown, the highest estimated concentration of each pollutant would be below the appropriate ambient air quality standard. None of the alternatives considered in this SWEIS, therefore, would exceed the applicable ambient air quality standards, and impacts on the public would be minor.

[1] *Stationery sources that emit criteria pollutants in quantities smaller than those requiring inclusion in the Title V operating permit are called insignificant sources. The analysis included two of the largest of these insignificant sources.*

Table B–3 Criteria Pollutant Emissions Summary [a] (grams per second)

Source	*Nitrogen Oxides*	*Sulfur Oxides*	*Carbon Monoxide*	*Total Suspended Particulates*	PM_{10}
TA-3 Power Plant, Stack 1 (2 boilers)	2.495	17.312	1.865	0.68	0.68
TA-3 Power Plant, Stack 2 (1 boiler)	1.247	8.656	0.932	0.34	0.34
TA-33 Diesel Generator	5.078	0.693	4.246	0.176	0.176
TA-21-357 Boilers (3)	0.563	1.38	0.315	0.093	0.093
TA-60 Asphalt Plant	0.252	0.046	4.032	0.097	0.097
TA-59-1 Boilers (2)	0.131	0.001	0.11	0.01	0.01
TA-55-6 Boilers (2)	0.303	0.002	0.255	0.023	0.023
TA-53-365 Boilers (2)	0.174	0.001	0.146	0.013	0.013
TA-50-2 Boiler	0.131	0.001	0.011	0.01	0.01
TA-48-1 Boilers (3)	0.218	0.001	0.183	0.017	0.017
TA-16-1484 Boilers (2)	0.058	0.001	0.13	0.012	0.012
TA-16-1485 Boilers (2)	0.071	0.001	0.161	0.015	0.015
TA-3-38 Carpenter Shop	0.0	0.0	0.0	0.178	0.178
TA-15-563 Carpenter Shop	0.0	0.0	0.0	0.163	0.163
TA-52-11 Paper Shredder	0.0	0.0	0.0	0.374	0.374

TA = technical area, PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers.

[a] Emissions represent the values modeled in the *Facility-Wide Air Quality Impact Analysis*. Not included in this table are the results of the analysis for air curtain destructors and a rock crusher that are no longer operated by LANL. About half of the boilers shown are actually backup boilers and would not be operated at the same time as the primary boiler at a facility, but were included for the purpose of bounding the potential impacts considered in the Title V permit.

Source: LANL 2003.

B.3 Other Air Pollutants – General Approach

The approach used to evaluate chemical air pollutants in the *1999 SWEIS* was based on the use of screening level emission values to identify chemicals that would be evaluated in more detail. Screening level emission values were conservatively estimated hypothetical emission rates for each of the air pollutants that could potentially be emitted from each of LANL's TAs and that would not result in air quality levels harmful to human health under current or future conditions. These screening level emission values were compared with conservatively estimated pollutant emission rates on a TA-by-TA basis to determine potential air quality impacts of air pollutants from LANL operations. This process consisted of the following steps:

- From over 2,000 chemical compounds listed as being used at LANL, 382 air pollutants (including 51 carcinogens) were selected for consideration based on chemical properties, volatility, and toxicity.

- A methodology based on screening level emission values was used to estimate the potential worst-case impacts of the air pollutants. Screening level emission values for each chemical for each TA were compared with emission rates conservatively estimated from chemical use rates. If a conservatively estimated emission rate for a given pollutant from a given TA was less than the screening level emission value, that pollutant emission source was deemed not to have the potential to cause significant air quality impacts, and, as such, no detailed analysis was required. If the screening level emission value was less

than the estimated emission rate for a given pollutant from a given TA, a more detailed analysis was conducted.

- An additive impact analysis was conducted to estimate the potential total impact from the emissions of each pollutant from more than one TA and the total incremental cancer risk from all of the carcinogenic pollutants combined at any of the sensitive receptor locations considered.

The methodology used in the analysis followed modeling guidelines for toxic pollutants established by the EPA in that it first used screening level evaluations based on conservative assumptions and resulting in maximum potential impacts, followed by more detailed analyses based on more realistic assumptions. The overall procedure used for the air quality assessment, including the development of screening level emission values, is summarized in the *1999 SWEIS* (DOE 1999).

B.3.1 Other Pollutants – Methodology for Individual Pollutants

Screening Level Analysis

The following sections provide more detail on the methodology used for screening and detailed analysis for air pollutants from chemical use in the *1999 SWEIS* (DOE 1999).

