5.5.7 Air Quality

The implementation of the Reduced Operations Alternative would result in air quality impacts that would be less than or equal to those estimated for the No Action Alternative (see Section 5.3.7). Section 5.5.7.1 describes nonradiological air quality impacts under the Reduced Operations Alternative, and Section 5.5.7.2 describes radiological impacts.

5.5.7.1 Nonradiological Air Quality

The Reduced Operations Alternative reflects minimum levels of activity required to maintain a facility s assigned capability. In some facilities, this alternative includes activity levels that would represent an increase over the base period activity levels (typically 1991 through 1995). In these cases, the activity levels would be those that, during the baseline period, have not been exercised sufficiently to maintain capability or to satisfy assigned theoretical or experimental research and development product requirements of the DOE.

Criteria Pollutants

The criteria pollutants generated under the Reduced Operations Alternative would be less than or equal to those described for the No Action Alternative. The sources of criteria pollutants would include the steam plant, electric power generator plant, boiler and emergency generator in Building 701, and the 600-kw-capacity generator in Building 870b. The criteria pollutant sources represent SNL/NM infrastructure and are not influenced by mission-specific activity levels. These sources would operate at levels comparable to those projected for the No Action Alternative. Table 5.3.7 1 presents the No Action Alternative criteria pollutant concentrations. Although this alternative reflects the minimum activity levels required to maintain a facility s assigned capability, the requirement for heat and emergency electric power would be likely to remain at the No Action Alternative level.

Mobile Sources

Motor vehicle emissions under the Reduced Operations Alternative would include carbon monoxide emissions from decreased commuter traffic. The estimated commuter traffic would be 97 percent of that under the No Action Alternative, or 13,175 commuter vehicles and 582 on-base vehicles. The carbon monoxide emission factor is determined by the EPA mobile source emission factor model *MOBILE5a*, projected to 2005, or 28.5 g per mi (SNL 1996c). Projected carbon monoxide emissions for SNL/NM under the Reduced Operations Alternative, based on the aforementioned assumptions and modeled emission factor, would be 3,385 tons per year, which is 702 tons per year less than the 1996 baseline. Projected carbon monoxide emissions for Bernalillo county for 2005 would be 206 tons per day, or 75,190 tons per year (AEHD 1998). The contribution of carbon monoxide emissions from vehicles commuting to and from SNL/NM and SNL/NM-operated on-base vehicles in 2005 would be 4.5 percent of the total county highway mobile sources carbon monoxide emissions. These estimates represent the Reduced Operations Alternative contribution of carbon monoxide emissions from mobile sources from SNL/NM.

Total carbon monoxide emissions will, therefore, also be less than those presumed for the No Action Alternative; and similarly, the DOE has concluded that no conformity determination is required for the Reduced Operations Alternative.

Lurance Canyon Burn Site

Lurance Canyon Burn Site emissions criteria and chemical pollutants are bounded by the No Action Alternative emissions. Operations at the Lurance Canyon Burn Site would be at or below the level of operations presented for the No Action Alternative. Table 5.3.7 4 presents the criteria pollutant concentrations estimated at the KAFB site boundary for the No Action Alternative level of activity, representing a test using 1,000 gal of JP-8 fuel. For each of the criteria pollutants (carbon monoxide, nitrogen dioxide, PM_{10}, and sulfur dioxide), for each of the averaging times, the modeled concentrations would be less than 5 percent of the applicable national and New Mexico ambient air quality standards. None of the chemical pollutants from tests performed at the facility would result in modeled concentrations above the OEL/100 guideline used to screen the chemical emissions for further analysis. Tests conducted at the Lurance Canyon Burn Site under the Reduced Operations Alternative would result in criteria and chemical pollutant concentrations less than or equal to those under the No Action Alternative.

Chemical Pollutants (Noncarcinogenic and Carcinogenic)

The estimated chemical usage under the Reduced Operations Alternative would be less than that under the No Action Alternative, resulting in concentrations less than or equal to those presented in Table 5.3.7 6. The usage of chemicals is based on mission activity levels,

which for the Reduced Operations Alternative would be less than those under the No Action Alternative level of activity. The estimates of chemical usage for the Reduced Operations Alternative for 5 of the 12 major chemical users range from a factor of 1.0 to 0.2 times the chemical usage for the base year 1996, and less than under the No Action Alternative usage for each facility.

5.5.7.2 Radiological Air Quality

The SWEIS analysis reviewed the radiological emissions from all SNL/NM facilities. Section 4.9.2 identifies 17 SNL/NM facilities as producing radiological emissions. Based on historic SNL/NM radionuclide emissions data, NESHAP compliance reports, and the FSID (SNL/NM 1998ee), 10 of the 17 SNL/NM facilities were modeled for radiological impacts (Table 5.5.7 1). The ACRR would be operated under one of two configurations: medical isotope production (primarily molybdenum-99 production) or DP. However, for the purpose of conservative analysis, the ACRR was evaluated under simultaneous operation of both configurations. For analysis purposes, based on the review of historical dose evaluations, other facilities that would not contribute more than 0.01 mrem/yr (0.1 percent of the NESHAP limit) to the MEI were screened from further consideration in the SWEIS. The modeled releases to the environment would result in a calculated dose to the MEI and the population within 50 mi of TA-V. TA-V was selected as a center for the population within a 50-mi radius, because the majority of radiological emissions would be from TA-V, specifically the HCF, and TA-V is historically addressed for annual SNL/NM NESHAP compliance.

The *CAP88-PC* computer model (DOE 1997e) was used to calculate the doses. Details on the *CAP88-PC* model, radionuclide emissions, model and source parameters, exposures, meteorological data, and population data are presented in Appendix D. Figure 5.3.7 3 shows the locations of the 10 facilities modeled in the SWEIS. Table 5.5.7 1 presents the estimated radiological emissions from the 10 SNL/NM facilities under the Reduced Operations Alternative. The radiological emissions from each facility were estimated based on SNL/NM planned operations and tests projected into the future. Detailed information is available in the FSID (SNL/NM 1998ee). The ACRR and HCF emissions for base year 1996 are different due to the refurbishing operations to change over to medical isotope production configuration. The SPR emissions were estimated to be higher than emissions during the base year. This is due to instituting NESHAP requirements for confirmatory measurements of radiological air emissions where measured emission factors were determined for both the SPR and the ACRR. These measured emission factors were found to be higher than the calculated emission factors. These measurements are source-specific to the SPR and ACRR and would not affect the calculations or measurements for other facilities.

Because the general public and USAF personnel have access to SNL/NM, 14 core receptor locations and 2 offsite receptor locations of public concern were considered for dose impact evaluations (see Appendix D.2). Based on NESHAP reports, 16 onsite and 6 offsite additional receptor locations were also evaluated. A total of 38 receptor locations were evaluated for dose impacts. The core receptor locations include schools, hospitals, a museum, and clubs, and were considered for analysis because of potential impacts to children, the sick, and the elderly. The 32 modeled onsite and core receptor locations are shown in Figure 5.3.7 4.

The dose to an individual at each receptor and to the population within 50 mi from the radionuclide emissions from each source was calculated using the *CAP88-PC* model. The receptor receiving the maximum dose was identified as the MEI. The model-calculated dose contributions, including external, inhalation, and ingestion from each of the 10 sources, calculated individually at each receptor location, were combined to determine the overall SNL/NM site-wide normal operations dose to the MEI. Under the Reduced Operations Alternative, the maximum EDE to the MEI from all exposure pathways from all modeled sources was calculated to be 0.020 mrem per year. This MEI having the highest combined dose would be located at the Eubank gate area, offsite of SNL/NM. The EDE contributions from these 10 sources to this combined MEI dose are presented in Table 5.5.7 2. Table 5.5.7 3 presents the doses to 38 onsite, core, and offsite receptor locations. The potential doses for these additional locations would be much lower than the highest combined MEI dose. Under the Reduced Operations Alternative, the total collective dose to the population of 732,523 within a 50-mi radius of TA-V was calculated to be 0.80 person-rem per year. The contributions from all of the 10 modeled sources to the overall SNL/NM site-wide normal operations collective dose to the population within 50 mi are also presented in Table 5.5.7 2. The average dose to an individual in the population within 50 mi of TA-V (collective dose divided by the total population) would be 1.1×10^{-3} mrem per year.

Table 5.5.7 1. Radiological Emissions from Sources at SNL/NM Under the Reduced Operations Alternative

FACILITY NAME	TECHNICAL AREA	RADIONUCLIDE[a]	RELEASE (Ci/year)
Annular Core Research Reactor (ACRR, medical isotopes production configuration), Building 6588	V	Argon-41 Tritium	0.24 0.24
Explosive Components Facility (ECF), Building 905	II	Tritium	2.0×10^{-3}
High-Energy Radiation Megavolt Electron Source (HERMES III), Building 970	IV	Nitrogen-13 Oxygen-15	1.0×10^{-4} 1.0×10^{-5}
Hot Cell Facility (HCF), Building 6580	V	Iodine-131 Iodine-132 Iodine-133 Iodine-134 Iodine-135 Krypton-83m Krypton-85 Krypton-85m Krypton-87 Krypton-88 Xenon-131m Xenon-133 Xenon-133m Xenon-135 Xenon-135m	0.117 0.3 0.54 0.022 0.33 19.8 0.019 29.0 5.7 48.0 0.18 216.0 10.2 207.0 36.0
Mixed Waste Landfill (MWL)	III	Tritium	0.29
Neutron Generator Facility (NGF), Building 870	I	Tritium	156
Radioactive and Mixed Waste Management Facility (RMWMF), Building 6920	III	Tritium	2.203[b]
Radiographic Integrated Test Stand (RITS), Building 970	IV	Nitrogen-13	0.02
Sandia Pulsed Reactor (SPR), Building 6590	V	Argon-41	2.85

Source: SNL/NM 1998a
Ci/year: curies per year
DP: Defense Programs
SNL/CA: Sandia National Laboratories/California

[a] Radiological emissions are projections based on planned activities, projects, and programs. Radionuclide releases are not the same as those presented in Chapter 4.
[b] Because SNL/CA tritium-contaminated oil levels handled at RMWMF during the base year were abnormally high, this maximum level of emissions was assumed to be released in any year and, therefore, was constant for all alternatives.

Table 5.5.7 2. Summary of Dose Estimates to SNL/NM Public Under the Reduced Operations Alternative from Radioactive Air Emissions

SOURCE	ANNUAL MEI DOSE, EDE (mrem)	ANNUAL POPULATION DOSE, person-rem
Annular Core Research Reactor (ACRR, medical isotopes production configuration)	7.1×10^{-6}	1.2×10^{-3}
Explosive Components Facility (ECF)	1.9×10^{-8}	4.19×10^{-7}
High-Energy Radiation Megavolt Electron Source (HERMES III)	2.2×10^{-9}	1.7×10^{-8}
Hot Cell Facility (HCF)	2.8×10^{-3}	0.461
Mixed Waste Landfill (MWL)	4.9×10^{-6}	6.16×10^{-4}
Neutron Generator Facility (NGF)	1.7×10^{-2}	0.322
Radioactive and Mixed Waste Management Facility (RMWMF)	1.9×10^{-5}	3.24×10^{-3}
Radiographic Integrated Test Stand (RITS)	4.5×10^{-7}	3.4×10^{-6}
Sandia Pulsed Reactor (SPR)	3.1×10^{-5}	7.6×10^{-3}
TOTAL MEI DOSE	**2.0×10^{-2}**	-
50-MILE POPULATION COLLECTIVE DOSE	-	**0.80**

Sources: DOE 1997e, SNL/NM 1998a
DP: Defense Programs
EDE: effective dose equivalent
MEI: maximally exposed individual
mrem: millirem

Note: Although the Annular Core Research Reactor is expected to be operated under DP configuration intermittently, for this analysis, it was assumed to be operated continuously in conjunction with molybdenum-99 production. Its contribution to the total dose would not be appreciable.

The calculated total MEI dose of 0.020 mrem per year (see Table 5.5.7 2) would be much lower than the regulatory limit of 10 mrem per year to an MEI from SNL/NM site-wide total airborne releases of radiological materials (40 CFR Part 61). This dose would be small compared to an individual background radiation dose of 360 mrem per year (see Figure 4.10 2). The calculated collective dose from SNL/NM operations to the population within 50 mi of TA-V would be 0.80 person-rem per year, which would be much lower than the collective dose from background radiation. Based on this individual radiation dose, the population within 50 mi of TA-V would receive 263,700 person-rem per year.

5.5.8 Human Health and Worker Safety

The implementation of the Reduced Operations Alternative would result in human health and worker safety impacts for normal and accident conditions, as detailed in the following sections.

5.5.8.1 Normal Operations

This section provides information on public health and worker health and safety under the Reduced Operations Alternative. It assesses the potential human health effects associated with routine releases of radioactive and nonradioactive hazardous material from normal SNL/NM operations. For detailed discussions of analytical methods and results along with terminology, definitions, and descriptions, see Appendix E.

Health risk analyses are presented for potential exposures at specific receptor locations and for the potential maximum exposures to radiation and chemical air releases. For a description of receptor locations, exposure scenarios, and environmental pathways selected for assessing human health impacts, see Section 5.3.8.

Chemical Air Release Pathways

Under the Reduced Operations Alternative, chemical use would be less than the quantities anticipated under the No Action Alternative. Therefore, the exposure to

Table 5.5.7 3. Summary of Dose Estimates From Radioactive Air Emissions to 38 Onsite and Offsite Receptors Under the Reduced Operations Alternative

RECEPTOR	ANNUAL RECEPTOR DOSE, EDE (mrem)
ONSITE AND NEAR-SITE RECEPTORS	
Albuquerque International Sunport (Bldg. 1064)	3.6×10^{-3}
Albuquerque International Sunport (Bldg. 760)	5.4×10^{-3}
Building 20706	7.8×10^{-3}
Building 24499	7.5×10^{-3}
Child Development Center-East	5.1×10^{-3}
Child Development Center-West	2.6×10^{-3}
Civil Engineering Research Facility (Bldg. 5701)	1.4×10^{-3}
Coronado Club	5.7×10^{-3}
Coyote Canyon Control Center	1.4×10^{-3}
Golf Course Clubhouse	7.9×10^{-3}
Golf Course Maintenance Area	5.5×10^{-3}
Kirtland Elementary School	2.5×10^{-3}
KAFB Firestation #4 (Bldg. 9002)	1.9×10^{-3}
KAFB Landfill	5.0×10^{-3}
Kirtland Underground Munitions and Maintenance Storage Complex (KUMMSC)	1.6×10^{-2}
Loop Housing	8.4×10^{-3}
Lovelace Hospital	2.8×10^{-3}
Lovelace Respiratory Research Institute	1.4×10^{-3}
Manzano Offices (Fire Station)	3.8×10^{-3}
Maxwell Housing	2.2×10^{-3}
National Atomic Museum	9.0×10^{-3}
Pershing Park Housing	4.9×10^{-3}
Riding Stables	6.8×10^{-3}
Sandia Base Elementary	4.1×10^{-3}
Sandia Federal Credit Union	1.4×10^{-2}
Shandiin Day Care Center	6.3×10^{-3}
Technical Onsite Inspection Facility	6.8×10^{-3}
Veterans Affairs Medical Center	4.0×10^{-3}
Wherry Elementary School	4.5×10^{-3}

Table 5.5.7 3. Summary of Dose Estimates From Radioactive Air Emissions to 38 Onsite and Offsite Receptors Under the Reduced Operations Alternative (concluded)

RECEPTOR	ANNUAL RECEPTOR DOSE, EDE (mrem)
Zia Park Housing	5.8×10^{-3}
OFFSITE RECEPTORS	
Albuquerque City Offices	1.5×10^{-2}
East Resident	1.1×10^{-2}
Eubank Gate Area (Bldg. 8895)	2.0×10^{-2}
Four Hills Subdivision	1.0×10^{-2}
Isleta Gaming Palace	1.1×10^{-2}
Northeast Resident	1.2×10^{-2}
Seismic Center (USGS)	1.1×10^{-2}
Tijeras Arroyo (West)	1.5×10^{-2}

Sources: DOE 1997e, SNL/NM 1998a
EDE: effective dose equivalent
mrem: millirem
USGS: U.S. Geological Survey

receptors would also decrease. Potential exposure concentrations of chemicals under the Reduced Operations Alternative are estimated and shown in Appendix E, Table E.3 4. The chemical assessment process, described in Section 5.3.8 for chemical air release pathways, identified seven COCs under the Reduced Operations Alternative. Several of the COCs are common among the three facilities. These COCs are associated with SNL/NM operations in Buildings 878 (AMPL), 897 (IMRL), and 870 (NGF).

The health risk and corresponding potential for adverse health effects from airborne exposures to chemicals is a range of values. Several receptor locations, individual exposure scenarios, and a hypothetical worst-case exposure scenario were used to represent this range. Adult, child, residential, and visitor risk assessments were calculated. Table 5.5.8 1 lists the human health impacts from the estimated exposures to chemical air releases from SNL/NM facility operations. These potential health risks would be low and no adverse health effects would occur at these risk levels. Assessing the hypothetical worst-case exposure scenario for chemicals establishes the upper limit (bounding value) to health risk. Under the Reduced Operations Alternative, the upper bound value for health risk from noncarcinogenic chemicals would be HIs of less than 1; from carcinogenic chemicals, the ELCRs would be less than 10^{-6} (see Table E.6 5).

Radiation Air Release Pathways

Under the Reduced Operations Alternative, air releases of radionuclides would be lower than those projected under the No Action Alternative. Section 5.5.7 identifies these lower doses to the MEI and the population within the ROI. Radiological health effects would also be lower under the Reduced Operations Alternative. The greatest dose resulting from the SNL/NM yearly air release of radionuclides would occur offsite at the Eubank gate and would increase the lifetime risk of fatal cancer to the MEI by 1.0×10^{-8}. This means that the likelihood of fatal cancer to the MEI from a 1-year dose from SNL/NM normal operations would be less than 1 chance in 100 M. The annual collective dose to the population due to these releases would increase the annual number of fatal cancers in the entire population within the ROI by 4.0×10^{-4}. Therefore, no additional LCFs would be likely to occur in the ROI due to SNL/NM radiological air releases.

