DOE/EA-1153

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Environmental Assessment for Operations, Upgrades, and Modifications in SNL/NM Technical Area IV

April 1996

Sandia National Laboratories/New Mexico

U.S. Department of Energy
Albuquerque Operations Office
Albuquerque, New Mexico

U.S. DEPARTMENT OF ENERGY
FINDING OF NO SIGNIFICANT IMPACT

OPERATIONS, UPGRADES, AND MODIFICATIONS IN SNL/NM TECHNICAL AREA IV at SANDIA NATIONAL LABORATORIES ALBUQUERQUE, NEW MEXICO

AGENCY: U.S. Department of Energy

ACTION: Finding of No Significant Impact

SUMMARY

The U.S. Department of Energy (DOE) has prepared an environmental assessment (EA) on the proposed Operations, Upgrades, and Modifications in Sandia National Laboratories/New Mexico (SNL/NM) Technical Area (TA) IV. The proposed action for this EA includes continuing existing operations, modification of an existing accelerator (Particle Beam Fusion Accelerator [PBFA] II) to support defense-related Z-pinch experiments, and construction of two transformer oil storage tanks to support the expansion of the Advanced Pulsed Power Research Module (APRM). The proposed action is located at SNL/NM TA-IV, within the boundaries of the Kirtland Air Force Base (KAFB) in Albuquerque, New Mexico.

Consistent with its Strategic Plan and mission, the DOE must maintain the safety, security, and reliability of the United States' nuclear weapons stockpile; secure national defense; and assist industry to sustain long-term economic growth to create jobs and a clean environment. Modification to existing capabilities in pulsed power technologies, computational sciences, engineered processes and materials, and advanced manufacturing technologies support programs (including stockpile stewardship at SNL/NM TA-IV) are needed to meet these mission requirements.

Based on the analyses within the EA, the DOE believes that the proposed action is not a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.) and the Council on Environmental Quality (CEQ) NEPA implementing regulations in 40 CFR 1508.18 and 1508.27. Therefore, an environmental impact statement is not required, and DOE is issuing this Finding of No Significant Impact (FONSI).

PROPOSED ACTION

In support of the purpose and need, the proposed action contains the following three elements:

The first element of the proposed action would be to continue the operations and activities currently taking place in TA-IV. These activities are diverse, although the dominant activity is related to pulsed power technology. Other areas of activity include computer science, flight dynamics, satellite processing, and robotics. All activities in TA-IV fall into the basic categories of scientific research, development, and testing.

The second element of the proposed action is to modify PBFA II, an existing accelerator, in order to conduct Z-pinch experiments. In the Z-pinch mode, the 100-nanosecond pulse produced by the pulse-forming section of PBFA II would be transmitted to the central region of the accelerator where the current (approximately 20 MA) would flow through either an array of wires, a cylindrical metal foil, or an inert gas. The magnetic force associated with the current would cause the material in the wires, foil, or gas puff to compress, heat up, and generate x-rays. This technique for generating x-rays is commonly referred to as a Z-pinch or plasma radiation source (PRS). In addition, experiments that produce tritium through the process of the pinch activation between 2.5 MeV neutrons and deuterium (D_2) gas are planned for PBFA II in the Z-pinch mode.

The third element of the proposed action includes the future expansion of the APRM from its present 1/4 configuration to its final full system. The APRM is a single pulse accelerator designed to evaluate the performance of new pulsed power components and component alignments that could be used to improve the performance of future accelerators. The construction of two additional, 284,000-liter (75,000-gallon) outside transformer oils storage tanks, with appropriate secondary containment, would be required for the expansion of the APRM.

ALTERNATIVES CONSIDERED

The EA also analyzes the effects of the no action alternative (continuing operations at TA-IV). As a result of the moratorium on underground testing, the proposed activities at SNL/NM are necessary. The no action alternative would not allow DOE to meet its national security goals with respect to science-based stockpile stewardship. For this reason, this alternative does not meet the purpose and need for agency action, but is analyzed to provide a basis of comparison with the proposed action.

DOE considered, but dismissed from further analysis, two alternatives: 1) discontinuing operations in the near term and decommissioning of existing facilities, and 2) relocating or replicating all TA-IV facilities at another location. If operations in TA-IV were discontinued and all facilities decommissioned, DOE would not be able to meet its important national defense mission and purpose and need for agency action. The alternative to site TA-IV operations at another location was rejected because it offered no technical, scientific, or economic advantages over the present SNL/NM site and would result in potentially more adverse environmental impacts than the proposed action. This alternative would not support the purpose and need for agency action.

ENVIRONMENTAL IMPACTS

The EA analyzed the impacts of continuing existing operations at SNL/NM TA-IV, together with modifying the existing accelerator, PBFA II, and expanding the APRM. The analysis evaluated the potential environmental, human health, and safety effects of construction, routine operations, accidents, and abnormal events. Cumulative impacts were also considered and evaluated. The results of the impact assessment are summarized in the following information:

Soils, Geology, and Seismology — No impacts to geology, soils, or seismology would occur as a result of continuing current operations in TA-IV, which is part of the proposed action. However, short-term impacts to on-site soils would result from the construction of the two transformer oil storage tanks as part of the APRM expansion. Although the site where the oil storage tanks are proposed is currently a parking lot, clearing of the approximate 186 m^2 (2,000 ft^2) site would temporarily disturb surface soil during construction activities. Since the soils in TA-IV have been extensively disturbed in the past, the proposed action represents a minor impact to the on-site soils. The construction of the transformer oil storage tanks would take approximately six weeks. The proposed action would have no impacts on geology or seismology.

Air Quality — Airborne emissions of hazardous air pollutants regulated under the Clean Air Act Amendments of 1990 during continuing operations would be negligible and would not require any air quality permits. Nor would there be any major long-term effects on air quality resulting from operations or future construction activities in TA-IV. In the short-term, construction-related effects could increase levels of particulates (fugitive dust) and other air pollutants generated by the internal combustion engines of construction equipment. However, dust control techniques required by construction practices would help mitigate these minor impacts. Construction-related emissions, however, would not be of sufficient quantity to affect compliance with the National Ambient Air Quality Standards.

Few facilities within TA-IV routinely generate radioactive air emissions. The HERMES III and PBFA II accelerators generate short-lived ^{13}N and ^{15}O radioactive emissions (which are regulated under the 1990 Clean Air Act Amendments), but the emissions are in amounts millions of times smaller than the standard limits. The Saturn accelerator has released tritium (^{3}H) during research experiments in the past, but the dose was at such a low level that the source was exempted from the National Emission Standard for Hazardous Air Pollutants permit requirement.

Radiological air emissions would decrease as a result of the modification of PBFA II for Z-pinch experiments. Under the proposed action, PBFA II would be operated at a much lower voltage (3 MeV vs. 15 MeV) in the Z-pinch mode; therefore, there would be no air activation, as the threshold for activation of ^{13}N and ^{15}O is 10.5 MeV. Consequently, radiological air emissions of ^{13}N and ^{15}O would be absent in the

Z-pinch mode. In addition, D_2 experiments that generate tritium are proposed. A maximum of 25 D_2 shots per year may be conducted, producing a total of 250 μCi of tritium released to the atmosphere. The effective dose equivalent (EDE) to the maximally exposed individual (MEI) for the tritium release would be less than the EDE to the MEI for PBFA II in its current configuration. Therefore, the proposed action would result in a beneficial radiological emission impact.

Water Resources — According to investigations conducted by the U.S. Army Corps of Engineers, neither the 100-year nor the 500-year flood plain encroaches on the boundary of TA-IV. There is low potential of flood waters encroaching on the area. The depth to groundwater in the area is deep (152.4 meters [500 feet]) therefore even a large spill of transformer oil would not affect the groundwater hydrology or quality before it could be cleaned up. Furthermore, there are no wetlands at the site area that could be impacted by present or proposed activities in TA-IV. Current water consumption in TA-IV is estimated to be 378,500 liters (100,000 gallons) per day. This minor impact to water resources will not increase as a result of proposed activities.

Biological Resources — TA-IV is heavily disturbed and virtually devoid of natural habitat for plants or animals. Sufficient food, water, and cover are not available to support populations of smaller wildlife at the site. The results of biological surveys in the area indicate that there are no federal or state-listed threatened or endangered species of plants or animals present at TA-IV. Therefore, the proposed action would not affect biological resources.

Cultural Resources — Approximately 28 acres of TA-IV were surveyed in 1987 prior to the construction of buildings 962 and 963. Subsequently, all of TA-IV was surveyed for archaeological and historic resources in 1990. Neither survey identified any known historic or archaeological sites within TA-IV. Therefore, the proposed action would have no effect on historic properties.

Noise — Any operational or future construction noise levels would have minimal effect on TA-IV personnel and have no effect on persons residing in KAFB housing areas. Because of the considerable distance between TA-IV and residential areas, there is negligible impact from noise.

Waste Management — Radioactive waste would be decreased as a result of the modification of PBFA II for Z-pinch experiments because there would be no activation of ^{13}N and ^{15}O, as there is in the current mode of operation. Consequently, radiological waste would not be generated when PBFA II is in the Z-pinch mode except when D_2 experiments that generate tritium are conducted. For the maximum of 25 D_2 shots per year that may be conducted, an estimated 34 kg (75 lbs) of waste per year would be generated, compared to the less than 276-408 kg (600-900 lbs) of waste currently generated per year. Therefore, as a result of the proposed action, there would be a beneficial radiological waste impact.

Radiological Exposures from Routine Operations — Based on past dosimetry data and the analysis of future activities, the impact to workers or the public from radiological exposures at existing or proposed accelerators is estimated to be negligible. Adequate shielding limits the radiation which leaves accelerator test cell areas or penetrates building walls to outside areas. The prompt radiation generated by an accelerator exists for only a fraction of a second, and occurs only a few times per day. Furthermore, modeling results indicate that the extremely low levels of ^{13}N and ^{15}O, emitted to the atmosphere during existing or proposed accelerator operations, would have no impact on the environment or human population. In calculations for the proposed deuterium experiments in PBFA II, the EDE to the MEI for tritium would be less than the current configuration, therefore, radiological exposures would decrease as a result of the deuterium experiments.

Radiological Exposures from Accidents and Abnormal Events — The only scenario where an individual could possibly receive a lethal dose of radiation from an accelerator would occur if an individual were present in the target area of an accelerator during a shot. This exposure could be fatal, however, it would be extremely unlikely for an individual to be present in the target area because of the redundant engineering controls and strict procedural safeguards that are applied.

Hazardous Chemical Exposures from Routine Operations — Other than hazards of the types and magnitudes routinely encountered and accepted by the general public, the chemical hazards associated with existing or proposed operations in TA-IV have the potential for no more than minor on-site and negligible off-site impacts to people or the environment.

Hazardous Chemical Exposures from Accidents and Abnormal Events — A major earthquake or an aircraft crash into a facility are the only scenarios where major exposure of personnel or the environment to transformer oil is possible. An earthquake could cause rupturing of either a main accelerator tank or an oil storage tank, and rupturing of the secondary containment system. The result would be oil leakage into the environment. If a spill did occur, the EPA-mandated Sandia Spill Prevention Control and Countermeasure Plan would require removal of the contamination as a matter of urgency. An aircraft crash into a facility, an extremely unlikely event, could result in ignition of transformer oil in an accelerator oil tank. If the resulting fire were not extinguished by an automatic fire protection system, the burning oil could produce large amounts of smoke.

Cumulative Effects — The cumulative effect due to existing or planned activities in TA-IV would be negligible on geology, seismology, biological resources, cultural resources, solid waste, noise levels, and human health issues. Activities in TA-IV would have minor impacts on soils, water resources, and air quality.

DETERMINATION

In accordance with the Council of Environmental Quality requirements contained in 40 CFR parts 1500-1508, the EA examined the potential environmental impacts of the proposed continued operation of SNL/NM TA-IV facilities together with the modification of the existing accelerator, PBFA II, to support defense-related Z-pinch experiments, and the construction of two transformer oil storage tanks to support the expansion of the Advanced Pulsed Power Research Module (APRM) at SNL/NM TA-IV. It also discussed potential alternatives. Based on the analyses in the EA, the DOE has determined that the proposed action is not a major federal action that would significantly affect the quality of the human environment within the meaning of the NEPA and CEQ regulations at 40 CFR parts 1508.18 and 1508.27. Therefore, an environmental impact statement is not required, and DOE is issuing this Finding of No Significant Impact.

For a detailed description of the proposed action and its environmental consequences, refer to the EA. Single copies of the EA may be obtained from:

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(505) 845-4094

For further information of the NEPA review process, contact:

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Issued this 4th day of April, 1996.

Michael J. Zamorski
Acting Area Manager, Kirtland Area Office

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Acronyms and Abbreviations

ABC/AQCB	Albuquerque-Bernalillo County/Air Quality Control Board
ACHP	Advisory Council on Historic Preservation
AIS	Albuquerque International Sunport
ALARA	As Low As Reasonably Achievable
ALIAS	Advanced Light Ion Accelerator System
APRM	Advanced Pulsed Power Research Module
ARS	Advanced Radiation Source
C	Celsius
CAAA	Clean Air Act Amendments
CDS	Compact Driver System
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
Ci	Curies
cm	centimeter
CO	carbon monoxide
^{56}Co	cobalt 56, a radioactive isotope of cobalt
^{57}Co	cobalt 57, a radioactive isotope of cobalt
COE	U.S. Army Corp of Engineers
D_2	deuterium, heavy hydrogen, a hydrogen isotope that is twice the mass of ordinary hydrogen
DOE	U.S. Department of Energy
DOI	U.S. Department of Interior
DOT	U.S. Department of Transportation
EA	Environmental Assessment
EBFA	Electron Beam Fusion Accelerator
ECF	Explosives Component Facility
EDE	Effective Dose Equivalent
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ES&H	Environmental, Safety, and Health
F	Fahrenheit
FONSI	Finding of No Significant Impact

FWS	U.S. Fish and Wildlife Service
^{3}H	tritium, a radioactive isotope of hydrogen
HERMES	High-Energy Radiation Megavolt Electron Source
HI	hazard index
HWMF	Hazardous Waste Management Facility
ICF	Inertial Confinement Fusion
ICR	incremental cancer risk
IMP	Intermediate Pulser
ISS	Interim Storage Site
KAFB	Kirtland Air Force Base
KUMSC	Kirtland Underground Munitions Storage Center
kV	kilovolt
LLW	low-level waste
MA	megampere
MEI	Maximally Exposed Individual
MeV	mega electron volt
MINX	Mine Detection X-ray Facility
^{54}Mn	manganese 54, a radioactive isotope of manganese
mrem	millirem
MV	megavolt
^{22}Na	sodium 24, a radioactive isotope of sodium
^{13}N	nitrogen 13, a radioactive isotope of nitrogen
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NIF	National Ignition Facility
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollution Discharge Elimination System
NRHP	National Register of Historic Places
ns	nanosecond
^{15}O	oxygen 15, a radioactive isotope of oxygen
OSHA	Occupational Safety and Health Administration
PBFA	Particle Beam Fusion Accelerator
PCB	Polychlorinated biphenyls

PEIS	Programmatic Environmental Impact Statement
PETL	Processing and Environmental Technology Laboratory
PI 112A	Physics International Model 112A
PM-10	Particulate matter less than 10 microns
POTW	Publicly-Owned Treatment Works
PPE	Personal Protective Equipment
PRS	Plasma Radiation Source
PSD	Prevention of Significant Deterioration
R&D	Research and Development
RAMBO	Really Awesome Microwave Beam Oscillator
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, Testing and Evaluation
rem	roentgen equilvalent man
RHEPP	Repetitive High Energy Pulsed Power
RMSEL	Robotic Manufacturing Science and Engineering Laboratory
RMWF	Radioactive and Mixed Waste Facility
SABRE	Sandia Accelerator and Beam Research Experiment
SDF	Strategic Defenses Facility
SDI	Strategic Defense Initiative
SHPO	State Historic Preservation Officer
SNL/NM	Sandia National Laboratories, New Mexico
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control and Countermeasures
SPHINX	Short Pulse High Intensity Nanosecond X-radiator
SS&M	Stockpile Stewardship and Management
STF	Subsystem Test Facility
STL	Simulation Technology Laboratory
SWHAS	Sandia Workplace Hazardous Awareness System
SWMU	Solid Waste Management Unit
TA	Technical Area
TDX	Test Driver Experimental
TLV	Threshold Limiting Value
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, Disposal Facility
TTF	Thermal Treatment Facility
TWA	Time Weighted Average

USC	United States Code
USGS	United States Geological Survey
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
^{65}Zn	Zinc 65, a radioactive isotope of zinc

EXECUTIVE SUMMARY

Introduction

Sandia National Laboratories/New Mexico (SNL/NM) is located in Bernalillo County, New Mexico, situated entirely within the boundaries of Kirtland Air Force Base (KAFB). Technical Area IV (TA-IV) presently occupies approximately 33.6 hectares (83 acres) at SNL/NM. Figure ES-1 shows the location of SNL/NM within the State of New Mexico, Figure ES-2 shows the location of TA-IV within SNL/NM, and Figure ES-3 is a map of TA-IV.

The U. S. Department of Energy (DOE) is responsible for ensuring that U.S. nuclear weapons remain safe, secure, and reliable. Presidential directive has mandated that the DOE develop the means sufficient to meet these responsibilities in the absence of nuclear testing. In response, DOE has formed science-based weapons stockpile stewardship and related programs. Furthermore, Presidential policy mandates that the DOE enhance the technology infrastructure and core competencies for national security while supporting industrial competitiveness. To support this policy, DOE has developed science and technical goals in defense, industrial competitiveness, and the environment. DOE has also formed science-based weapons stockpile stewardship and related programs. Ongoing and new activities proposed for TA-IV at SNL/NM are directly related to these goals.

Major existing TA-IV facilities include the SATURN x-ray facility, the High Energy Radiation Megavolt Electron Source (HERMES) III gamma-ray facility, and the Particle Beam Fusion Accelerator II (PBFA II). Other smaller facilities (which support various technologies) are also present in TA-IV. These facilities include the Rocket Systems and Flight Dynamics Laboratory, the Payload and Satellite Processing Facility, the Parallel Computing Science Laboratory, the Robotics Laboratory, and a number of small accelerators.

Consistent with the its Strategic Plan and its mission, the DOE must maintain the safety, security, and reliability of the United States' nuclear weapons stockpile; secure national defense; and assist industry to sustain long-term economic growth to create jobs and a clean environment. Modification to existing capabilities in pulsed power technologies, computational sciences, engineered processes and materials, and advanced manufacturing technologies support programs (which includes stockpile stewardship at SNL/NM TA-IV) is needed to meet these mission requirements.