Once screening level emission values (both short-term and long-term) were established for each of the air pollutants on a TA-specific basis, a comparison was made between these values and conservatively estimated emission rates. A ratio was developed for each chemical by dividing the screening level emission value by the estimated emission rate (SLEV/Q).

These results, in the form of worksheets, were presented to knowledgeable site personnel who were aware of the activities and processes occurring at each TA, as well as those that might occur in the future. To streamline the process, the relationship between screening level emission values and the estimated emission rates for each TA were presented in two data sets.

The first data set included those chemicals having SLEV/Q ratios greater than 100. For each of these chemicals, a determination was made as to whether the use of that chemical would increase by more than 100 times under future operation(s) of LANL under any of the alternatives considered in this SWEIS. Essentially, this meant that for each TA a determination had to be made as to whether the use of a chemical would increase over current use rates by a factor of 100. If a determination could be made that the future use of that chemical would not increase by this factor, no further evaluation of that chemical was required. If such a determination was not possible, a more detailed analysis was conducted.

The second data set included all chemicals having a SLEV/Q ratio less than 100, and all chemicals having an SLEV/Q ratio greater than 1 but less than 100, and all chemicals having a ratio less than 1. For each chemical having a ratio greater than 1 but less than 100, an evaluation was made as to whether the estimated emissions under any of the future alternatives would exceed the screening level emission values. Essentially, this meant that for each TA a determination had to be made as to whether the use of that chemical would increase over current rates by a factor greater than the SLEV/Q ratio. If a determination could be made that the future

use of that chemical would not increase by this factor, no further evaluation of that chemical was required. If such a determination was not possible, a more detailed analysis was conducted. For those chemicals having an SLEV/Q ratio less than 1 (in other words, screening level emission values were potentially being exceeded under current conditions), more detailed analyses were conducted.

Two exceptions to the methodology described above were made. Information on the TAs for high explosive operations were derived using a model more appropriate for screening short-term exposure concentrations under those conditions. The second exception involved screening the emissions of chemicals from the Bioscience Facilities (formerly the Health Research Laboratory Complex) at TA-43. Because of the proximity of the Bioscience Facilities to actual receptors, all analyses for carcinogens, as well as noncarcinogens, were performed for actual receptors rather than fence line receptors.

Detailed Analysis

The detailed air quality analysis consisted of one or both of the following steps:

- Development of emission rates and source term parameters using actual process knowledge, and
- Dispersion modeling using actual stack parameters and receptor locations.

Two consequences may result from detailed analysis of each chemical from each TA: (1) either there is no potential to exceed a guideline value (in which case no additional analyses were required), or (2) there is a potential to exceed a guideline value (in which case additional analyses were required). A pollutant having the potential to exceed a guideline value was subject to evaluation in the health and ecological risk assessment process.

B.3.2 Other Pollutants – Results of Individual Pollutants Analysis

Screening Level

The first data set considered those chemicals having SLEV/Q ratios greater than 100. For more than 90 percent of the air pollutants from chemical use, a determination was made that the use of these chemicals would not increase by more than 100 times under any of the SWEIS alternatives. The second data set included chemicals having SLEV/Q ratios greater than 1 but less than 100, and ratios less than 1. A determination was made as to whether the use of that chemical would increase over current use rates by a factor greater than the SLEV/Q ratio. The list of carcinogens also was reduced from 51 to 35 because some of the chemicals are no longer used and were not projected for future use. Based on worksheets for the chemicals in the data sets, and information on potential future use, operations at 13 locations were identified with the potential to exceed a guideline value, and more detailed analyses were conducted.

Emissions from two sources were referred to the health and ecological risk analysis process. The analysis for TA-43 showed the potential to exceed the guideline values for four chemical carcinogens from the Bioscience Facilities: chloroform, trichloroethylene, formaldehyde, and acrylamide.

The detailed analysis for the High Explosive Firing Sites indicated that the same chemicals that had the potential to exceed a guideline value in the previous screening step would also have the potential to exceed their respective guideline values using somewhat different parameters and a different model than that used in the screening analysis. The HOTSPOT 8.0 and ISCST3 models were used in the detailed analysis in order to provide output data in a form more readily usable for the health risk analysis. Additional information on the following chemicals was referred to the health and ecological risk assessment process for the *1999 SWEIS*:

- Depleted uranium, beryllium, and lead from TA-15;
- Depleted uranium, beryllium, and lead from TA-36;
- Beryllium and lead from TA-39; and
- Depleted uranium and lead from TA-14.