To estimate a range in the potential for human health effects, radiation doses at specific receptor locations such as schools, hospitals, and daycare centers in the SNL/NM vicinity were calculated. These doses are identified in Table 5.5.7 3. Radiological health risks associated with the doses to receptors at several of these locations are presented in Table 5.5.8 2. The risk from radiation at these receptor locations would be much lower than the highest risk determined for the MEI receptor offsite at the Eubank gate.

Table 5.5.8 1. Human Health Impacts in the Vicinity of SNL/NM from Chemical Air Emissions Under the Reduced Operations Alternative

RECEPTOR LOCATIONS	RECEPTOR	TOTAL HAZARD INDEX RME/AEI	TOTAL EXCESS LIFETIME CANCER RISK RME/AEI
RESIDENTIAL SCENARIOS			
Four Hills Subdivision[a]	Adult	<0.01/<0.01	$1.8x10^{-11}/1.1x10^{-11}$
	Child	<0.01/<0.01	$7.4x10^{-12}/7.4x10^{-12}$
Isleta Gaming Palace	Adult	<0.01/<0.01	$1.7x10^{-10}/1.7x10^{-12}$
	Child	<0.01/<0.01	$1.2x10^{-10}/1.3x10^{-12}$
KAFB Housing (Zia Park Housing)	Adult	<0.01/<0.01	$3.6x10^{-10}/3.8x10^{-12}$
	Child	<0.01/<0.01	$2.5x10^{-10}/2.9x10^{-12}$
VISITOR SCENARIOS			
Child Development Center-East	Child	<0.01/<0.01	$3.4x10^{-10}/3.9x10^{-12}$
Child Development Center-West	Child	<0.01/<0.01	$6.7x10^{-11}/7.6x10^{-13}$
Coronado Club	Adult	<0.01/<0.01	$5.9x10^{-10}/6.0x10^{-12}$
	Child	<0.01/<0.01	$4.1x10^{-10}/4.6x10^{-12}$
Golf Course (Clubhouse)	Adult	<0.01/<0.01	$1.9x10^{-11}/1.9x10^{-12}$
Kirtland Elementary School	Child	<0.01/<0.01	$5.5x10^{-11}/6.2x10^{-13}$
Kirtland Underground Munitions and Maintenance Storage Complex (KUMMSC)[b]	Adult	<0.01/<0.01	$1.8X10^{-10}/1.8x10^{-12}$
Lovelace Hospital	Adult	<0.01/<0.01	$1.6x10^{-10}/1.7x10^{-12}$
	Child	<0.01/<0.01	$1.1x10^{-10}/1.3x10^{-12}$
National Atomic Museum	Adult	<0.01/<0.01	$9.9x10^{-10}/1.0x10^{-11}$
	Child	<0.01/<0.01	$6.9x10^{-10}/7.8x10^{-12}$
Riding Stables	Adult	<0.01/<0.01	$9.7x10^{-11}/1.0x10^{-12}$
Sandia Base Elementary School	Child	<0.01/<0.01	$4.7x10^{-10}/5.3x10^{-12}$
Shandiin Day Care Center	Child	<0.01/<0.01	$3.7x10^{-10}/4.2x10^{-12}$
Veterans Affairs Medical Center	Adult	<0.01/<0.01	$1.6x10^{-10}/1.6x10^{-12}$
Wherry Elementary School	Child	<0.01/<0.01	$2.5x10^{-10}/2.8x10^{-12}$

Source: SmartRISK 1996
AEI: average exposed individual
RME: reasonable maximum exposed
[a] Four Hills Subdivision receptor location impacts were based on Lurance Canyon Burn Site open burning air emissions, not SNL/NM building air emissions.
[b] This receptor location was analyzed using a worker scenario, as discussed in Appendix E.5.
Note: See Section 5.3.8 for a discussion of selection of receptor locations.

Table 5.5.8 2. Human Health Impacts in the SNL/NM Vicinity from Radiological Air Emissions Under the Reduced Operations Alternative

RECEPTOR LOCATIONS	LIFETIME RISK OF FATAL CANCER FROM A 1-YEAR DOSE
Child Development Center-East	2.6×10^{-9}
Child Development Center-West	1.3×10^{-9}
Coronado Club	2.9×10^{-9}
Four Hills Subdivision	5.0×10^{-9}
Golf Course (Clubhouse)	4.0×10^{-9}
Kirtland Elementary School	1.3×10^{-9}
KAFB Housing (Zia Park Housing)	2.9×10^{-9}
Kirtland Underground Munitions & Maintenance Storage Complex (KUMMSC)[a]	8.0×10^{-9}
Lovelace Hospital	1.4×10^{-9}
National Atomic Museum	4.5×10^{-9}
Riding Stables	3.4×10^{-9}
Sandia Base Elementary School	2.1×10^{-9}
Shandiin Day Care Center	3.2×10^{-9}
Isleta Gaming Palace	5.5×10^{-9}
Veterans Affairs Medical Center	2.0×10^{-9}
Wherry Elementary School	2.3×10^{-9}

Sources: DOE 1997e, SNL/NM 1998a
MEI: maximally exposed individual

[a] The radiological MEI location for normal operations.
Note: Calculations were completed using *CAP88-PC*.

Receptors in the SNL/NM vicinity would also have the potential to be exposed to radionuclides by way of the indirect air pathway of ingesting food that contains radionuclides. *CAP88-PC* integrates doses from this pathway in the collective dose estimation for the population within the ROI, but does not integrate it to the dose evaluation for the potential onsite MEI receptor. The estimated percentage of the population dose from ingesting potentially contaminated food would be 18 percent (0.101 person-rem of the 0.80 person-rem collective population dose) which means it would also account for approximately 13 percent of the health risk value. When the same percent contribution is assumed, the potential onsite MEI s lifetime risk of fatal cancer from a 1-year dose would be increased by 1.0×10^{-9} (18 percent) under the Reduced Operations Alternative. Overall, the cancer risk to the MEI from radiation would remain less than 1 chance in 100 M.

Nonfatal Cancers and Genetic Disorders

Radiation exposures can cause nonfatal cancers and genetic disorders. The NCRP has adopted risk estimators developed by the ICRP for the public assessing these health effects from radiation (ICRP 1991). Under the Reduced Operations Alternative, SNL/NM s maximum annual dose to the MEI would increase the lifetime risk of nonfatal cancers and genetic disorders by 1.6×10^{-9} and 2.1×10^{-9}, respectively, which would be less than 1 chance in 475 M. The SNL/NM annual collective dose to the ROI population would increase the number of nonfatal cancers and genetic disorders by 8.0×10^{-5} and 1.0×10^{-4}, respectively. This means that no additional nonfatal cancers or genetic disorders would be likely to occur in the ROI population from SNL/NM radiological air releases.

Transportation

The potential human health risks and accident fatalities for transporting various radiological materials for SNL/NM operations are discussed in Section 5.5.9. The radiological dose to the population along the route within the ROI was estimated by assuming 10 percent of the total travel distance would occur within the ROI. Therefore, 10 percent of the total radiological dose (off link and on link) calculated for all radiological materials transport would be considered as an additional human health impact to the population along the route within the ROI (see Appendix G). This percentage of the annual collective dose to the population along the route due to transportation activities would increase the ROI number of LCFs by 2.0×10^{-4}. Adding this to the number of LCFs associated with the annual collective population dose from routine air releases would change the risk to 6.0×10^{-4}. In other words, no additional LCFs in the ROI population would likely occur from SNL/NM radiological material transportation activities.

Composite Cancer Risk

The increase in lifetime cancer risk due to SNL/NM normal operations is associated with both the small amounts of radionuclides and small amounts of carcinogenic chemicals emitted into the air. The composite cancer risk associated with the Reduced Operations Alternative would be lower than that calculated for either the No Action or Expanded Operations Alternatives. Under those alternatives, the composite cancer risk values calculated would all be within the EPA risk range established for the protection of human health of 10^{-6} to 10^{-4} (40 CFR Part 300). This would be a risk of less than 1 chance in 1 M. The SNL/NM potential contribution to an individual s lifetime cancer risk is very low considering that in the U.S., men have a 1-in-2 lifetime risk and women have a 1-in-3 lifetime risk of developing cancer. One out of every four deaths in the U.S. is from cancer (ACS 1997).

Worker Health and Safety

Under the Reduced Operations Alternative, the worker safety assessment shows impacts would be less than those under the No Action Alternative. Worker health consequences would be the same as those presented in Section 4.10 for the period 1992 through 1996. Tables and figures in Section 4.10 show that for the entire SNL/NM worker population, zero fatalities per year, an average of 47 mrem per year radiation dose (TEDE) to radiation-badged workers, approximately 287 nonfatal injuries and illnesses per year, and 1 or 2 confirmed chemical exposures occurred annually from 1992 through 1996.

Routine air emissions evaluated for potential exposures to specific receptors in the SNL/NM vicinity have the potential to impact noninvolved workers at SNL/NM. A noninvolved worker is not exposed to chemical or radiological work related activities but is potentially exposed because they work at SNL/NM in the vicinity of facility releases. Potential exposures to airborne radiation were identified using the KUMMSC receptor location. Potential exposures to airborne chemicals were identified using a receptor location at the center of TA-I, near SNL/NM s chemical facility sources. Based on an exposure scenario for a worker, health risks from chemicals to the noninvolved worker would be below a HI of 1 and less than 10^{-6} for an ELCR (see Appendix E, Table E.6 5).

The average annual individual worker dose, annual maximum worker dose, and annual workforce collective dose for the radiation workers under the Reduced Operations Alternative are identified in Table 5.5.8 3.

Table 5.5.8 3. Radiation Doses (TEDE)[a] and Health Impacts to Workers from SNL/NM Operations Under the Reduced Operations Alternative

RADIATION WORKER DOSE RATES	RADIATION DOSE	RISK OF CANCER FATALITY FROM A 1-YEAR DOSE
Annual Average Individual Worker Dose	47[b] (mrem/yr)	1.9×10^{-5}
Annual Maximum Worker Dose	845[b] (mrem/yr)	3.4×10^{-4}
RADIATION WORKER DOSE RATES	**RADIATION DOSE**	**NUMBER OF LCFs**
Annual Workforce Collective Dose	10 (person-rem/year)	4.0×10^{-3}

Source: SNL/NM 1997k
mrem/yr: millirems per year
TEDE: total effective dose equivalent
[a] Average measured TEDE means the collective TEDE divided by the number of individuals with a measured dose greater than 10 mrem.
[b] Annual average individual and annual maximum worker doses would be expected to remain consistent with the base year, 1996 (see Section 4.10).
Note: Because not all badged workers are radiation workers, radiation worker s means those badges with greater than 10 mrem above background measurements used in the calculations.

Health risks from the annual average individual and annual maximum worker doses would be expected to remain constant for all alternatives (based on the REMS database dose information for 1996). The annual collective dose to the radiation worker population at SNL/NM would be lower than under the No Action Alternative. This would equate to a lower risk of fatal cancer to the radiation worker population under the Reduced Operations Alternative.

Nonfatal Cancers and Genetic Disorders

The SNL/NM maximum annual dose to the radiation worker population would increase the number of nonfatal cancers and genetic disorders by 8.0×10^{-4}, based on the ICRP dose-to-risk conversion factor for workers of 80 health effects per 1 M person-rem for both effects. In other words, no additional nonfatal cancers or genetic disorders would be likely to occur in the SNL/NM radiation worker population due to operations. The annual average and annual maximum workers dose and associated potential health impacts would remain consistent with 1996 values.

Nonionizing Radiation

Routine high-voltage impacts to SNL/NM and the public would not occur.

5.5.8.2 Accidents

This section describes, under the Reduced Operations Alternative, the potential impacts to workers and the public for accidents involving the release of radioactive and/or chemical materials, explosions, and other hazards. Additional details on the accident analyses and impacts are presented in Appendix F.

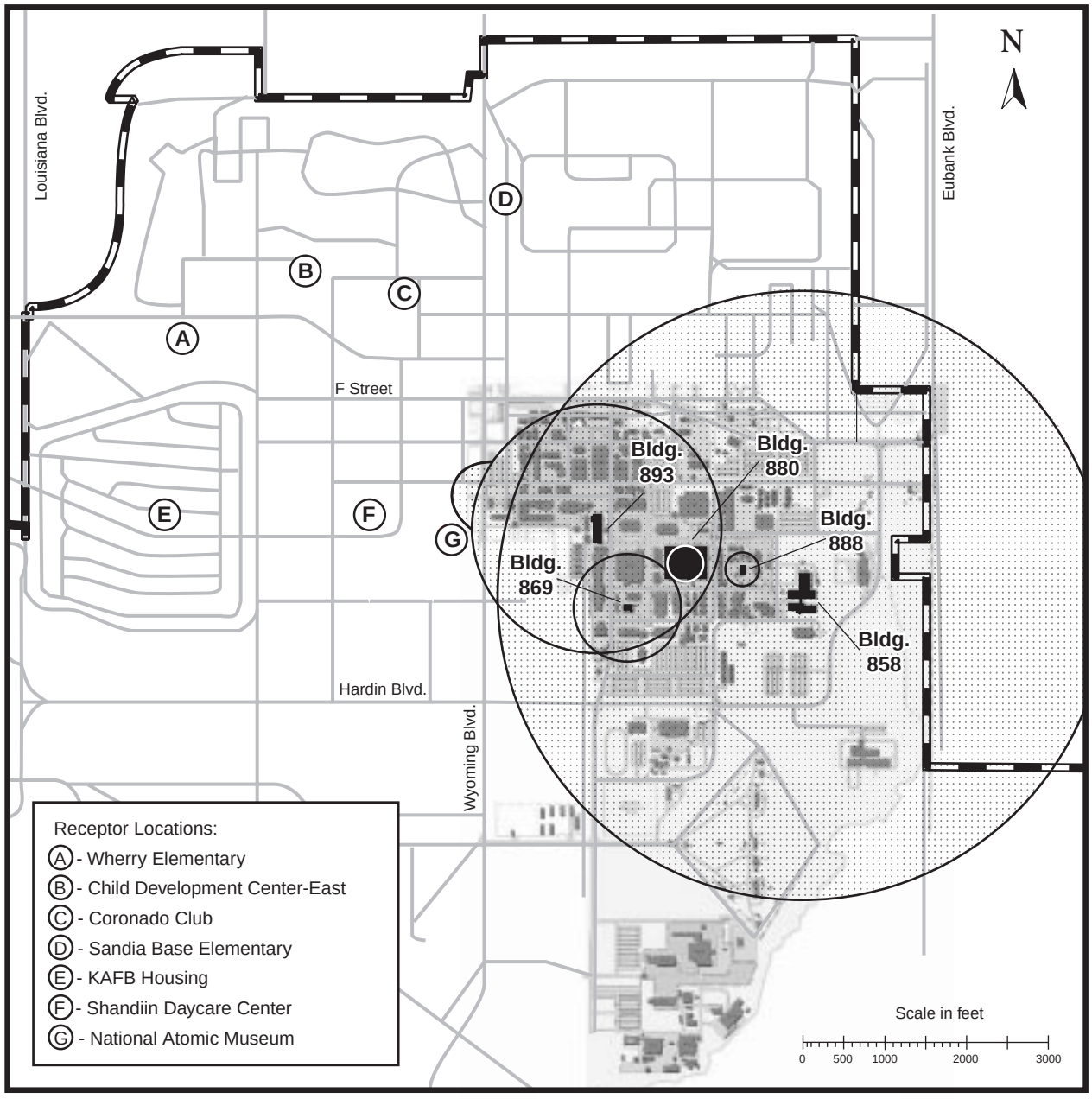
Site-Wide Earthquake

An earthquake in the Albuquerque, New Mexico, area has the potential for human injury and building damage throughout the local region. Due to differences in structural design, SNL/NM buildings and structures vary in their capabilities to withstand earthquake forces. Any magnitude earthquake has the potential to cause injury to workers in and around buildings and damage to structures from the physical forces and effects of the earthquake. Additional injury to workers and the public would be possible from explosions and from exposure to chemical and radioactive materials that could be released from buildings and storage containers. Facilities in TA-I are the predominant source of chemical materials that could be released during an earthquake. Facilities in TA-V are the predominant source of radioactive materials that could be released. The ECF in TA-II is the predominant source of explosive materials. Lesser quantities of radioactive materials in TAs-I and -II could also be released and cause exposures to workers and the public.

In the event of an earthquake (UBC, 0.17 *g*), various buildings in TA-I could be affected and various chemicals could be released (see Appendix F, Table F.7 7). Larger magnitude earthquakes could cause more serious impacts. The shape and direction of the chemical plumes would depend upon local meteorological conditions and physical structures. All potential plumes and concentration levels exceeding ERPG-2 are shown as shaded areas in Figure 5.5.8 1. Some of the potentially affected area extends offsite. Within the shaded area, out to a distance of 3,800 ft, there could be as many as 5,300 persons at risk of exposure depending on the time of day and plume shape and direction. However, in the event of a release of chemicals, the plumes would cause exposures in excess of ERPG-2 to only a portion of the 5,300 persons at risk. Mitigation features designed to limit the release of chemicals from storage containers, rooms, and buildings would limit or reduce plume size, concentration levels, and exposures. Emergency procedures and sheltering would also minimize exposures to workers and the public.