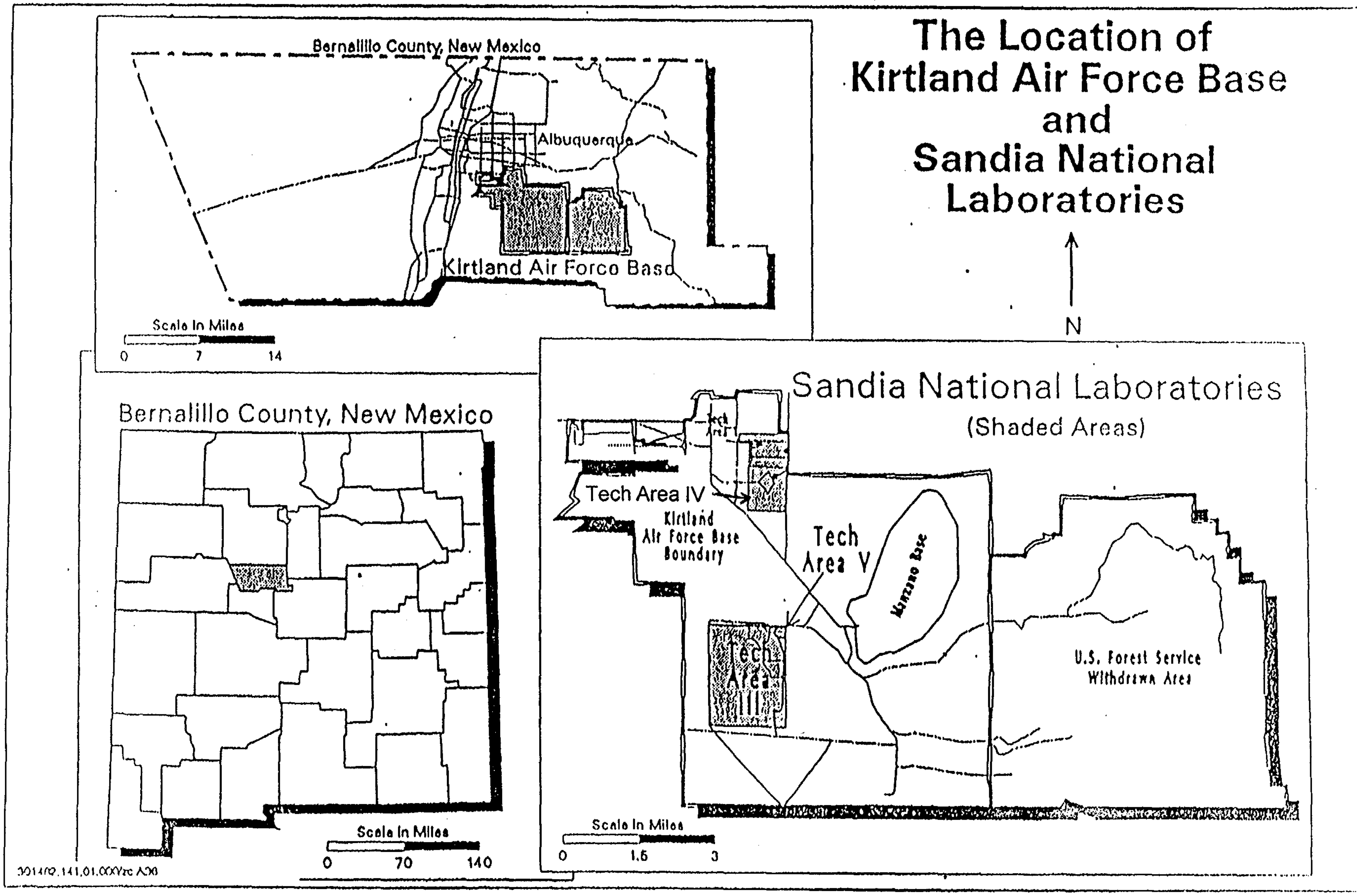


Figure ES-1. Location of SNL/NM in New Mexico

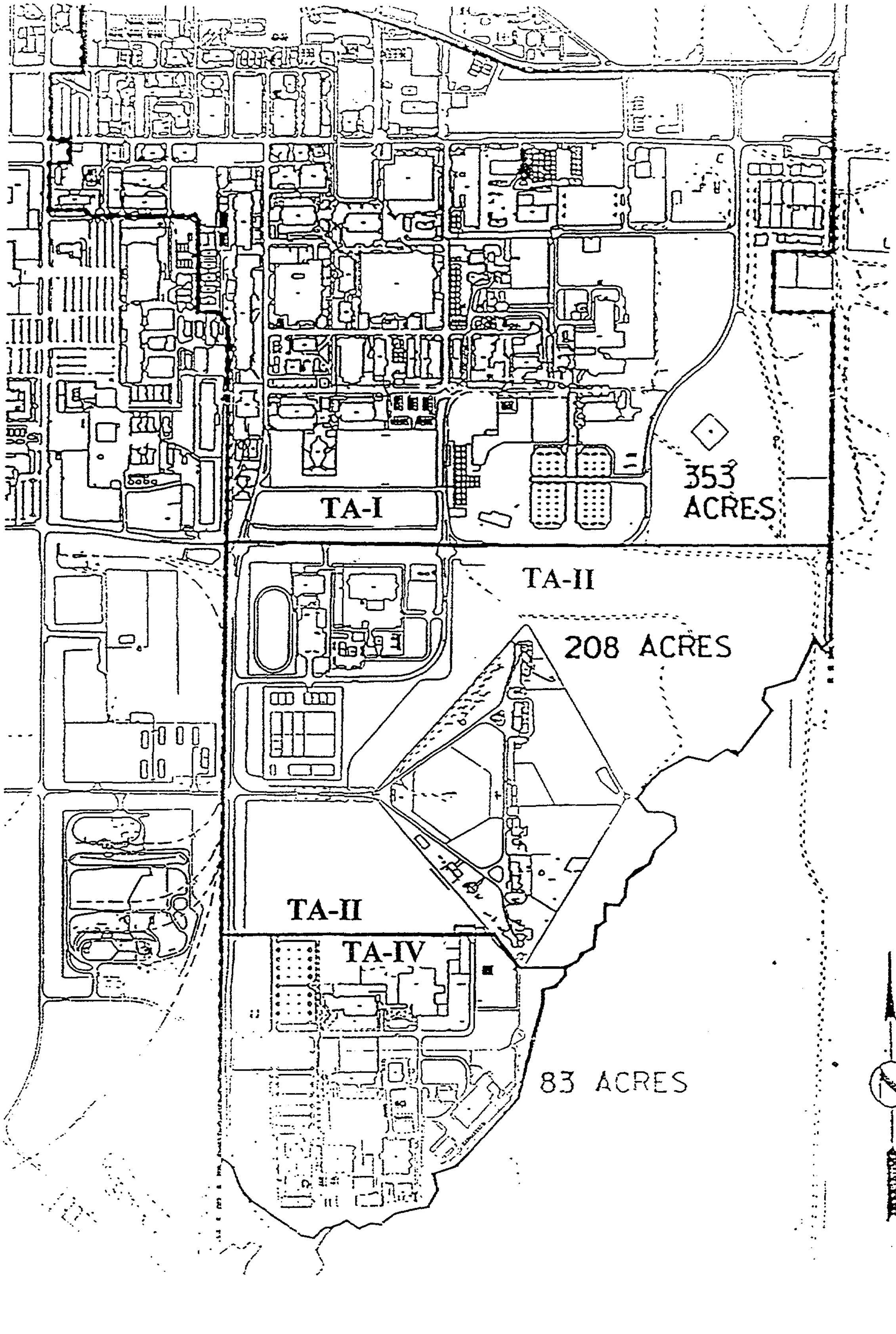


Figure ES-2. Location of TA-IV in SNL/NM

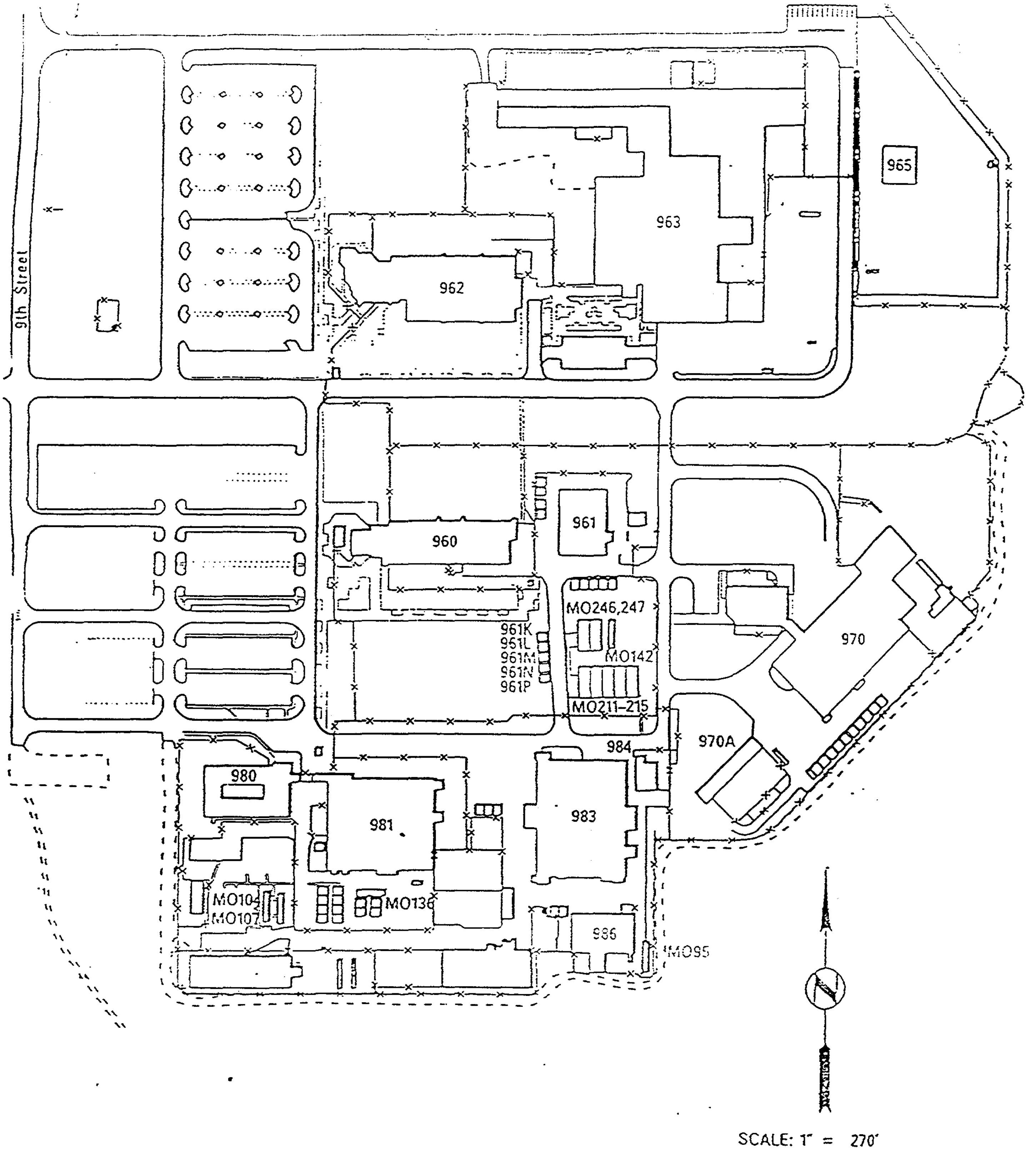


Figure ES-3. Map of TA-IV

Proposed Action

In support of the purpose and need, the DOE proposes to continue existing operations at the SNL/NM's TA-IV together with the modification of the existing accelerator, PBFA II, to support defense-related Z-pinch experiments, and the construction of two transformer oil storage tanks to support the expansion of the Advanced Pulsed Power Research Module (APRM). Table ES-1 summarizes the proposed action and its alternatives.

TABLE ES-1

PROPOSED ACTION AND ALTERNATIVES

Proposed Action:	• Continue existing activities being conducted at TA-IV. • Modify PBFA II, an existing accelerator, for Z-pinch experiments. • Expand the APRM from its present 1/4 configuration to its final full system to include the construction of two transformer oil storage tanks.
No Action Alternative:	• Continue present course of activities with no new proposals or projects.
Alternatives Considered but Eliminated from Further Analysis:	• Discontinue TA-IV operations and decommission the site. • Relocate or replicate all TA-IV activities/facilities at another location.

Continuing Operations at TA-IV

The first element of the proposed action would continue the operations and activities currently taking place in TA-IV. These activities are diverse, although the dominant activity is related to Pulsed Power Technology. Other areas of activity include computer science, flight dynamics, satellite processing, and robotics. All activities in TA-IV fall into the basic categories of scientific research, development, and testing. More specifically, these activities include:

- computer modeling of nuclear weapons' performance over time as the stockpile ages;

- capabilities for testing the survivability of nuclear weapon systems by utilizing accelerators or pulsed power devices to simulate the x-rays and gamma-rays produced by a nuclear weapon detonation;
- materials research, development, testing, and evaluation (RDT&E);
- minor modifications to existing accelerators to support pulsed power RDT&E;
- RDT&E activities to support new pulsed power components and designs associated with accelerators or pulsed power devices;
- physical simulations that support the design and development of navigation, guidance, and control systems that enhance both the accuracy and survivability of nuclear weapon delivery systems;
- research on robots that are vital in the manufacture of new nuclear weapon components and the cleanup of radioactive and hazardous waste at former DOE nuclear weapon sites;
- research activities to enhance satellite surveillance capabilities; and
- research and development of new commercial and defense-related applications such as materials processing, waste and product sterilization, mine detection, and food purification.

Modification of PBFA II for Z-Pinch Experiments

The second element of the proposed action is to modify PBFA II, an existing accelerator in Building 983, in order to conduct Z-pinch experiments. In the Z-pinch mode, the 100-nanosecond pulse produced by the pulse-forming section of PBFA II would be transmitted to the central region of the accelerator where the current (approximately 20 MA) would flow through either an array of wires, a cylindrical metal foil, or an inert gas puff (all approximately 2 centimeters in diameter and several centimeters in length [approximately 0.75 inch in diameter by 1-2 inches long]). The magnetic force associated with the current would cause the material in the wires, foil, or gas puff to compress, heat up, and generate x-rays. This technique for generating x-rays is commonly referred to as a Z-pinch or plasma radiation source (PRS). In addition, experiments that produce tritium through the process of the pinch activation between 2.5 MeV neutrons and deuterium (D_2) gas are planned for PBFA II in the Z-pinch mode.

Future Expansion of the Advanced Pulsed Power Research Module (APRM)

The third element of the proposed action includes the future expansion of the APRM located in the Southwest High Bay of Building 963 in TA-IV. The APRM is a single pulse accelerator designed to evaluate the performance of new pulsed power components and component alignments that could be used to improve the performance of future accelerators.

In its current configuration, the accelerator essentially represents one quarter of a conceptual pulsed-power-module. However, the APRM is designed to accommodate expansion; and, in its final "full system" configuration (i.e., current configuration x 4), it would represent one complete, state-of-the-art module. The construction of two additional, 284,000-liter (75,000-gallon) outside transformer oil storage tanks, with appropriate secondary containment, would be required to meet APRM's "full system" oil needs. The new tanks would be located northeast of Building 963, adjacent to (and immediately to the east of) the existing transformer oil storage tank and the 963 support building, Building 966. In addition, the expansion of APRM into its final full configuration involves the installation of three additional sub-modules. All modifications for these sub-modules would occur inside Building 963.

No Action Alternative

The no action alternative would be to continue operations of TA-IV at the present level of activities without modifying an existing accelerator or installing transformer oil storage tanks. This alternative would not allow DOE to meet its mission in support of national security goals and in support of science-based stockpile stewardship.

Affected Environment

Aspects of the environment that could be affected by the proposed action are described in detail in Chapter 3.0. Topics discussed include the physical setting, land use, geology and soils, surface water and groundwater hydrology, air quality, biologic resources, cultural resources, noise, and socioeconomics.

Environmental Consequences of the No Action and Proposed Action Alternatives

Since the proposed action includes the no action alternative (continuation of existing activities being conducted in TA-IV), the following summary of the principle issues associated with human health and environmental impacts are described for the no action alternative, with any changes in impacts described for the proposed action.

<u>Soils, Geology and Seismology</u> - No impacts to geology, soils, or seismology would occur as a result of continuing current operations in TA-IV. However, short-term impacts to on-site soils would result from the construction of the two transformer oil storage tanks as part of the APRM

expansion. Although the site where the transformer oil storage tanks are proposed is currently a parking lot, clearing of the approximate 186 m^2 (2,000 ft^2) site would temporarily disturb surface soil during construction activities. Since the soils in TA-IV have been extensively disturbed in the past, the proposed action only represents a minor impact to the on-site soils. The transformer oil storage tanks construction duration is expected to be approximately six weeks. The proposed action would have no impacts on geology or seismology.

Air Quality - Airborne emissions of hazardous air pollutants regulated under the Clean Air Act Amendments of 1990 for continuing operations would be negligible and would not require any air quality permits. Nor would there be any major long-term effects on air quality resulting from operations or future construction activities in TA-IV. In the short-term, construction-related effects could increase levels of particulates (fugitive dust) and other air pollutants generated by construction equipment internal combustion engines. However, dust control techniques required by construction practices would help mitigate these minor impacts. Construction-related emissions would not, however, be of sufficient quantity to affect compliance with the National Ambient Air Quality Standards (NAAQS).

Few facilities within TA-IV routinely generate radioactive air emissions. The HERMES III and PBFA II accelerators generate short-lived ^{13}N and ^{15}O radioactive air emissions, and the SABRE accelerator generates ^{13}N, (which are regulated under the 1990 Clean Air Act Amendments), but the emissions are in amounts millions of times smaller than the standard limits. The SATURN accelerator has released tritium (^{3}H) during research experiments in the past, but the dose was at such a low level that the source is exempted from the National Emission Standards for Hazardous Air Pollutants (NESHAP) permit requirement.

Radiological air emissions would decrease as a result of the modification of PBFA II for Z-pinch experiments. Under the proposed action, PBFA II would be operated at a much lower voltage (3 MeV vs 15 MeV) in the Z-pinch mode; therefore, there would be no air activation, as the threshold for activation of ^{13}N and ^{15}O is 10.5 MeV.

Consequently, radiological air emissions of ^{13}N and ^{15}O would be nonexistent in the Z-pinch mode. In addition, deuterium (D_2) experiments that generate tritium are proposed. A maximum of 25 D_2 shots per year may be conducted, producing a total of 250 μCi of tritium released to the atmosphere. The effective dose equivalent (EDE) to the maximally exposed individual (MEI) for the tritium release would be less than the EDE to the MEI for PBFA II in its current configuration. Therefore, the proposed action would result in a beneficial radiological emission impact.

Water Resources - According to investigations conducted by the U.S. Army Corps of Engineers (COE), neither the 100-year nor the 500-year flood plain encroaches on the boundary of TA-IV. There is low potential of flood waters encroaching on the area. Groundwater in the area is at so great a depth (152.4 meters [500 feet]) that even a large spill of transformer oil would not affect the groundwater hydrology or quality before it could be cleaned up. Furthermore, there are no wetlands in the site area that could be impacted by present or proposed activities in TA-IV. Water consumption under the no action alternative is an estimated 378,500 liters (100,000 gallons) per day. This usage would not increase as a result of the proposed action.

Biological Resources - TA-IV is heavily disturbed and virtually devoid of natural habitat for plants or animals. Sufficient food, water, and cover are not available to support populations of smaller wildlife species at the site. There are no federal or state-listed threatened or endangered species of plants or animals present at TA-IV. Continuing existing operations and modification as part of the proposed action would have no impacts to biological resources.

Cultural Resources - Approximately 11.33 hectares (28 acres) of TA-IV were surveyed in 1987 prior to the construction of Buildings 962 and 963 (see Section 3.5). Subsequently, all of TA-IV was surveyed for archaeological and historic resources in 1990. Neither survey identified any known historic or archaeological sites within TA-IV. Therefore, continuing existing operations and modifications in the proposed action would not be expected to impact archaeological or historic resources.

Noise - Accelerator activities in TA-IV, for the most part, produce only a very short duration (less than 1 second) noise during an accelerator firing (i.e., shot noise). Inside an accelerator building, the peak noise level may approach 140 dBA (Herring, 1990a). Because of the considerable distance between TA-IV and residential areas, there is no potential for noise increases that would adversely impact the general public. Therefore, negligible impacts on noise levels would occur due to the no action alternative. Any operational or future construction noise levels would have minimal effect on TA-IV personnel and have no effect on Air Force personnel residing in KAFB housing areas.

Waste Management - Radioactive waste generated under existing operations would be decreased as a result of the modification of PBFA II for Z-pinch experiments. Because PBFA II would be operated at a much lower voltage in the Z-pinch mode under the proposed action, there would be no activation of the experimental chamber, as occurs in the current mode of operation. Consequently, radiological waste would not be generated when PBFA II is in the Z-pinch mode except when deuterium experiments that generate tritium are conducted. For the maximum of 25 D_2 shots per year that may be conducted, an estimated 34 kg (75 lbs) of waste per year would be generated. This is less than the 23-34 kg (50-75 lbs) of waste per month that is generated in the current configuration. Therefore, as a result of the proposed action, there would be a beneficial radiological waste impact. The volumes of other types of waste generated in TA-IV would not change substantially.

Radiological Exposures from Routine Operations - Based on past dosimetry data and the analysis of future activities, the impact to workers or the public from radiological exposures at existing or proposed accelerator activities is estimated to be negligible. The prompt radiation (see Glossary) generated by an accelerator exists for only a fraction of a second, and occurs only a few times per day. Furthermore, modeling results indicate that the extremely low levels of ^{13}N and ^{15}O, emitted to the atmosphere during existing or proposed accelerator operations, would have negligible impact on the environment or human population. In calculations for the proposed deuterium experiments in PBFA II, the EDE to the MEI for the tritium release would be less than the EDE to the MEI for the PBFA II in its current configuration. Therefore, radiological exposures would decrease as a result of deuterium experiments in PBFA II.

Radiological Exposures from Accidents and Abnormal Events - The only scenario where an individual could possibly receive a lethal dose of radiation from an accelerator would occur if an individual were present in the target area of an accelerator during a shot. This exposure could be fatal. However, it would be extremely unlikely because of the redundant engineering controls and strict procedural safeguards that are applied.

Hazardous Chemical Exposures from Routine Operations - Other than hazards of the types and magnitudes routinely encountered and accepted by the general public, the chemical hazards associated with existing or proposed operations in TA-IV have the potential for no more than minor on-site and negligible off-site impacts to people or the environment.

Hazardous Chemical Exposures from Accidents and Abnormal Events - A major earthquake or an aircraft crash into a facility are the only scenarios where major exposure of personnel or the environment to transformer oil is possible. An earthquake could cause rupturing of either a main accelerator tank or a transformer oil storage tank, and rupturing of the secondary containment system. The result would be oil leakage into the environment. If a spill did occur, the EPA-mandated Sandia Spill Prevention Control and Countermeasure (SPCC) Plan would require removal of the contamination as a matter of urgency. An aircraft crash into a facility, an extremely unlikely event, could result in ignition of transformer oil in an accelerator oil tank. If the resulting fire were not extinguished by an automatic fire protection system, the burning oil could produce large amounts of smoke.

Cumulative Effects - The cumulative effect due to existing or planned activities in TA-IV would be negligible on geology, seismology, biological resources, cultural resources, solid waste, noise levels and human health issues. Activities in TA-IV would have minor cumulative impacts on soils, water resources and air quality.

1.0 PURPOSE AND NEED FOR ACTION

1.1 Background

The U.S. Department of Energy (DOE) is responsible for ensuring that U.S. nuclear weapons remain safe, secure, and reliable. Presidential directive has mandated that the Department develop the means sufficient to meet these responsibilities in the absence of nuclear testing.

The DOE "Strategic Plan" of April 1994 sets forth several goals for the Department. These include reducing the nuclear danger, fueling a competitive economy, and improving the environment. Ongoing and new activities proposed for Technical Area IV (TA-IV) at Sandia National Laboratories/New Mexico (SNL/NM) are directly related to these goals.

To reduce the nuclear danger, DOE has formed science-based weapons stockpile stewardship and related programs. The Programmatic Environmental Impact Statement for Stockpile Stewardship and Management, DOE/EIS-0236, currently in draft form, analyzes the impacts of major long-term programmatic decisions that involve the consolidation of management functions and operation of significant new facilities for stockpile stewardship. The proposed actions for TA-IV, as discussed in this EA, are for continuation of ongoing operations and upgrades and tailoring of modifications to existing capabilities. Currently, ongoing programs in TA-IV:

- support the computer modeling of nuclear weapons' performance over time as the stockpile ages;
- support weapon systems survivability testing by simulating the x-rays and gamma-rays produced by a nuclear weapon detonation;
- support materials research, development, testing, and evaluation; and
- support weapons and defense systems capabilities and improvements.

In support of the Presidential directive to fuel a competitive economy, DOE must enhance the technology infrastructure and core competencies for national security while assisting industrial competitiveness. A number of DOE programs in TA-IV are directed toward meeting these goals. They include:

- simulations that support the design and development of navigation, guidance, and control systems that enhance both the accuracy and survivability of nuclear weapon delivery systems;
- research on robots that are vital in the manufacture of new nuclear weapon components and the cleanup of radioactive and hazardous waste at former DOE nuclear weapon sites;
- enhanced satellite surveillance capabilities; and
- new commercial and defense-related applications such as materials processing, waste and product sterilization, mine detection, and food purification.

1.2 Purpose and Need

Consistent with its Strategic Plan and mission, the DOE must maintain the safety, security, and reliability of the United States' nuclear weapons stockpile; secure national defense; and assist industry to sustain long-term economic growth to create jobs and maintain a clean environment. Modification to existing capabilities in support of currently assigned programs (including stockpile stewardship, pulsed power technologies, computational sciences, engineered processes and materials, and advanced manufacturing technologies) at SNL/NM TA-IV specifically supports these mission requirements.

2.0 DESCRIPTION OF PROPOSED ACTION & ALTERNATIVES

2.1 Background

Operations in TA-IV commenced in 1980 after the construction of Building 980, an office support building, and Building 981, which housed the Electron Beam Fusion Accelerator (EBFA). At that time, the EBFA was a major part of SNL/NM's Inertial Confinement Fusion (ICF) program. EBFA represented a third generation fusion accelerator, the previous generations being Proto I and Proto II, which were operated in TA-V. The Particle Beam Fusion Accelerator (PBFA) (later renamed PBFA I) was constructed in TA-IV because there was not enough room in TA-V, a highly restricted area containing SNL/NM's reactor facilities.

In the early 1980s, three more fusion-related buildings were constructed in TA-IV: Building 983, built to house the fourth generation fusion accelerator, PBFA II; and Buildings 960 and 961, built to house office space, electrical and mechanical laboratories, and high-bay space for pulsed power research and development.

In the mid 1980s, Building 970 was constructed to house the Simulation Technology Laboratory (STL). The main facility in STL is HERMES III, a third generation gamma-ray accelerator used primarily for the simulation of nuclear weapon-produced gamma-rays. The previous generations of this type accelerator, HERMES I and HERMES II, were located in TA-V.

In the late 1980s, Proto II was moved from TA-V to the STL and modified to function as an x-ray simulation accelerator, and construction of Buildings 962 and 963 began. These buildings comprised the Strategic Defense Facility (SDF). SDF was initially intended to support the nation's Strategic Defense Initiative (SDI), or "Star Wars" program. They were to house a variety of pulsed-power-related facilities needed to conduct research in such areas as directed-energy weapons (electron beams, lasers, microwaves), and an earth-to-orbit launcher. With the reduction of the SDI budget in the early 1990s, however, many of these programs were discontinued while others, such as the High Power Microwave Laboratory and the Repetitive Pulsed Power Laboratory, were established.

By 1990, all the TA-V accelerators had either been moved to TA-IV or decommissioned, and TA-IV had become the center for SNL/NM's Pulsed Power Sciences activities.

The early 1990s saw an infusion of programs into TA-IV which support the DOE goals in defense, industrial competitiveness, and the environment. A computer sciences group moved into Building 980; a group that prepares rocket payloads for flight tests moved into one of the high-bays in Building 963; a robotics group moved into Building 965; and a number of diverse groups occupied office and laboratory space in Building 962.

Accelerators, in general, are devices which electromagnetically accelerate atomic-sized particles such as electrons, protons, and ions. Examples of these devices range from huge cyclotrons to television sets. The accelerators used in TA-IV are based on pulsed power technology and are called pulsed power accelerators.

Basically, pulsed power accelerators are single shot devices that accelerate large numbers of particles (energy) in a very short period of time. Since power is defined as energy over time, these accelerators are considered high-power. The HERMES III accelerator, for example, can generate a 350 kJ pulse of electrons in 20 nanoseconds. This translates into 17 terawatts (17×10^{12} watts) of power. However, because of the low shot rate of these machines (sometimes one per day), the average power generated is typically very low. One of the areas of research being conducted in TA-IV is to increase the shot rate, or repetition rate, of these accelerators for applications which require high average power.