The health risk analysis calculated Hazard Indices for two of the three metals. A Hazard Index equal to or greater than 1 is considered consequential from a human toxicity standpoint. The Expanded Operations Alternative in the *1999 SWEIS* is comparable to the No Action Alternative in this SWEIS. For the Expanded Operations Alternative, the worst-case Hazard Index for lead did not exceed 0.000015, and, for depleted uranium, the worst-case Hazard Index did not exceed 0.000065. Beryllium has no established EPA reference dose from which to calculate the Hazard Index. However it was evaluated as a carcinogen. The estimate of excess latent cancer fatalities for beryllium under the Expanded Operations Alternative in the *1999 SWEIS* was 1 chance in 2.7 million (3.6×10^{-7}) per year (DOE 1999).

B.3.3 Other Pollutants – Methodology for Combined Impacts Analyses

The following analyses were conducted for the *1999 SWEIS* to ensure that the combined effects from the releases of all of the chemicals from all the TAs would not exceed the guideline values.

Noncarcinogens

An analysis of potential short-term impacts at a TA's fence line receptor location showed that the 8-hour impacts from the releases of that TA were greater (more than two orders of magnitude) than the impacts from the releases of a nearby TA. This is because the TAs are relatively far apart compared to the distances between the emission sources of a TA and its fence line receptors. Therefore, it is unlikely that the additive short-term impacts of noncarcinogenic pollutants at the fence line receptors of a TA would be significantly different from the maximum concentrations previously estimated for that TA.

An analysis of annual potential impacts at sensitive receptor locations showed that these impacts were significantly less (less than two orders of magnitude) relative to the appropriate guideline values than the corresponding short-term impacts at the fence line receptors. Therefore, it would be unlikely that the additive annual impacts of the noncarcinogenic pollutants at the sensitive receptor locations would be significant.

Carcinogens

Two different versions of additive impacts for carcinogens were presented. Both versions considered impacts at sensitive receptor locations based on annual ambient concentrations of pollutants. Short-term additive impacts for carcinogens at fence line receptor locations were not considered (for the same reasons as for noncarcinogens). However, long-term impacts at sensitive receptor locations were considered because EPA considers in their standard setting process that risk from carcinogens can be additive for all carcinogenic chemicals.

The first version considered whether emissions of the same chemical from all TAs (whether or not it was actually used at that TA), at the screening level emission value rate (whether or not that maximum rate was actually projected at that TA), would exceed the total guideline risk value of 1×10^{-6}. The risk due to exposure at the maximum concentration over a lifetime for any receptor for each of the TAs was added to the separately calculated maximum concentration for any receptor for each of the other TAs, regardless of whether the same receptor was indicated.

The second version modeled simultaneous emissions of the same chemical at actual projected rates for each of the TAs, and recorded the maximum concentration at any receptor location. The risk due to exposure at that concentration over a lifetime was then added to the risks calculated in a similar fashion for each of the other chemicals. Risks were added regardless of whether the same receptor was involved. That total risk was also compared to the guideline risk value of 1×10^{-6} of any excess cancer from a lifetime of exposure.

B.3.4 Other Pollutants – Results of Combined Impact Analysis

Releases of Each Carcinogenic Pollutant from All TAs

The estimated combined cancer risk associated with releases of each of these pollutants from all TAs was 1.23 in ten million (1.23×10^{-7}), which was below the guideline value of one in a million (1.0×10^{-6}). As such, no potentially significant air quality impacts were estimated.

Releases of All Carcinogenic Pollutants from All TAs

Results of this analysis indicated that the potential combined incremental cancer risk associated with releases of all carcinogenic pollutants from all TAs would be slightly above the guideline value of one in a million (1.0×10^{-6}).

The major contributors to the estimated combined cancer risk values were chloroform, formaldehyde, and trichloroethylene from the Bioscience Facilities at TA-43, and multiple sources for methylene chloride. Of these, the relative contribution of chloroform emissions alone to the combined cancer risk value was more than 87 percent. The impacts of TA-43 emissions were due to a combination of relatively high emission rates, close proximity between receptors and sources, and the elevation of the receptors. A more detailed analysis that considered the impact at each specific receptor location was conducted. This more refined analysis estimated the combined cancer risk at each of the 180 sensitive receptor locations. The health risk analysis concluded that the combined cancer risk at the two receptor locations at the Los Alamos Medical Center was 0.73 to 0.74 in a million (7.3 to 7.4×10^{-7}). This value was below the guideline value for human health consequences from carcinogenic air emissions (DOE 1999).

B.4 References

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