Nuclear facilities in TAs-I, -II, and -V could also be damaged during an earthquake. The frequency of an earthquake (0.17 *g*) that could cause the release of radioactive materials from TAs-I and -II facilities is 1.0×10^{-3} per year, or 1 chance in 1,000 per year. The frequency of an earthquake (0.22 *g*) that could cause the release of radioactive materials from TAs-I (NG-1), -II (ECF-1), and -V facilities is 7.0×10^{-4} per year, or 1 chance in 1,500 per year. The consequences are shown in Table 5.5.8 4. If a 0.22-*g* earthquake was to occur, there would be an estimated 6.4×10^{-2} additional LCFs in the total population within 50 mi of the site, associated with the HC-1 accident scenario. The MEI and noninvolved worker would have an increased probability of LCF of 6.9×10^{-6} and 3.0×10^{-2}, respectively, associated with the HC-1 accident scenario. The risks for these receptors can be estimated by multiplying these consequence values by the probability (frequency) of earthquake. If a stronger earthquake was to occur, larger releases of radioactive materials would be possible and could cause greater impacts.

A severe earthquake could also cause damage to other SNL/NM facilities and result in environmental impacts.



Source: Original
Note: see Appendix F, Figure F.7 1

Figure 5.5.8 1. Area Above ERPG-2 Levels from a Site-Wide Earthquake Under the Reduced Operations Alternative

The encircled areas represent locations where approximately 5,300 people are at risk of exposure to chemical concentrations above ERPG-2.

Table 5.5.8 4. Site-Wide Earthquake Radiological Impacts Under the Reduced Operations Alternative

ACCIDENT ID[a]	FREQUENCY (per year)	ADDITIONAL LATENT CANCER FATALITIES WITHIN 50-MILE POPULATION	INCREASED PROBABILITY OF LATENT CANCER FATALITY	
			MAXIMALLY EXPOSED INDIVIDUAL[b]	NONINVOLVED WORKER[c]
TECHNICAL AREA -I				
NG-1	7.0×10^{-4}	5.1×10^{-5}	1.4×10^{-9}	3.2×10^{-6}
TECHNICAL AREA -II				
ECF-1	7.0×10^{-4}	3.0×10^{-6}	1.5×10^{-10}	1.9×10^{-7}
TECHNICAL AREA -V				
AM-2	7.0×10^{-4}	2.0×10^{-3}	2.4×10^{-7}	7.4×10^{-5}
HC-1	7.0×10^{-4}	6.4×10^{-2}	6.9×10^{-6}	3.0×10^{-2}
SP-1	7.0×10^{-4}	9.2×10^{-3}	5.8×10^{-7}	2.7×10^{-4}

Source: Original (See also Appendix F, Tables F.7-4 and F.7-5)

[a] Facility Accident Descriptors:
Neutron Generator Facility: NG-1
Explosive Component Facility: ECF-1
Annular Core Research Reactor-Medical Isotope Production: AM-2
Hot Cell Facility: HC-1
Sandia Pulsed Reactor: SP-1

[b] The maximally exposed individual would be located at the Golf Course and the consequences can be added.

[c] Because the noninvolved worker is located 100 meters from the release point, the location varies relative to each technical area. Therefore, the consequences to the noninvolved worker can only be added for a given technical area.

For example, the large quantities of oil stored in external tanks and in accelerator buildings in TA-IV could potentially be spilled and cause impacts to the ecosystem and water resources. Underground natural gas lines could break and ignite causing brush and forest fires that could further damage facilities and persons in the vicinity. Hydrogen storage tanks in TA-I could be damaged, causing hydrogen combustion or explosion and potential injury to persons in the vicinity. Explosives in the ECF in TA-II and smaller quantities in other facilities could also be accidentally detonated during an earthquake with potential injury to persons in the vicinity. Occupants of all facilities would be at risk of injury as a result of the earthquake forces and building damage.

Facility Hazards

Some of the facilities at SNL/NM could contain occupational hazards with the potential to endanger the health and safety of involved workers near an accident. Some of these facilities also contain hazardous materials that, in case of an accident, could endanger the health and safety of people within the immediate vicinity and beyond. These people include noninvolved workers, members of the military assigned to KAFB, and a member of the public located within the KAFB boundary and offsite. Offsite consequences were determined to a 50-mi radius around the affected facility.

Radiological, chemical, and explosion accidents with the largest impacts to workers and the public have been analyzed, as discussed in the following sections. Potential accidents associated with other facility hazards such as lasers, electricity, X-rays, transformer oil, noise, shrapnel, pyrotechnics, and compressed gases could affect the health and safety of involved workers, but the impacts to noninvolved workers and the public for these other accidents would be lower than the impacts from radiological, chemical, and explosion accidents described in the SWEIS (Appendix F, Table F.6 3).

The DOE recognizes the potential adverse effects for workers, the public, and the environment caused by deterioration of SNL/NM equipment, structures, and facilities. However, the analysis of potential accidents discussed in this section assumes that the expected deterioration of equipment, structures, and facilities would not affect the occurrence, progression, and effects of accidents. The basis for this assumption is that the DOE safety analysis process, specified in DOE Orders and standards, would require periodic assessments of facility safety to ensure that operations are being performed within an approved safety envelop. The

process would also require an assessment of all unresolved safety questions that would result from any change in a facility or operation that could affect the operations authorization basis. Depending on the results of the assessment, modifications to the facility and/or operational procedures would be implemented to maintain operations within the authorization basis.

Explosion Accidents

Explosive materials are stored, handled, transported, and used at some SNL/NM facilities. Administrative controls and facility design would help prevent an explosion accident and limit the impacts to personnel, if an accident was to occur. The ECF, for example, contains large quantities of explosives for use in its testing programs. Hydrogen trailers are another large source of explosive material. There would be approximately five hydrogen trailers parked near facilities or routinely transported to facilities from remote locations.

The largest quantity of hydrogen with the highest potential for consequences to both SNL/NM workers and facilities is a set of horizontally mounted cylinders, with a storage capacity of approximately 90,000 SCF, located approximately east of the CSRL, Building 893, in TA-I. An explosion at the hydrogen storage cylinders near the CSRL was selected for detailed analysis to estimate the bounding impacts of an explosion accident. If a hydrogen explosion was to occur in this relatively populated area of TA-I, individuals in the area could be injured and nearby property could be damaged. Involved workers within 61 ft of an explosion could be seriously injured and would have a 50 percent chance of survival. Involved workers out to a distance of 126 ft from the explosion could receive damage to their eardrums and lungs. The resulting overpressure from this explosion and impacts to personnel and property would diminish with distance, as shown in Table 5.5.8 5.

The actual number of persons in the vicinity of the accident depends upon many factors and the actual number of potential fatalities is uncertain. Factors include the time of day (start of work day, lunchtime, after hours), the actual location of the people (amount of shielding between the hydrogen tank and the person), and the actual spread of the pressure waves in a very complex arrangement of buildings, alleys, and walkways.

This bounding facility explosion was postulated to occur from an accidental uncontrolled release of hydrogen, stored in a tank outside the CSRL building, caused by human errors (such as mishandling activities) or equipment failures (such as a pipe joint failure) and the presence of an ignition source (such as a spark) near the location of release. Because multiple failures would have to occur for an uncontrolled release of hydrogen to lead to an explosion, this accident scenario would be extremely unlikely (that is, between $1x10^{-6}$ and $1x10^{-4}$ per year).

Table 5.5.8 5. Impacts of an Explosion Accident Under the Reduced Operations Alternative

DISTANCE TO RECEPTOR OR PROPERTY (ft)	PEAK REFLECTIVE PRESSURE (psi) (472 lbm TNT EQUIVALENT)	COMMENTS
25	650	Peak pressure
61	50	For involved workers, there would be a 50% survival rate for pressures in excess of 50 psi.
126	10	For involved workers, there would be a 50% rate of eardrum rupture for pressures in excess of 10 psi. Total destruction of buildings could be expected for pressures in excess of 10 psi.
370	2.0	Pressures in excess of 2 to 3 psi would cause concrete or cinder block walls to shatter.
657	1.0	Pressures in excess of 1 psi would cause a house to be demolished.

Source: DOE 1992b (See also Appendix F, Table F.4 1)
ft: feet
lbm: pound mass
psi: pounds per square inch
TNT: trinitrotoluene

The human organs most vulnerable to shock explosions are the ears and lungs because they contain air or other gases. The damage would be done at the gas-tissue interface, where flaking and tearing could occur. Both the ear and the lung responses would be dependent not only on the overpressure, but also on impulse and body orientation. The shorter the pulse width, the higher the pressure the body could tolerate. An overpressure of approximately 50 psi would result in a 50 percent fatality rate; approximately 10 psi would result in eardrum rupture. These overpressure estimates are based on a square pressure wave with a pulse duration greater than 10 msec, and their effects could vary depending on body orientation to the pressure wave.

Structural damage produced by airblasts would depend on the type of structural material. An overpressure on the order of 1 pound psi would case partial demolition of houses (rendering them uninhabitable). An overpressure of 2 to 3 psi would shatter unreinforced concrete or cinder block walls shattering; An overpressure of 10 psi would probably cause total destruction of buildings.

Radiological Accidents

The largest quantities of radioactive materials at risk for radiological accidents are located in TA-V. The Manzano Waste Storage Facilities, and TAs-I, -II, and -IV also contain radioactive material, but in smaller amounts. The nuclear facilities in TA-V include the ACRR, SPR, HCF and GIF. The NGIF is under construction in TA-V. The planned primary use of the ACRR is medical isotope production (primarily molybdenum-99). The HCF has been reconfigured for medical isotope production, and the accidents analyzed reflect this mode of operation. Accidents have also been analyzed for storage of radioactive materials in the HCF not associated with molybdenum-99 production.

The most serious radiological accident impacts associated with SNL/NM facilities under the Reduced Operations Alternative are shown in Table 5.5.8 6. The table lists a set of accidents and their consequences in terms of an increased probability of an LCF for an exposed individual and an increased number of LCFs for the offsite population. Other radiological accidents could also occur at these facilities, but their impacts would be within the envelope of the selected set of accidents.

The accident at a single facility with the highest consequences to the public would be a fire in Room 108 at the HCF in TA-V (HS-2). If this accident was to occur, there would be 7.9×10^{-2} additional LCFs in the offsite population within 50 mi of the site. There would be an increased probability of an LCF for an MEI and a noninvolved worker of 6.6×10^{-6} and 7.4×10^{-6}, respectively. The estimated frequency of occurrence for this accident would be 2.0×10^{-7} per year, or less than 1 chance in 5,000,000 per year. Involved workers run the highest risk of injury or fatality in case of many radiological accidents discussed in this section, as well as the many others that could occur. Although there are protective measures and administrative controls to protect involved workers, they are usually in the immediate vicinity of the accidents where they could be exposed to radioactivity. Accident scenarios for the Reduced Operations Alternative are described in Section 5.3.8.2.

The impacts of accidents have also been analyzed for other receptors located on the KAFB site. The impacts to all other receptors would be less than for the MEI. Details on the impacts to the core receptors are provided in Appendix F.2.

Chemical Accidents

Many SNL/NM facilities store and use a variety of hazardous chemicals. For the chemical with the highest RHI in a building, a catastrophic accident and total release of the building inventory was postulated as the bounding event and estimates were made of the chemicals concentrations at various distances from the accident. The results are shown in Table 5.5.8 7. Building inventory and 50 percent of the largest single source are shown for the source term to reflect the variability and uncertainty in the actual amount of the chemical that could be present at the time of an accident. Similarly, estimates are shown for the range of distances within which the ERPG-2 would be exceeded. The ERPG-2 is an accepted guideline for public exposure (see Appendix F.3 for the description of the various ERPG levels).

In case of the most severe chemical accident in TA-I, involved workers, noninvolved workers, KAFB personnel, onsite residents, and onsite members of the public would be at risk of being exposed to chemical concentrations in excess of ERPG-2 levels. The maximum number of individuals at risk is shown in Table 5.5.8 8. The actual number exposed would depend on the time of day, location of people, wind conditions, and other factors, but would be much less than what is shown.

As shown in Table 5.5.8 7, the worst-case chemical accident would be a catastrophic release of arsine from

Table 5.5.8 6. Potential Impacts of Radiological Facility Accidents Under the Reduced Operations Alternative

FACILITY	ACCIDENT ID[a]	SCENARIO	FREQUENCY PER YEAR	ADDITIONAL LATENT CANCER FATALITIES TO 50-MILE POPULATION	INCREASED PROBABILITY OF LATENT CANCER FATALITY	
					MAXIMALLY EXPOSED INDIVIDUAL	NONINVOLVED WORKER
Annular Core Research Reactor-medical isotopes production configuration	*AM-1*	Airplane crash - collapse of bridge crane	6.3×10^{-6}	2.0×10^{-3}	2.4×10^{-7}	7.4×10^{-5}
	AM-3	Rupture of waterlogged fuel element	1.0×10^{-2} to 1.0×10^{-4}	4.9×10^{-4}	5.4×10^{-8}	3.8×10^{-6}
	AM-4	Rupture of one molybdenum-99 target	1.0×10^{-4} to 1.0×10^{-6}	3.9×10^{-4}	4.3×10^{-8}	3.0×10^{-6}
	AM-5	Fuel handling accident - irradiated element	1.0×10^{-4} to 1.0×10^{-6}	4.9×10^{-3}	6.1×10^{-7}	7.6×10^{-5}
	AM-6	Airplane crash and fire in reactor room with unirradiated fuel and targets present	6.3×10^{-6}	1.6×10^{-6}	1.0×10^{-10}	4.9×10^{-8}
	AM-7	Target rupture during Annular Core Research Reactor to Hot Cell Facility transfer	$< 1.0 \times 10^{-6}$	3.9×10^{-4}	4.9×10^{-8}	1.4×10^{-5}
Hot Cell Facility-medical isotopes production	*HM-1*	Operator error - molybdenum-99 target processing	1.0×10^{-1} to 1.0×10^{-2}	3.8×10^{-5}	3.3×10^{-9}	1.6×10^{-7}
	HM-2	Operator error - iodine-125 target processing	1.0×10^{-1} to 1.0×10^{-2}	1.6×10^{-6}	1.0×10^{-10}	4.2×10^{-9}
	HM-4	Fire in glovebox	1.0×10^{-2} to 1.0×10^{-4}	2.6×10^{-3}	2.4×10^{-7}	2.3×10^{-6}
Hot Cell Facility-Room 108 Storage	*HS-1*	Fire in room 108, average inventories	3.3×10^{-5}	2.1×10^{-3}	1.8×10^{-7}	2.0×10^{-7}

Table 5.5.8 6. Potential Impacts of Radiological Facility Accidents Under the Reduced Operations Alternative (concluded)

FACILITY	ACCIDENT ID[a]	SCENARIO	FREQUENCY PER YEAR	ADDITIONAL LATENT CANCER FATALITIES TO 50-MILE POPULATION	INCREASED PROBABILITY OF LATENT CANCER FATALITY	
					MAXIMALLY EXPOSED INDIVIDUAL	NONINVOLVED WORKER
Hot Cell Facility-Room 108 Storage (continued)	***HS-2***	Fire in room 108, maximum inventories	2.0×10^{-7}	7.9×10^{-2}	6.6×10^{-6}	7.4×10^{-6}
Sandia Pulsed Reactor	***S3M-2***	Control-element misadjustment before insert	1.0×10^{-4} to 1.0×10^{-6}	1.2×10^{-3}	1.5×10^{-7}	2.5×10^{-4}
	S3M-3	Failure of a fissionable experiment	1.0×10^{-4} to 1.0×10^{-6}	7.9×10^{-3}	8.4×10^{-7}	3.8×10^{-3}
	SS-1	Airplane crash into North Vault storage vault	6.3×10^{-6}	9.2×10^{-3}	5.8×10^{-7}	5.5×10^{-4}

Source: Original
ACRR: Annular Core Research Reactor
SPR: Sandia Pulsed Reactor
TA: technical area
[a] TA-V Facility Accident Descriptors:
ACRR - Medical Isotope Production: AM-1, AM-3, AM-4, AM-5, AM-6, AM-7
Hot Cell - Medical Isotope Production: HM-1, HM-2, HM-4
Hot Cell - Room 108 Storage: HS-1, HS-2
SPR: S3M-2, S3M-3, SS-1

Table 5.5.8 7. Potential Impacts of Chemical Accidents Under the Reduced Operations Alternative

BUILDING	CHEMICAL	SOURCE TERM		ERPG-2 LEVEL OF CONCERN (ppm)	EXCEEDANCE DISTANCE		FREQUENCY[a] (PER YEAR)
		HIGH (lb)	AVERAGE (lb)		BUILDING INVENTORY (ft)	50% OF LARGEST SINGLE SOURCE (ft)	
823	Nitrous oxide	32.17	15.26	125	348	237	$1.0x10^{-3}$ to $1.0x10^{-4}$
858	Chlorine	106.4	53.2	3	3,726	2,598	$1.0x10^{-3}$ to $9.7x10^{-5}$
869	Nitric acid	18.6	9.3	15	666	465	$1.0x10^{-3}$ to $1.0x10^{-4}$
878	Nitrous oxide	50	25	125	438	309	$1.0x10^{-3}$ to $3.2x10^{-5}$
880	Hydrofluoric acid	2	1	20	219	153	$1.0x10^{-3}$ to $1.0x10^{-4}$
883	Phosphine	6.8	3.4	2.5	1,440	1,002	$1.0x10^{-3}$ to $1.0x10^{-4}$
884	Hydrofluoric acid	10	5	20	504	351	$1.0x10^{-3}$ to $1.0x10^{-4}$
888	Fluorine	0.07	0.04	1	207	93	$1.0x10^{-3}$ to $1.0x10^{-4}$
893	Arsine	65	20	1	4,884	2,640	$1.0x10^{-3}$ to $1.0x10^{-4}$
897	Chlorine	4.4	2.2	3	699	486	$1.0x10^{-3}$ to $6.6x10^{-5}$
905	Thionyl chloride	101.1	50.5	5	2,067	1,434	$1.0x10^{-3}$ to $9.0x10^{-5}$

Source: Original (See also Appendix F, Tables F.3 4 and F5 2)
Average: Average Inventory
ERPG: Emergency Response Planning Guideline
ft: feet
High: High Inventory
lb: pounds
ppm: parts per million
TA: technical area
[a] Frequency ranges from $1.0x10^{-3}$ form an earthquake in TA-I to $1.0x10^{-4}$ for an aircraft crash into a generic building in TA-I, or a lower number based on an aircraft crash described in Appendix F.5.