The TA-IV pulsed power accelerators are designed to compress (in time) the electrical pulse. This is what generates the high power: transfer a high percentage of the energy while shortening the pulse. For most accelerators in TA-IV, Marx Generators are the primary power source. Marx Generators are arrays of capacitors which are charged in parallel and discharged in series. This allows the use of a relatively low voltage DC power supply to generate a high voltage pulse. The pulse generated by the Marx Generator is then transferred through a chain of capacitors, pulse-forming lines, and switches which progressively shorten and shape the pulse. Finally the pulse arrives at the "load" where it can be used for a variety of applications. In some accelerators many of these chains are tied together in parallel, usually in a radial configuration, to get more energy to the load. Both PBFA and Saturn are examples of this configuration. HERMES III is an example of configuration in a series mode. The RHEPP II accelerator uses a 750 kW power supply, seven stages of magnetic pulse compression, ten stages of linear induction voltage addition, and a vacuum diode in its configuration.

The pulsed power research and development at TA-IV covers both the pulsed power technology itself and the applications. For example, the desire to create controlled fusion for commercial power generation initially motivated the development of pulsed power technology. Later it was determined that the same technology could be used to generate x-rays and gamma-rays for weapon effects testing. New uses for pulsed power technology are continually being explored. Usually any particular application will require some modification to existing devices and consequently knowledge is added to the pulsed power technology base. Many applications such as materials hardening and sterilization have resulted in the development of high-power, high repetition rate accelerators. The descriptions of the current accelerators at TA-IV represent a range of possible future research that could occur at the site.

2.2 Summary of Proposed Action and Alternatives

To meet its need for action, the DOE considered several alternatives, including continuing existing operations at SNL/NM's TA-IV (no action); continuing existing operations at TA-IV plus, modification of PBFA II to support defense-related Z-pinch experiments, and the expansion of the Advanced Pulsed Power Research Module (APRM) from its present 1/4 configuration to its final full system (proposed action); and two other alternatives that were later eliminated from further analysis. Table 2-1 summarizes the proposed action and its alternatives.

Table 2-1. Proposed Action and Alternatives

No Action Alternative:	• Continue present course of activities with no new proposals or projects.
Proposed Action:	• Continue existing activities being conducted at TA-IV. • Modify PBFA II, an existing accelerator, for Z-pinch experiments. • Expand the APRM from its present 1/4 configuration to its final full system to include the construction of two transformer oil storage tanks.
Alternatives Considered but Eliminated from Further Analysis:	• Discontinue TA-IV operations and decommission the site. • Relocate or replicate all TA-IV activities/facilities at another location.

2.3 No Action Alternative

2.3.1 Continuation of Existing Operations

SNL/NM TA-IV is a 33.6-hectare (83.0-acre) tract located about 1.6 kilometers (1.0 mile) south of the main SNL/NM technical area, TA-I. It is bounded on the north by R Boulevard, on the west by 9th Street, and on the south and east by the Tijeras Arroyo. Figure 2.1 shows the relative locations of TA-I, TA-II, and TA-IV; Figure 2.2 is a map of TA-IV; and Figure 2.3 is an aerial photograph of TA-IV taken in late 1995.

TA-IV presently consists of almost 46,500 square meters (a half-million square feet) of office space, computer labs, light electrical and mechanical labs, medium-bays, and high-bays distributed throughout twelve major buildings. Approximately 750 people work in TA-IV. The operations and activities taking place in TA-IV are diverse, although the dominant activity is related to Pulsed Power Technology. Other areas of activity include computer science, flight dynamics, satellite processing, and robotics. All activities in TA-IV fall into the basic categories of scientific research, development, and testing, and include:

- computer modeling of nuclear weapons' performance over time as the stockpile ages;
- capabilities for testing the survivability of nuclear weapon systems by utilizing accelerators or pulsed power devices to simulate x-rays and gamma-rays produced by a nuclear weapon detonation;
- materials research, development, testing, and evaluation (RDT&E), including but not limited to material hardening and material surface preparation, ion diodes and ion diode coatings, integrated circuit radiation hardness testing, system and component radiation hardness and testing, material use in accelerator components for reliability and duration, and laser preparation of materials, etc.;
- minor modifications to existing accelerators to support pulsed power RDT&E, including but not limited to improvements and/or changes to energy storage systems, pulse forming systems, voltage conditioning networks, and other accelerator components that do not place accelerator operations outside the analyzed environmental impacts;
- RDT&E activities to support new pulsed power components and designs associated with accelerators or pulsed power devices;
- physical simulations that support the design and development of navigation, guidance, and control systems that enhance both the accuracy and survivability of nuclear weapon delivery systems;

- research on robots that are vital in the manufacture of new nuclear weapon components and the cleanup of radioactive and hazardous waste at former DOE nuclear weapons sites;
- research activities to enhance satellite surveillance capabilities; and
- research and development of new commercial and defense-related applications utilizing TA-IV facilities for activities such as materials processing, waste and product sterilization, mine detection, and food purification.

A comprehensive listing of locations, activities, and operations in TA-IV is presented in Table 2-2.

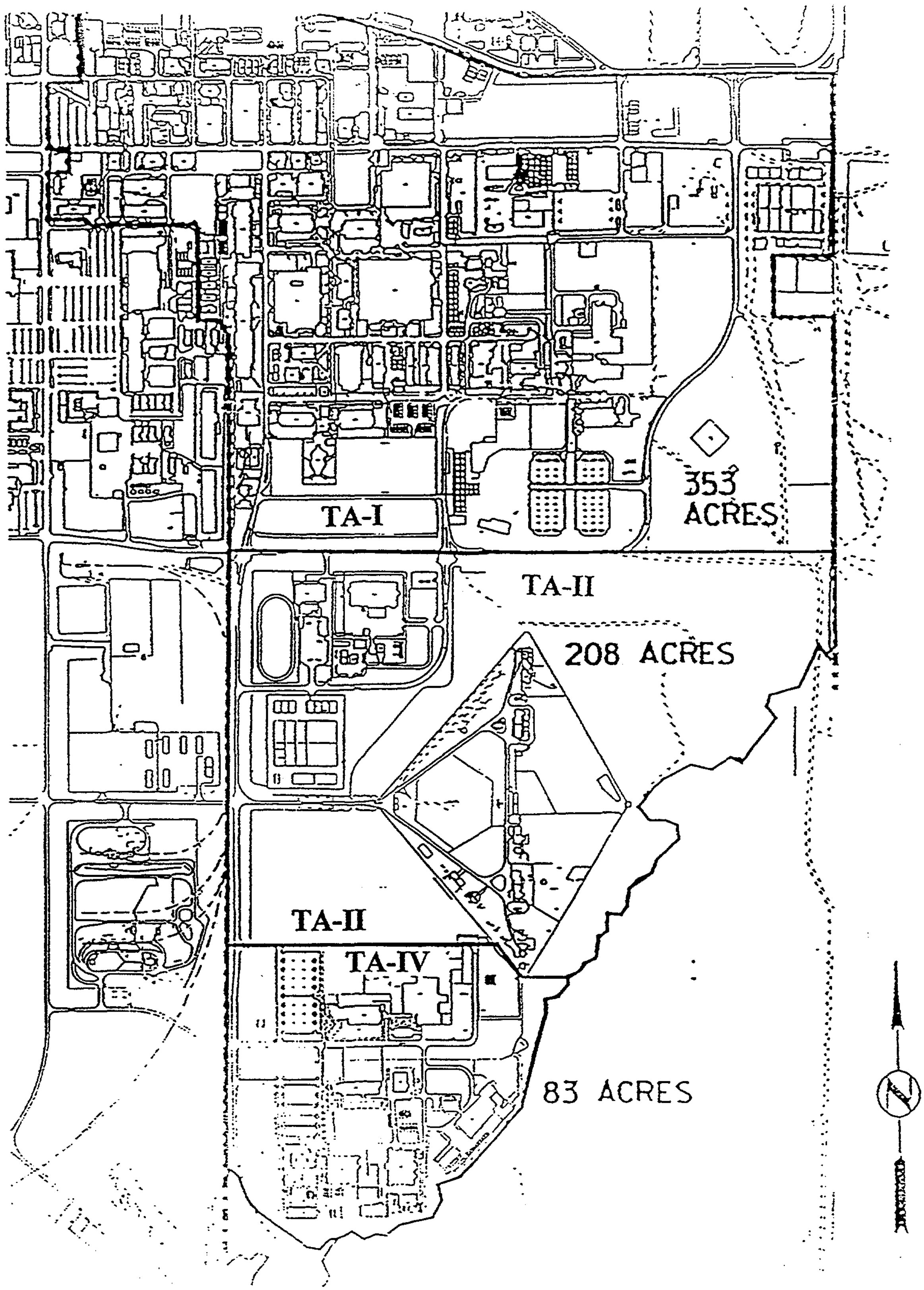


Figure 2.1 Map of Technical Areas (TAs) I, II, and IV

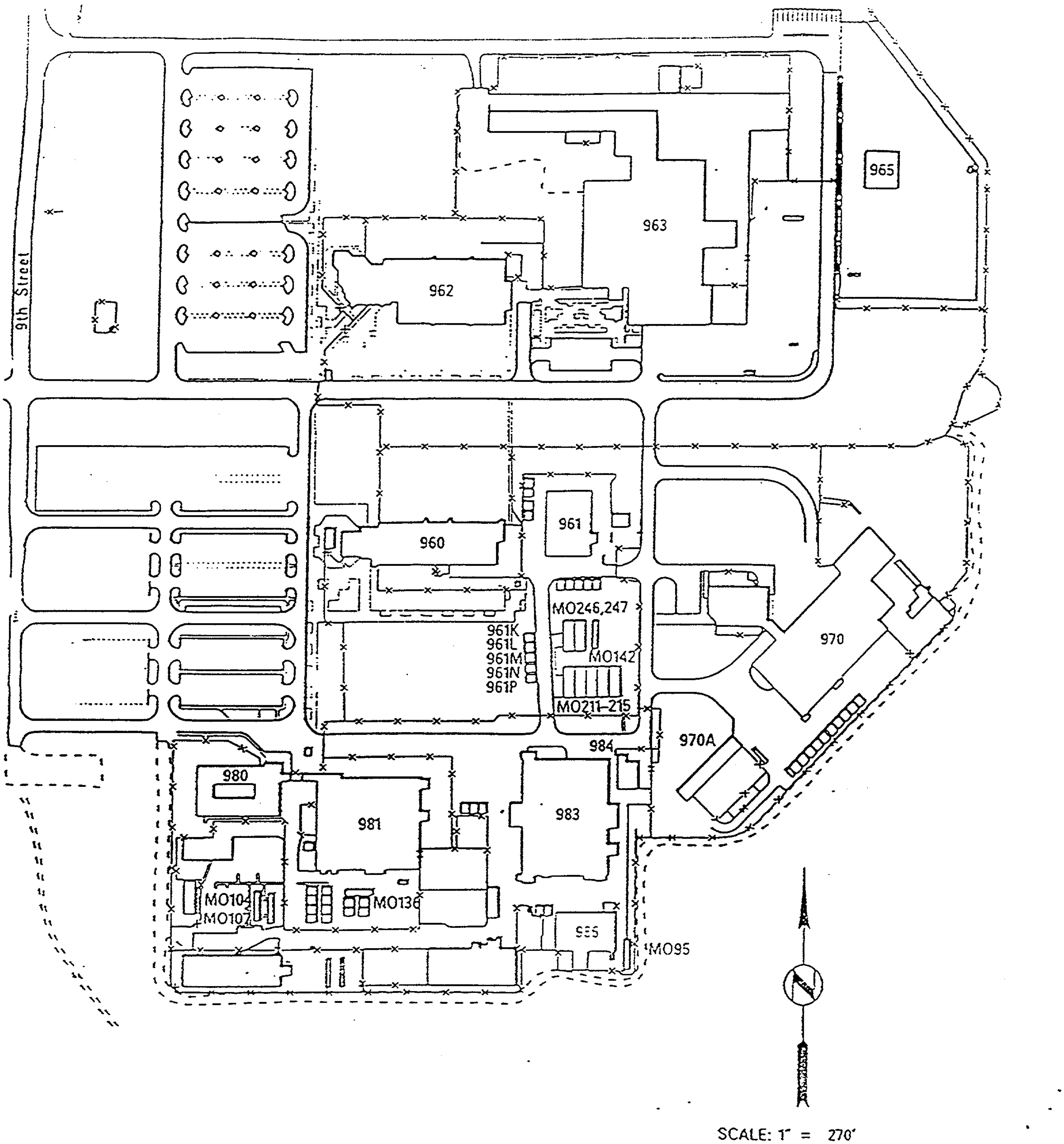


Figure 2.2 Map of SNL/NM Technical Area IV

SNL/NM TECHNICAL AREA IV (TA-IV)

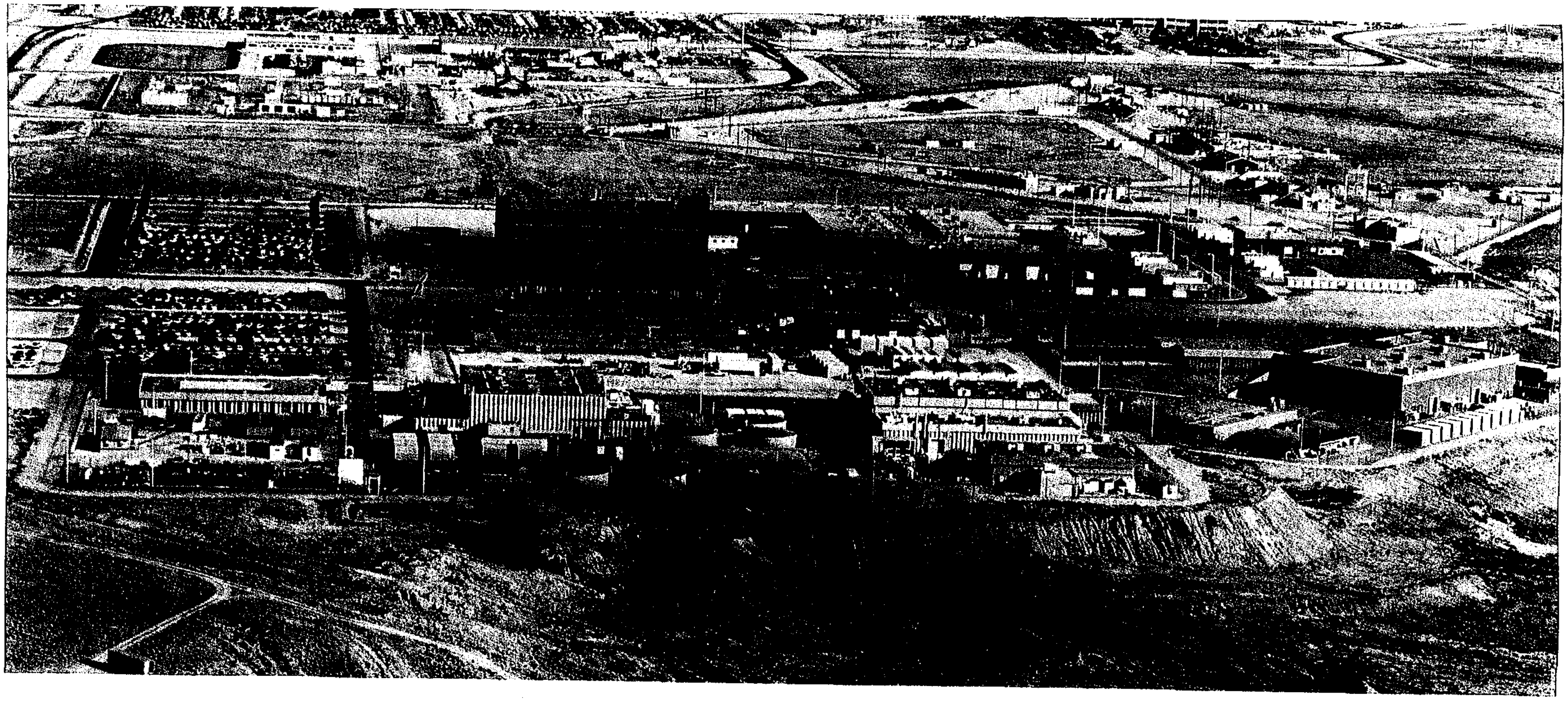


Figure 2.3 Aerial Photograph of Technical Area IV

Table 2-2. Existing Activities in TA-IV Buildings

Bldg	Building Description	Activities/Operations	Potential Hazards
960	Two-story building that includes offices, computer rooms, light labs; 3,251 square meters (35,000 square feet)	Electrical, mechanical and optical research laboratories	None
961	High-bay and light labs; 1,068 square meters (11,500 square feet)	Tesla accelerator; used for research and development of a plasma opening switch	Transformer oil; prompt gamma radiation
		NIF switch research facility; experiment to develop high current switch for flash lamps	None
962	Four story building that includes a basement, offices, computer rooms, light labs; 4,645 square meters (50,000 square feet)	Electrical, mechanical and optical research laboratories	None
963	High-bays, light labs, offices; 5,574 square meters (60,000 square feet)	Electron-Beam Program Development Lab; Hawk and PI 112A accelerators used for experiments on new applications of high average power e-beams in materials treatment, modification, and synthesis	Small amounts of x-ray radiation
		High Power Microwave Laboratory; IMP, RAMBO, CDS, TDX - accelerators used for research on generation of high-power microwaves	Transformer oil, prompt microwave radiation
		RHEPP II - rep-rated accelerator conducting research on potential commercial applications	Transformer oil, x-ray radiation
		APRM - single-pulse accelerator, prototype module for future accelerator	Transformer oil, prompt gamma radiation
		Flight Dynamics Laboratory; research on guidance control systems	None
		Rocket Systems Laboratory; preparation of payloads for flight tests	None
		Payload and Satellite Processing Facility	None

Table 2-2. Existing Activities in TA-IV Buildings (continued)

Bldg	Building Description	Activities/Operations	Potential Hazards
965	High-bay, light labs; 437 square meters (4,700 square feet)	Advanced Controls Manipulation Laboratory; research and development of robots for such applications as retrieving waste from underground storage tanks	None
966	Mechanical room and basement; 492 square meters (5,300 square feet)	Equipment Building for 963	Transformer oil
970	High-bay, light labs, offices; 4,552 square meters (49,000 square feet)	HERMES III Gamma-ray Facility - single pulse (5 to 7 per day) accelerator that produces gamma-rays for weapon effects testing	Transformer oil, prompt gamma radiation, small amounts of radionuclides (^{13}O and ^{15}N) released to atmosphere, ozone
		STF - single pulse (3 to 5 per day) research device used for pulsed power research	Transformer oil
		SABRE - single pulse (3 to 5 per day) accelerator used for diode research in inertial confinement fusion program	Transformer oil, prompt gamma radiation, small amounts of radionuclides (^{13}O and ^{15}N) released to atmosphere
		Proto II accelerator (non-operational)	None
	Medium-bay; 560 square meters (6,000 square feet)	MINX (a.k.a. Imatron) - small commercial accelerator used to generate x-rays for detecting mines	Small amounts of x-ray radiation
		ALIAS - single pulse, two-stage, ion diode accelerator used for beam propagation studies	Small amounts of x-ray radiation
		TROLL - single pulse electron-beam accelerator used for beam propagation studies	Small amounts of x-ray radiation
		PI-112 - single pulse, commercial accelerator used for beam studies.	Small amounts of x-ray radiation

Table 2-2. Existing Activities in TA-IV Buildings (continued)

Bldg	Building Description	Activities/Operations	Potential Hazards
970A	Mechanical room and basement; 1,393 square meters (15,000 square feet); oil and water storage tanks	Equipment building for 970	Transformer oil
980	Offices, computer rooms; 1,486 square meters (16,000 square feet)	Computational/Computer Sciences & Math Center	None
981	High-bay and light labs; 3,901.9 square meters (42,000 square feet); oil and water storage tanks	SATURN X-Ray Facility - multipurpose single pulse (1 or 2 per day) x-ray generator; primarily used for weapon effects testing	Transformer oil; prompt x-ray radiation; ozone
		SPHINX accelerator - weapon effects related research and testing	Transformer oil; prompt gamma radiation
		Accelerator diagnostics, etc.	None
983	High-bay and light labs; 5,574 square meters (60,000 square feet)	PBFA II - Single pulse (1 or 2 per day) accelerator used primarily for inertial confinement fusion research	Transformer oil; prompt gamma radiation; radioactive contamination of accelerator hardware; small amounts of radionuclides (^{13}O and ^{15}N); ozone
984	Light labs; 213 square meters (2,300 square feet)	Accelerator diagnostics preparation. Originally this building was designed to make measurements of neutrons generated in the PBFA II target chamber, but program changes have made it extremely unlikely that this would ever happen	None
986	Medium-bay; 1,003 square meters (10,800 square feet)	RHEPP I - rep-rated accelerator used for research in rep-rated pulsed power. Building also houses various other small pulsed-power experiments	Transformer oil, x-ray radiation for some experiments

As a result of the moratorium on underground nuclear testing, new activities at SNL/NM are necessary. The no action alternative does not provide the weapons effect simulation needed to meet DOE's purpose and need for action; however, it is analyzed in this EA to provide a baseline for comparison with the proposed action.

All activities and operations in TA-IV are governed by stringent occupational safety and health requirements of various DOE Orders (such as DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, and DOE 5480.25, *Safety of Accelerator Facilities)*, the SNL/NM Environmental, Safety, and Health (ES&H) Manual, and the SNL/NM policy for environment, safety, and health protection. In addition, hundreds of ES&H Standard Operating Procedures (SOPs) exist for particular activities and operations in TA-IV, that address operations, responsibilities, hazards, precautions, and emergency procedures

TA-IV Accelerators and Other Devices

TESLA — The TESLA accelerator, located in Building 961 highbay, consists of oil, water, and vacuum sections. The oil section contains one, 4.8 MV, 740 kJ, Marx Generator triggered by one 500 kV Marx Trigger Generator. The water section contains one coaxial water capacitor and a electrically triggered gas switch. The gas switch feeds into the vacuum insulator where a Magnetically Insulated Transmission Line (MITL) transports the energy to the vacuum chamber region of the accelerator. The MITL serves as an energy store by placing energy in the internal magnetic field. Inside the vacuum chamber, a Plasma Opening Switch (POS) initially shorts the MITL to achieve the inductive energy storage in the MITL. When the voltage at the vacuum insulator decays to zero, the POS is opened and energy in the MITL is transported in a short, 40 ns, pulse to an electron beam load where the energy is dissipated in the form of heat and radiation. The POS and electron beam load are located in the vacuum chamber. TESLA is used for research and development on plasma opening switches.

NIF Test Facility — The National Ignition Facility (NIF) Switch Test Facility, also located in the Building 961 highbay, is not an accelerator but a large capacitor bank that is operated at voltages as high as 25 kV and store as much as 1.7 MJ of electrical energy. The NIF Switch Test Facility is primarily operated as an experiment to develop high current switches for flash lamps used to drive lasers in the NIF.

IMP — The Intermediate Pulser (IMP) is located in Building 963. The Marx Generator powering IMP is a 10 stage (100 kV per stage), 0.3 microfarad (μf) capacitor bank which is contained within an oil tank, and delivers a pulse of one microsecond (μs) duration and up to one megavolt (MV) amplitude to the Pulse Forming Line (PFL). The PFL is approximately 0.7 meters (2 feet) diameter and 6.3 meters (18 feet) in length, delivering pulses of 300 nanoseconds (ns) duration, and up to 100 kiloamperes (kA) at 500 kilo-volts (kV) to the microwave generator. The microwave generator, an Annular Beam Amplifier (ABA), uses a small portion of the electron beam to produce microwaves which are, in turn, absorbed into various microwave loads. The microwaves are routed through a vacuum tube from the test cell and into the anechoic chamber. The vacuum tube, or microwave guide is of metal fabrication, approximately 20 centimeters (8 inches) in diameter, and is cryogenically maintained at negative 5 atmospheres.

RAMBO — The Really Awesome Microwave Beam Oscillator (RAMBO) is located in Building 963. The RAMBO Marx Generator is a 10 stage, 0.3 μf, 100 kV per stage driver contained within an oil tank. The accelerator driver is capable of producing a single-shot electron beam emitted through a cathode and then extracted through an anode. The beam is then compressed by coils as it propagates towards the interaction region. It is currently connected to a dummy load for accelerator pulsed-power testing. The oscillator produces radio-magnetic energy, but its microwave capability is not yet fully developed. Its gyrotron backward wave oscillator (gyro-BWO) capability has not yet been fully implemented but will eventually augment the IMP accelerator, producing microwaves for the anechoic chamber experiments.