Table 5.5.8 8. Impacts of Chemical Accidents on Individuals Within KAFB

BUILDING	CHEMICAL NAME	RELEASE (lb)	ALOHA RADIUS REQUIRED TO REACH ERPG-2 LEVEL (ft)	NUMBER OF PEOPLE WITHIN ERPG-2
823	Nitrous oxide	32.17	348	844
858	Chlorine	106.41	3,726	3,783
869	Nitric acid	18.6	666	1,511
878	Nitrous oxide	50	438	880
880	Hydrofluoric acid	2	219	529
883	Phosphine	6.8	1,440	3,743
884	Hydrofluoric acid	10	504	800
888	Fluorine	0.07	207	0
893	Arsine	65	4,884	8,254
897	Chlorine	4.4	699	625
905	Thionyl chloride	101.1	2,067	1,356

Source: Original [See also Appendix F, Table F.3 6]
ALOHA: Areal Locations of Hazardous Atmospheres (model)
ERPG: Emergency Response Planning Guideline
ft: feet
lb: pound

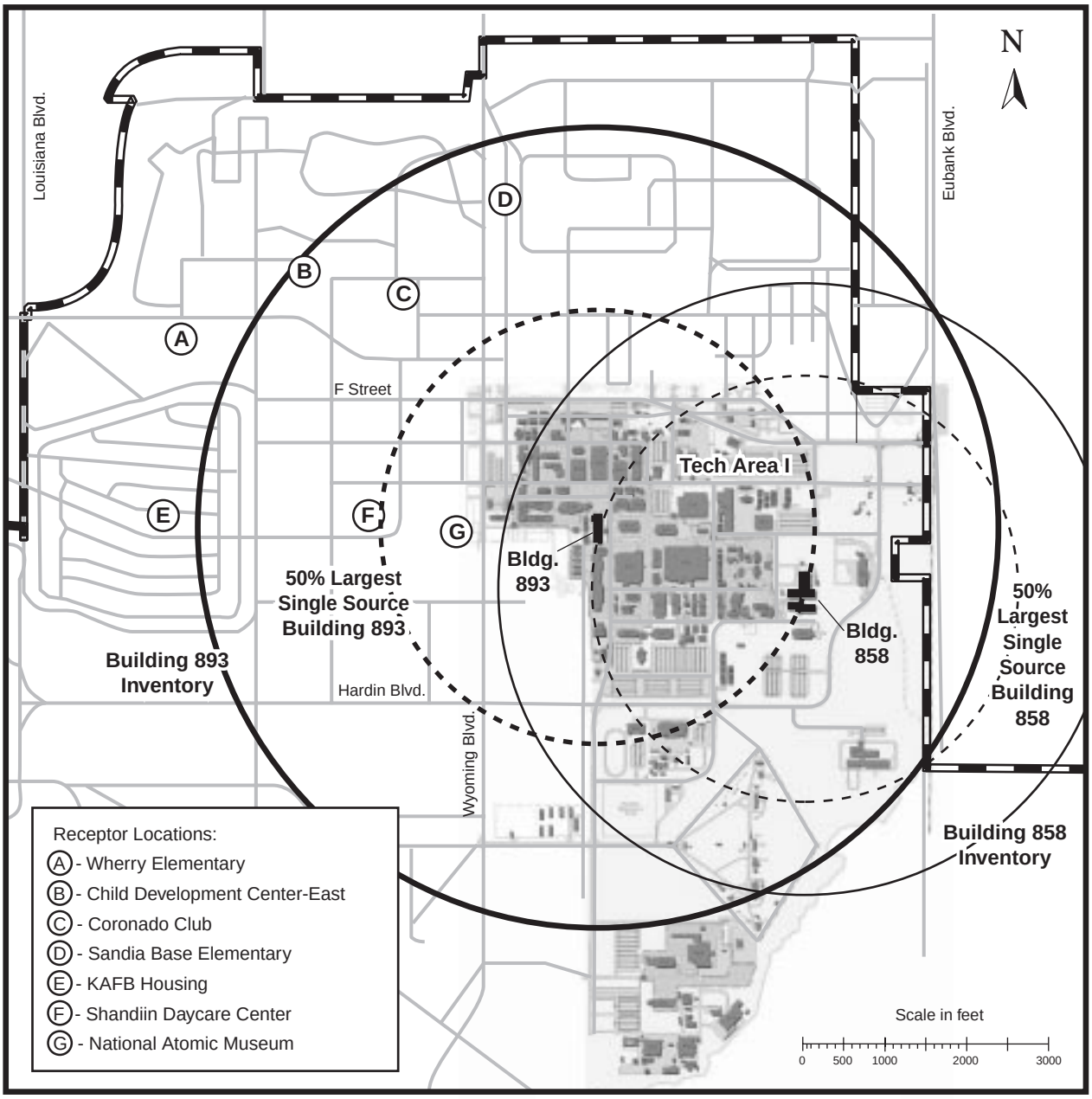
Building 893 in TA-I. If this accident was to occur and 20 lb of arsine was released, individuals within 2,640 ft of the point of release would receive exposures that exceed the ERPG-2. If the building inventory of 65 lb of arsine was released, individuals within a distance of 4,884 ft from the point of release would receive exposures that exceed the ERPG-2. Figure 5.5.8 2 illustrates the KAFB locations that would be affected by worst-case chemical accident scenarios involving the release of arsine or chlorine from Buildings 893 and 858, respectively. The circles on the figure correspond to the distances within which the ERPG-2 would be exceeded. However, the actual affected area within the circles would depend upon wind conditions, and only a small portion of the circular area would be affected. In the event of a release, the area exceeding the level of concern would be shaped by the wind and nearby buildings, perhaps affecting 1/16th to 1/10th of the circular area out to the indicated distance. All individuals exposed for 1 hour or more at these distances could experience or develop irreversible or other serious health effects or symptoms that could impair their abilities to take protective action. For any release, the seriousness of any exposure would generally decrease for distances further from the point of release.

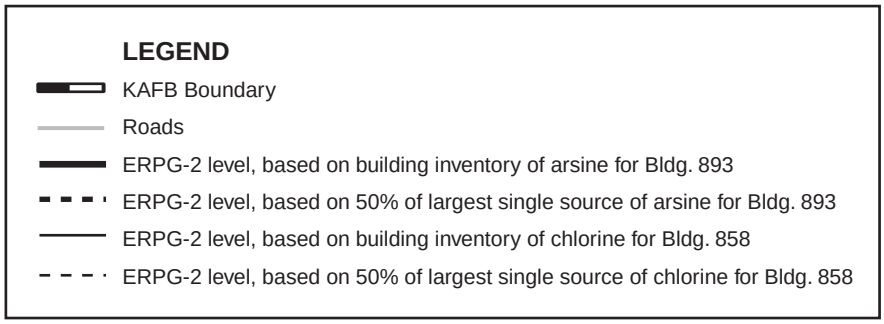
In case of an aircraft crash or earthquake involving buildings with various chemical inventories, multiple chemicals would be released and could mix and interact. Although the impacts of mixed chemicals could be greater than individual chemicals, their behavior, dispersion, and health effects can be complex and have therefore, not been considered quantitatively. An earthquake could also cause the release of like chemicals from multiple buildings and lead to increased concentration where individual plumes overlap. The potential and impacts for overlapping plumes are discussed in Appendix F.3.

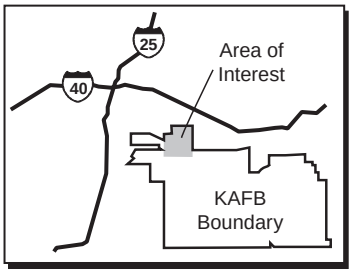
Other Accidents

Other types of potential accidents have been identified whose impacts are not measured in terms of LCFs or chemical concentrations. These could cause serious injury or fatality for humans or impacts to the nonhuman environment such as the ecology, historical sites, or sensitive cultural sites.

Brush Fires Small fires are expected and planned for during outdoor testing that involves propellants and explosives. The potential exists for brush and forest fires when hot test debris or projectiles come in contact with combustible elements in the environment. One such incident was reported in 1993 in TA-III when a rocket motor detonated during a sled track impact test and resulted in a 40-ac brush fire. Another accident occurred at the Aerial







Source: Original
Note: see Appendix F.3, Table F.3 4

Figure 5.5.8 2. Projected Extent of ERPG-2 Levels from Accidental Release of Arsine (Bldg. 893) and Chlorine (Bldg. 858)

Circled areas represent the distances within which an ERPG-2 level would be exceeded for an accidental release of arsine (Building 893) and/or chlorine (Building 858) under the Reduced Operations Alternative.

Cable Facility in the Coyote Test Field, which resulted in a fire that swept up the side of a mountain before being extinguished by SNL/NM workers. Many others have also occurred that were contained in the immediate vicinity of the test area. Measures would be taken to prevent fires and, should a fire occur, the effects would be mitigated by activating fire fighting facilities in the test area (DOE 1995a, SNL/NM 1993d, SNL/NM 1998i).

Natural Phenomena Naturally occurring events such as tornadoes, lightning, floods, and heavy snow, as documented in existing SNL/NM safety documentation, were considered for their potential to initiate the accidental release of radioactive, chemical, and other hazardous materials that affect workers and the public. Any of these events, should they occur, could also lead to serious injury or fatality because of the physical and destructive forces associated with the events. The risks of such events to workers and the public would be equivalent to everyday risks from naturally occurring events to the general public wherever they work and reside.

Spills and Leaks The potential would exist throughout SNL/NM for the accidental spill of radioactive, chemical, or other hazardous materials. The effects of such spills on workers and the public through airborne pathways were considered earlier in this section. The impacts from pathways other than airborne would normally be bounded by exposure from airborne pathways. Any spill of a hazardous substance would have the potential for impacts to the nonhuman elements of the environment. A spill could make its way into surface and groundwater systems, affecting water quality and aquatic life. Spills of flammable substance could cause fires that damage plant and animal life and other land resources. There have been spills of hazardous substances at the SNL/NM site that had the potential to affect the nonhuman elements of the environment. In 1994, over 100 gal of oil were spilled at the Centrifuge Complex in TA-III when a hydraulic pump failed during a centrifuge test causing a potential impact to the nonhuman elements of the environment. In addition, in 1994, a small spill of transformer oil occurred from an oil storage tank in TA-IV when a gasket failed and, at the Coyote Test Field, a leaking underground storage tank containing ethylene glycol was discovered.

Radiological and Chemical Contamination Some accidents analyzed in this section and others, that were considered but not analyzed, could potentially affect the nonhuman elements of the environment. Any accidentally released chemicals would result in concentrations that would typically decrease with increasing distance from the point of release. While chemical concentrations would diminish over distance to a point where a human hazard would no be longer present, the concentrations could still affect other elements of the environment such as the ecology, water quality, and cultural resources. Radiological releases could also affect nonhuman elements of the environment. After an accident, SNL/NM, through their spill and pollution control and radiological emergency response plans, would be required to assess the potential for ground contamination; if contamination exceeds guidance levels, plans would be developed for remediation.

Industrial Besides radioactive and chemical materials and explosives, many SNL/NM facilities conduct operations and use materials and equipment that could also be potentially hazardous to workers. These hazards are typically referred to as normal industrial hazards, not unlike similar hazards that workers are exposed to throughout the nation, and include working with electricity, climbing ladders, welding, and driving forklifts. All operations and activities at SNL/NM facilities, as well as all DOE facilities, would be subject to administrative procedures and safety features designed to prevent accidents and mitigate their consequences should they occur.

5.5.9 Transportation

Under the Reduced Operations Alternative, transportation impacts were assessed for each of three ROIs: KAFB; major Albuquerque roadways; and major roadways between Albuquerque and specific waste disposal facilities, vendors, and other DOE facilities. This analysis involved estimating the number of trips made by SNL/NM-associated vehicles under normal operations in each of these transportation corridors. Transportation evaluators and activity multipliers are discussed in Section 5.3.9, Appendix A, and Appendix G.

5.5.9.1 Transportation of Material and Wastes

The number of material shipments received by SNL/NM is generally proportional to total SNL/NM material consumption. According to facility projections, material consumption under the Reduced Operations Alternative is projected to decrease by 54 percent from current levels. Thus, total material shipments would also decrease, although not necessarily for all types of material.

Radioactive and explosive material shipments are often delivered through government carriers, unless the quantities and activities being transported are low enough to meet the Federal guidelines and restrictions in place for authorized commercial transporters. Government carriers operate on an as-needed basis, thus the general decrease in material inventory under the Reduced Operations Alternative would result in a similar decrease in these kinds of shipments.

Due to their shipment method, there would be very little impact to the number of chemical shipments that are made to SNL/NM. JIT chemicals, which are ordered infrequently and in small quantities, are usually shipped to SNL/NM by way of commercial carriers such as Federal Express and UPS. These carriers make daily shipments to SNL/NM to deliver packages other than chemicals, and a slight decrease in the volume of chemicals they handle per shipment would not likely decrease their frequency. Similarly, major chemical vendors who deliver their own material, rather than use a commercial carrier, also generally make daily shipments to SNL/NM. Therefore, any slight decrease in the volume of material that major vendors ship per load would not have an impact on the frequency of those shipments. Thus, chemical shipments would remain at approximately the same level regardless of the fluctuations in material consumption.

Considering the above factors, overall material transportation due to normal operations would increase by 24 percent over current levels. This increase would be due to shipment requirements of the medical isotopes production project. The anticipated changes in annual and daily material shipments for each material category are presented in Table 5.5.9 1. The analysis assumed that SNL/NM has 250 work days per calendar year.

Waste Transportation

The amount of waste shipped from SNL/NM to disposal facilities correlates directly to SNL/NM waste generation levels. Overall offsite waste shipments would increase by 291 percent. Of this increase, 285 percent is considered to be waste currently disposed of at the KAFB landfill. This leaves a real projected increase of 6 percent under the Reduced Operations Alternative. The total anticipated changes in waste shipments during all operations for each type of waste are presented in Table 5.5.9 2 and Appendix G, Table G.3 3.

Specials Projects

Two special project wastes, ER Project and legacy, were addressed separately due to their one-time operation/project status and in order to avoid skewing the SNL/NM normal operations impact. Legacy wastes would be anticipated to account for an additional 18 shipments of LLW, 3 shipments of LLMW, and 2 shipments of TRU/MTRU wastes over the 10-year time frame (see Figures 4.12 1, 4.12 2, and 4.12 3). In 1998 through 2000, the ER Project could account for up to an additional 312 offsite shipments of LLW, 101 offsite shipments of LLMW, 2 offsite shipments of RCRA waste, 5 offsite shipments of TSCA waste, and 75 shipments of nonhazardous waste. Both of these special projects have been included within the total facility risks.

Table 5.5.9 1. SNL/NM Annual Material Shipments Under the Reduced Operations Alternative

MATERIAL TYPE		BASE YEAR[a] ANNUAL SHIPMENTS	REDUCED OPERATIONS ANNUAL SHIPMENTS
Radioactive		305	140
Radioactive (medical isotopes production)	*Receiving*	0	2
	Shipping	0	1,140
Chemical		2,750	2,750
Explosive		303	138
TOTAL		**3,358**	**4,170**

Sources: SNL/NM 1997b, 1998a

[a] The base year varies depending on information provided in the *Facilities and Safety Information Document* (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.

Table 5.5.9 2. Annual Waste Shipments Under the Reduced Operations Alternative

WASTE TYPE	BASE YEAR SHIPMENTS	REDUCED OPERATIONS SHIPMENTS
LLW[a] (1996)	4	8
LLMW (1996)	1	3
Hazardous (RCRA+TSCA) (1997)	102	95
Recyclable (Hazardous and Nonhazardous)[a,b] (1997)	86	8
Solid (Municipal, Construction, and Demolition)[b] (1997)	51	650

Sources: Rinchem 1998a; SNL/NM 1998a, 1998y, n.d. (d)
LLMW: low-level mixed waste
LLW: low-level waste
MTRU: mixed transuranic
RCRA: *Resource Conservation and Recovery Act*
TRU: transuranic
TSCA: *Toxic Substances Control Act*
[a] Excludes decontamination and decommissioning
[b] Recyclable and solid wastes currently handled by the KAFB landfill could be shipped offsite in the future, contributing an additional 741 shipments.

Offsite Receipts and Shipments of Material and Waste

The bounding case for this analysis assumed that each material and waste shipment is composed of two trips: one to and one from SNL/NM. Thus, the total number of trips made by material and waste transporters under this alternative would be 10,374 (total shipments x 2). Assuming that the year is comprised of 250 work days, the average work day traffic within KAFB contributed by these carriers would be 41 trips. This is small compared to 26,349 trips of SNL/NM vehicles entering and exiting KAFB under this alternative (SNL 1996a, SNL/NM 1998a). Therefore, the overall traffic impacts on KAFB from SNL/NM material and waste shipments under the Reduced Operations Alternative would be minimal.

Shipments of Material and Waste in the Albuquerque Area

The total SNL/NM placarded material and waste shipment traffic under this alternative would comprise only 1.2 percent, or 41 shipments per day, of the total placarded truck traffic (1,767) entering the greater Albuquerque area. Although a 43-percent increase in SNL/NM placarded material and waste truck traffic would be expected, this increase would represent the inclusion of waste currently managed at KAFB landfill and new shipments from the MIPP. ER Project and legacy waste are addressed separately under special projects. Thus, the impacts under the Reduced Operations Alternative would be insignificant.

Shipments of Material and Waste Outside of Albuquerque

All material and waste transported to and from SNL/NM from outside of Albuquerque must enter and depart the city by way of Interstate 25 or Interstate 40. Table 5.5.9 3 presents the impacts to those corridors from material and waste shipments under the Reduced Operations Alternative. The specific remote facility locations are listed in Section 4.11. Daily SNL/NM shipment figures were derived for comparison purposes by dividing the annual waste and material shipment totals in Tables 5.5.9 1 and 5.5.9 2 by the approximately 250 work days in a calendar year.

Table 5.5.9 3. 24-Hour Placarded Material and Waste Traffic Counts Under the Reduced Operations Alternative

ROUTE (ALL TRAFFIC)[a]	BASE YEAR[b]	REDUCED OPERATIONS
I-25 North (52,400)	230	268
I-25 South (18,000)	94	110
I-40 West (16,400)	621	725
I-40 East (54,200)	569	664
TOTAL (141,000)	**1,514**	**1,767**
SNL/NM[c]	**14.5**	**20.7**

Sources: Scientific Services 1995; SNL/NM 1997b, 1998a
I: Interstate
[a] Total vehicle count for all types of vehicles entering and departing Albuquerque
[b] The base year varies depending on information provided in the Facilities and Safety Information Document (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.
[c] SNL/NM placarded trucks

Based on this analysis, overall SNL/NM material and waste shipments would be expected to increase in frequency by 43 percent under this alternative. Furthermore, the reduced SNL/NM truck traffic would only comprise less than 0.013 percent of all traffic (165,000 vehicles per day), including all types of vehicles, projected to be entering and departing Albuquerque by way of interstates. For the base year (1996 or 1997), waste leaving Albuquerque represented 35 percent of the total shipments, with an additional

20 percent going to Rio Rancho. Because most materials are supplied through the JIT vendors, origination points are generally not known. However, most vendors use local suppliers; therefore, in the base year, 82 percent of material was assumed to be provided locally, with the remaining 18 percent coming from outside Albuquerque. Thus, the impact to this ROI from the Reduced Operations Alternative would be insignificant.

5.5.9.2 Other Transportation (Traffic)

Overall vehicular traffic impacts under the Reduced Operations Alternative were assessed by projecting the total number of SNL/NM commuter vehicles that would be traveling to and from SNL/NM. The term commuter includes all vehicles operated by SNL/NM employees, contractors, and visitors; DOE employees; and additional traffic, such as delivery vehicles.

Traffic on KAFB

Table 5.5.9 4 presents general anticipated traffic impacts at KAFB under the Reduced Operations Alternative. The number of SNL/NM commuter vehicles traveling to and from the site each work day was conservatively assumed to decrease at the same rate as the SNL/NM work force levels (see Section 5.5.12). Based on this analysis, overall KAFB traffic would decrease by 1 percent under this alternative.

Table 5.5.9 5 shows projected 24-hour KAFB vehicular flow for each of the three main gates under the Reduced Operations Alternative. It was assumed that the Carlisle and Truman gates would be used primarily by KAFB personnel and not by SNL/NM employees. For the bounding case for this analysis, it was assumed that the SNL/NM contribution to total KAFB flow at each gate would fluctuate by the same factor as the total fluctuation in SNL/NM traffic under the Reduced Operations Alternative. Based on this analysis, the daily KAFB gate traffic would decrease by 1 percent under the Reduced Operations Alternative. This minimal change would not have an appreciable impact on the level of service at the gates.

Traffic in the Albuquerque Area

To determine the traffic impacts in the Albuquerque traffic corridor, roadways most likely to be affected by SNL/NM traffic were selected for analysis. The bounding case used the projected SNL/NM traffic contributions from Table 5.5.9 5 to approximate the SNL/NM component of the total traffic count for each roadway. For worst-case impacts, the SNL/NM traffic component was assumed to be equivalent to the total SNL/NM traffic at the nearest gate. In actuality, a significant percentage of traffic would likely diffuse onto other nearby roads, which would greatly reduce the magnitude of the SNL/NM component. The projected impacts to these roadways under the Reduced Operations Alternative, according to the bounding case factors, are presented in Table 5.5.9 6.

Based on this analysis, there would be a 3 percent overall average decrease in the SNL/NM traffic component on these roadways under the Reduced Operations Alternative. There would also be a 0.8 percent decrease in the total vehicular traffic.

Traffic Outside of Albuquerque

The additional local SNL/NM traffic under the Reduced Operations Alternative would have minimal impacts on transportation routes between Albuquerque and other

Table 5.5.9 4. KAFB Daily Traffic Projections Under the Reduced Operations Alternative

COMPONENT	BASE YEAR[a]			REDUCED OPERATIONS			CHANGE (%)
	%	VEHICLES	TRIPS	%	VEHICLES	TRIPS	
SNL/NM Commuters	36	13,582	27,164	35	13,174	26349	-3
KAFB Commuters	64	24,145	48,290	65	24,145	48,290	0
TOTAL KAFB COMMUTER TRAFFIC	**100**	**37,727**	**75,453**	**100**	**37,319**	**74,639**	**-1**
SNL/NM Waste & Material Transporters	0.04	14.5	29	0.06	20.7	41	+43[b]

Sources: SNL/NM 1997a, 1997b

[a] The base year varies depending on information provided in the *Facilities and Safety Information Document* (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.

[b] This increase represents inclusion of waste currently managed at the KAFB landfill and new shipments from the medical isotopes production project.

Table 5.5.9 5. Total KAFB Gate Traffic Under the Reduced Operations Alternative

GATE	BASE YEAR[a]			REDUCED OPERATIONS ALTERNATIVE			% CHANGE GATE TOTAL
	24-HOUR SNL/NM[b]	24-HOUR TOTAL[c]	PEAK HOUR[d]	24-HOUR SNL/NM	24-HOUR TOTAL	PEAK HOUR	
Wyoming	7,141	19,835	1,941	6,927	19,621	1,922	-1
Eubank	5,324	14,788	2,683	5,164	14,626	2,656	-1
Gibson	8,108	22,523	1,571	7,865	22,280	1,555	-1

Sources: Bohannan-Huston 1995; SNL/NM 1997a, 1997b

[a] The base year varies depending on information provided in the *Facilities and Safety Information Document* (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.

[b] SNL/NM commuter and transporter trips per day equals 36 percent of total KAFB trips per day

[c] Total KAFB trips per day

[d] Total KAFB trips per hour, 1996 traffic counts

Table 5.5.9 6. Albuquerque Daily Traffic Counts Under the Reduced Operations Alternative

ROADWAY		BASE YEAR[a]		REDUCED OPERATIONS		% CHANGE
		DAILY[b]	PEAK[c]	DAILY	PEAK	DAILY
Gibson west at Louisiana	*TOTAL*	15,671	2,066	15,428	2,034	-1.6
	SNL/NM	8,108	1,069	7,865	1,037	-3
	% SNL/NM	52		51		-2
Wyoming south of Lomas	*TOTAL*	37,639	2,293	37,853	2,280	-0.6
	SNL/NM	7,141	435	6,927	423	-3
	% SNL/NM	19		18.6		-2
Eubank south of Copper	*TOTAL*	14,572	1,852	14,732	1,832	-1.1
	SNL/NM	5,324	677	5,164	657	-3
	% SNL/NM	37		36		-3
Interstate 25 at Gibson[d]	*TOTAL*	91,000		91,243		-0.3
	SNL/NM	8,108		7,865		-3
	% SNL/NM	8.9		8.6		-3
Interstate 40 at Eubank[d]	*TOTAL*	90,300		90,460		-0.2
	SNL/NM	5324		5,164		-3
	% SNL/NM	5.9		5.7		-3
Wyoming north of KAFB gate	*TOTAL*	20,272	1,749	20,486	1,731	-1.0
	SNL/NM	7,141	612	6,927	594	-3
	% SNL/NM	35		34		-3

Sources: MRGCOG 1997b, 1997c; SNL/NM 1997b, 1998a; UNM 1997b

[a] The base year varies depending on information provided in the *Facilities and Safety Information Document* (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.

[b] Vehicles per day, *1996 Traffic Flows for the Greater Albuquerque Area*

[c] Vehicles per hour, *1996 1998 Traffic Counts*

[d] Peak hour counts for this intersection are not available

DOE facilities, vendors, and disposal facilities (see Section 4.11 for a list of these facilities). In a worst-case assessment, the SNL/NM component represents an average 19 percent of the total traffic count (144,000 vehicles per day) on major roadways entering and departing Albuquerque in the base year (MRGCOG 1997b). Under the Reduced Operations Alternative, the SNL/NM component would decrease to 16 percent of total vehicular traffic due to the increase in Albuquerque population and commuters. This assumes that all SNL/NM traffic would actually enter and depart Albuquerque by way of the interstates every day, although a significant portion of SNL/NM traffic would more likely diffuse onto other roadways or remain in Albuquerque.

5.5.9.3 Transportation Risks Associated with Normal Operations

Incident-Free Exposure

The bounding case for this analysis used the representative distances traveled by SNL/NM waste and material carriers, as listed in Table 5.3.9 7. These distances were based on the average distance traveled by trucks in route to other facilities under all alternatives.

Truck emissions impacts are a function of the number of truck shipments to and from SNL/NM. The bounding case for truck emissions impact analysis assumed that the greatest risk is when these shipments are transported through urban areas, such as the Albuquerque transportation corridor, because these areas are most susceptible to emissions related problems. To evaluate the actual risk associated with SNL/NM truck shipments, the most common origins and destinations of all shipments of concern were compiled to determine the urban distance each material or waste would be transported (Section 4.11). Table 5.5.9 7 presents projected truck emissions impacts resulting from the Reduced Operations Alternative.

The impact analysis of incident-free exposure from material and waste shipments was conducted using the *HIGHWAY* computer code as part of the *RADTRAN 4* modeling program (SNL 1992a). The distance parameters presented in Table 5.3.9 7 were used to project the incident-free exposure impacts to the public and crew resulting from this alternative. The projected public and crew dose calculations are presented in Table 5.5.9 8.

This table shows that the LCFs due to annual shipments of radioactive material and wastes under the Reduced Operations Alternative would decrease appreciably although the magnitude is small.

In the absence of an accident that compromises package integrity, no incident-free chemical or explosive exposure would be foreseen to affect the public, workers, or vehicle transport crews under this alternative.

5.5.9.4 Transportation Risks Associated with Accidents

General Accidents

The bounding case for general vehicular traffic impacts under the Reduced Operations Alternative assumed that the percent decrease in accidents would be equal to the percent decrease in SNL/NM traffic. Therefore, SNL/NM traffic accidents would decrease by 3 percent under this alternative.

Hazardous Material Waste-Related Accidents

The SNL/NM material and waste shipments projected in Table 5.5.9 1 and Table 5.5.9 2 were used in conjunction with traffic fatality statistics (SNL 1986) to project the truck accident fatality incidence rate that would be expected under the Reduced Operations Alternative. The details are presented in Appendix G. These impacts are presented in Table 5.5.9 9. Based on this analysis, accident fatalities due to SNL/NM truck transportation would decrease from 0.22 to 0.18 under this alternative.

Radiological Transportation Accidents

The annual risk to population due to transportation accidents that potentially involve radiological releases resulting from the Reduced Operations Alternative are presented in Table 5.5.9 10. This analysis indicates that under normal routine operations, LCFs would decrease from 9.0×10^{-6} to 7.5×10^{-6} in incidents due to the worst-case radiological transportation accident under the Reduced Operations Alternative. In addition, 5×10^{-5} LCFs would result from legacy and ER Project waste shipments. For more information see Appendix G.

Risks due to radiological, chemical and explosives accidents are evaluated in detail in Appendix F. The bounding transportation accident analysis involves explosion of a tractor-trailer containing 40,000 ft^3 of hydrogen. Based on the results presented in Appendix F, Table F.4 1, the hydrogen explosion

Table 5.5.9 7. Reduced Operations Alternative Incident-Free Exposure: Truck Emissions

CARGO	UNIT RISK FACTOR PER URBAN KILOMETER	URBAN DISTANCE TRAVELED PER SHIPMENT (km)	LCFs PER ROUND TRIP SHIPMENT	ANNUAL NO. SHIPMENTS		ANNUAL LCFs	
				BASE YEAR[a]	REDUCED OPERATIONS	BASE YEAR[a]	REDUCED OPERATIONS
NORMAL ROUTINE OPERATIONS							
RAD Materials	1.0×10^{-7}	73.0	1.5×10^{-5}	305	140	4.6×10^{-3}	2.1×10^{-3}
Explosives	1.0×10^{-7}	48.0	9.6×10^{-6}	303	138	2.9×10^{-3}	1.3×10^{-3}
Chemicals	1.0×10^{-7}	8.0	1.6×10^{-6}	2,750	2,750	4.4×10^{-3}	4.4×10^{-3}
LLW	1.0×10^{-7}	33.0	6.6×10^{-6}	4	8	2.6×10^{-5}	5.3×10^{-5}
Medical Isotopes Production (receipts)	1.0×10^{-7}	NA	NA	0	2	NA	3.5×10^{-4}
Medical Isotopes Production (shipments)				0	1,140		
LLMW (shipments)	1.0×10^{-7}	40.6	8.1×10^{-6}	1	3	8.1×10^{-6}	2.4×10^{-5}
LLMW (receipts)	1.0×10^{-7}	35.6	7.1×10^{-6}	0	1	7.1×10^{-6}	7.1×10^{-6}
Hazardous Waste	1.0×10^{-7}	33.0	6.6×10^{-6}	64	58	4.2×10^{-4}	3.8×10^{-4}
Recyclable Hazardous to California	1.0×10^{-7}	23.0	4.6×10^{-6}	2	2	9.2×10^{-6}	9.2×10^{-6}
Recyclable Hazardous to New Mexico	1.0×10^{-7}	6.4	1.3×10^{-6}	6	6	7.8×10^{-6}	7.8×10^{-6}
Solid Waste	1.0×10^{-7}	10.0	2.0×10^{-6}	51	51	1.0×10^{-4}	1.0×10^{-4}
D&D Hazardous Waste TSCA-PCBs	1.0×10^{-7}	33.0	6.6×10^{-6}	1	1	6.6×10^{-6}	6.6×10^{-6}
D&D Hazardous Waste TSCA-Asbestos	1.0×10^{-7}	10.0	2.0×10^{-6}	14	14	2.8×10^{-5}	2.8×10^{-5}
Biohazardous Waste	1.0×10^{-7}	24.0	4.8×10^{-6}	1	1	4.8×10^{-6}	4.8×10^{-6}
Recyclable D&D Hazardous Waste	1.0×10^{-7}	6.4	1.3×10^{-6}	22	22	2.9×10^{-5}	2.9×10^{-5}
Recyclable Nonhazardous Solid Waste	1.0×10^{-7}	6.4	1.3×10^{-6}	78	78	1.0×10^{-4}	1.0×10^{-4}
Nonhazardous Landscaping Waste	1.0×10^{-7}	10	2.0×10^{-6}	NA	142	NA	2.8×10^{-4}

Table 5.5.9 7. Reduced Operations Alternative Incident-Free Exposure: Truck Emissions (concluded)

CARGO	UNIT RISK FACTOR PER URBAN KILOMETER	URBAN DISTANCE TRAVELED PER SHIPMENT (km)	LCFs PER ROUND TRIP SHIPMENT	ANNUAL NO. SHIPMENTS		ANNUAL LCFs	
				BASE YEAR[a]	REDUCED OPERATIONS	BASE YEAR[a]	REDUCED OPERATIONS
Construction and Demolition Solid Waste	1.0×10^{-7}	10	2.0×10^{-6}	NA	599	NA	1.2×10^{-3}
RCRA Hazardous Waste (Receipt)	1.0×10^{-7}	3	6.0×10^{-7}	12	25	7.2×10^{-6}	1.5×10^{-5}
LLW (D&D)	1.0×10^{-7}	33	6.6×10^{-6}	4	4	2.6×10^{-5}	2.6×10^{-5}
TOTAL[b]						**1.33×10^{-2}**	**1.1×10^{-2}**
SPECIAL PROJECT OPERATIONS							
TRU/MTRU	1.0×10^{-7}	8.4	1.7×10^{-6}	0	2	0	3.4×10^{-6}
TRU/MTRU (legacy)	1.0×10^{-7}	8.4	1.7×10^{-6}	0	2	0	3.4×10^{-6}
LLW (legacy)	1.0×10^{-7}	33	6.6×10^{-6}	0	56	0	3.7×10^{-4}
LLMW (legacy)	1.0×10^{-7}	40.6	8.1×10^{-6}	0	8	0	6.5×10^{-5}
LLW (ER)	1.0×10^{-7}	33	6.6×10^{-6}	0	136	0	9.0×10^{-4}
LLMW (ER)	1.0×10^{-7}	40.6	8.1×10^{-6}	0	5	0	4.1×10^{-5}
Hazardous Waste (ER)	1.0×10^{-7}	33	6.6×10^{-6}	0	113	0	7.5×10^{-4}
Nonhazardous Solid Waste (ER)	1.0×10^{-7}	10	2.0×10^{-6}	0	9	0	1.8×10^{-5}
TOTAL[b]						**0**	**2.1×10^{-3}**

Sources: DOE 1996h; SNL 1992a; SNL/NM 1982, 1997b, 1998a
D&D: decontamination and decommissioning
ER: environmental restoration
km: kilometer
LCFs: latent cancer fatalities
LLMW: low-level mixed waste
LLW: low-level waste
MTRU: mixed transuranic
NA: not applicable
PCB: polychlorinated biphenyl
RAD: radiological
RCRA: *Resource Conservation and Recovery Act*
TRU: transuranic
TSCA: *Toxic Substances Control Act*
[a] The base year varies depending on information provided in the *Facilities and Safety Information Document* (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.
[b] Lifetime estimated total LCFs