TDX — TDX, a "table-top" accelerator, is located in Building 963. The accelerator is a small, single-shot, pulse-power device used for repetitive shot, pulse-power development. TDX utilizes a 30 keV power supply, connected to a 6-to-1 step-up transformer, creating a 180 keV, 2 kA pulsed power driver. The electron beam travels through a small vacuum chamber, striking a diamond target. While the TDX produces x-rays, its primary purpose is to provide a test bed for repetitive shot capability.

CDS — The CDS accelerator is located in Building 963. The CDS device is a small pulser, self-contained, semi-mobile, and currently inactive. It is capable of generating microwaves, and is located within an anechoic chamber.

APRM — The Advanced Pulsed Power Research Module (APRM), located in Building 963 southwest highbay, has a single cavity configuration consisting of: (1) a Marx Generator bank with 56 capacitors arranged in a series/parallel configuration; (2) two intermediate storage capacitors (coaxial, cylindrical assemblies) which are external to the accelerator's oil tank and use approximately 15,140 liters (4,000 gallons) of deionized water as their dielectric; (3) an intermediate storage, gas-insulated switch which is about 0.7 meters (2 feet) in diameter by 0.7 meters (2 feet) in length and is insulated with sulfur hexafluoride (SF_6) (as are all the gas switches used in the accelerator); (4) four, gas switch controlled, pulse forming lines (PFLs) which are each .7 meters (2 feet) in diameter and about 2.78 meters (8 feet) long and are filled with approximately 757 liters (200 gallons) of deionized water; (5) the single inductively isolated voltage adder cavity; and (6) a magnetically insulated transmission line (MITL). The APRM's capacitors are submerged in two 4.18 meters (12 feet) by 6.96 meters (20 feet) by 5.92 meters (17 feet) high oil tank sections. The other pulsed power components (except the two intermediate storage capacitors) are contained in a 8.35 meters (24 feet) by 11.48 meters (33 feet) oil tank section with the MITL extending into a heavily shielded experiment cell. The oil tank is capable of holding a total of about 492,050 liters (130,000 gallons) of oil for the proposed "full system" configuration. The initial experiments (single cavity configuration) are limited to about 246,030 liters (65,000 gallons) by the use of a temporary wall that divides the tank into two halves.

RHEPP II — Repetitive High Energy Pulsed Power (RHEPP) II, located in Building 963, includes the Micro-second Pulse Compressor (MPC), the Pulse Forming Line (PFL), the Linear Induction Voltage Adder (LIVA), and the Vacuum Diode Load (VDL). The maximum (electron energy) output is approximately 2.5 MeV, 26 kA, 60 ns FWHM pulses at 120 pulses per second. The system consists of an 750 kW power supply, seven stages of magnetic pulse compression, ten stages of linear induction voltage addition, and a vacuum diode. The 750 kW power supply serves as the prime power source. The MPC is housed in a 8.7 meters (25 feet) by 3.83 meters (11 feet) by 1.91 meters (5 1/2) feet tall oil tank located at the southeast corner of the fenced RHEPP II area.

Ringing waveforms of 8 ms duration are compressed in time to 1 microsecond and boosted in voltage to 250 kV peak by five stages of open geometry magnetic pulse compression and one transformer stage in the MPC. These pulses are further compressed to 60 ns FWHM and shaped into flat-top trapezoidal waveforms by the water filled triaxial PFL. The PFL is a horizontal, 1.39 meters (4 foot) diameter, 2.78 meters (8 foot) long stainless steel cylinder that extends from the northwest end of the MPC. Configured as a slow switched Blumlein, the PFL delivers a voltage gain of two and nominally 250 kV into the fifty matched cables that carry the pulses from the output of the PFL to the LIVA. The LIVA is a vertical, fifteen foot tall, five foot diameter column in the center of a raised concrete platform at the northwest end of the RHEPP II area. Ten stages of magnetically insulated voltage addition in the LIVA boost the pulse voltages to nominally 2.5 MV at 26 kA and deliver the pulses to the vacuum diode load (VDL). The VDL is located just below the 1.39 meters (4 foot) thick high-density concrete ceiling of the radiation chamber, below the raised concrete platform. Electrons are emitted from a 10 cm (3.94 inches) x 100 cm (39.4 inches) area on the cathode surface and impact a flat anode 20 cm (7.87 inches) away that either dumps the beam, converts it to X-rays, or extracts it.

PI112A — The PI112A accelerator, located in Building 963, is a commercial electron beam accelerator that produces a 1.8 MV, 30 kA, 30 nanosecond beam and consists of a Marx Generator in an accelerator chamber and is filled with transformer oil during operation. The Marx and other high voltage switches in the PI112A accelerator use SF_6 gas at pressures up to 95 psig during operation.

HAWK — The HAWK accelerator, located in Building 963, is an electron beam accelerator, DC charged to a maximum voltage of 1.1 MV that generates an electron beam with a maximum current of about 2.0 Amps. HAWK can operate with pulse widths as short as 1 micro-second or up to DC output.

HERMES III — The High-Energy Radiation Megavolt Electron Source (HERMES) III is the major facility in the Simulation Technology Laboratory (STL) in Building 970. The HERMES III accelerator is a high-energy, linear induction machine which generates a gamma-ray output with a 20 MeV endpoint voltage. It was designed and built to take advantage of short pulse, low-inductance pulsed power to provide a laboratory gamma-ray effects testing capability since 1988. The facility includes the accelerator, an exposure (test) cell, and an outdoor exposure area. HERMES III has the capability to provide high-fidelity simulation over very large areas; and applications include electronics testing for component and weapon system development. The accelerator is 21 meters (69 feet) wide, 11 meters (36 feet) long, and 5 meters (16 feet) high. Routine radiation exposures are performed in the heavily shielded exposure cell. The outdoor area is also shielded and allows the testing of large assemblies and entire weapon systems.

STF — Not an accelerator, the Subsystem Test Facility (STF) is a pulsed-power device/test-bed that is used to evaluate the performance of standard accelerator components. STF occupies approximately 100 square meters (1100 square feet) of floor space at an average height of 4.6 meters (15 feet) and is located in Building 970 highbay. The STF energy storage section consists of a single 5.6 MV, 870 kJ Marx Generator. STF's Marx Generator, intermediate storage capacitor, gas insulated switch, and pulse forming lines are contained within an oil-filled tank, which holds approximately 227,000 liters (60,000 gallons) of transformer oil.

SABRE — The Sandia Accelerator (&) Beam Research Experiment (SABRE), located in the highbay of Building 970, is a 10 megavolt, 250 kiloampere, pulsed accelerator used as a driver for advanced extraction ion diode research as well as target and focusing studies in support of the Inertial Confinement Fusion Program. The test facility includes the accelerator, a lead and concrete shielded test cell, a basement area (occupied by diode capacitor banks), three local screen rooms, and other work areas. The SABRE accelerator consists of an oil tank, a test cell, and a control console. The 113,550-liter (30,000-gallon) oil tank contains a 3.6 MV, 230 kJ Marx Generator, one 50 kV Mini-Marx Generator (12 small capacitors used to trigger the main generator), two intermediate storage capacitors, two electrically-triggered gas switches, and the high voltage distribution network for twenty pulse-forming lines (PFLs). The PFLs feed into cavities on the outside of the tank. A magnetically insulated transmission line (MITL) delivers the power pulse into the test cell. A small amount of ionizing radiation is produced at the diode within the test chamber; and concrete, lead, and steel shields prevent radiation exposure to personnel in other areas of the Building 970 highbay. In addition, SABRE downline shots with an ion diode load (especially lithium) may activate diode hardware.

Proto II — Prototype (Proto) II was originally designed and constructed as a prototype for driving inertially confined fusion targets. In 1986, it was converted to an X-ray simulator. Proto II is currently non-operational with all fluids drained and energy sources locked-out. When operational this accelerator is an eight-module, radially converging, pulsed, X-ray simulator. By using an imploding plasma as a load it can generate soft X-rays for materials effects testing; and by using a bremsstrahlung load, it can produce X-rays with up to a 1.5 MeV endpoint energy for electronics vulnerability and survivability tests. The accelerator is 16 meters (52 feet) in diameter and 4 meters (13 feet) high. The center 8 meter (26 feet) diameter tank is water filled, with the remaining annulus oil filled.

MINX — The Mine Detection X-ray (MINX) facility (a.k.a. IMATRON), located in the Building 970 medium bay, is a 2-meter wide continuous wave (CW) X-ray source that operates at 160 KVP and 0.63 amps. The machine was manufactured by IMATRON Corporation of San Jose, CA. The source is rastered across its 2-meter width to provide discrete rastered X-ray spots used to develop detectors and imaging techniques for detecting buried land mines. Only mock mines are used in the experiments.

ALIAS — Advanced Light Ion Accelerator System (ALIAS), located in the Building 970 medium bay, is a two stage pulsed ion beam accelerator used for beam propagation studies.

TROLL — The TROLL accelerator is a pulsed electron-beam accelerator used for electron beam propagation at high altitude. TROLL has been disassembled and is currently not operational.

PI112A — PI112A, located in the Building 970 medium bay, is a commercial electron beam accelerator that produces a 1.8 MV, 30 kA, 30 nanosecond beam and consists of a Marx Generator in an accelerator chamber and is filled with transformer oil during operation. The Marx and other high voltage switches in the PI112A accelerator use SF_6 gas at pressures up to 95 psig during operation. This small accelerator is used for electron beam material interaction research.

Saturn — The Saturn accelerator, located in Building 981, is a modular, high-power, variable-spectrum, x-ray simulation source. Saturn can be operated with two different bremsstrahlung diodes or any one of several plasma radiation sources. The diodes and sources provide x-ray radiation environments with enhanced simulation fidelity based on fast rise-time, short pulse duration, and tailored spectral content. Saturn is used to simulate the radiation effects of nuclear countermeasures on electronic and material components, as a pulsed-power and radiation source, and as a diagnostic test bed. Areas of application include the testing of satellite systems, SDI space assets, and reentry vehicles (RV) and missile subsystems. The Saturn accelerator facility is located in Building 981 (which includes a highbay, office space, shop areas, light labs, a mechanical room, exposure cell, and basement) and storage tanks and transfer systems for large quantities of insulating oil and de ionized water. The accelerator, which is located in the high bay, is a radially symmetric, parallel current driver consisting of 36 identical pulse compression and power flow modules. The 36 modules are arranged like the spokes of a wheel and can easily be configured to drive either annular electron beam bremsstrahlung diodes or z-pinch plasma loads. The pulsed power components are housed in a 96-ft diameter, 14-ft high, open-air tank, that is divided into energy storage, pulse compression, power flow, and power combination sections. The concrete and earth-shielded exposure cell is located in a basement room beneath the accelerator.

SPHINX — The Short-Pulse High Intensity Nanosecond X-Radiator (SPHINX), located in the highbay of Building 981, is a high-voltage, high-shot-rate bremsstrahlung accelerator. It was placed in operation in 1992 and is primarily used to measure the x-ray-induced photo currents from short , fast-rise-time pulses in integrated circuits. SPHINX is located in a 6.7 x 10.2-meter (22 x 33-feet) concrete-shielded test cell adjacent to the Saturn accelerator. This small accelerator consists of an 18-stage, low-inductance Marx Generator; two oil pulse-forming lines; and a vacuum pulse-forming line. Several sets of voltage and current monitors are included in the lines. The pulse width of SPHINX is continuously variable from 3.5 ns to 10 ns and the pulse rise time of 2 ns is independent of pulse width.

PBFA II — The Particle Beam Fusion Accelerator (PBFA) II, located in Building 983, is a multi-use facility supporting the Internal Confinement Fusion (ICF) Program and the High Energy/Density Weapons Physics Program for stockpile stewardship. Operating on the principle of pulsed power, PBFA II stores electrical energy over a period of minutes, then releases that energy in a concentrated burst. PBFA II consists of thirty-six modules arranged radially around a central experiment vacuum chamber. These thirty-six identical accelerator modules converge to produce a single, extremely short, extremely powerful pulse of energy that can be focused on a fusion target.

The accelerator is located in a tank approximately 33 meters (108 feet) in diameter and 6 meters (20 feet) high. The tank is divided into three annular regions. The outer annulus approximately 5 meters (17 feet) wide contains transformer oil. The oil is high voltage dielectric material which prevents electrical breakdown when the accelerator is charged. The middle annulus is approximately 10 meters (31 feet) wide contains deionized water as the dielectric medium for pulse-forming components. Approximately 2,043,900 liters (540,000 gallons) of transformer oil and 2,271,000 liters (600,000 gallons) of deionized water fill the outer annulus and middle annulus respectively. The primary operating mode of PBFA II produces a pulse that lasts 60 nanoseconds with approximately 3 megajoules of electrical energy and a peak power of 50 terawatts.

RHEPP I — The Repetitive High Energy Pulsed Power (RHEPP) I, located in Building 986 highbay, includes a Marx Generator (MG), Pulse Forming Line (PFL), Linear Induction Voltage Adder (LIVA), and Vacuum Diode Load(VDL). During normal operation, the RHEPP I accelerator system produces pulses of electrons that may be stopped, converted to ions, or extracted, depending upon the configuration of the VDL. The maximum (electron energy) output is approximately 1.0 MeV, 45 kA, 60 ns FWHM pulses at 10 pulses per second. The system consists of an 150 kW power supply, four stages of linear induction voltage addition, and a vacuum diode. The 150 kW power supply serves as the prime power source. Pulses of nominally 1 μs duration and 450 kV amplitude are delivered to the PFL. These pulses are further compressed to 60 ns FWHM waveforms by the water filled PFL. The PFL delivers a voltage gain of one-half and nominally 220 kV into the 40 matched cables that carry the pulses from the output of the PFL to the LIVA. The LIVA is a vertical cylinder, 2.78 meters (8 feet tall) and 1.78 meters (5 feet) in diameter at the center of a raised concrete platform. Four stages of magnetically insulated voltage addition in the LIVA boost the pulse voltages to nominally 800 kV at 45 kA and deliver the pulses to the vacuum diode load (VDL). The VDL is located just below the four foot thick high-density concrete ceiling of the radiation test pit, below the raised concrete platform. Electrons or ions are produced by flashover or puffed gas anodes and are focused onto a treatment table located 25 cm (.82 ft) to 50 cm (1.64 ft) below the diode.

TA-IV Light Laboratories and Commonly-Used Equipment

Light laboratories for research and development in TA-IV are used by engineers, scientists, and technicians to conduct prototype fabrication, instrument repair, diagnostic calibration, data gathering and measuring, experiment preparation (which includes assembling, testing, cleaning, and aligning), and other sorting and cataloging of information related to experiments. Normal operations in these labs involve working with a variety of general laboratory, electrical or electronic equipment. Examples of general electrical equipment include circuit breakers, transformers, and power distribution cables. General electronic equipment could include power supplies, solder irons, solder removers, passive electronic components (e.g., resistors, inductors, capacitors, etc.), active electronic components (e.g., integrated circuits, oscilloscopes, amplifiers, etc.)

Other equipment used in light labs could include microwave equipment, power meters, reflectors, sweep oscillators, power oscillators, high voltage supplies, and microwave power amplifiers. Vacuum equipment includes vacuum pumps, fast valves, and other vacuum components. Class IV lasers are used for triggering pulsed power components, spectroscopic analysis, particle ionization, laser diagnostic and materials research. Class III lasers are used for equipment alignment, and optical calibration measurements. Class II lasers are used for bar code moving beam scanner systems. Work with various hand tools and power hand tools may be performed. The powered hand tools include hand drills, heat guns, wire wrap tools, and wire strippers. Lab personnel may also work with normal computing equipment such as terminals, printers, magnetic tape drives, and PC's. Some light labs have satellite waste storage areas used to dispose of solvents, oily rags, and solder scrap. SOP's, OP's, and the *SNL ES&H Manual* define the procedures required for the various operations.

Commonly used equipment in TA-IV includes riding forklifts (gas, diesel, and electric), hand operated electric lifts, EZ GO carts, cranes, standard shop machines (e.g., lathes, mills, etc.) hand tools, oscilloscopes, calibration equipment, and computers. Materials that are commonly used include different types of metals and plastics. In addition, many different kinds of chemicals are used in TA-IV activities, including acids and bases (e.g., primarily photochemicals, copper sulfate, and sodium hydroxide), compressed gases (e.g., nitrogen, argon, helium, sulfur hexafluoride, laser gases, etc.), and solvents (e.g., methanol, ethanol, isopropanol, hexanes, etc.) for everyday laboratory use such as preparing and cleaning experiments.

2.4 Proposed Actions

2.4.1 Continuation of Existing Operations

This proposed action includes the continuation of all existing operations in TA-IV (no action alternative), together with the modification of existing accelerator PBFA II, to support defense-related Z-pinch experiments, and the expansion of the APRM (Sections 2.4.2 and 2.4.3, respectively). Section 2.3 and Table 2-2 summarize current activities within TA-IV. Continuing operations in TA-IV, with the proposed modifications are necessary for the DOE to meet its mission requirements as described in Section 1.2, Purpose and Need. In the past, underground nuclear testing provided a means for assessing the effectiveness of weapon performance. In the future, with the moratorium on underground nuclear tests, modification of PBFA II and the expansion of the APRM are necessary to meet National Security goals with respect to science-based stockpile stewardship.

2.4.2 Modification of PBFA II for Z-Pinch Experiments

PBFA II, an existing accelerator in Building 983, must be modified in order to conduct Z-pinch experiments. In the Z-pinch mode, the 100-nanosecond pulse produced by the pulse forming section of PBFA II would be transmitted to the experimental chamber located at the center of the accelerator where the current (approximately 20 megamperes [MA]) would flow through either an array of wires, a cylindrical metal foil, or an inert gas puff (all approximately 2 cms [0.75 in.] in diameter and 2.5 - 5 cms [1-2 in.] in length. The magnetic force associated with the current would cause the material in the wires, foil, or gas puff to compress, heat up, and generate x-rays. This technique for generating x-rays is commonly referred to as a Z-pinch or plasma radiation source (PRS).

The experimental chamber in PBFA II is currently configured in a high impedance mode with a peak diode voltage of 15 megavolts (MV) and a peak diode current of 3 MA. The modification would allow operation in a low impedance mode with a peak voltage of 2.5 MV and peak current of 20 MA. The purpose of the proposed action is to increase hohlraum temperatures and K-shell radiation yields, and to conduct high energy density weapon physics research experiments. Experiments that produce tritium through the process of the pinch activation between 2.5 MeV neutrons and deuterium (D_2) gas are planned for PBFA II in the Z-pinch mode. A maximum of 25 D_2 shots per year would be conducted releasing a total of 250 μCi of tritium to the atmosphere.

The proposed project would utilize all existing oil, water, and sulfur hexafluoride (SF_6) gas transfer and processing equipment housed in Building 983. Because Building 983 houses the PBFA II accelerator, no site preparations would be required. All modifications would occur inside the existing accelerator's water tank. Modifications would consist of removing the water section (coaxial section) and installing newly designed triplate water lines, a magnetically insulated transmission line and vacuum convolute, and diagnostic lines-of-sight. Rerouting existing conduit and plumbing for gas and water inside the accelerator tank may be necessary. Modifications to existing conduit, gas and water lines, access control gates, and accelerator interlock switches outside the accelerator tank, but inside the high-bay, would not be necessary.

Because PBFA II would be operated at a much lower voltage in the Z-pinch mode, there would be no activation of the experimental chamber, as there is in the current mode of operation. Consequently, the hazards associated with the handling of radioactive materials and radioactive wastes that now exist would be reduced in the Z-pinch mode. In addition, operations in the Z-pinch mode would reduce radioactive air emissions.

Upon completion of the experiments, PBFA II would most likely be returned to its current configuration. Total projected cost of the PBFA II-Z Project is approximately $11 M.

2.4.3 Expansion of the Advanced Pulsed Power Research Module (APRM)

The APRM, located in the Southwest High-Bay of Building 963 in TA-IV, is a single-pulse accelerator designed to evaluate the performance of new pulsed power components and component alignments that could be used to improve the performance of future accelerators. In its current configuration, the accelerator essentially represents one quarter of a conceptual pulsed power module. However, the APRM is designed to accommodate expansion and, in its final "full system" configuration (i.e., current configuration x 4), it would represent one complete, state-of-the-art module. At present, the pulsed power components of the machine are submerged in about

246,000 liters (65,000 gallons) of insulating oil within a partitioned portion of an accelerator tank designed to hold almost 681,000 liters (180,000 gallons) of oil which would be needed for the proposed full system configuration.

The APRM currently shares a 284,000-liter (75,000-gallon) transformer oil storage, transfer, and processing system with the other accelerators in Building 963, but the construction of two additional, 284,000-liter (75,000-gallon) outside transformer oil storage tanks, with appropriate secondary containment, would be required to meet APRM's full system oil needs. The new tanks would be located northeast of Building 963, adjacent to (and immediately east of) the existing transformer oil storage tank and the 963 support building, Building 966.

The expansion of APRM into its final full system configuration would involve the installation of three additional sub-modules. Each sub-module would consist of hardware with output capabilities of 2.5 MV at 2 MA. Each set of hardware will include one Marx Generator, two intermediate storage capacitors, and four pulse-forming lines. Each of the four pulse-forming transmission lines would drive a single "cavity" that would add up to a total of 10 MV at 2 MA to a Magnetically Insulated Transmission Line (MITL). The MITL, which transports the power from the cavity to a load in a radiologically shielded experimental cell, would deliver the power into a carbon anode "beam stop" where the power would be dissipated. This dissipation of power would generate some x-ray (bremsstrahlung) output due to the incident electrons. However, even in the full system configuration (with an output voltage approaching 10 MV), only small amounts of x-radiation would be produced and the surrounding air would not become radioactive. In addition, the activation of other materials, such as internal machine parts, would be negligible. Research conducted at the APRM would continue to concentrate on pulsed power issues. None of the research would involve the use of radioactive materials.

The expansion would utilize all existing gas transfer and processing equipment, power distribution systems, and access control gates and interlock switches housed in Building 963. All modifications would occur inside the existing highbay where the accelerator is located, therefore, no site preparations would be required. Rerouting of existing conduit and plumbing for the accelerator may also be necessary.

2.5 Alternatives Considered but Eliminated from Further Analysis

2.5.1 Discontinue Operations in the Near Term and Decommission

Under this alternative, operations in TA-IV would be discontinued and all facilities decommissioned. While this alternative is theoretically feasible, it is does not meet the Purpose and Need as described in Section 1.2. Therefore, this alternative was eliminated from further analysis.

2.5.2 Relocate or Replicate all TA-IV Facilities at Another Location

Construction of the facilities in TA-IV has cost hundreds of millions of dollars, and the infrastructure for supporting these facilities is well established. The proximity to TA-I allows for efficient interaction of people and materials between the areas. No benefit, either technical nor economical, would be gained by replicating or relocating the TA-IV facilities to another location. Therefore, this alternative was eliminated from further analysis.

2.6 Other Related National Environmental Policy Act (NEPA) Documents

DOE is currently preparing two programmatic NEPA documents that are related to the proposed action. They are the *Programmatic Environmental Impact Statement for Stockpile Stewardship and Management*, DOE/EIS-0236, and *The Environmental Assessment for the Environmental Restoration Project at Sandia National Laboratories/New Mexico*, DOE/EA-1140.

2.6.1 *Programmatic Environmental Impact Statement (PEIS) for Stockpile Stewardship and Management* (SS&M), DOE/EIS-0236

The SS&M PEIS, currently in draft form, analyzes the impacts of major long-term programmatic decisions that involve the consolidation of management functions and the siting and operation of significant or new facilities for stockpile stewardship. The alternatives analyzed for configuration of the Nuclear Weapons Complex are consistent with national policy directives and applicable laws and regulations.

The Advanced Radiation Source (ARS), an accelerator facility, if proposed and constructed, would utilize the latest pulsed power technology and expand DOE's above ground simulation capabilities.

The ARS is briefly described in the SS&M PEIS. However, this program is not ripe for decision and therefore site-specific environmental review for the ARS cannot be included in the SS&M PEIS or the SNL/NM TA-IV EA. SNL/NM TA-IV might be considered for siting the ARS. If the construction of ARS is proposed, additional NEPA review would be required.

The proposed actions for TA-IV, as discussed in this EA, are for a continuation of ongoing operations and upgrades and tailoring modifications to existing capabilities. These proposed actions support stockpile stewardship and management as well as other assigned programs.

2.6.2 *The Environmental Assessment for the Environmental Restoration Project at Sandia National Laboratories/New Mexico*, DOE/EA-1140

This EA for the SNL/NM Environmental Restoration Project was issued for public review in late December 1995 and received a Finding of No Significant Impact (FONSI) in March 1996. The EA proposes to conduct site characterization and waste cleanup (corrective action) at approximately 157 environmental restoration (ER) sites. Eleven ER sites, also known as Solid Waste Management Units (SWMUs), are located within the boundary of or near TA-IV. Eight of the sites involve outfalls of the storm drain system along the northern embankment of Tijeras Arroyo. The impacts of the proposed corrective actions for these sites are not addressed in the TA-IV EA because they are part of the proposed remedial action for DOE/EA-1140. The action proposed in this TA-IV EA would not disturb the SWMUs located in or near TA-IV.

3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

A comprehensive description of the SNL/NM site and the affected environment is presented in the site-wide *Environmental Impact Assessment,* (ERDA, 1977) with updated information contained in the *SNL Albuquerque Environmental Baseline Update* report (IT *et al.*, 1993) and the *Strategic Defenses Facility Environmental Assessment* (DOE/EA-0352, 1988). This section describes the environmental resources (e.g., soils, surface water, and vegetation) that could potentially be affected by activities associated with the proposed action and for alternatives described in Section 2.0. The descriptions include physical setting, biological characteristics, archeological and historical characteristics, potential human health effects, and socioeconomic conditions at TA-IV and its environs. (Section 4.0 provides an assessment of environmental consequences of the no action and proposed action alternatives.)

3.1 Geographic Setting

3.1.1 Location

Kirtland AFB, which includes lands occupied by SNL/NM, is located on the eastern portion of the Albuquerque Basin. TA-IV occupies an area of approximately 33.6 hectares (83 acres) at SNL/NM. Except where site-specific environmental descriptions are provided, it may be assumed that existing environs at TA-IV are similar to those prevalent in the entire southeast Albuquerque area (IT, 1993; Culp *et al.*, 1993).

3.1.2 Geology, Soils, Seismology

3.1.2.1 Geology

TA-IV has been established on a broad alluvial plain that consists primarily of unconsolidated sand, gravel, and silt derived from granite and metamorphosed rocks of Precambrian age. The alluvial plain formed during the mid-Pleistocene period by sediment filling of the Rio Grande trough. This trough is between the Sandia and Manzano Mountains to the east and the Lucero uplift and Puerco plateau to the west. The sediments are approximately 4.5 kilometers (2.8 miles) deep at the center of the trough and may be just as deep in TA-IV. Underlying the alluvium are rocks of Permian, Pennsylvanian, and Precambrian epochs which are the major strata constituents of the Sandia and Manzano Mountains (Kelley, 1977).

The stratigraphy is characterized by poorly consolidated Cenozoic deposits resulting from erosion of the surrounding mountains and plateaus, and from sediments brought in by the ancestral Rio Grande. These actions (erosional and depositional) formed the Albuquerque-Belen Basin. The deposits, called the Santa Fe formation, underlie a relatively thin veneer of gravels known as the Ortiz Gravel. The Ortiz Gravel is predominately an alluvial fan deposit, whereas the Santa Fe formation consists of unconsolidated deposits of sand, clay, silt, and caliche. The Santa Fe formation extends from approximately 30 meters (100 feet) below the surface to a depth of approximately 2,750 meters (9,000 feet) below SNL/NM, where it rests on Mesozoic sedimentary rocks (Kelley, 1977). The Precambrian basement is encountered at a depth of approximately 3,650 meters (12,000 feet) (DOE/EA-0466, 1993).

3.1.2.2 Soils

TA-IV has been constructed on the East Mesa where soils were formed in old unconsolidated alluvium, modified by wind, and are described as a portion of the Madurez-Wink Association. Two soil series are common to the site and vicinity: Embudo fine sandy loam and Wink fine sandy loam (DOE/EA-0466, 1993).

Formed in alluvium derived from decomposed, coarse-grained, granite rock found on old alluvial fans, Embudo soils are deep, well drained, and moderately alkaline. Runoff from these soils has a moderate water erosion hazard (DOE/EA-0466, 1993).

Formed in old unconsolidated alluvium modified by wind, Wink soils are deep, well drained, calcareous, and moderately alkaline (Hacker, 1977). Runoff from these soils has a moderate water erosion hazard (DOE/EA-0466, 1993).

Both soil series fall under the dryland capability classification. Such soils are unsuitable for cultivation or are severely limited unless protective cover is maintained to prevent erosion (DOE/EA-0466, 1993)

3.1.2.3 Seismology

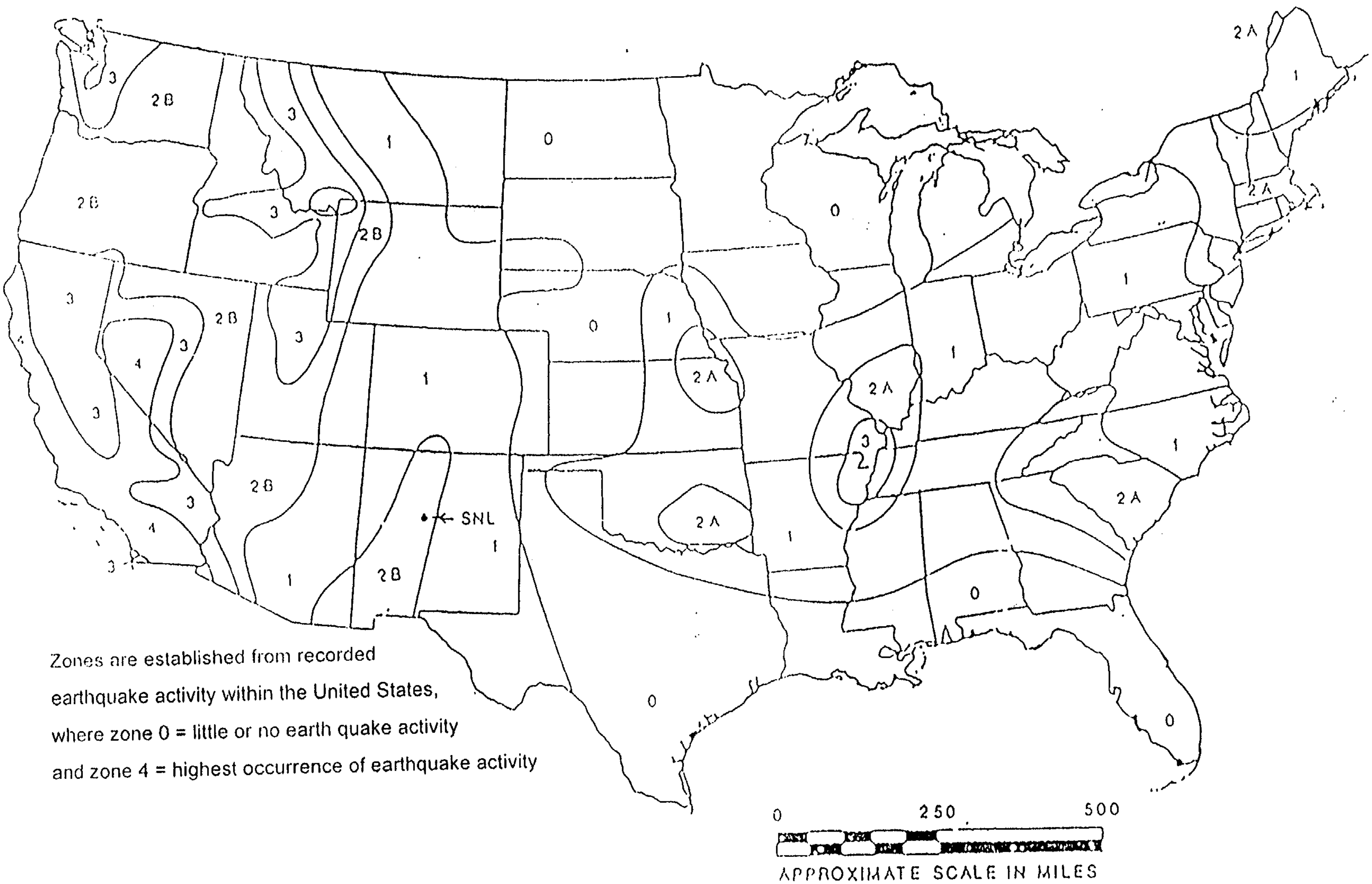
The Albuquerque area is located in Seismic Risk Zone 2B (see Figure 3.1), a region of seismic activity expected to result in moderate damage to structures from earthquakes. The amount of damage corresponds to Intensity VII of the Modified Mercalli Intensity Scale of 1931 (characterized by people fleeing buildings; damage to buildings varying depending on construction; and observations by automobile drivers). Ten earthquakes of Intensity VII have occurred in New Mexico in the last 100 years, two of which occurred in Albuquerque. The worst earthquake on record for the vicinity had an epicenter to the west of the Rio Grande and occurred on January 4, 1971. That earthquake had a magnitude of 4.7 on the Richter Scale. There has been no documented damage from earthquakes to SNL/NM facilities (DOE/EA-0352, 1988).

Albuquerque is located within a basin bounded on the east by a complex series of steeply dipping fault zones along the western edge of the Sandia and Manzano Mountains (see Figure 3.2). This series of faults, produced in Miocene times, has a vertical displacement of at least 6,100 meters (20,000 feet). TA-IV is approximately 4.5 kilometers (2.8 miles) from the nearest of these faults. There is no geological evidence that movement along these faults, with accompanying strong earthquakes, has occurred within geologically recent times. These faults appear to have been stable at least for the past million years (DOE/EA-0352, 1988).

Four faults have been identified that have potential for influencing the SNL/NM area. These are the Hubbel Springs Fault, the Manzano Fault, the Tijeras Fault, and the Sandia Fault (IT, 1993). The Tijeras, Hubbell Springs and Sandia faults converge near the Chemical Waste Landfill in TA-III (Culp *et al.*, 1993) which is approximately 5.6 kilometers (3.5 miles) from TA-IV. As stated above, there is no geological evidence that movement along these faults, with accompanying strong earthquakes, has occurred within geologically recent times.

3.1.3 Climate

The climate in and around Albuquerque is mild and dry but given to large diurnal and seasonal temperature variations, with a record high of 40.6°C (105°F) and a record low of -27.2°C (-17°F). Meteorological conditions are dominated by the influence of the Rio Grande Valley to the west and the Manzano Mountains to the east. Wind patterns are influenced by both these topological features



From UBC, 1988.

Figure 3.1. Seismic Risk Map of the United States

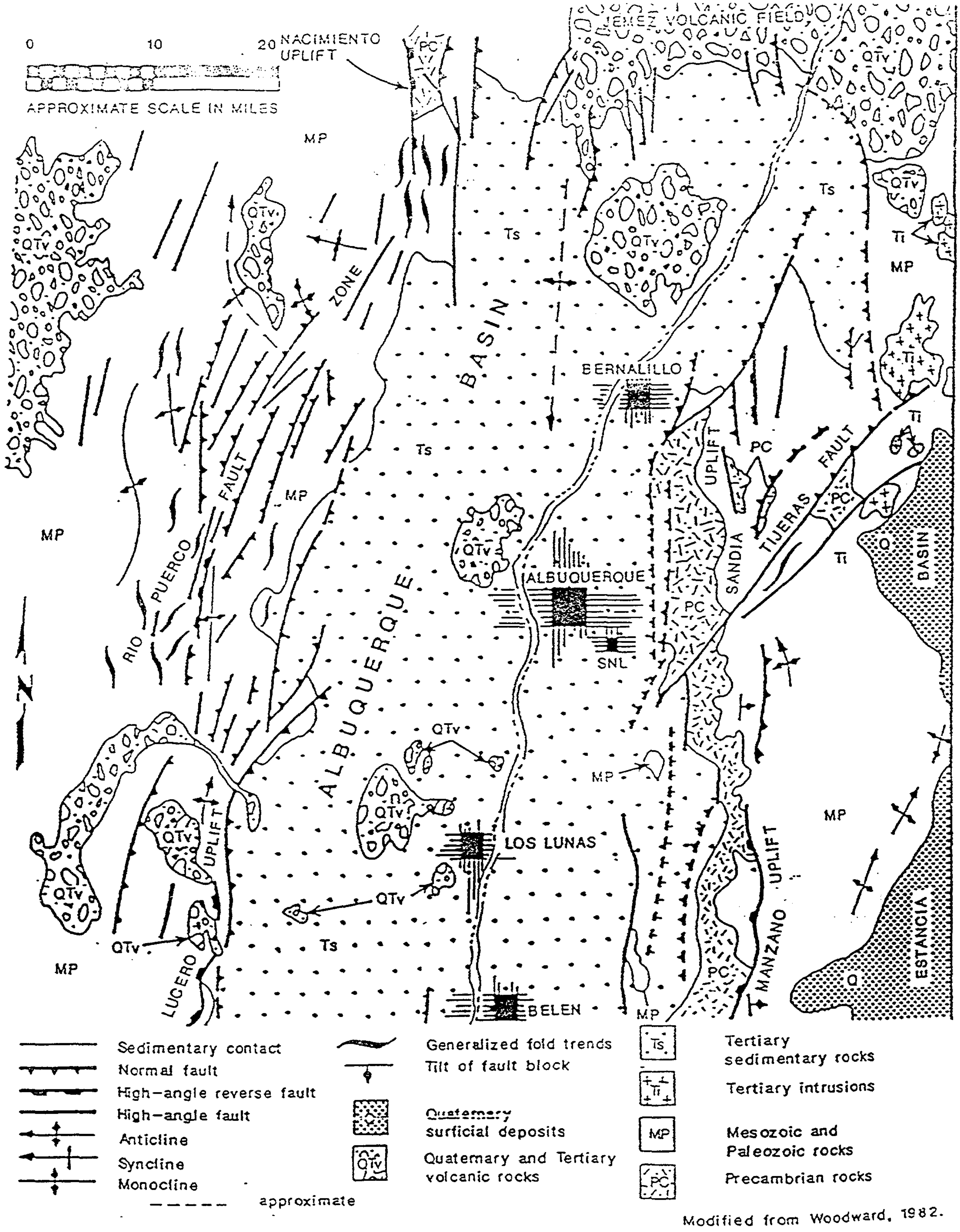


Figure 3.2. Locations of Seismic Fault Zones in Relation to TA-IV

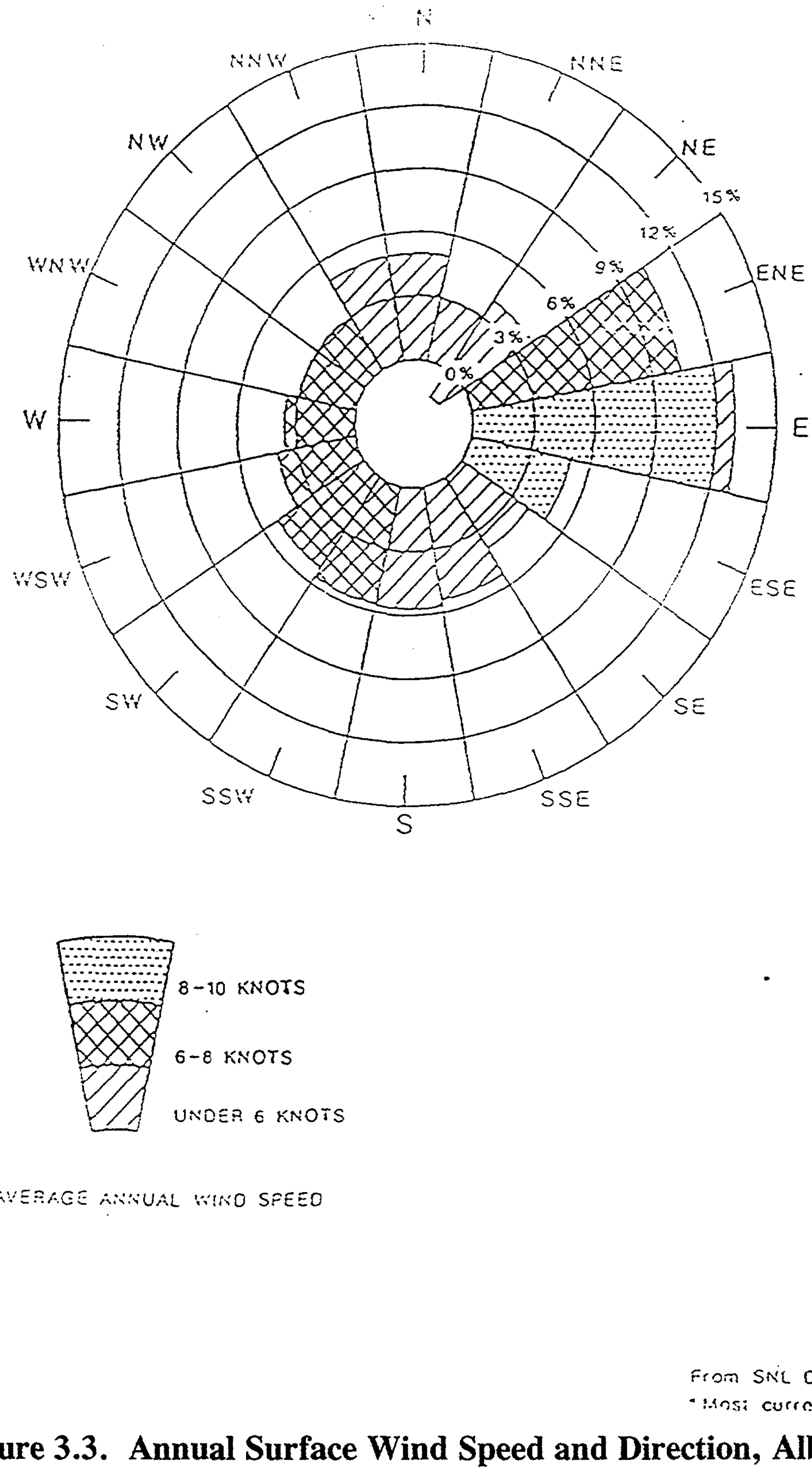
during severe weather conditions. During normal conditions, wind directions are almost equally divided in all directions (easterly winds prevail slightly). Windspeeds are generally less than 14.5 kilometers per hour (9 miles per hour). Winds reach a maximum velocity of 51.5 kilometers per hour (32 miles per hour) on an average of 46 days during the year. A wind gust of 96.5 kilometers per hour (60 miles per hour), lasting at least 1 minute, is expected to occur once every 2 years (DOE/EA-0352, 1988). A wind rose (compass card) for SNL/NM TA-I (approximately 1.2 kilometers [0.75 mile] north of TA-IV) is provided as Figure 3.3.

Scattered, torrential thunderstorms during July through September produce most of the average annual precipitation, approximately 20.3 centimeters (8 inches). The average number of thunderstorm days in the Albuquerque area is 41.

Tornado occurrences within the State of New Mexico vary from a minimum annual frequency of 0.2 to a maximum of 1.1 (Thom, 1963). Statistically, the highest frequency has been observed in the eastern half of the state. For the western half of the state, generally demarcated by the Rio Grande and the mountain ranges that parallel it on the east side, tornado frequencies are 0.3 or less. In the Albuquerque area, which lies west of the Sandia and Manzano Mountains, only two tornadoes have been reported in more than 20 years. These occurred within the center of the city of Albuquerque in the years 1985 and 1987 and are officially listed in the climatological records of the National Weather Service as "small tornadoes." Damage was light and no official wind readings are available.

3.2 Air Quality

Ambient air quality is regulated by the joint Albuquerque-Bernalillo County/Air Quality Control Board (ABC/AQCB). The ABC/AQCB also monitors compliance with federal and state and local air quality regulations. The only airborne pollutant for which Albuquerque is designated a "non-attainment" area for National Ambient Air Quality Standards (NAAQSs) is carbon monoxide (CO). However, the city recently became eligible for "maintenance" status for this pollutant and application for redesignation by the U.S. Environmental Protection Agency (EPA) is currently underway. The Air Pollution Control Division under the Albuquerque Environmental Health Department has set up several ambient air sampling stations throughout the city, including the site 3.2 kilometers (2 miles) northwest of SNL/NM, to monitor suspended particulates, ozone, nitrous oxide, and CO. Sulfur dioxide and Volatile Organic Compounds (VOC) are also regulated by the ABC/AQCB. To date, the monitored criteria pollutants have not exceeded the acceptable levels at the station nearest to SNL/NM (Culp *et al.*, 1994).



From SNL DIVISION 7251, 1970.*
*Most current data available.

Figure 3.3. Annual Surface Wind Speed and Direction, Albuquerque, NM

Additionally, SNL/NM has established an Air Quality Program to ensure compliance with Department of Energy Order 5400.1, *General Environmental Protection Program* requirements, EPA requirements listed in 40 CFR, Parts 50-58, and other applicable federal and local regulations. The Air Quality Program is managed by the SNL/NM Air Quality Department. Its main objective is to qualify and quantify the potential impacts of on-site activities to off-site populations and the surrounding environment. Other DOE requirements include the following: (1) establishing background concentration levels of chemical species associated with DOE activities; (2) determining representative pollutant concentrations at areas of concern to public health; and (3) evaluating the effects of DOE emissions on ambient levels of particular contaminants of concern. Data are collected and shared with the City of Albuquerque.

To achieve Air Quality Program objectives, ambient air sampling is performed at seven permanent air-monitoring stations around SNL/NM. One semi-mobile station for criteria pollutants can also be used. Sampling site selection is based on all potential releases and other possible impacts to off-site residents and the surrounding area, and takes into account emissions, meteorology, topography, and geography. A table giving the locations and sample types is presented as Table 3.1 and a map depicting these locations is shown in Figure 3.4. Data are collected on the "criteria" pollutants (sulfur dioxide, oxides of nitrogen, carbon monoxide, ozone, PM-10 [particulate matter less than 10 microns in diameter ($4x10^{-4}$ inch)], and lead particulate). In addition, VOC and acid gas vapor samples are collected and analyzed. In the future, radon gas and tritium monitoring may also be included.

SNL/NM, including TA-IV, has conducted a preliminary inventory of the 189 hazardous air pollutants listed under the Clean Air Act Amendments of 1990. In TA-IV, four listed chemicals are used in quantities greater than 3.8 liters (1 gallon) per year and include methanol (189 liters; 50 gal/yr), isopropanol (189 liters; 50 gal/yr), acetone (19 liters; 5 gal/yr) and hexanes (57 liters; 15 gal/yr). All airborne chemicals released are within compliance levels established by the ABC/AQCB. DOE is currently in the process of applying for a Title V operating permit under the Clean Air Act Amendments of 1990 from the City of Albuquerque.

Table 3-1. Locations of Ambient Air Monitoring Stations at SNL/NM

Location Number	Location	Sample Types*
PVPM	Photovoltaic Facility, NE of TA-I	PM-10
KUPM	Kirtland Underground Munitions Storage Complex (KUMSC)	PM-10
A2PM	Area II	PM-10
MWPM1	Area III, Mixed Waste Landfill, E	PM-10
MWPM2	Area III, Mixed Waste Landfill, W	PM-10
CWPM	Chemical Waste Landfill	PM-10
BSPM	East of Burn Site, Manzano Mountains	PM-10
Mobile	Mobile station - currently west of the PVPM location, north of Area I	CP

*PM-10 = Particulate Matter ≤ 10 microns; CP = Criteria Pollutants (SO_2, NO_x, CO, ozone, PM-10, and Pb); Personnel would collect samples for VOCs, radon gas, tritium vapor, and acid gas analyses at any of these locations as needed.