Table 5.5.9 8. Doses to Crew and Public Under the Reduced Operations Alternative

CARGO	ANNUAL DOSE/TRUCK CREW (person-rem)		ANNUAL DOSE/GENERAL PUBLIC (person-rem)		ANNUAL LCFs	
	BASE YEAR[a]	REDUCED OPERATIONS	BASE YEAR[a]	REDUCED OPERATIONS	BASE YEAR[a]	REDUCED OPERATIONS
NORMAL ROUTINE OPERATIONS						
RAD Materials	9.8	4.5	82.4	37.8	4.5×10^{-2}	2.1×10^{-2}
LLW	0.21	0.41	0.6	1.2	3.8×10^{-4}	7.6×10^{-4}
LLMW	2.6×10^{-2}	9.6×10^{-2}	0.26	0.88	1.4×10^{-4}	4.8×10^{-4}
Medical Isotopes Production	0	0.92	0	2.7	0	1.7×10^{-3}
LLW (D&D)	0.21	0.21	0.60	0.60	3.8×10^{-4}	3.8×10^{-4}
TOTAL[b]					**4.6×10^{-2}**	**2.4×10^{-2}**
SPECIAL PROJECT OPERATIONS						
TRU/MTRU	0	3.6×10^{-3}	0	2.0×10^{-2}	0	1.1×10^{-5}
TRU/MTRU (Legacy)	0	3.6×10^{-3}	0	2.0×10^{-2}	0	1.1×10^{-5}
LLW (Legacy + ER)	0	10.0	0	28.8	0	1.8×10^{-2}
LLMW (Legacy + ER)	0	0.34	0	3.4	0	1.8×10^{-3}
TOTAL[b]					**0**	**2.0×10^{-2}**

Sources: DOE 1996h, SNL 1992a, SNL/NM 1997b, 1998a
D&D: decontamination and decommissioning
ER: environmental restoration
LCFs: latent cancer fatalities
LLMW: low-level mixed waste
LLW: low-level waste
MTRU: mixed transuranic
RAD: radiological
rem: roentgen equivalent, man
TRU: transuranic
[a] The base year varies depending on information provided in the *Facilities and Safety Information Document* (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.
[b] Lifetime estimated total LCFs

Table 5.5.9 9. Truck Transportation Traffic Fatalities Under the Reduced Operations Alternative

CARGO	TRAFFIC FATALITY RATE: CREW AND GENERAL PUBLIC PER SHIPMENT (ROUND TRIP)	ANNUAL FATALITIES	
		BASE YEAR[a]	REDUCED OPERATIONS
NORMAL ROUTINE OPERATIONS			
RAD Materials	3.5×10^{-4}	0.11	4.9×10^{-2}
Explosives	2.9×10^{-4}	8.8×10^{-2}	4.0×10^{-2}
Chemicals	2.1×10^{-6}	5.8×10^{-3}	5.8×10^{-3}
LLW	2.2×10^{-4}	8.8×10^{-4}	1.8×10^{-3}
Medical Isotopes Production	NA	NA	7.7×10^{-4}
LLMW (shipments)	3.0×10^{-4}	3.0×10^{-4}	9.0×10^{-4}
LLMW (receipts)	2.1×10^{-4}	0	2.1×10^{-4}
Hazardous Waste	2.2×10^{-4}	1.4×10^{-2}	1.3×10^{-2}
Recyclable Hazardous to California	1.5×10^{-4}	3.0×10^{-4}	3.0×10^{-4}
Recyclable Hazardous to New Mexico	1.6×10^{-7}	9.6×10^{-6}	9.6×10^{-6}
Solid Waste	2.6×10^{-6}	1.3×10^{-5}	1.3×10^{-4}
D&D Hazardous Waste TSCA-PCBs	2.2×10^{-4}	2.2×10^{-4}	2.2×10^{-4}
D&D Hazardous Waste TSCA-Asbestos	2.2×10^{-5}	3.1×10^{-4}	3.1×10^{-4}
Biohazardous Waste	1.4×10^{-4}	1.4×10^{-4}	1.4×10^{-4}
Recyclable D&D Hazardous Waste	1.6×10^{-6}	3.5×10^{-5}	3.5×10^{-5}
Recyclable Nonhazardous Solid Waste	1.6×10^{-6}	1.2×10^{-4}	1.2×10^{-4}
Nonhazardous Landscaping Waste	2.6×10^{-6}	NA	3.7×10^{-4}
Construction and Demolition Solid Waste	2.6×10^{-6}	NA	1.6×10^{-3}
RCRA Hazardous Waste (receipt)	6.7×10^{-7}	8.0×10^{-6}	1.7×10^{-5}
Low-level waste (D&D)	2.2×10^{-6}	8.8×10^{-4}	8.8×10^{-4}
TOTAL[b]		**0.22**	**0.11**
SPECIAL PROJECT OPERATIONS			
TRU/MTRU	1.9×10^{-5}	0	3.8×10^{-5}
TRU/MTRU (Legacy)	1.9×10^{-5}	0	3.8×10^{-5}
LLW (Legacy)	2.2×10^{-4}	0	1.2×10^{-2}

Table 5.5.9 9. Truck Transportation Traffic Fatalities Under the Reduced Operations Alternative (concluded)

CARGO	TRAFFIC FATALITY RATE: CREW AND GENERAL PUBLIC PER SHIPMENT (ROUND TRIP)	ANNUAL FATALITIES	
		BASE YEAR[a]	REDUCED OPERATIONS
LLMW (Legacy)	3.0×10^{-4}	0	2.4×10^{-3}
LLW (ER)	2.2×10^{-4}	0	3.0×10^{-2}
LLMW (ER)	3.0×10^{-4}	0	1.5×10^{-3}
Hazardous Waste (ER)	2.2×10^{-4}	0	2.5×10^{-2}
Nonhazardous Solid Waste(ER)	2.6×10^{-6}	0	2.3×10^{-5}
TOTAL[b]		0	7.1×10^{-2}

Sources: SNL 1986, 1992a; SNL/NM 1997b, 1998a
D&D: decontamination and decommissioning
ER: environmental restoration
LLW: low-level waste
LLMW: low-level mixed waste
MTRU: mixed transuranic
NA: not applicable
PCB: polychlorinated biphenyl
RAD: radiological
RCRA: *Resource Conservation and Recovery Act*
TRU: transuranic
TSCA: *Toxic Substances Control Act*
[a] The base year varies depending on information provided in the *Facilities and Safety Information Document* (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.
[b] Lifetime estimated total fatalities from annual shipments and total special project shipments

Table 5.5.9 10. Doses to Population Due to Transportation Radiological Accident, Maximum Annual Radiological Accident Risk for Highway Shipments

CARGO	ANNUAL DOSE TO POPULATION PERSON-REM		LCFs	
	BASE YEAR[a]	REDUCED OPERATIONS	BASE YEAR[a]	REDUCED OPERATIONS
NORMAL ROUTINE OPERATIONS				
Radioactive Material	1.3×10^{-2}	6.0×10^{-3}	6.6×10^{-6}	3.0×10^{-6}
LLW	2.3×10^{-3}	4.6×10^{-3}	1.2×10^{-6}	2.3×10^{-6}
LLMW	3.8×10^{-5}	1.1×10^{-4}	1.7×10^{-8}	5.3×10^{-8}
Medical Isotopes Production	0	1.9×10^{-3}	0	9.6×10^{-7}
LLW (D&D)	2.3×10^{-3}	2.3×10^{-3}	1.2×10^{-6}	1.2×10^{-6}
TOTAL[b]			**9.0×10^{-6}**	**7.5×10^{-6}**
SPECIAL PROJECT OPERATIONS				
TRU/MTRU	0	3.4×10^{-6}	0	3.4×10^{-9}
TRU/MTRU (Legacy)	0	6.8×10^{-6}	0	3.4×10^{-9}
LLW (Legacy + ER)	0	0.11	0	5.5×10^{-5}
LLMW (Legacy + ER)	0	4.4×10^{-4}	0	2.2×10^{-7}
TOTAL[b]			**0**	**5.5×10^{-5}**

Sources: DOE 1996h; SNL 1992a; SNL/NM 1997b, 1998a
D&D: decontamination and decommissioning
ER: environmental restoration
LCFs: latent cancer fatalities
LLMW: low-level mixed waste
LLW: low-level waste
MTRU: mixed transuranic
TRU: transuranic
[a] The base year varies depending on information provided in the *Facilities and Safety Information Document* (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.
[b] Lifetime estimated total LCFs

would result in structural damage to buildings up to a distance of 91 m from the truck. Fatalities would result up to a distance of 15 to 18 m from the truck, while eardrum ruptures would occur up to a distance of 36 m from the truck.

5.5.10 Waste Generation

Implementation of the Reduced Operations Alternative would not result in any major changes in the types of waste streams generated onsite. Except for new operations, waste generation levels at SNL/NM would remain constant or decrease slightly, consistent with slight decreases in laboratory operations. These lower waste volumes would be enhanced by the waste minimization and pollution prevention programs, which project a 33-percent overall decrease in total waste disposal needs by FY 2000. Therefore, the decreased generation activities would not exceed current existing waste management disposal capacities.

For projection purposes, the baseline waste generation data were considered to be constant for existing facilities with no major increases or decreases in the amount of wastes generated. Operations waste are considered to be derived from mission-related work. Nonoperations waste are generated from special programs. New operations are discussed separately in order to show the maximum likely existing operational increases. Waste generation levels for special operations waste, such as for the ER Project, are derived separately from the representative facilities projections under special projects. However, the amount of waste generated is anticipated to reflect proportionally increases or decreases in SNL/NM activity levels over the next 10 years, with the exception of waste to be generated by new programs. The waste quantities projected, listed in Table 5.5.10 1, represent a site-wide aggregate of quantities for each type of waste stream from existing selected facilities. As appropriate, the balance of operations (not selected facilities or special projects) waste generated is discussed within the individual waste sections. Units shown for each waste type are based on how industrial facilities charge commercial clients for disposal of these wastes.

5.5.10.1 Radioactive Wastes

Only three types of radioactive waste, LLW, LLMW, and MTRU waste, would potentially be generated under the Reduced Operations Alternative. SNL/NM would not generate any high-level waste or TRU waste. Projections for waste generation at selected facilities from new and existing operations are presented in Appendix H.

Existing Operations

Under the Reduced Operations Alternative, SNL/NM anticipates a maximum 20 percent decrease in the generation of LLW from existing operations over the next 10 years. LLW generated by SNL/NM is and will continue to be transported offsite to appropriate DOE-approved disposal facilities, such as the NTS. LLMW generation would decrease by 13 percent for existing operations through 2008. Under the *Resource Conservation and Recovery Act Part B, Permit Application for Hazardous Waste Management Units* (SNL/NM 1996a), some treatment of the hazardous component of LLMW could be performed at SNL/NM (Table 4.12 2). LLMW for which no onsite treatment is available would be shipped offsite for treatment and disposal. SNL/NM also projects no TRU waste would be generated annually. The existing TRU/MTRU wastes stored onsite, as well as all future TRU/MTRU wastes, are anticipated to be transferred to LANL for certification, as indicated in the Waste Management Programmatic Environmental Impact Statement (DOE 1997i) ROD (DOE 1998n), prior to disposal at the WIPP. Projected MTRU waste generated would decrease to 0.23 m^3 annually. Existing SNL/NM operations would use less than 1 percent (0.17 percent) annually of the available radioactive waste storage capacity.

New Operations

SNL/NM anticipates a maximum of 10.8 m^3 of LLW would be generated from new operations annually over the next 10 years. The majority of this increase would be primarily due to the full implementation of medical isotopes production operations in 2003. These operations, described in the *Medical Isotopes Production Project: Molybdenum-99 and Related Isotopes Environmental Impact Statement* (DOE 1996b), would account for over 47 percent of the total projected LLW in the Reduced Operations Alternative. However, due to the nature of the waste, it would be managed at the generation facility to minimize worker exposure until disposal offsite. LLMW generation from all new onsite sources would be a maximum of 0.14 m^3 annually through 2008.

SNL/NM does not expect to generate TRU or MTRU wastes from new operations. Approximately 42 kg of spent fuel would be generated over the 10-year period. Spent fuel is further discussed in Appendix A as a material resource.

Table 5.5.10 1. Waste Generation for Existing Selected SNL/NM Facilities Under the Reduced Operations Alternative

ALL WASTE		UNIT	BASE YEAR[a]	REDUCED ALTERNATIVE
RADIOACTIVE WASTE				
Low-Level Waste (500 kg/m³)	Existing Operations	m³(kg)	16(8,000)	18(9,000)
	New Operations	m³(kg)	4(2,000)	11(5,500)
	SNL/NM Balance of Operations	m³(kg)	74(37,000)	74(37,000)
	SNL/NM Total LLW	m³(kg)	94(47,000)	102(51,000)
	Percent change		0.0%	8.8%
Low-Level Mixed Waste (550 kg/m³)	Existing Operations	m³(kg)	3.85(2,120)	3.36(1,850)
	New Operations	m³(kg)	0.20(110)	0.14(80)
	SNL/NM Balance of Operations	m³(kg)	0.28(150)	0.28(150)
	SNL/NM Total LLMW	m³(kg)	4.33(2,380)	3.79(2,080)
	Percent change		0.0%	-12.6%
TRU Waste (310 kg/m³)	Existing Operations	m³(kg)	-	-
	New Operations	m³(kg)	-	-
	SNL/NM Balance of Operations	m³(kg)	-	-
	SNL/NM Total TRU	m³(kg)	-	-
MTRU Waste (76 kg/m³)	Existing Operations	m³(kg)	0.45(34)	0.23(26)
	New Operations	m³(kg)	-	-
	SNL/NM Balance of Operations	m³(kg)	-	-
	SNL/NM Total MTRU	m³(kg)	0.45(34)	0.23(26)
	Percent change		0.0%	-50.0%
RADIOACTIVE WASTE TOTAL[c]	**Existing Operations**	**m³(kg)**	**20.34 (10,154)**	**21.55 (10,876)**
	New Operations	**m³(kg)**	**4.62(2,110)**	**10.96 (5,580)**
	SNL/NM Balance of Operations	**m³(kg)**	**73.92 (37,150)**	**73.92 (37,150)**
	SNL/NM Total Radioactive Waste	**m³(kg)**	**98.88 (49,414)**	**106.42 (53,606)**
	Percent change		**0.0%**	**7.6%**

Table 5.5.10 1. Total Waste Generation Facilities Under the Reduced Operations Alternative (concluded)

ALL WASTE	UNIT	BASE YEAR[a]	REDUCED ALTERNATIVE
RCRA HAZARDOUS WASTE			
Existing Operations	kg	16,187	15,176
New Operations	kg	398	598
SNL/NM Balance of Operations	kg	39,267	37,349
SNL/NM Total RCRA Hazardous	kg m^3	55,852 44.3	53,123 42.1
Percent change		0.0%	-4.9%
SOLID WASTE			
SNL/NM Total Solid Waste[b]	m^3(kg)	0.6M (2,022)	0.6M (1,955)
Percent change		0.0%	-3.3%
WASTEWATER			
Existing Operations	M gal	49	51
New Operations	M gal	0	3
SNL/NM Balance of Operations	M gal	231	214
SNL/NM Total Wastewater	M gal	280	268
Percent change		0.0%	-4.3%

Sources: SNL/NM 1997b, 1998a, 1998c, 1998t
kg: kilogram
LLMW: low-level mixed waste
LLW: low-level waste
M: million
M gal: million gallons
m^3: cubic meter
MTRU: mixed transuranic
RCRA: *Resource Conservation and Recovery Act*
TRU: transuranic
[a] The base year varies depending on information provided in the *Facilities and Safety Information Document* (SNL/NM 1997b). Typically, the base year is 1996 or 1997, as appropriate.
[b] Individual breakdowns of solid waste for existing, new, and balance of operations are unavailable because of tracking methods.
[c] Numbers are rounded and may differ from calculated values.
Note: Densities shown are found in Table H.3 1.

Balance of Operations

The waste level for the balance of operations was determined for each type of radioactive waste (Table 5.5.10 1). Only LLW and LLMW would be affected. Balance of operations at SNL/NM would account for an additional 73.6 m^3 per year of LLW. These same operations would account for an additional 0.28 m^3 of LLMW per year. The overall operations impacts for this alternative would increase by 9 percent for LLW and would decrease by 13 percent for LLMW.

Current Capacity

Previously generated radioactive wastes (legacy waste) occupy approximately 494 m^3 of the available 11,866 m^3 of total radioactive waste storage capacity at the RMWMF and its associated storage areas. This represents approximately 4.2 percent of the total available capacity. Therefore, there is sufficient capacity to accommodate the anticipated decrease in radioactive wastes generated.

Special Projects

Projections indicate the ER Project, a special project beyond the scope of normal operations, will actually be the single largest waste generator at SNL/NM in 1998. The ER Project will produce approximately 2,862 m^3 of LLW and 221 m^3 of LLMW, primarily contaminated soil and debris, prior to the end of the project in 2004 (Table 5.3.10 2). Actual cleanup is now expected to be completed by 2002, with ER Project wastes disposed of by 2004. Prior to disposal, ER Project waste must be properly characterized. Therefore, lag time is built into

the project schedule between field remediation and actual disposal of waste.

5.5.10.2 Hazardous Waste

Existing Operations

As shown on Table 5.5.10 1, under the Reduced Operations Alternative, SNL/NM anticipates a decrease in the generation of RCRA hazardous waste from 16,187 kg in the base year to 15,176 kg per year. Projections are shown in Appendix H. Projected RCRA hazardous waste generation is presented in Figure 4.12 4.

No appreciable change in the generation of explosive waste would occur. Therefore, the TTF, with a treatment capacity of 9.1 kg of waste per burn, would continue to accommodate those wastes, as discussed in the No Action Alternative. The majority of explosive waste would be disposed of at SNL/NM or through KAFB.

New Operations

SNL/NM anticipates annual generation of a maximum of approximately 600 kg of hazardous waste by new operations over the next 10 years. The increase would be primarily due to the full implementation of medical isotopes production operations associated with the MIPP in 2003. These operations, described in the *Medical Isotopes Production Project: Molybdenum-99 and Related Isotopes Environmental Impact Statement* (DOE 1996b), would account for less than 2 percent (1.2 percent) of the total projected hazardous waste in 2003 and 2008.

New SNL/NM operations would use less than 1 percent (0.2 percent) annually of the available hazardous waste storage capacity at SNL/NM. This is considered to be a minimal impact.

Balance of Operations

It was assumed that the RCRA hazardous waste levels for the balance of operations at SNL/NM would decrease by the same proportion as RCRA wastes for selected facilities, because facilities represent the overall plant. Consequently, multipliers were used to project RCRA hazardous waste levels under all three alternatives. In the base year, the selected facilities will generate 16,187 kg out of a total of 55,852 kg of all operational RCRA waste. The remainder, 39,267 kg, is the balance of operations RCRA hazardous waste. For the Reduced Operations Alternative, the maximum projected balance of operations amount would be 37,349 kg.

Current Capacity

Under the Reduced Operations Alternative, the total volume of hazardous waste generated at SNL/NM requiring offsite disposal at licensed/approved facilities, would not exceed the existing 286.5 m^3 of storage and handling capacities at the HWMF and its associated storage buildings. The outside nonpermitted bermed storage area for nonhazardous waste was not included in the onsite storage capacity calculations. Hazardous waste is routinely shipped out on a monthly basis to various offsite disposal facilities by SNL/NM. Projections indicate that a maximum of 15.4 percent of the existing hazardous waste capacity would be used. Therefore, a minimum of six years capacity exists for the hazardous waste based on the highest level of generation. Most, if not all, waste would be shipped in less than 1 year to meet regulatory requirements. Based on these projections and continued operations at selected facilities under the Reduced Operations Alternative, the hazardous waste generation impacts would continue to be minimal.

Special Projects

During field remediation, the ER Project, likely the single largest waste generator at SNL/NM in 1998, would produce an additional 26 M kg of hazardous waste by 2002 (Table 5.3.10 2). Final disposal would be accomplished by 2004. ER Project waste must be properly characterized. Therefore, lag time is built into the project schedule between field remediation and actual disposal of waste.

D&D operations would continue (as outlined in Section 2.3.5). This program would directly impact the quantity of TSCA hazardous waste requiring disposal. Under this modernization program, SNL/NM would continue to generate TSCA hazardous waste, primarily PCBs and asbestos that are removed from transformers and buildings. Since the main PCB relamping and transformer removal is now completed, quantities of TSCA waste have dropped to approximately 122,000 kg per year and should remain at that level (Figures 4.12 5 and 4.12 6).

The total volume of TSCA waste would eventually decrease as the targeted facilities are removed. Currently, SNL/NM has 674 buildings providing a total of 5 M gross ft^2 of office and operational space. Through this facility modernization program, the number of buildings would be reduced to 465 buildings totaling approximately 4.9 M gross ft^2. This program would remove 138 buildings accounting for 179,204 gross ft^2

within FY 1998 and FY 1999 at SNL/NM. During FY 2000 through FY 2002, 49 additional buildings accounting for 108,937 gross ft^2 are potentially scheduled for removal. Over the long term, an additional 29 buildings would be removed with a total of 84,132 gross ft^2. To make up for the loss of office and operational space, seven additional buildings would be built, adding approximately 240,000 gross ft^2. No predictions are made for years beyond 2007.

5.5.10.3 All Other Wastes

All SNL/NM operations also involve four additional waste management activity areas, discussed below.

Biohazardous (Medical) Waste

The total volume of medical waste would generally remain a function of the total number of full-time employees and subcontractors located at SNL/NM. Under the Reduced Operations Alternative, approximately 2,423 kg of medical waste would be generated. The existing waste handling capabilities would be adequate to accommodate this waste. No additional offsite impacts would occur, because offsite disposal capacity would continue to be sufficient.

Nonhazardous Chemical Waste

The maximum quantity of nonhazardous waste generated annually at SNL/NM and managed by the HWMF under the Reduced Operations Alternative would be 65,934 kg, based on the waste multiplier (see Appendix A) developed for RCRA waste (Rinchem 1998a). Existing commercial disposal facilities would have adequate capacities to handle the continued generation of nonhazardous waste; thus, no additional impacts would be anticipated.

Municipal Solid Waste

Site-wide solid waste generation trends at SNL/NM would generally remain a function of total building area and the number of full-time and subcontractor employees. This function is based on general build operations activities, such as maintenance and cleaning, and, to a lesser extent, the general office waste created by SNL/NM employees. Over the 10-year time frame, a decrease of 2.2 percent would be anticipated. Despite the projected 3 percent personnel decrease, no appreciable onsite impacts to disposal facilities would be anticipated because existing waste handling capabilities are already in place. As existing buildings are replaced, personnel would be moved to make more efficient use of the space. No additional offsite impacts would occur, since offsite disposal capacity would continue to be sufficient. However, a significant amount of C&D waste, a special class of solid waste, would potentially be generated under the facility modernization program described above. Quantities of C&D waste associated with the facility modernization program were projected to be similar to prior years. This waste would be disposed of at KAFB and would not create an offsite impact. Table 5.3.10 3 summarizes construction debris disposal.

Wastewater

SNL/NM would generate approximately 268 M gal of wastewater annually. However, SNL/NM entered into an MOU with KAFB, the DOE, the city of Albuquerque, and the state of New Mexico to reduce its water use by 30 percent by 2004 (SNL/NM 1997p). The MDL would be the single facility discharging the largest volume of wastewater at SNL/NM. Reduction efforts would focus on the MDL in order to reduce the amount of process wastewater being generated. See Section 5.3.2 for additional discussion of wastewater quantities and capacities.

5.5.11 Noise and Vibration

Implementation of the Reduced Operations Alternative could include activity levels at some facilities that would increase over the 1996 baseline activity levels. In these cases, the activity levels would be those that were not exercised sufficiently during the baseline period to maintain the capability or to satisfy testing requirements of the DOE.

The frequency of impulse noise events under the Reduced Operations Alternative is projected to be 65 percent less than the 1996 baseline level of activity and approximately 75 percent less than the 2008 No Action Alternative level for all test activities combined. This level of activity would result in an average of approximately 1.5 impulse noise tests per day, compared to an average of 5.5 impulse noise tests per day under the 2008 No Action Alternative. Only a small fraction of these tests would be of sufficient magnitude to be heard or felt beyond the site boundary. The vast majority of tests would be expected to be below background noise levels for receptor locations beyond the KAFB boundary and would, therefore, be unnoticed by the neighborhoods bounding the site. These impulse noise levels resemble a dull thud and generally are considered an annoyance because of startle effects, including window vibrations. The effects on the public would be minor.

5.5.12 Socioeconomics

The implementation of the Reduced Operations Alternative would result in no noticeable changes in the socioeconomic categories discussed in the following sections. Environmental impacts to demographic characteristics, economy, and community services in the ROI under the Reduced Operations Alternative are discussed below. The discussion of impacts is based on a bounding economic analysis.

5.5.12.1 Demographic Characteristics

The Reduced Operations Alternative would not likely generate a noticeable change in the existing demographic characteristics within the ROI (Section 4.14.3). Under this alternative, overall expenditures and employment at SNL/NM would decrease gradually and then remain constant through 2008.

5.5.12.2 Economic Base

The Reduced Operations Alternative would not be likely to result in a noticeable economic change in the existing economic base within the ROI (Section 4.14.3).

Table 5.5.12 1 presents an estimate of the Reduced Operations Alternative impacts on the ROI economy from a 3-percent decrease in operational levels of activity and associated decreases in expenditures, income, and employment, both direct and indirect, at SNL/NM. Minimal operational activities associated with selected facilities are included in the totals presented in the table. If operations at SNL/NM were to decrease by 3 percent over current levels, overall economic activity and income within the ROI would be expected to decrease by about 0.3 percent. As presented in Table 5.5.12 1, a 3-percent decrease in operational levels of activity at SNL/NM through 2008 would result in a decrease from $42.4 B to $42.28 B, amounting to a $120-M total reduction in

Table 5.5.12 1. SNL/NM s Impact on Central New Mexico s Economy if Operations Were to Decrease by 3 Percent

ECONOMIC MEASURE	FY 1996[a]			ASSUMING A 3-PERCENT DECREASE IN OPERATIONS			
	SNL/NM	TOTAL ROI	PERCENT OF ROI	SNL/NM	TOTAL ROI	PERCENT OF ROI	PERCENT CHANGE
ECONOMIC ACTIVITY ($ BILLIONS)							
Direct Expenditures	1.43			1.39			
Indirect & Induced	2.50	42.4	9.3	2.43	42.28	9.0	-0.3
Total Economic Activity	3.93			3.81			
Economic Activity Multiplier: 2.75[b]							
INCOME ($ BILLIONS)							
Net Wages & Salaries	0.48			0.47			
Indirect & Induced	0.58	13.4	8.0	0.56	13.37	7.7	-0.3
Total Income	1.07			1.03			
Income Multiplier: 2.21[b]							
EMPLOYMENT (NUMBER OF EMPLOYEES)							
SNL/NM Employment	7,652			7,422			
Indirect & Induced	18,826	331,800	8.0	18,259	331,004	7.6	-0.4
Total Employment	26,478			25,682			
Employment Multiplier: 3.46[b]							

Source: DOE 1997j
ROI: region of influence
FY: fiscal year

[a] Modeled results from DOE 1997j
[b] The use of multipliers in calculating economic impacts in the ROI is explained in Section 4.14.3.

economic activity (an average loss of $12 M per year). Total income would decrease from $1.07 B to $1.03 B, amounting to a $40-M reduction in total income (an average loss of $4 M per year). Total employment would decrease from 331,800 to 331,004, amounting to a reduction of 796 total jobs (an average loss of 80 jobs per year) in the ROI. By 2008, contributory effects from other industrial and economic sectors within the ROI would reduce or mask some of SNL/NM s effect on the ROI economy (Section 6.4.1).

5.5.12.3 Housing and Community Services

The Reduced Operations Alternative would not be likely to have a noticeable impact on existing housing and community services within the ROI (Section 4.14.3). Under this alternative, overall expenditures and employment at SNL/NM would decrease gradually and then remain constant through 2008. Contributory effects from other industrial and economic sectors within the ROI would reduce or mask the SNL/NM proportional impact.

5.5.13 Environmental Justice

In general, SNL/NM operations under the Reduced Operations Alternative would have no known disproportionately high or adverse health or environmental impacts on minority or low-income populations within the ROI. One area of concern is water resources and hydrology. Anticipated water resources adverse impacts would equally affect all communities in the area (see Section 5.5.4). Thus, no disproportionately high and adverse impacts to minority or low-income communities are anticipated for this resource area.

Table 5.5.13 1 provides a brief summary of environmental justice impacts on each resource or topic area under the Reduced Operations Alternative. It also identifies areas where the impacts do not vary from the No Action Alternative. See Section 5.3.13 for an expanded discussion of environmental justice issues by resource area.

Table 5.5.13 1. Summary of Potential Environmental Justice Impacts Under the Reduced Operations Alternative

RESOURCE OR TOPIC AREA	SUMMARIZED EFFECT	EFFECT ON RESOURCE OR TOPIC AREA ROI	PROPORTIONAL EFFECT ON	
			LOW-INCOME	MINORITY NEIGHBOR-HOODS
Land Use and Visual Resources, Infrastructure, Geology and Soils, Water Resources and Hydrology[a], Biological and Ecological Resources, Cultural Resources[b], and Waste Generation	Same as under the No Action Alternative	Same as under the No Action Alternative	Same as under the No Action Alternative	Same as under the No Action Alternative
Air Quality Nonradiological Air	Emissions would be below the most stringent standards, which define the pollutant concentrations below which there are no adverse impacts to human health and the environment. Concentrations would be below regulatory standards and human health guidelines. SNL/NM carbon monoxide emissions would be 5.6% of Bernalillo County carbon monoxide emissions.	Not adverse	Not adverse	Not adverse
Air Quality Radiological Air	MEI: 0.020 mrem/yr Collective ROI dose: 0.80 person-rem/yr Average collective dose in ROI: 1.1×10^{-3} mrem/yr	Not adverse	Not adverse	Not adverse
Human Health and Worker Safety	MEI lifetime risk of fatal cancer would increase by 8.0×10^{-9} Fatal cancers (additional ROI): 4.0×10^{-4} Risk of cancer fatality to workforce is 4.0×10^{-3}	Not adverse	Not adverse	Not adverse
Transportation	Total annual material shipments: 4,170 Total KAFB traffic (daily vehicles): 37,319 Incident-free exposure, truck emissions - annual LCFs: 1.1×10^{-2} Incident-free exposure, dose - annual LCFs: 2.4×10^{-2}	Not adverse	Not adverse	Not adverse

Table 5.5.13 1. Summary of Potential Environmental Justice Impacts Under the Reduced Operations Alternative (concluded)

RESOURCE OR TOPIC AREA	SUMMARIZED EFFECT	EFFECT ON RESOURCE OR TOPIC AREA ROI	PROPORTIONAL EFFECT ON	
			LOW-INCOME	MINORITY NEIGHBOR-HOODS
Noise and Vibration	Test activities would be 85% less than the 1996 level, an average of approximately 1.5 impulse noise tests per week. Only a fraction of these tests would be of sufficient magnitude to be heard or felt beyond the site boundary. The vast majority of tests would be expected to be below background noise levels for receptor locations beyond the KAFB boundary and would, therefore, be unnoticed in neighborhoods bounding the site.	Not adverse	Not adverse	Not adverse
Socioeconomics	SNL/NM employees: 7,422 SNL/NM total economic activity: $3.81 B/yr Percent of ROI total economic activity: 9%	Not adverse	Not adverse	Not adverse

Source: Original
B: billion
LCFs: latent cancer fatalities
MEI: maximally exposed individual
mrem: millirem
ROI: region of influence
TCPs: traditional cultural properties
yr: year
[a] Groundwater withdrawal was considered adverse; however, the effects are not disproportionately high and adverse to low-income and minority neighborhoods.
[b] No TCPs have been identified; ongoing consultations may yet result in determination of impacts.
[c] SNL/NM represents approximately 10% of the total economic activity in the ROI.

5.6 MITIGATION MEASURES

The regulations promulgated by the CEQ to implement the procedural provisions of NEPA (42 U.S.C. §4321) require that an EIS include a discussion of appropriate mitigation measures (40 CFR §1502.14[f] and 16[h]). The term mitigation includes the following (40 CFR §1508.20):

> avoiding an impact by not taking an action or parts of an action;
>
> minimizing impacts by limiting the degree or magnitude of an action and its implementation;
>
> rectifying an impact by repairing, rehabilitating, or restoring the affected environment;
>
> reducing or eliminating the impact by preservation and maintenance operations during the life of the action; and
>
> compensating for the impact by replacing or providing substitute resources or environments.

This section describes mitigation measures by resource area, along with descriptions and key proactive initiatives. These mitigation measures and proactive initiatives address the range of potential impacts of continuing to operate SNL/NM.

SNL/NM operates under existing programs and controls, including regulations, policies, contractual requirements, and administrative procedures, to mitigate impacts. The existing programs and controls are too numerous to list completely. Examples include the Fire Protection Program, Pollution Prevention and Waste Minimization Programs, Water and Energy Conservation Programs, and a Natural Resource Management Plan.

In large part, these programs and controls effectively reduce the need for additional mitigation measures in a majority of resource areas evaluated in the SWEIS. Also, as presented in Chapter 5, the majority of resource area impacts would not pose substantial harm to the environment or the public, and thus mitigation measures would not be required or anticipated. However, several resource areas, including cultural resources and environmental justice, present potential mitigation measures.

The description of these potential mitigation measures does not constitute a commitment to undertake any of them. Any such commitments would be reflected in the ROD following the Final SWEIS, with a more detailed description and implementation plan in a Mitigation Action Plan published following the ROD.

5.6.1 Resource-Specific Mitigation Measures

Resource-specific mitigation measures are discussed below. Unless otherwise noted, the analyses in Chapter 5 assume that these measures would not be implemented.

5.6.2 Land Use and Visual Resources

No land use or visual resources impacts are anticipated that would require specific mitigation measures. Because land use on KAFB is influenced by a variety of landowners, permit arrangements, and withdrawal agreements, future land use is a complex issue. As a proactive means of developing future use options for properties owned by the DOE or permitted for its use on KAFB, SNL/NM is participating in a Future Use Options Logistics and Support Working Group with the DOE as the lead. Additional members of this group include other DOE affiliates (such as the Lovelace Respiratory Research Institute, Nonproliferation and National Security Institute (NNSI), TSD, KAFB, USFS, NMED, and EPA). Public involvement is encouraged through the DOE/SNL Citizens Advisory Board, which has been instrumental in providing interim recommendations on future land use options. These recommendations recognize the high probability of continued Federal use of KAFB and propose, for future use planning and cleanup level determination, reasonable land use classifications based on residential, recreational, and industrial use (SNL 1997a, Keystone 1995).

Improving the visual quality of SNL/NM is currently accomplished through incorporating Campus Design Guidelines. These guidelines contain a set of principles and detailed design guidance for the physical development and redevelopment of SNL/NM sites. They include guidance for building massing, facades, color palettes, building orientation and entries, circulation corridors, standardized signage, and landscaping, including low-water use plant selections. All new and modified facilities will be brought into compliance with these guidelines over time. They have been endorsed by senior management of SNL/NM and are administered through the Corporate Projects Department, the Sites Planning Department, and the Campus Development Committee (SNL 1997a). Where decommissioning, demolition, or environmental restoration are planned, actions will be taken to restore the area to its

approximate natural condition by backfilling, reducing side slopes, applying topsoil, reseeding, and establishing plant growth (SNL/NM 1997a).

5.6.3 Infrastructure

SNL/NM site infrastructure resources are capable of accommodating any of the alternatives with regular maintenance, repair, and upgrades. No mitigation measures would be anticipated.

5.6.4 Geology and Soils

Of the two analyses (slope stability and soil contamination) conducted for the Geology and Soils resource area, negligible environmental impacts were noted. Therefore, no mitigation measures would be required. Slope stability has not been an issue at SNL/NM because of the location of major facilities on relatively level ground and the stable bedrock-dominated mountainous areas. For soil contamination, this finding assumes SNL/NM s continued compliance with applicable regulations regarding the management and disposal of waste. Mitigation measures for potential releases of hazardous or radioactive materials at outdoor testing areas would be part of future operations (SNL 1997e).