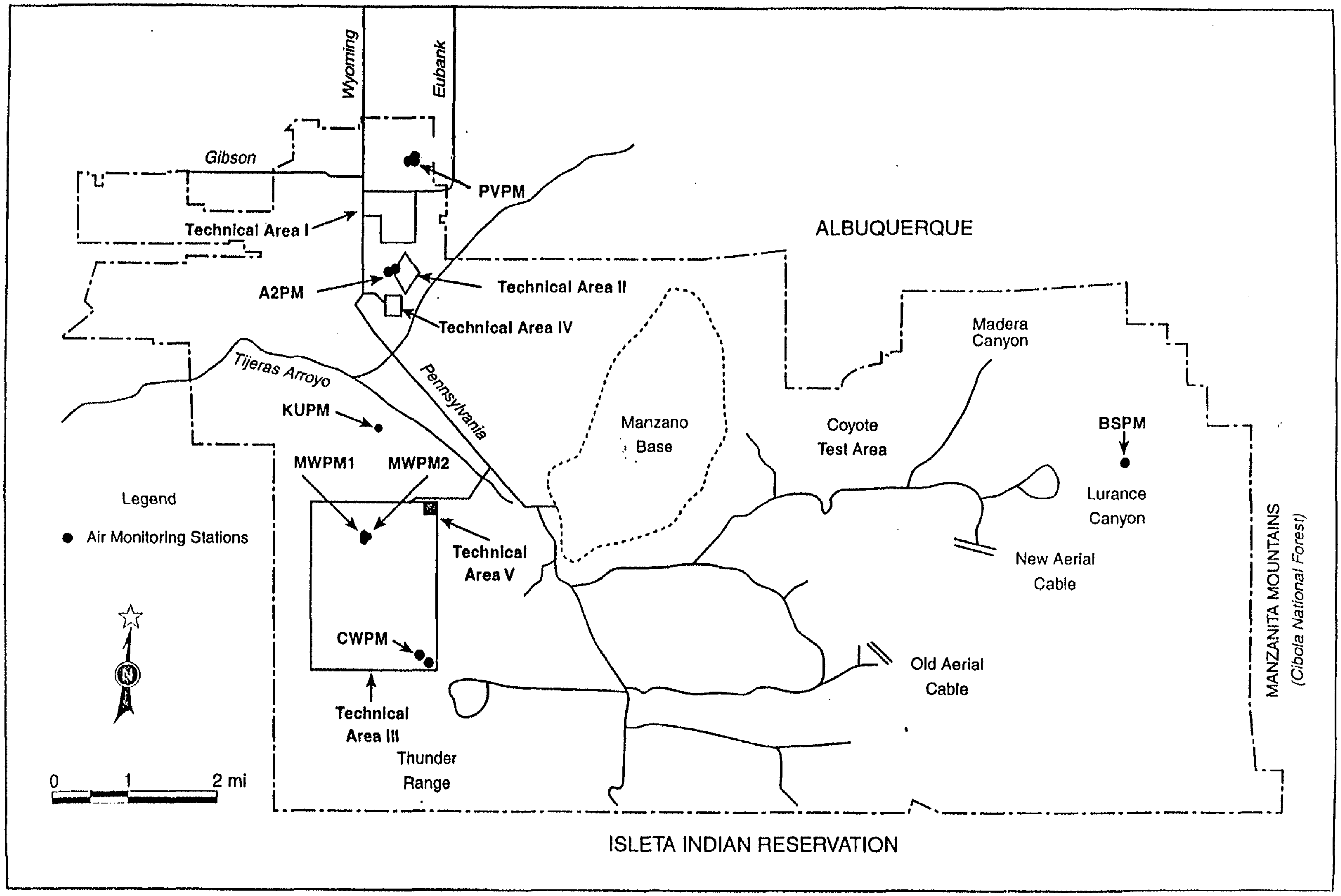


Figure 3.4. Locations of Air Monitoring Stations at SNL/NM

3.2.1 Radiological Emissions

Several facilities within TA-IV routinely generate radioactive emissions. The HERMES III Accelerator located in Building 970, the PBFA II Accelerator in Building 983, and the SABRE activation products. When the energies of the radiation produced by these facilities is below 10.5 MeV, no air activation products are produced. At energies greater than 10.5 MeV, the short-lived ^{13}N and ^{15}O are produced from the energy interactions with the air. The SATURN Accelerator located in Building 981 has the potential to generate radioactive emissions in the form of tritium (^{3}H). Tritium can be produced by this accelerator through the process of the pinch activation between 2.5 MeV neutrons and deuterium (D_2) gas contained in certain targets.

The HERMES III Accelerator is currently operating at a voltage of 20 MeV with a maximum operating capacity of 2000 shots per year. HERMES III does not operate at the maximum capacity. During a HERMES III shot, the ^{13}N and ^{15}O produced are vented through a stack in the roof of the HERMES III Test Cell. This source of radionuclide emission constitutes a NESHAP radionuclide source according to 40 CFR 61, Subpart H. A monitoring system has been installed in the HERMES III Test Cell ventilation stack and is used for periodic, or confirmatory, measurements of the stack emissions. The reported emissions for the HERMES III facility are based on the stack emission measurements. Typical releases of ^{13}N and ^{15}O for HERMES III are 2.32 Ci/yr and 0.030 Ci/yr, respectively.

The PBFA II Accelerator is currently operating at voltages from 10 to 15 MeV and a maximum operating voltage of 30 MeV and a typical operating capacity of 5 shots per week. PBFA II does not operate at the maximum capacity. PBFA II is considered a NESHAP source but the air concentrations released after each shot are lower than what can readily be measured. Because of this, air emissions are calculated. The ^{13}N and ^{15}O produced during operations are released via leakage of air from the building as part of the normal air infiltration and diffusion. Since there is no exhaust stack or forced ventilation system for controlling the release of airborne radionuclides, the potential release is assumed to be at ground level and at zero velocity. The maximum potential release attributable to PBFA II, at a maximum voltage of 30 MeV and at 5 shots per week, is 0.042 Ci/yr of ^{13}N and 0.005 Ci/yr of ^{15}O. Under these maximum conditions, 0.000168 Ci of ^{13}N and 0.00002 Ci of ^{15}O are calculated to be produced per shot (PBFA II Application for Approval of Modification Under 40 CFR Part 61, SNL 1989).

In the past, the SATURN Accelerator has produced ^{3}H as part of routine operations. An estimate of 4.75 μCi of ^{3}H was produced during experiments conducted between October 29 and November 9,

1990. No experiments with the potential to result in ^{3}H production have been conducted since November 1990. Should future experiments that have the potential to produce ^{3}H be conducted, appropriate NESHAP permitting and monitoring requirements would be met.

The SABRE Accelerator is currently operating at voltages from 6 to 10 MeV with a maximum operating voltage of 12 MeV and a current operating capacity of 10 shots per week. SABRE does not routinely operate at the maximum capacity. SABRE is considered a NESHAP source, but the air concentrations expected after each shot are lower than what can readily be measured. Because of this, air emissions are calculated. The ^{13}N produced during operations is released via leakage of air from the building as part of the normal air infiltration and diffusion (^{15}O threshold of generation is greater than 15 MeV for a γ,n reaction, therefore no ^{15}O is produced at SABRE). Since there is no exhaust stack or forced ventilation system for controlling the release of airborne radionuclides, the potential release is assumed to be at ground level and at zero velocity. The maximum potential release attributable to SABRE, at a maximum voltage of 12 MeV and at 10 times per week, is estimated to be 0.0058 Ci/yr of ^{13}N. Under these maximum conditions, 1.16×10^{-5} Ci of ^{13}N would be calculated to be produced per shot.

Minor modifications to TA-IV facilities occur as part of routine operations. These modifications in no way change the maximal operating parameters of the facilities in TA-IV for which radiological emissions are calculated.

3.3 Water Resources

3.3.1 Surface Water Hydrology

The major surface hydrologic feature in central New Mexico is the Rio Grande, which flows north to south through Albuquerque and lies approximately 10 kilometers (6 miles) west of KAFB. Surface water drainage at TA-IV is provided by Tijeras Arroyo which originates at Tijeras Canyon to the northeast and terminates at the Rio Grande. Drainage consists primarily of sheet flow into small, shallow arroyos which eventually empty into the Tijeras Arroyo. There are no natural lakes or wetlands in the area and all drainage flows are intermittent, occurring only during periods of precipitation.

TA-IV is situated at an elevation of 1,643.5 meters (5,392 feet) and encompasses a small portion of the Tijeras Arroyo. The United States Geological Survey (USGS) maintains a floodcrest flow station near the mouth of Tijeras Canyon. The maximum flood stage recorded during 16 years of record keeping was 2 meters (9 feet), which corresponds to a flow volume of 181 cubic meters per second (6,400 cubic feet per second). This flow volume extrapolates to a maximum 25-year flood flow rate. The channel width at the USGS gauging station is approximately 15 meters (50 feet). The floodplain width at the floodcrest flow station is 609 meters (2,000 feet). This change in channel width, together with the loss of momentum resulting from the slope decrease as the stream bed leaves the mountains, indicates that the 24-meter (80-foot) walls of Tijeras Arroyo are adequate to protect against flooding.

The U.S. Army Corps of Engineers (COE) has estimated that a 100-year flood would reach a crest of 1,615 meters (5,301 feet) and a 500-year flood would reach a crest of 1,616 meters (5,302 feet) (COE, 1979). The Army Corps of Engineers has defined the 100-year and 500-year floodplains for Tijeras Arroyo, as shown in Figure 3.5. However, neither the 100-year nor the 500-year floodplains encroach upon TA-IV. All of TA-IV lies outside these floodplains.

3.3.2 Groundwater Hydrology

The alluvial material underlying the east and west mesas of the Rio Grande trough and TA-IV is the major subsurface groundwater reservoir of the Albuquerque area. The subsurface water is unconfined since the water table is free to move with the local hydraulic gradient to the extent that local permeability permits. The water table is an irregular, gently sloping surface with an overall gradient of approximately 4.9 meters per kilometer (10 feet per mile) west-southwest toward the Rio Grande. Although groundwater is closer to the surface in some areas, generally the water table is approximately 152 meters (500 feet) below the site and the flow is on the order of only 6 meters (20 feet) per year. Because of withdrawal for city and industrial use, the water table is gradually lowering. USGS projections indicate that by the end of the century it would have dropped another 9 to 15 meters (30 to 50 feet) (Reeder *et al.*, 1967).

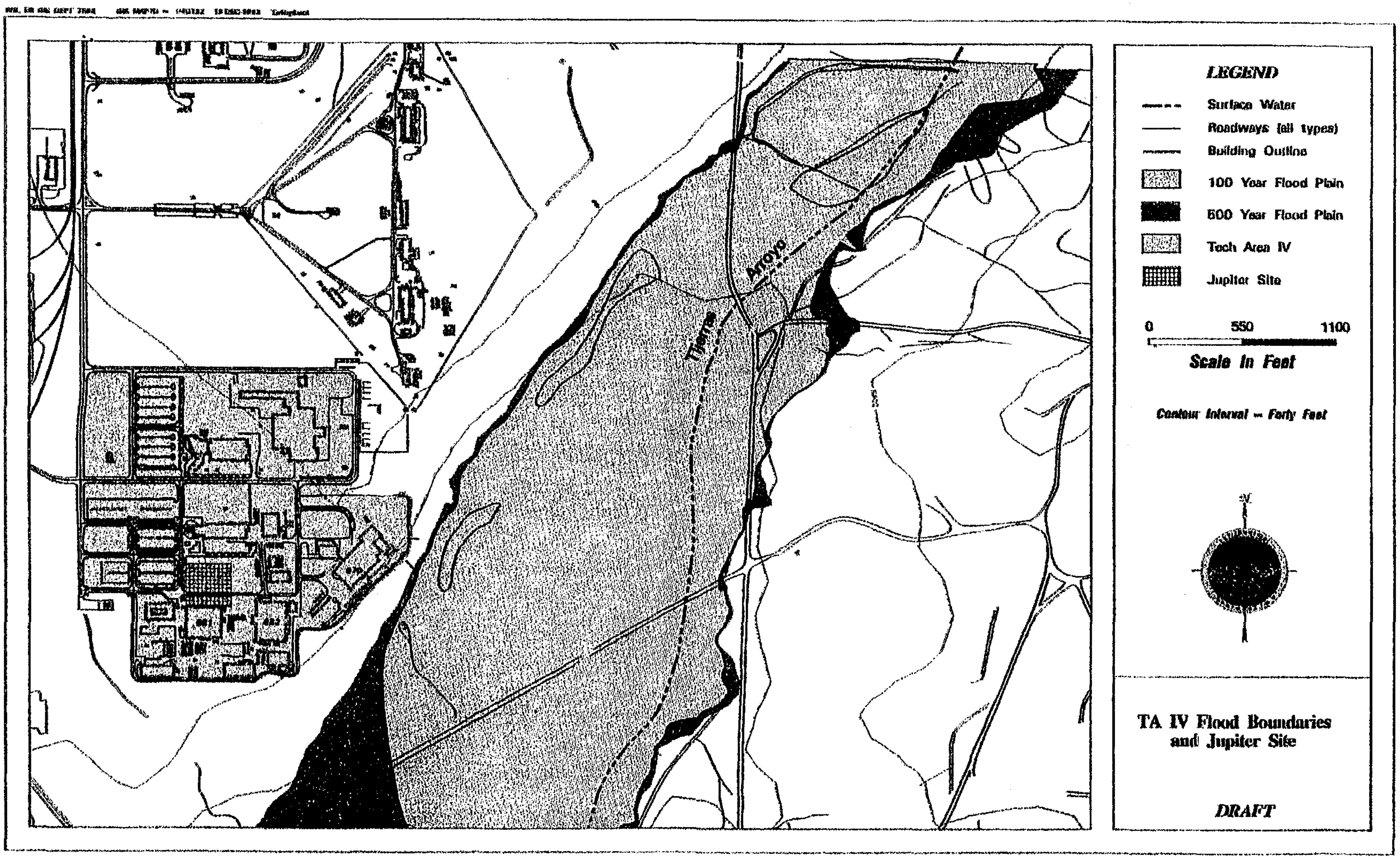


Figure 3.5. Technical Area IV Flood Boundaries

3.3.3 Water Usage

Water for domestic consumption is supplied to TA-IV by U.S. Air Force wells. Water consumption for TA-IV is estimated at 378,500 liters (100,000 gallons) per day. The TA-IV sewage system is connected to the Air Force system, which ultimately leads to the City of Albuquerque's South Valley Sewage Plant. TA-IVs effluent is combined with effluent from TA-II and parts of TA-I and monitored by the SNL/NM Water Quality Department. Flow and pH are continuously monitored. On a periodic basis, samples are taken and analyzed for toxic organics, various metals and chemicals, and radioactivity. In compliance with SNL/NM's Waste Water Discharge Permit, semi-annual waste water discharge reports (SNL/NM, 1995a) are submitted to the DOE, the Waste Water Utilities Department of the City of Albuquerque, and the New Mexico Environmental Department (NMED). These reports document SNL/NM's compliance with its permit requirements.

3.4 Biological Resources

3.4.1 Vegetation and Wildlife

There is no undisturbed natural habitat remaining at TA-IV. A consultation on biological resources in TA-IV and a map of the survey area are provided in the Appendix. Vegetation is limited to scattered ruderal plants and a row of ornamental ash trees along the sidewalk to the west. The chainlink fence enclosing the bare soil area restricts access by larger wildlife species. Sufficient food, water, and cover are not available to support populations of smaller wildlife species at the site.

3.4.2 Threatened and Endangered Species and Species of Concern

No federally-listed endangered or threatened species (plants or animals) or state-listed endangered wildlife species (Group 1 or Group 2) are known to occur within the site vicinity, based on two biological surveys performed by IT Corporation in 1995 for the SNL/NM Environmental Restoration Project (IT, 1995). The grama grass cactus (*Pediocactus papyracanthus*), which is listed as an endangered plant by the New Mexico Energy, Minerals and Natural Resource Department and is a C2 candidate species for federal listing, has been recorded on similar soils within 1.6 kilometers (1 mile) of TA-IV (IT, 1991). However, the external soil disturbance at and around the TA-IV precludes its occurrence within the proposed impact area. Other state-listed endangered and rare plants known to occur within the KAFB boundary, i.e., Wright's pincushion cactus (*Mammillaria wrightii* [endangered]), visnagita cactus (*Neolloydia intertexta* [endangered]), and Santa Fe milkvetch (*Astragalus feensis* [rare]), are also unlikely to occur in the site vicinity due to disturbance and unfavorable soil type. As a result of past site disturbances associated with construction and development in the surrounding area, biological resources within the technical area are limited.

3.4.3 Wetlands

There are no natural lakes or wetlands in TA-IV and all drainage flows are intermittent, occurring only during periods of precipitation.

3.5 Cultural Resources

All of TA-IV has been surveyed for archeological and historic resources (Hoagland, 1990b). DOE consulted with the New Mexico State Historic Preservation Officer (SHPO) under Section 106 of the National Historic Preservation Act. On October 17, 1990, the SHPO concurred in DOE's finding that no properties listed on or eligible for inclusion on the National Register of Historic Places (NRHP), are within TA-IV (see Appendix).

TA-IV has been extensively disturbed. All locales not containing structures have been bladed, landscaped, graveled, and/or paved. No historic properties (listed in or eligible for listing in the NRHP) are located in TA-IV and none would be expected to have survived previous construction and earth-modifying activities. Existing facilities lack sufficient antiquity or other attributes to be considered eligible for inclusion in the National Register.

Three other cultural resource surveys that included portions of TA-IV were conducted in recent years:

- In 1987 approximately 28 acres of TA-IV were surveyed for archaeological resources (see Appendix). No archaeological sites or artifacts were found. On the basis of this survey, DOE concluded that construction of the (then proposed) SDF site (now known as Buildings 962 and 963), would have no effect upon archaeological or historic resources (DOE/EA-0352, 1988).

- Two surveys for individual projects were also conducted in TA-IV in 1990, again concluding that no archeological or historic sites are present (Hoagland, 1990a, c).

These surveys concluded that there were no properties within TA-IV that were eligible for inclusion on the NRHP.

3.6 Noise

Noise levels in TA-IV are currently relatively low. The main source of noise comes from occasional aircraft overflight and traffic. Baseline noise monitoring data provided an estimated noise level range of 54 to 94 dBA near the east end of the Albuquerque International Sunport (AIS) east/west runway (IT and Zephyr Design, 1993). A KAFB skeet shooting range is approximately 350 meters (1,150 feet) southwest of TA-IV.

Accelerator activities in TA-IV, for the most part, produce only a very short duration (less than 1 second) noise during an accelerator firing (i.e., "shot noise"). Inside an accelerator building, the peak noise level may approach 140 dBA (Herring, 1990). Personnel who remain inside the accelerator enclosure may need to wear personal protective equipment (PPE) during a shot. However, due to the infrequency that these accelerators are fired (from one to ten times per day), the average noise level is well below OSHA standards. Outside the accelerator enclosure, as well as outside the building, the shot noise level is minimal. PPE is not required in these areas.

3.7 Waste Management

Waste management for ongoing activities in TA-IV are conducted in accordance with the SNL ES&H Manual Chapter 19 *Waste Management* MN471001. Four basic types of waste can be generated in TA-IV and include hazardous waste (RCRA and TSCA regulated), radioactive waste, mixed waste (radioactive and RCRA), and solid waste.

Hazardous, radioactive, mixed, and solid waste management programs at SNL/NM are administered in compliance with pertinent EPA, U.S. Department of Transportation (DOT), DOE, and State of New Mexico regulations. Responsibilities for hazardous, radioactive, mixed, and solid waste management at SNL/NM are divided among three departments: the Compliance and Generator Interface Department, the Pollution Prevention and Hazardous Waste Management Department, and the Radioactive and Mixed Waste Management Department.

The Compliance and Generator Interface Department is responsible for providing guidance to SNL/NM hazardous, radioactive, mixed, and solid waste generators; performing spot checks of generator compliance; and providing the interface to the DOE, EPA, and the state of New Mexico on matters concerning waste. The Pollution Prevention and Hazardous Waste Management Department manages three basic types of wastes — RCRA hazardous waste, Toxic Substances Control Act (TSCA) waste (asbestos and PCBs), and solid waste. Their responsibilities include collecting waste from generator locations, packaging waste into DOT containers, operating the Hazardous Waste Management Facility (HWMF), arranging for and overseeing off-site shipment, treatment, and disposal of the waste. The Radioactive and Mixed Waste Department manages radioactive and mixed wastes. Their responsibilities include collecting waste from generator locations, packaging waste into DOT containers, operating the Radioactive and Mixed Waste Facility (RMWF) and the Interim Storage Site (ISS), and arranging for and overseeing off-site shipment, treatment, and disposal of the waste.

Minor modification to TA-IV facilities occur as part of routine operations. These modifications do not change the amount and types of waste that are produced in TA-IV.

3.7.1 Radioactive and Mixed Wastes

The interaction of surrounding experimental hardware with the partical beam of an accelerator produces activation. With the current materials in use (mainly stainless steel and aluminum) the primary activation products are ^{65}Zn, ^{57}Co, ^{56}Co, ^{54}Mn, and ^{22}Na. Many other radionuclides are produced but have half-lives so short that they are undetectable after one hour. Radioactive waste generated in TA-IV consists primarily of Low Level Waste (LLW). The potential exists for generation of some mixed LLW (i.e., contains one or more RCRA regulated constituents and a radioactive constituent). In the current configuration the only accelerators that can produce radioactive waste are HERMES III, PBFA II, and SABRE.

LLW is generated by the decontamination of experimental hardware, and when the experimental hardware is no longer usable it constitutes LLW and potentially small quantities (less than 2.8 cu meters/yr [100 cu ft/yr]) of mixed waste. This waste is highly heterogeneous in composition, consisting of personal protective equipment (PPE), wipes, rags, and paper absorbents used to decontaminate the experimental hardware, as well as the experimental hardware itself. In all of TA-IV less than 907 kg/yr (2000 lbs/yr) of LLW is produced. PBFA II generates the bulk of this waste in its current operating mode. Routine health physics surveys of this waste generally show a very small measurable activity above background levels. For example, the radiation levels from PBFA II LLW are normally 7-14 μR/hr on contact with background being approximately 7-8 μR/hr. Therefore, the external radiation exposure levels for waste packages are generally less than 20 μrem/hr for handling, shipment, and disposal. These radiation exposure levels are so low that any human health effects would be negligible.

Mixed LLW could be generated if an experimental plan required the use of a RCRA-regulated substance in an area where beam interactions are expected (i.e., within the bounds of a Radioactive Materials Management Area). There are currently no activities in TA-IV that produce mixed waste.

A waste stream for LLW generated at PBFA II (Waste Stream 1A PBFA II Dry Active Waste) has been identified and approved by DOE in accordance with the *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements*, (NVO-325 [Rev.1] June 1992). Since February 1992, about 1360 kg (3000 lbs) of "Dry Active Waste" have been generated and approximately 907 kg (2000 lbs) of this waste (constituting approximately 17 cu meters [600 cu ft] packaged) have been shipped to the Nevada Test Site under this program. Typically an estimated 23-34 kg (50-75 lbs) of this type of waste are generated at PBFA II every month.

3.7.2 Non-Radioactive Wastes (Chemical and Solid Wastes)

TA-IV facilities generate hazardous (RCRA and TSCA regulated) wastes as part of ongoing operations. The wastes are comprised primarily of photochemicals, copper sulfate liquid, contaminated oils and oily rags, waste capacitors, and non-halogenated solvent-contaminated rags. The total volume of waste submitted to the HWMF for disposal over the last three years was 5,621 kg (12,392 lbs), for an average annual waste generation of 1,873 kg/yr (4,129 lbs/yr).

TA-IV facilities also generate an estimated 566 cu meters (20,000 cu ft) of varied solid waste that consists primarily of office waste (paper, cardboard, packaging materials, etc.). This waste is collected in dumpsters and disposed of in an offsite commercial sanitary landfill.