5.6.5 Water Resources and Hydrology

Groundwater contamination exists at the CWL as a result of prior waste disposal activities. Groundwater contamination also exists in an area beneath TAs-I and -II, although contamination may not be of SNL/NM origin (see discussion in Section 5.3.4.1). At the Lurance Canyon Burn Site, nitrates exceeding the MCL have been detected in groundwater, but may be naturally occurring. Investigations or cleanup are underway at all of these sites, and further actions will be coordinated with the NMED.

The groundwater quantity analysis established SNL/NM s current and future contribution to local aquifer drawdown to be approximately 11 percent. To mitigate impacts to groundwater supplies, SNL/NM has announced a plan to cut water usage by 30 percent (SNL/NM 1997a). However, the effectiveness of any SNL/NM conservation initiative in reducing aquifer drawdown must be evaluated in the context of SNL/NM s portion of aquifer usage, determined to be approximately 1 percent (see Chapter 6). Accordingly, significant water conservation by SNL/NM will have a limited effect on regional aquifer drawdown.

5.6.6 Biological and Ecological Resources

Surveys for the presence or absence of threatened and endangered species and sensitive species, as well as for migratory bird nests, would be conducted at sites prior to commencing activities that could result in ground disturbance or destruction. If any of these species are encountered at a site, avoidance measures would be implemented. Such measures could include scheduling the activities outside of the breeding season and transplanting populations to another location. Migratory bird nests and birds occupying those nests, which could be affected by the activity, would be removed in accordance with the *Migratory Bird Treaty Act* (MBTA) (16 U.S.C. §703) permit from the USFWS. These thirteen species of birds would include, for example, the western burrowing owl and the gray vireo (see 4.7).

5.6.7 Cultural Resources

The likelihood for discovery or identification of previously unrecorded archaeological sites or TCPs in the ROI is high. Currently, there are no identified archaeological sites or TCPs on DOE-administered land within the ROI. If resources are discovered as a consequence of ongoing consultation, the stipulations outlined in the *National Historic Preservation Act* (NHPA) (16 U.S.C. §470 as amended) and its regulations (36 CFR Part 800) would be followed. Activities in the immediate vicinity of the discovery would cease until the significance and disposition of the resource could be determined in consultation with the New Mexico SHPO, Native American tribes with cultural affiliation, and the Advisory Council on Historic Preservation. The inadvertent discovery of Native American human remains or funerary objects (associated or unassociated) would require adherence to the *Native American Graves Protection and Repatriation Act* (NAGPRA) (25 U.S.C. §3001). The activity leading to the discovery would stop and would be delayed for 30 days after certification that notification to the agency or tribes had been received. Protection of the individual or objects *in situ* or while curated would be initiated and continue until disposition of the individual or objects is completed. A notice of the discovery would be sent to the Native American tribes with the closest known cultural affiliation, and direction would be requested for treatment and disposition of the items. For land that is permitted to the DOE by another agency, the stipulations in the permits

governing the management and treatment of cultural resources would determine which agency is responsible for each of the steps identified above.

The additional security that is enforced at selected facilities during certain activities would increase protection of archaeological sites and TCPs from inadvertent and intentional damage. Although no specific TCPs have been identified within the ROI, if any are identified on DOE-administered land in the future, access to these sites could become an issue. If TCPs are identified and access is desired, the DOE would consult with the appropriate Native American tribe to develop an agreement and procedure for access to the specific TCP. For lands permitted to the DOE by the USAF or USFS, such agreements would potentially involve multiple Federal agencies. Any agreement would have to take into account the additional security enforced by that particular SNL/NM facility.

5.6.8 Air Quality

5.6.8.1 Nonradiological Air Quality

Mitigation measures to control the emissions of chemical and criteria pollutants would not be required under the alternatives. The health impacts associated with the atmospheric release of chemicals were evaluated in Sections 5.3.8.1, 5.4.8.1, and 5.5.8.1. No health effects were identified.

5.6.8.2 Radiological Air Quality

Under each alternative, the calculated radiological annual dose due to air emissions from SNL/NM operations to the MEI and total population within 50 mi of SNL/NM would be minimal and not expected to have any adverse impacts. Therefore, no mitigation measures would be required.

5.6.9 Human Health and Worker Safety

5.6.9.1 Normal Operations

Adverse human health effects are not expected under any of the alternatives. Therefore, no mitigation measures would be necessary to protect human health.

5.6.9.2 Accidents

DOE operations at SNL/NM are conducted in strict accordance with DOE orders, laws, and regulatory requirements to minimize the chances of an accidental release of chemical and radiological materials. Measures can be taken to prevent accidents and, in the event of an accident, to eliminate, lessen, or compensate for potential impacts. For example, engineered safety features and administrative controls are designed to prevent accidents from occurring or stop the progression of the accident. Other measures taken following an accident would minimize impacts to workers, the public, and the environment. For example, air filtration systems, room and building barriers, and air locks that contain releases of hazardous materials, dikes for controlling spills, fire-fighting equipment, evacuating workers and/or the public, restricting the consumption of contaminated food and water, cleaning up contaminated areas, and restricting public access to contaminated areas are existing means to mitigate the adverse effects of accidents. Specific measures for preventing and mitigating accident impacts depend on the accident scenarios, facility locations, and other factors. For this reason, additional existing mitigation measures and their effects are discussed in the context of specific accidents, where applicable, in Appendix F.

Emergency Preparedness and Emergency Plan

SNL/NM has prepared and maintains an Emergency Plan (Sandia 1993zz) in accordance with DOE requirements. The plan uses inputs from the HA process, SARs, site development plans, and other documents to establish the basic requirements for emergency response. The plan establishes an Emergency Response Organization that is responsible for minimizing the effect of an emergency incident on people, property, and the environment. SNL/NM maintains a working relationship with offsite authorities. The goal is to share information that might be needed during an event, establish response interfaces, maintain rapport, and share resources when requested for event mitigation. The city of Albuquerque, county of Bernalillo, state of New Mexico, KAFB, U.S. Department of Agriculture, USFS, and the DOE have established roles and responsibilities for emergency response. These include the notification processes for each of the response groups and mutual aid in the event of an emergency. SNL/NM, upon request from the DOE, would respond with technical support to transportation accidents involving radiological and hazardous materials. No emergency response roles are identified between SNL/NM and tribal organizations.

5.6.10 Transportation

5.6.10.1 Normal Operations

The transportation of many different materials and waste streams from SNL/NM operations and projects results in a continuous need for proper packaging, labeling, and manifesting. General transportation requirements are anticipated to decrease in 2003 and 2008, based on full implementation of waste minimization/pollution prevention projects. To minimize the impact to the environment, SNL/NM, whenever possible, would transport full shipments of waste materials offsite for treatment and disposal within the programmatic goals and schedules. Using the JIT procurement system would minimize the quantities of materials transported (for example, more packages, smaller quantities) by using specific chemical providers, thereby reducing the number of trips.

Special projects such as the ER Project and shipments of legacy wastes would, in the short-term, increase total transportation requirements for radioactive and hazardous waste. Mitigation measures for the different wastes are discussed in Section 5.6.11.

5.6.11 Waste Generation

5.6.11.1 Waste Generation

No impacts from waste generation would be anticipated. Therefore, no specific mitigation measures would be required. However, the generation of the many different waste streams from SNL/NM operations and projects poses a continuous need for the proper packaging, labeling, manifesting, transportation, storage, and ultimate disposal of the waste. General waste trends are anticipated to decrease in quantity for 2003 and 2008 based on full implementation of waste minimization/ pollution prevention projects. All waste management is considered to be part of the general infrastructure of SNL/NM and has been identified as such in facility documents.

Radioactive Wastes

As part of the effort to minimize the total quantity of radioactive wastes that are generated at SNL/NM facilities, all wastes originating from a Radioactive Materials Management Area (RMMA) must be identified prior to pick-up and disposal. A RMMA is an area where the reasonable potential exists for contamination due to the presence of unconfined or unencapsulated radioactive material, or an area that is exposed to beams or other sources of particles (neutron, proton, and so on) capable of causing activation. Managers of all facilities must document the location of any RMMAs. Procedures to minimize the generation of radioactive wastes are developed with the Generator Interface and Pollution Prevention Department, Health Protection Department, and the Radiation Protection Operation Department.

The ER Project has been the largest single contributor of LLW and LLMW. Based on current program objectives, the ER Project will be completed around 2004, depending on funding of cleanup projects and NMED approval. Once sites are cleaned up, significant reductions in total waste volumes generated are anticipated. Procedures for this project are detailed in the EA for the ER Project (DOE 1996c). ER Project waste generation would be minimized through a detailed sampling analysis. Site-specific restoration details would be negotiated and approved by the DOE and the NMED program to determine contamination of waste materials from ER sites.

Hazardous Waste

Under the DOE and the NMED, RCRA hazardous waste would be closely managed with annual audits to determine SNL/NM s level of compliance. RCRA hazardous waste operations at SNL/NM are covered under a SNL/NM permit. The largest single contributor of RCRA hazardous waste would be the ER Project. Based on current program objectives, the ER Project will be completed around 2004, depending on funding of cleanup projects and state of NMED approval. Once sites are cleaned up, significant reductions in the total waste volumes being generated would be anticipated. Procedures for this project are detailed in the EA for the ER Project (DOE 1996c). Site-specific restoration details would be negotiated and approved by the DOE and the NMED. In order to more effectively handle and treat hazardous waste generated by this program a CAMU has been constructed. This will minimize the amount of waste generated and pollution generated through packaging and transportation operations. Waste generation would be minimized through a detailed sampling analysis program to determine contamination of waste materials from ER sites and treatment requirements.

As TSCA hazardous wastes (PCBs and asbestos) are removed from existing facilities, the total volume of this type of waste material would decrease. Proper sampling and management of TSCA wastes would reduce overall quantities generated at SNL/NM.

Biohazardous Medical Waste

The total volume of biohazardous waste would remain a function of the total number of full-time employees and subcontractors located at SNL/NM. Proper management of biohazardous wastes would reduce overall quantities and the combined cost for disposal of this waste to SNL/NM.

Wastewater

Measures are currently being implemented that will reduce the total process water used, this will directly reduce the wastewater being generated. SNL/NM entered into a MOU with KAFB, the DOE, the city of Albuquerque, and the state of New Mexico to reduce its water use by 30 percent by 2004 (SNL/NM 1997a). The MDL accounts for approximately 90 percent of all process wastewater generated by SNL/NM. Recycling efforts would focus on the MDL in order to reduce the amount of process wastewater being generated. If all of the planned water conservation projects are implemented, 63 to 205 M gal of the current 440 M gal of the water used per year at SNL/NM would be saved. Section 5.3.2 discusses wastewater quantities and capacities.

Waste Minimization/Pollution Prevention Program

The Waste Minimization/Pollution Prevention Program is a central element of the SNL/NM Environment Safety and Health management strategy, and day-to-day operations. The program was developed to change the corporate culture, including pollution prevention practices, into everyday activities and tasks. As a result, reducing or eliminating the generation of waste has become an integral part of the philosophy and operations at SNL/NM. SNL/NM developed a formal program plan that provides programmatic guidance, specifying strategies, activities, and methods that are to be employed to reduce the quantity and toxicity of waste and pollutants, to conserve energy and resources, and to encourage the purchase of products with recycled content.

SNL/NM also employs a comprehensive waste minimization program to reduce the quantity of chemical and radioactive wastes generated onsite. The key components of this program are identified in the *SNL/NM Pollution Prevention Plan* (SNL/NM 1997p). These include having senior SNL/NM management committed to the plan, identifying quantitative source reduction and recycling goals, performing Pollution Prevention Opportunity Assessments, and incorporating pollution prevention designs and training into new facilities or processes.

Another aspect of the SNL/NM environmental management strategy includes the implementation of a comprehensive recycling program to reduce the amount of waste generated onsite. Annual projections for recycled waste are presented in Figures 5.3.10 1, 5.3.10 2, and 5.3.10 3. Actual waste trends are shown for RCRA hazardous, TSCA PCB, and TSCA asbestos wastes in Figures 5.3.10 4, 5.3.10 5, and 5.3.10 6. SNL/NM has identified an overall goal to reduce the generation of radioactive and hazardous wastes onsite by 50 percent from the 1993 level, and to reduce the annual generation of sanitary waste by 33 percent.

5.6.12 Noise and Vibration

No impacts would be anticipated; therefore, no specific mitigation measures would be required. However, the existing Weather Watch Program is used by KAFB meteorologists to help engineers select a time for testing when atmospheric conditions are most favorable for deadening sound. These conditions exist during cloudless days with unstable air as opposed to meteorological conditions that favor noise propagation such as when it is overcast or there is an inversion (DOE 1997e).

5.6.13 Socioeconomics

No mitigation measures would be required.

5.6.14 Environmental Justice

In general, no mitigation measures would be required. If access to traditional cultural sites becomes an issue, the DOE would consult with the respective Native American tribe to develop an agreement and procedure for access to specific sites. Any agreement would have to take into account the additional security enforced by that particular SNL/NM facility.

5.7 UNAVOIDABLE ADVERSE EFFECTS

Under any of the three alternatives, SNL/NM operations would require the use of large quantities of groundwater, approximately 400 to 500 M gal per year. Analysis shows that the regional demands on the Albuquerque-Belen Basin aquifer would continue to exceed recharge. SNL/NM s portion of water use in Albuquerque would be less than 2 percent (400 M gal

per year, compared to 35 B gal per year). Although SNL/NM could use waste avoidance measures and has committed to a 30-percent reduction by 2004, water use would be unavoidable.

Other areas where effects would be small but unavoidable include human health, worker safety, transportation, and waste generation.

During normal operations at SNL/NM, a minimal amount of radioactive material and activation products would be released to the environment. However, any radiation dose received by a member of the public from emissions from SNL/NM would be too small to distinguish from naturally occurring background radiation. During normal operations, even with a strong as-low-as-reasonably-achievable (ALARA) program and engineering and administrative controls, some radiological exposures to workers would be expected.

In addition, because hazardous and toxic chemicals would be routinely handled at SNL/NM facilities, worker exposure to these chemicals would be unavoidable. However, no onsite chemical concentrations would exceed the Occupational Exposure Limit (OEL) guidelines. Analysis has shown that chemical pollutant emissions would be of minimal consequence and would not pose a danger to the public. For details on the human health and worker safety impacts, see Sections 5.3.8.1, 5.4.8.1, and 5.5.8.1, and Appendix E.

Under any alternative, many different materials and waste streams would be transported at SNL/NM, and such transport would have unavoidable adverse consequences. Transporting materials along public routes would impose unavoidable effects on the environment, which include health effects from radioactive materials and truck emissions.

SNL/NM operations would generate a variety of wastes (including radioactive, biohazardous, solid, liquid, gas, and sanitary) as an unavoidable result of normal operations. Although SNL/NM uses pollution prevention and waste avoidance measures, generation of chemical and radioactive wastes would be unavoidable. SNL/NM would continue to further reduce hazards and potential exposures through the continued success of pollution prevention and waste avoidance measures. Details regarding waste generation impacts are presented in Sections 5.3.10, 5.4.10, and 5.5.10 for each alternative. Appendix H contains expanded information on SNL/NM operations regarding waste generation.

5.8 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The implementation of any of the alternatives would cause some adverse impacts to the environment and permanently commit some resources to specific SNL/NM activities. The alternatives for SNL/NM would require the short-term use of resources (for example, fuel, electricity, water, material, land, expertise, and labor) to reach the long-term goal of achieving DOE s missions in national security, energy resources, environmental quality, and science and technology.

5.9 IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Operations at SNL/NM under any of the three alternatives would require an irreversible and irretrievable commitment of resources. A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource. For example, as a landfill receives waste, the primary impact is a limit on waste capacity. The secondary impact is a limit on future land use options. An irretrievable commitment refers to the use or consumption of a resource that is neither renewable nor recoverable for use by future generations. This section discusses four major resources water, land, material, and energy that are committed irreversibly or irretrievably under the three alternatives.

5.9.1 Water

All SNL/NM water needs are met by groundwater. Regional demand on the Albuquerque-Belen Basin aquifer continues to exceed recharge. Therefore, large portions of the water resources that support SNL/NM operations represent expenditure of a nonrenewable resource. The maximum consumption of water under the three alternatives would be 463 M gal per year (No Action Alternative, Section 5.3.2), 495 M gal per year (Expanded Operations Alternative, Section 5.4.2), and 416 M gal per year (Reduced Operations Alternative, Section 5.5.2).

5.9.2 Land

SNL/NM has in the past used onsite landfills for chemical and radioactive waste disposal of SNL/NM-generated wastes. These sites and other ER Project sites are essentially unavailable for use for other purposes due to a variety of factors. These include construction-related criteria involving soil compacting, regulatory restrictions, and compatibility issues related to DOE missions. The total acreage removed from future or unrestricted use is yet-to-be-determined, because some sites (for example, the CWL) would require continued monitoring, limited access, limited use, and potentially require other future corrective actions for an extended period of time.

5.9.3 Material

Resources irreversibly and irretrievably committed during the 10-year period of the SWEIS, associated with the operation of SNL/NM in support of DOE missions and programs include construction, maintenance, and operational support materials. Consumption of these widely available materials would not be expected to result in critical shortages. Appendix A contains information related to the types and quantities of materials used, stored, and shipped to support SNL/NM operations.

5.9.4 Energy

The irretrievable commitment of resources during construction and operation of the facilities would include nonrenewable fuels to generate heat and power. Energy would be expended in the form of electricity and natural gas. The maximum consumption of electricity, 198,000 MWh per year, would occur under the Expanded Operations Alternative. Corresponding natural gas consumption would be at 475 M ft^3 per year (see Section 5.4.2).