Two water evaporative lagoons are maintained in TA-IV. Lagoon #1 [518,545 liters (137,000 gallons)] services Buildings 981 and 983, and Lagoon #2 [480,695 liters (127,000 gallons)] services Building 970. The primary purpose of both lagoons is to receive surface runoff from precipitation that collects in the sump of the transformer oil tank farm spill-containment area. The collected runoff is pumped to the lagoons by a manually operated sump pump. If visible oil is present in the sump, a manually operated transformer oil skimmer is used to remove the oil from the containment area to a transformer oil storage tank at each facility. These two sites are designated ER sites under investigation by the Draft Environmental Restoration Project at SNL/NM (DOE/EA-1140). The sumps in the oil tank farms also receive non-routine water and transformer oil spills from floor trenches in Buildings 970, 981 and 983. The trenches are designed to prevent the oil or water from flooding the buildings in the event of a spill.

The lagoons are operated under a discharge plan (DP-530) which is approved by the NMED. The plan requires semi-annual monitoring for major cations, major anions, total dissolved solids, and volatile and extractable organic compounds. Typically, the concentrations measured in the lagoons are less than the applicable New Mexico Water Quality Control Commission standards. State of New Mexico Environment Department Lagoon Discharge Reports containing water level measurements and monitoring results were submitted in January and July to the NMED Groundwater Bureau (SNL, 1995a). These reports show that water samples analyzed from these lagoons demonstrate compliance with the New Mexico Water Quality Control Commission Regulations.

3.8 Human Health Exposure

3.8.1 Radiological Exposures

As part of normal operations, accelerators in TA-IV produce prompt ionizing radiation in the form of bremsstrahlung. Bremsstrahlung is ionizing radiation produced as a part of normal operations, by an electrically charged subatomic particle (i.e., an electron) subjected to sudden deceleration in the electric field of an atomic nucleus. This type of radiation is readily shielded and no exposure generally occurs as it is confined to the access control areas of the accelerators. Additionally, some accelerators produce energetic beams to activate air, as discussed earlier in section 3.2.1. These beams may also be energetic enough to activate the experimental chamber. Radiation exposure is maintained ALARA through the use of radiation protection practices (PPE, monitoring, etc.).

The most plausible scenario for major radiological exposure to personnel would occur if they were present in the test cell when an accelerator was fired. However, since access control features including redundant interlocks and door alarms have been installed, the presence of workers in a test cell during a shot would be extremely unlikely. As documented by SNL/NM's dosimetry program, employees working at SNL/NM accelerators have historically received very low exposures. Workers' exposures to radiation under normal operations are controlled under established DOE

Orders and SNL/NM SOPs, which limit exposures to 5 rem per year and, further, to be at ALARA levels. Workers have not nor would be expected to incur any harmful health effects from radiation exposures during normal operations conducted according to these limits.

SNL/NM dosimetry records also show that a person working with SNL/NM accelerators in excess of 20 years would receive less than 1.0 rem. For personnel working in radiological areas the dose limit is 5 rem over a 1-year period (10 CFR Part 835). Based on dosimetry records at the SATURN, PBFA II, and HERMES III facilities, workers in TA-IV accelerator facilities could expect to receive a cumulative dose of between 0 and 20 millirem (0 to 0.020 rem) in a 1-year period.

As a further check of historic doses received by individuals who have worked with accelerators, the records of 10 individuals, randomly selected, who worked exclusively at the SATURN facility since its operational start date of June 1987 for a seven year period, were retrieved from the SNL/NM dosimetry database. The average dose received (per individual) was 0.013 rem for the 7-year period (Stanley, 1994). This figure is well below the 1-year regulatory limit for radiation workers of 5 rem per year adopted by DOE. The individual with the highest exposure over the 7-year period received only 0.050 rem as a cumulative dose.

Background radiation originates from cosmic (extraterrestrial), terrestrial (radioactive elements in the earth's crust) and internal (radionuclides in food and water) sources, as well as from radon. The average total exposure to the general population in the U.S. is about 360 mrem/yr (NAS, 1990). Radon, cosmic, and terrestrial sources contribute to the external gamma exposure. The external gamma exposure from background radiation levels in Albuquerque is estimated to be about 105 milliroentgen/yr. Based on the dosimetry history at the TA-IV accelerator facilities, the average worker receives only 13 millirem (0.013 rem) per year (Stanley, 1994).

Accelerator facilities are designed to prevent personnel outside the facility from receiving any prompt radiation dose when the accelerator is fired. Except for HERMES III, which sometimes operates in an outdoor mode, the electron beams of the accelerators are focused and confined within the TA-IV buildings, and adequate shielding limits the radiation that leaves the test cell areas or penetrates the building walls to outside areas. When HERMES III is operated in its outdoor mode, an outdoor exclusion area, with observers, is established to ensure that personnel in the area are not exposed.

Minor modifications to TA-IV facilities occur as part of routine operations. These modifications in no way change the maximal operating parameters of the facilities in TA-IV for which radiological exposures are calculated.

3.8.2 Nonradiological Exposures

Nonradiological exposures associated with TA-IV involve the use of chemicals in routine operations. In accordance with DOE 5480.25, *Safety of Accelerator Facilities*, hazards posed by chemicals that are used in routine operations of TA-IV facilities are classified as "routinely accepted" through "low hazard" (DOE, 1992).

Many different kinds of chemicals are used in TA-IV, including acids and bases (primarily photochemicals, copper sulfate, and sodium hydroxide), compressed gases (nitrogen, argon, helium, laser gases, etc.), non-halogenated solvents (methanol, ethanol, isopropanol, hexanes, etc.), and oils (vacuum pump, hydraulic, etc.), for everyday laboratory type use (cleaning and experimental preparation). Most are used in small quantities (up to several gallons or pounds). The following chemicals are discussed further because of their usage quantities (thousands of gallons) or toxic characteristics.

- Transformer Oil (Shell Diala Oil AX): The oil is used as electrical insulation in the primary storage section of the accelerators. It is regularly filtered to maintain breakdown strength. Polychlorinated biphenyls (PCBs) are not present in this oil. The exposure potential for workers during routine operations would arise during removal and maintenance of Marx generators and Marx pulser units from the accelerator oil tank. Brief skin exposure to the oil is possible during these actions and during inspections of the accelerator oil tank as it is drained for maintenance activities; however, exposure is mitigated by the use of gloves and other PPE as appropriate. There is no health hazard from contact with this product and it is not regulated as a hazardous waste, hazardous substance, or toxic pollutant (see Subsection 3.7.2). If skin contact occurs, washing with soap and water is recommended.

- Sulfur Hexafluoride Gas: This gas is used as an electrical insulator in spark gaps and switches. Most of the gas (roughly 50 to 70 percent) is filtered and reused. Individuals repairing a broken "rimfire switch" might inhale some of this inert, non-toxic gas when performing repair, or other maintenance functions. The primary hazard involved with the use of sulfur hexafluoride gas is asphyxiation. Hazards associated with the use of SF_6 are controlled with the requirements specified in OSHA 29 CFR 1910.1200.

  Effects of exposure after oxygen is displaced are headache, dizziness, labored breathing, eventual unconsciousness, and death. All operations personnel receive confined space training. Sulfur hexafluoride gas could be released to the environment when repair of accelerator rimfire switches becomes necessary. Small leaks within the gas system inside accelerator facilities or in gas reclaimer systems would be additional pathways for sulfur hexafluoride to reach the environment during routine operations. Since sulfur hexafluoride is an inert, non-hazardous gas (Alphagaz, 1985), there would be no detrimental effect to the public or the environment as a result of these dispersals.

- Helium (95%)/Fluorine (5%) Gas: Approximately 3400 liters (120 cubic feet) per year of the helium/fluorine gas mixture is used in individual 566-liter (20 cubic feet) cylinders to generate lasers. The primary hazard associated with the gas mixture is the 5% fluorine. Fluorine is irritating to personnel at low concentrations and toxic at high concentrations. An accident involving the release of the gas in a confined space with simultaneous failure of ventilation systems could result in a situation immediately dangerous to life and health. The maximal consequence to a worker would be death; however, the hazard is mitigated by the use of continuously ventilated gas handling cabinets (i.e., gas from a leaking cylinder is vented to the outside atmosphere), oxygen deficiency monitors, and a documented confined space program. Consequences to the public and the environment would be negligible.

3.8.3 Physical Hazards

Numerous industrial-type hazards exist for personnel working in TA-IV. Major hazards include electric shock from electrical equipment, bodily injury from falls or from working with large and heavy components, asphyxiation from working in confined spaces, and eye injury from working with lasers. However, the hazards are controlled through SNL/NM procedures and training.

3.9 Socioeconomics

As a major employer in New Mexico, SNL/NM has a major economic and social impact on the state and, in particular, the Albuquerque metropolitan area. Approximately 7,670 people are employed by SNL/NM at several New Mexico locations. TA-IV employs approximately 750 of these people. In addition, approximately 500 pensioners who are surviving family members of former SNL/NM employees reside in New Mexico.

3.10 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629, February 11, 1994) requires Federal agencies to identify and address the possibility of disproportionately high and adverse health and environmental impacts of programs and activities on minority and low-income populations.

Isleta Pueblo is immediately south of SNL/NM; the border is about 11 km (7 miles) from Tech Area II. The pueblo acreage is about 80,940 hectares (200,000 acre) in size, and the 4,000- person population is clustered along the Rio Grande.

A trailer park residential area, to the east of the KAFB boundary, is approximately 3.9 km (2.4 miles) from TA-IV. Additionally, the closest KAFB base housing would be about 2.9 km (1.8 miles) southwest of TA-IV.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Overview

This section examines potential consequences to the existing environment associated with the proposed action and the no action alternatives. In general, the amount of detail presented with respect to the various environmental categories in this section is proportional to the potential for adverse impacts. The proposed action and the no action alternative would have negligible impacts on geology, seismology, biological resources, cultural resources, solid waste, noise levels, and human health issues. The proposed action, however, would have minor impacts to soils, water resources and air quality. The proposed action would have beneficial impacts by reducing generated radiological wastes and air emissions, and subsequent exposure to radiological air emissions and waste.

4.2 Geology, Soils, and Seismology

No impacts to geology, soils, or seismology would occur as a result of the no action alternative. There would also be no impacts to geology and seismology as a result of the proposed action, however, minor impacts to soils would result from the installation of two transformer oil storage tanks as part of the APRM expansion.

4.2.1 Soils

4.2.1.1 No Action Alternative

Based on a reconnaissance of the area, there are currently no locales situated within TA-IV that have not been severely disturbed in the past (Hoagland, 1990b, c). Those locales not containing structures have been bladed, landscaped, graveled and/or paved. Eleven environmental restoration (ER) sites, also known as Solid Waste Management Units (SWMUs), are located within the boundary of or near TA-IV. Eight of the sites involve outfalls of the storm drain system along the northern embankment of Tijeras Arroyo. A description of the potential soil contamination at the eleven ER sites in or near TA-IV is provided in the ER EA (DOE EA-1140). No changes in soil profiles or soil properties (as described in section 3) would occur from the no action alternative.

4.2.1.2 Proposed Action

Short-term impacts to on-site soils would result from the construction of the two transformer oil storage tanks as part of the APRM expansion. Although the site where the transformer oil storage tanks are proposed is currently a parking lot, clearing of the approximate 186 m^2 (2,000 ft^2) site would temporarily disturb surface soil during construction activities. Since the soils in TA-IV have been extensively disturbed in the past, the proposed action only represents a minor impact to the on-site soils. The transformer oil storage tanks construction duration is expected to be approximately six weeks.

4.3 Air Quality

4.3.1 No Action Alternative

Only negligible impacts to air quality or radiological emissions would occur as a result of the no action alternative.

4.3.1.1 Radiological Emissions

Based on the HERMES III measured release of ^{13}N and ^{15}O, the effective dose equivalent (EDE) to the maximally exposed individual (MEI) was determined to be approximately 3.8×10^{-4} mrem/yr (SNL, 1995). Based on the PBFA II calculated releases of ^{13}N and ^{15}O, the EDE to the MEI was determined to be approximately 9.5×10^{-6} mrem/yr (SNL, 1995). For the purpose of this analysis, the maximally exposed individual is at the Raytheon/DNA Facility located 920m (3018 ft) west northwest of TA-IV. Based on the SATURN estimated release of ^{3}H, the EDE to the MEI was determined to be 7.0×10^{-9} mrem/yr (LATA, 1991).

Because the current operating energy of the SABRE Accelerator is 1.5 MeV greater than the minimum energy required to produce air activation products (10.5 MeV) and the typical operating capacity of the facility is only 2 shots per day, it is not likely that SABRE could cause a major increase to the impact of TA-IV radionuclide emissions. The majority of the EDE related to TA-IV emissions is from HERMES III (3.8×10^{-4} mrem/yr), with much smaller contributions from PBFA II (9.5×10^{-6} mrem/yr) and when performing D_2 experiments at SATURN (7.0×10^{-9}

mrem/yr). The emissions from these three sources is $4x10^{-4}$ mrem/yr, which represents a very small percent (0.004%) of the EPA NESHAP standard of 10 mrem/yr to the MEI (40 CFR 61, subpart H).

Since the no action alternative is a continuation of current operations, there is negligible impact to air quality under this alternative.

4.3.2 Proposed Action

4.3.2.1 Particulate Emissions

A temporary increase in particulate emissions would be expected during the construction of two transformer oil storage tanks in support of the APRM expansion. However, dust control techniques required by construction practices would help mitigate these minor impacts. The transformer oil storage tanks construction is expected to take approximately six weeks. Therefore, only minor air quality impacts are associated with the construction of the two transformer oil storage tanks.

4.3.2.2 Radiological Emissions

Radiological air emissions would decrease as a result of the modification of PBFA II for Z-pinch experiments. Because under the proposed action PBFA II would be operated at a much lower voltage (3 MeV vs 15 MeV) in the Z-pinch mode, there would be no air activation as the threshold is 10.5 MeV. Consequently, radiological air emissions would be nonexistent in the Z-pinch mode except when deuterium (D_2) experiments that generate tritium are conducted. Tritium is produced through the process of the pinch activation between 2.5 MeV neutrons and deuterium (D_2) gas. A maximum of 25 D_2 shots per year may be conducted, producing a total of 250 μCi of tritium released to the atmosphere. The effective dose equivalent (EDE) to the maximally exposed individual (MEI) for the tritium release is estimated to be $3.68x10^{-7}$ mrem/yr, which is less than the EDE to the MEI for PBFA II in its current configuration (9.5×10^{-6} mrem/yr). Therefore, as a result of the proposed action, there would be a beneficial radiological emission impact.

4.4 Water Resources

The no action alternative and the proposed action would have minor impacts on water resources. Water consumption under the no action alternative is estimated at 378,500 liters (100,000 gallons) per day. This usage would not increase as a result of the proposed action.

4.5 Biological Resources

Because there are no federal or state-listed threatened or endangered species of plant or animals present in TA-IV, the no action alternative and proposed action would have no impact on biological resources.

4.6 Cultural Resources

Because no archaeological or historic resources are known to exist within TA-IV, neither the no action nor proposed action alternatives would be expected to result in impacts to cultural resources.

4.7 Noise

The no action alternative and the proposed action would have only negligible impacts on noise levels.

4.7.1 No Action Alternative

Accelerator activities in TA-IV, for the most part, produce only a very short duration (less than 1 second) noise during an accelerator firing (i.e., shot noise). Inside an accelerator building, the peak noise level may approach 140 dBA (Herring, 1990a). However, due to the infrequency of accelerator firing (one to ten times per day), the average noise level is well below OSHA standards and has minimal effect on worker personnel or the environment. Outside the accelerator enclosure, as well as outside the building, the shot noise level is negligible. Because of the considerable distance between TA-IV and residential areas, there is no potential for noise increases that would adversely impact the general public. Therefore, negligible impacts on noise levels would occur due to the no action alternative.

4.7.2 Proposed Action

Modification of PBFA II would result in the same operating noise levels as currently exist during normal operations. Minor and temporary noise increases would occur during the construction activities associated with the building of two transformer oil storage tanks.

4.8 Waste Management

The no action alternative would have negligible impacts to human health and the environment from generation, storage, or disposal of radioactive and non-radioactive wastes. The proposed action would have beneficial impact to the environment since the amount of radioactive waste produced in TA-IV would be reduced.

4.8.1 No Action Alternative

There are currently no adverse impacts due to the generation of hazardous, radioactive, or solid wastes in TA-IV since there are approved disposal methods for these types of waste. Currently no mixed waste is generated in TA-IV. However, if future activities should generate mixed wastes, quantities of these wastes would be limited. Mixed waste generation would have a negligible impact since disposal methods for this type of waste are very limited and long-term storage is usually the only solution. This long-term storage would potentially have to be done in TA-IV. Under the no action alternative of continuation of current operations there would be no impact to the environment from the continued generation of hazardous, radioactive, mixed and solid wastes.

4.8.2 Proposed Action

Radioactive waste would be decreased as a result of the modification of PBFA II for Z-pinch experiments. Because PBFA II would be operated at a much lower voltage in the Z-pinch mode under the proposed action, there would be no activation of the experimental chamber, as there is in the current mode of operation. Consequently, radiological waste would not be generated when

PBFA II is in the Z-pinch mode except when deuterium experiments that generate tritium are conducted. For the maximum of 25 D_2 shots per year that may be conducted, an estimated 34 kg (75 lbs) of waste per year would be generated. This is less that the 23-34 kg (50-75 lbs) of waste per month that is generated in the current configuration. Therefore, as a result of the proposed action, there would be a beneficial radiological waste impact. The volumes of other types of waste generated in TA-IV would not change substantially.

Typical construction waste would be generated due to the construction of the two transformer oil storage tanks. This additional solid waste would have only negligible impacts to the environment due to the very small quantities of waste that would be involved with this construction activity.

4.9 Human Health Effects

The proposed action and the no action alternative would be expected to have only negligible impacts on human health.

The health effects from radiological exposures are evaluated differently than the health effects from exposure to hazardous non-carcinogens (systemic toxicity hazards) (EPA, 1989). Because cancer risks and systemic toxicity hazards are not considered to be additive, they are evaluated separately. The sections below address the impacts from these two types of health effects.

4.9.1 Radiological Exposures

To evaluate worker exposures to radioactive contaminants, it is appropriate to compare exposures with existing occupational health and safety exposure protection limits. Workers' exposures to radiation under normal operations are regulated by 10 CFR 835 and SNL/NM SOPs to limit exposures to 5 rem per year and, further, to be at ALARA levels. Workers are not expected to incur any harmful health effects from radiation exposures they receive during normal operations conducted according to these limits. Risks of exposure to radionuclides are reported in this EA in terms of potential additional risk of contracting a fatal cancer during the lifetime of an exposed individual. These risks are calculated as an increased probability of contracting a fatal cancer over and above the existing risks facing any individual in a lifetime. This is defined as the excess cancer risk.

4.9.1.1 No Action Alternative

During routine operations there is a negligible risk of prompt radiological exposure to the public. The radiation produced by an accelerator is localized within the building and exists, in most cases, for only a brief instant (a small fraction of a second), and occurring only a few times per day.

Modeling results indicate that the extremely low levels of ^{13}N and ^{15}O, emitted to the atmosphere during accelerator operations, would have negligible impact on the environment or human population (DOE/EA-0352, 1988). The EDE to the MEI from all routine releases associated with TA-IV has been determined to be $3.8x10^{-4}$ mrem/yr. The location of the MEI is the Raytheon/DNA facility located 920m (3018 ft) west northwest of TA-IV (SNL 1994 NESHAP Report). This facility is within the SNL/NM and KAFB boundary and represents a work location rather than a permanent resident. The calculated dose represents a very small percent (0.004%) of the EPA NESHAP standard of 10 mrem/yr. According to the Standards for Protection Against Radiation (NRC, 1991), the chance of developing a fatal cancer is 5×10^{-4} per rem. Due to routine TA-IV operations, the anticipated excess fatal cancer risk at the MEI location is $1.9x10^{-10}$ or one in 1,900,000,000 exposed people.

The largest total individual dose from all routine releases at SNL/NM, including TA-IV, to a single receptor site at the southern KAFB boundary (Receptor Site 7, Isleta Gate) is calculated to be approximately $1.94x10^{-3}$ mrem/year (DOE/EA-0466, 1993). However, there are no residences at this location. This is an isolated location on the northern edge of the Isleta Pueblo Grant's southern KAFB boundary, with no permanent residents and restricted traffic. The projected dose represents a very small percentage (0.02 %) of the EPA annual standard of 10 mrem/year for a receptor site (EPA, 1989).

It is estimated that radiation causes 5 excess cancer fatalities per 10,000 person-rem in the general population and 4 excess cancer fatalities per 10,000 person-rem in workers (NRC, 1991). Using the factor of 5 for the general population, individuals located at the Kirtland Air Force Base site boundary would incur extremely small risk from exposures generated by TA-IV activities. Also using the factor of 4 for TA-IV workers, individuals working in TA-IV would incur extremely small risk from exposures generated by TA-IV activities.

The associated cumulative population dose per year from TA-IV and all other SNL/NM facilities was calculated to be 1.09 person-rem (DOE/EA-0466, 1993). Using the factor of 5 excess cancer fatalities per 10,000 person-rem, the health effects resulting from this population dose are calculated to be 5.45×10^{-4} excess cancer fatalities per year of exposure in the affected population from the cumulative SNL/NM site dose. This population dose estimate is a conservative value, calculated by assuming the entire population of the Albuquerque area (571,677 persons) resides at the location having the highest calculated individual dose (Isleta Gate), and that all exposure to the population occurs at that location (DOE/EA-0466, 1993).

The associated cumulative dose per year from TA-IV facilities to TA-IV workers was calculated to be 20 person-rem (0.020 rem expected high cumulative dose times a maximum number of 1000 TA-IV workers). Using the factor of 4 excess cancer fatalities per 10,000 person-rem, the health effects resulting from this population dose are calculated to be 8×10^{-3} excess cancer fatalities per year of exposure in the affected population from the cumulative TA-IV dose.

Under the no action alternative, exposures to radiation would continue to be controlled under established DOE Orders and SNL/NM SOPs that limit exposures to 5 rem per year and, further, ensure that exposures are at ALARA levels. Therefore, negligible impacts to human health effects due to radiological exposures would occur.

4.9.1.2 Proposed Action

Based on past dosimetry data and evaluation of proposed future activities, impacts to workers or the public from radiological exposures is estimated to be negligible. In fact, the modification of PBFA II for Z-pinch experiments, including tritium-producing experiments, would actually reduce any potential radiological exposures in two ways. First the prompt radiation produced from firing the accelerator would be primarily soft x-rays which are easily shielded. Second, since the operating voltage is not high enough to activate air and the experimental chamber, radiological exposures would be reduced in the PBFA II Z-pinch mode.

There are no radiological exposures due to the construction of two transformer oil storage tanks and therefore there are no impacts from this portion of the proposed action.

4.9.2 Nonradiological Exposures

Due to the fact that the OSHA Hazard Communication Standard (29 CFR 1910.1200) and Laboratory Standard (29 CFR 1910.1450) have been implemented in TA-IV, and based on past exposure and medical data (for the no action alternative) and evaluation of future activities (for the proposed action), impacts to workers or the public from nonradiological exposures is estimated to be negligible.

4.9.3 Physical Hazards

Impacts to workers or the public from physical hazards is estimated to be negligible due to: (1) requirements established by the SNL/NM ES&H Manual, (2) specific operating procedures and employee training that have been implemented in TA-IV, and (3) the evaluation of future activities that has been conducted (for the proposed action).

4.10 Socioeconomics

TA-IV currently employees approximately 750 persons. Under the no action alternative, the continued employment of the approximately 750 persons would be considered a beneficial impact. Under the proposed action no new permanent employees would be hired.

4.11 Environmental Justice

The largest total individual dose from all routine releases at SNL/NM, including TA-IV, to a single receptor site at the southern KAFB boundary is calculated to be approximately 1.94 $\times 10^{-3}$ mrem/yr (DOE/EA-0466, 1993). However, there are no residences at this location. This is an isolated location on the northern edge of the Isleta Pueblo Grants/southern KAFB boundary, with no permanent residents and restricted traffic. The projected dose represents a very small percentage (0.02%) of the EPA annual standard of 10 mrem/yr for a receptor site (EPA, 1989). Based on this data and past worker dosimetry data, impacts to workers or the public from radiological exposures is estimated to be negligible. Therefore, no foreseeable disproportionate or adverse health or environmental impacts to minority or low-income populations would occur as a consequence of the no action or proposed action alternatives.

4.12 Risks and Consequences of Selected Accident Scenarios and Abnormal Events

4.12.1 Transformer Oil and Chemical Spills

An earthquake or an aircraft crash into an accelerator facility could result in accidental exposure of personnel or the environment to transformer oil for either the no action or the proposed action. An earthquake could cause rupturing of either the main accelerator oil tanks or the transformer oil storage tanks, together with rupturing of secondary containment systems. The result would be oil leakage into the soil beneath the affected facility. Groundwater in the area is at so great a depth (152.4 meters [500 feet]) below the surface at the site location (IT, 1993), that even a large spill of transformer oil would not affect the groundwater hydrology or quality (DOE/EA-0792, 1993) before it could be cleaned up. Oil seepage to that depth is extremely unlikely. If a spill occurred, the EPA-mandated Sandia Spill Prevention Control and Countermeasure (SPCC) Plan would require removal of the contaminated soil as a matter of relative urgency.

The Sandia Oil Spill Contingency Plan contains supplemental actions for this unlikely event. If the cleanup was not accomplished as required, it would take many years for the oil to reach appreciable depths (Fink and Park, 1992). Transformer oil is not classified as a "hazardous waste" under RCRA, nor a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), nor a "toxic pollutant" under the Clean Water Act, and is not subject to the reportable quantity provisions of CERCLA Section 102 (a) or regulations in 40 CFR Part 302. However, discharges of oil into waters of the United States which may affect natural resources belonging to or managed by the United States, in quantities that may be determined to be harmful, is prohibited under Section 311 of the Clean Water Act. If the amount of oil released was in excess of 3,785 liters (1,000 gallons), the spill would be reported to the EPA.

Because of its containment within a building and rapid evaporation rate, a maximum-quantity ethanol spill would have negligible effect on the environment.

A maximum-quantity spill of copper sulfate solution would have no effect on the environment as long as the integrity of secondary containment systems are maintained. If secondary containment failed, the SPCC Plan would be implemented immediately. The depth to the water table would preclude the solution from reaching the water supply. Soil beneath the affected facility would be contaminated with copper sulfate, and spill cleanup and site remediation would be required.

4.12.1.1 No Action Alternative

Under the no action alternative, there would be no change in possible impacts caused by an accidental transformer oil spill or a maximum-quantity spill of ethanol or copper sulfate solution. Currently, all TA-IV programs operate within regulatory requirements.

4.12.1.2 Proposed Action

The potential impacts from a transformer oil spill associated with the proposed action would be essentially the same as the no action alternative, with the exception of two additional storage tanks. These new storage tanks would have the same spill prevention devices and procedures as the existing tanks.

4.12.2 Fire

Under both the no action and proposed action alternatives, fires in any of the high-bays could result from overheated equipment, overheated wiring, or from ignition of flammable solvents, oil-soaked rags, or absorbent materials. Less likely, but of more serious consequence, would be the ignition of the dielectric transformer oil. This is due to the fact that the transformer oil has a high flash point (148.9°C [300°F]). Because the fuel loading, other than transformer oil, is low and buildings in TA-IV are constructed of non-combustible materials, a fire that did not ignite the transformer oil would result in minimal structural damage.

An aircraft crash into any one of the accelerator facilities could result in ignition of the oil in the accelerator oil tank. The resulting fire, if not extinguished by the fire foam suppression system, could result in substantial structural damage and produce large amounts of smoke. This cloud of smoke would most likely contain carbon monoxide, along with a complex mixture of airborne solids, liquids, particulates, gases, and other unidentified organic compounds (Shell Oil, 1989). The nearest public access to TA-IV is the Eubank Boulevard entrance gate to KAFB. This gate is approximately 2.4 kilometers (1.5 miles) northeast of TA-IV. Adequate dispersion and dissipation of the smoke cloud would occur to preclude a hazardous exposure to the public or impacts on the environment.

If the aircraft crash did not ignite the oil, the possibility of oil spillage onto personnel in the facility is credible. However, skin contact with the transformer oil is not a serious hazard (Shell Oil, 1989).

4.12.2.1 No Action Alternative

Since the no action alternative is the continuation of existing operations, there would be no change in the potential impacts caused by a fire in TA-IV. Facilities in TA-IV are constructed in accordance with DOE and NFPA standards.

4.12.2.2 Proposed Action

Under the proposed action, the potential impact from fire would be increased by the additional two transformer oil storage tanks if they were filled. However, the same spill prevention and fire safeguards that exist for the no action alternative would apply to the proposed action.

4.12.3 Aircraft Crash

An airplane crash accident scenario is postulated for SNL/NM facilities and evaluated due to the proximity of the Albuquerque International Sunport. Many of the 225,000 annual operations at the airport could pass over SNL/NM facilities. SNL/NM is also located about 25 kilometers (15.5 miles) from Coronado Airport. However, since the general aviation aircraft using this facility would, in general, avoid the Albuquerque International Sunport traffic area and, based on the relatively long distance to Coronado Airport and the altitude that such aircraft would have if they happen to pass over Sandia, such aircraft are not a major factor in determining the crash probability.

The probability of an aircraft crash was calculated for the Processing and Environmental Technology Laboratory (PETL), a facility planned to be built approximately 1.8 kilometers (1.1 miles) northeast of TA-IV. The aircraft crash probability for the PETL was calculated to be 8.2×10^{-5} per year (DOE/EA-0812, 1994). The reciprocal of this probability (e.g., 12,000 years between crashes into the facility) can be used for clearer understanding; however, the airport, aircraft, and flight operations can change dramatically over time.

The probability of an aircraft crash into the proposed Robotic Manufacturing Science and Engineering Laboratory (RMSEL), a facility (currently under construction) located 1.85 kilometers (1.15 miles) northeast of TA-IV, was calculated to be 1.6×10^{-4} per year (DOE/EA-0885, 1993). In addition, the probability of an aircraft crash into the Explosive Components Facility (ECF) (located approximately 1.25 kilometers [0.78 miles]) northeast of TA-IV, was calculated to be 2×10^{-4} per year (DOE/EA-0576, 1992).

The PETL, the RMSEL, and the ECF sites are closer to the end of the main east-west runway of the Albuquerque International Sunport (the same runway that serves KAFB) than is TA-IV. Also, all three sites (PETL, RMSEL, and ECF) are closer to the landing and takeoff flight path for the main runway than is TA-IV (Manzanares, 1994). The likelihood of occurrence of an aircraft crash into any of the TA-IV facilities, therefore, would not be expected to exceed the upper bound of the probability range given in DOE/AL 5481.1B for an unlikely event (between 1×10^{-2} and 1×10^{-4} per year). That is, the crash probability densities per square kilometer are within two magnitudes of each other. Thus, the likelihood of an aircraft crash impacting TA-IV is unlikely.

Potential releases of ethanol, copper sulfate, and sulfur hexafluoride as a result of accidents (including an aircraft crash or an earthquake) are discussed below.

- Ethanol: Ethanol is only stored in 18.9-liter (5-gallon) plastic containers that are maintained inside approved flammable storage cabinets at all times. An ethanol container is opened only when accelerator personnel need to fill their 1-liter (0.264-gallon) containers. The 1-liter containers are used to apply ethanol to rags for cleaning various accelerator components. To fill the 1-liter containers, personnel remove a threaded container cap from a 5-liter (1.32-gallon) plastic jug and attach a cap incorporating a manual spigot. The 5-liter jug is then tipped to a horizontal position to fill the smaller container. In the event an individual (postulated to be alone at the time) suddenly became unconscious during this process (e.g., experienced a heart attack), the maximum amount of ethanol which could be spilled onto the facility floor would be 18.9 liters (5 gallons). In the event of an aircraft crash into a facility, a locked flammable storage cabinet containing a maximum of ten 18.9-liter (5-gallon) containers of ethanol could break open. The ten plastic containers holding 189 liters (50 gallons) of ethanol would be assumed to rupture and the alcohol to ignite. The combustion products from the burning alcohol would mix with those from the ignited 13,626 kiloliters (3,600,000 gallons) of transformer oil. In this scenario, evacuation of building personnel in accordance with emergency procedures would be standard procedure to minimize exposure.

- Copper sulfate: Copper sulfate granules are mixed with deionized water to construct various resistors for use in TA-IV accelerator facilities. (The solution is contained in tygon tubing.) Whereas an earthquake or aircraft crash could result in a copper sulfate spill, it would not pose a major health hazard to personnel working in TA-IV. In the unlikely event that an individual in the room with the copper sulfate solution received an exposure directly to the eyes (i.e., splashed liquid), eye irritation or damage could result (Occupational Health Services, 1989). There is no potential exposure pathway to the general public. If the secondary containment systems failed, the leakage into or onto the ground would be dealt with immediately under the Sandia Spill Prevention Control and Countermeasure (SPCC) Plan (Fink and Park, 1992).

- Sulfur hexafluoride: An aircraft crash or earthquake could cause a rupture(s) in the sulfur hexafluoride piping and reclaimer systems present at TA-IV accelerator facilities. A massive release of sulfur hexafluoride gas into a building, and subsequently the outside air, could possibly result. Sulfur hexafluoride is a non-toxic, nonflammable, non-hazardous inert gas (Alphagaz, 1985). The only hazard to personnel, associated with sulfur hexafluoride, would be possible asphyxiation in a confined space. All personnel involved in accelerator operations and maintenance receive confined space training. In addition, evacuation of the affected building is standard procedure in the event of one of the above emergency scenarios.

4.12.3.1 No Action Alternative

Because the no action alternative is the continuation of existing operations, it is expected that the potential effects of an aircraft crash in TA-IV would be commensurate with existing effects. There would be no change in the impacts caused by an aircraft crash in TA-IV.

4.12.3.2 Proposed Action

Under the proposed action, with the exception of an increase in potential impacts associated with the additional two transformer oil storage tanks (Subsections 4.12.1, 4.12.2, and 4.12.4), it is expected that the potential effects of an aircraft crash in TA-IV would be commensurate with existing effects.

4.12.4 Health Effects of Hazardous Chemical Exposures From Accidents and Abnormal Events

Skin exposure to transformer oil, especially on an acute (infrequent or one-time) basis, is not hazardous. Washing exposed skin with soap and water would remove the hazard. No special eye protection is routinely necessary (Shell Oil, 1989). Exposure to transformer oil combustion products (in the event of earthquake or aircraft crash) would be hazardous to building residents. Evacuation of the affected facility would be of prime concern in these scenarios, and personnel exposure would be minimized as a result. Hazards to the general public from combustion products would be negligible, because of air dispersion and the 2.1-kilometer (1.3-mile) distance to populated areas.

Skin exposure to ethanol on an acute (infrequent or one-time) basis may cause mild redness and burning. Acute inhalation of ethanol up to 10,000 parts per million may cause temporary irritation of the upper respiratory tract and coughing. If continued, it could result in central nervous system depression with headache, stupor, and fatigue (Occupational Health Services, 1989). There is no hazard of skin exposure to the general public since TA-IV is not located near populated areas nor does the general public have access to TA-IV.

Skin exposure to copper sulfate in solution on an acute basis may cause irritation, burns, itchiness, and blood disorders (Occupational Health Services, 1989). Copper sulfate solution splashed in the eyes (acute exposure) may cause severe irritation, swelling of the eyes, conjunctivitis, corneal ulceration and turbidity, and palpebral edema (Fisher Scientific, 1989; Occupational Health Services, 1989). An earthquake or aircraft crash in one of the TA-IV accelerator facilities could result in spillage of copper sulfate solution and could cause skin or eye exposure to personnel standing nearby. There would be no hazard to the general public, because the copper sulfate solution would be highly unlikely to reach the water table 152.4 meters (500 feet) below the surface. Also, the closest public access (e.g., individuals not cleared to work or reside on KAFB) to the spill site would be 2.4 kilometers (1.5 miles), thus precluding any type of exposure to the public.

Given a massive release of sulfur hexafluoride gas, asphyxiation could be possible in confined spaces. However, this is extremely unlikely because of personnel training and emergency evacuation procedures. No toxic hazards are presented to workers by this gas, and there is no hazard to the general public. Oxygen deficiency monitors are maintained at appropriate locations within TA-IV accelerator facilities.

4.12.5 Radiation Exposure

Accidental radiation exposure of personnel at the accelerator facilities in TA-IV is considered incredible. All accelerator facilities have redundant engineering access controls, i.e., electromechanical interlocks on gates to the target areas. These interlocks deactivate the accelerator immediately if a gate or door is opened. Procedural controls, which are rigorously enforced, are also in place at these facilities. For example, before any of the accelerators are allowed to begin an electrical charging sequence, an evacuation team initiates a comprehensive search of the facility to ensure no personnel are present in any of the areas where a radiation dose could be received. The engineering and procedural controls implemented at TA-IV facilities are adequate to prevent any personnel exposure.

4.13 Cumulative Effects

4.13.1 No Action Alternative

Under the no action alternative, there would be no change in the cumulative impacts to the unoccupied, already-disturbed areas in TA-IV. In addition, under the no action alternative, there would be no expected change in the cumulative impacts associated with radiological emissions. Currently, all TA-IV programs operate within regulatory requirements. Because the No Action Alternative is the continuation of existing programs, it is expected that the cumulative effects would be commensurate with existing effects.

4.13.2 Proposed Action

The cumulative effect due to activities in TA-IV would be negligible on geology, seismology, biological resources, cultural resources, solid waste, noise levels and human health issues. Activities in TA-IV would have minor impacts on soils, water resources, and air quality.

Long-term impacts to on-site soils might result from destruction of soil profiles and soil properties due to construction activities, particularly clearing and leveling during the construction of TA-IV facilities. Although the site is not presently, nor is it anticipated in the future to be, used for agricultural purposes, long-term productivity was eliminated due to covering the site with buildings and paved parking areas and access roads.

Three facilities in TA-IV (HERMES III, PBFA-II, and SABRE) release negligible amounts of short-lived ^{13}N and ^{15}O to the atmosphere (see subsection 3.7.1).

As for human health issues, the cumulative effects of radiological exposures are postulated to involve a radiation worker who receives the highest dose over a 30-year period. Extrapolating from the records of the individual who received the highest 7-year dose at the SATURN facility (0.050 rem), the estimated cumulative dose over 30 years would be [0.05 rem/7 years x 30 years], which equals 0.21 rem. This figure is far below the yearly permissible limit of 5 rem for a radiation worker, and still does not exceed the yearly dose equivalent of background radiation received by an individual (Kathren, 1991). Since radiological emissions are not expected to increase from activities involved with the proposed action, there would be no expected increase in cumulative impacts.

The only hazardous chemical exposure to humans over time could be repeated skin contact with ethanol used for cleaning accelerator components. Defatting of the skin, producing a dry, fissured dermatitis may result from chronic exposure (Occupational Health Services, 1989).

5.0 APPLICABLE ENVIRONMENTAL REGULATIONS, PERMITS, AND DOE ORDERS

Compliance by the proposed action with applicable environmental laws and regulations at the federal, state, and local level helps to fulfill the national environmental policy objectives enumerated in §101(b) of NEPA and serves to mitigate what might otherwise be unacceptable environmental consequences. This section contains a discussion of environmental laws and regulations that pertain to the following environmental parameters:

- Air Emissions
- Hazardous Waste Management
- Radioactive Waste Management
- Wastewater Discharge
- Spill Control
- Storm Water Discharge
- Threatened and Endangered Species
- Cultural Resources
- Noise
- Preoperational Environmental Monitoring

Regulatory requirements not applicable to the proposed action are not discussed in this section.

Table 5-1 summarized the Federal, State of New Mexico, and local requirements by which SNL/NM's TA-IV operates and would operate under the proposed action.

Table 5-1
Representative List of Permits and Compliance Requirements that May be Applicable to the Sandia National Laboratories/New Mexico TA-IV Operations

Consultation, Permit, or Compliance Requirement	Granting or Approving Agency	Statute or Regulation	Activity
Air Quality			
Requirement	EPA Region 6	Clean Air Act (42 U.S.C. §§.7401 et seq. and Amendments	Federal air quality program.
Requirement	EPA Region 6	NESHAP Requirements 40 CFR Part 61, subpart H	National Emission Standards for Hazardous Air Pollutants (NESHAP)
Requirement	NMED (with the ABC/Air Quality Control Board having local authority)	New Mexico Air Quality Control Act	Air quality standards for New Mexico.
Requirement or Permit	City of Albuquerque, Environmental Health Department, Air Pollution Control Division	ABC Air Quality Control Regulations	Ambient air quality standards for the following air contaminants: beryllium; carbon monoxide; hydrogen sulfide; lead; nitrogen dioxide; sulfur dioxide; total reduced sulfur; total suspended particulate; and particulate matter less then 10 microns (PM-10). Other applicable regulations include, but are not limited to: visible air contaminants (20 NMAC 11.64); airborned particulates (2- NMAC 11.20); volatile organic compounds (20 NMAC 11.65); and process equipment emissions (20 NMAC 40, 41, 429, 66 and 67). The regulations also contain a list of 25 compounds that are carcinogens or pose other serious human health effects resulting from ambient air exposure.
Water Quality			
Permit	City of Albuquerque Publicly Owned Treatment Works	City Ordinance Sewer Use and Wastewater Control Ordinance (Chapter VIII, Article X1)	Regulates discharges to publicly-owned treatment works through issuance of waste water discharge permits.
Permit	EPA Region 6	40 CFR 122-124	Stormwater discharge monitoring. Permit application under review.

Table 5-1 (continued)
Representative List of Permits and Compliance Requirements that May be Applicable to the Sandia National Laboratories/New Mexico TA-IV Operations

Consultation, Permit, or Compliance Requirement	Granting or Approving Agency	Statute or Regulation	Activity
Requirement	New Mexico Water Quality Control Commission	New Mexico Water Quality Regulations 74-6-1 to 74-6-13 (N.M.S.A)	Prior authorization for discharges to the land surface, or any discharges that may affect groundwater; unplanned discharges. Additional remedial actions may be required through the abatement plan process.
Floodplains and Wetlands			
Requirement	DOE (as lead agency)	Executive Order 11988	Evaluation of the potential effects of any activity to be undertaken in a floodplain to consider floodplain hazards and management.
Requirement	NEPA	40 CFR 1502.25	Integrate preparation of NEPA documents with other environmental review requirements and Executive Orders.
Requirement	Doe (as lead agency)	10 CFR Part 1022	Requirements for floodplain management and wetlands protection.
Threatened, Endangered, and Sensitive Species			
Consultation	USFWS	Endangered Species Act	Consultation(s) with the USFWS Regional Director to determine impacts (if any) on proposed or listed threatened or endangered species or their critical habitats; preparation of a biological assessment if any protected species would be affected.
Consultation	New Mexico Department of Game and Fish	The New Mexico Endangered Wildlife Act	Protected wildlife for New Mexico.
Consultation	The New Mexico Forestry and Resource Conservation Division of the Energy, Minerals, and Natural Resources Department	The New Mexico Endangered Plant Species Act	Protected endangered plants of New Mexico.
Cultural Resources			
Consultation	New Mexico State Historic Preservation Office and the ACHP	National Historic Preservation Act and Executive Order 11593 (36 CFR 800)	Identification of historic properties that may be potentially affected by a proposal action; determination of the effects of the action on such properties; consultation(s) (at an early date) among the federal agency, the State Historic Preservation Office, and others to identify ways to mitigate potential effects on such properties; and a reasonable opportunity for ACHP to comment on the undertaking.

Table 5-1 (continued)
Representative List of Permits and Compliance Requirements that May be Applicable to the Sandia National Laboratories/New Mexico TA-IV Operations

Consultation, Permit, or Compliance Requirement	Granting or Approving Agency	Statute or Regulation	Activity
Permit	Department of Interior National Park Service	The Antiquities Act of 1906 (16 U.S.C. §§432 et seq.)	Protection of historic and prehistoric remains and monuments on federal lands; permitting system for conducting scientific archaeological investigations.
Requirement	Department of Interior National Park Service	The Historic Sites Act of 1935 (16 U.S.C. §§461 et seq.)	Historic Sites Surveys, Historic American Buildings Surveys, and the National Architectural and Engineering Record.
Requirement	Department of Interior National Park Service	The Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469 et seq.)	Nationwide program for the recovery, protection, and preservation of scientific, prehistoric, and archaeological data that would otherwise be damaged or destroyed through federal action.
Permit	Department of Interior National Park Service	The Archaeological Resources Protection Act of 1979 (16 U.S.C. §§470aa-27)	Comprehensive framework for protecting and regulating the use of archaeological resources on federal and Indian lands; permit for excavating and removing archaeological resources prior to the occurrence of surface-disturbing activities.
Requirements Reviewed	Department of Interior National Park Service	The American Indian Religious Freedom Act of 1978 (42 U.S.C. §§1996 et seq.)	Requirements would be reviewed to determine if an action constitutes an infringement on religious rites or ceremonial sites.
Requirements Reviewed	Department of Interior National Park Service	The Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. §§3001 et seq.)	Protection of Native American graves, burial grounds, human remains, and funerary objects.
Noise			
Requirement	OSHA City of Albuquerque	Noise Control Act (42 U.S.C. 4901 et seq.) 29 CFR 1910.95 [a] City of Albuquerque Noise Control Ordinance (Art. XXII)	Time-weighted average for 8-hour day and for 15 minutes per day (29 CFR 1910.95 [a]). Standards for short-term noise levels.

Table 5-1
Representative List of Permits and Compliance Requirements that May be Applicable to the Sandia National Laboratories/New Mexico TA-IV Operations

Consultation, Permit, or Compliance Requirement	Granting or Approving Agency	Statute or Regulation	Activity
Waste Management			
Requirement	NMED	RCRA, 20 NMAC 4.1, 40 CFR 261 to 272	Hazardous waste identification. Generator requirements for packaging, labeling, marking, placarding, manifesting, accumulating, and recordkeeping.
Requirement	NMED	20 NMAC 4.1, 40 CFR 241	Non hazardous waste disposal subpart to RCRA, subtitle D.
Requirement	DOE	DOE Order 5820.2A	Policies, guidelines, and minimum requirements for managing radioactive and mixed waste at DOE facilities.
Requirement	DOE	DOE Order 5400.3	Policies and requirements to implement the RCRA.
Requirement	DOE	DOE Order 5400.5	Standards for radiation protection of the public and the environment.
Requirement	NTS	NVO 325 NTS, Waste Acceptance Criteria	Acceptance criteria, certification and transfer requirements for LLW disposal at NTS.
Occupational Health and Safety			
Requirement	EPA	40 CFR 112	Requirements for Spill Prevention, Controls, and Countermeasures Plan defines processes for reporting and cleanup of releases of hazardous substances.
Requirement	DOE	10 CFR 835	Occupational radiation protection standards.
Requirement	DOE	DOE Order 5480.1B	Requirements for: radiation protection for occupational workers; an environment, safety, and health program; the packaging and transportation of hazardous materials, hazardous substances, and hazardous wastes; environmental protection, safety, and health protection and reporting; general environmental protection; and contractor industrial hygiene.

ABC Albuquerque/Bernalillo County
ACHP Advisory Council on Historic Preservation
CFR Code of Federal Regulations
DOE U.S. Department of Energy
EPA U.S. Environmental Protection Agency
NEPA National Environmental Policy Act
NMAC New Mexico Administrative Code
NMED New Mexico Environmental Department
RCRA Resource Conservation and Recovery Act
U.S.C. United States Code
USFWS U.S. Fish and Wildlife Service

6.0 AGENCIES AND PERSONS CONTACTED

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GLOSSARY

accelerator	A device that imparts kinetic energy to charged subatomic particles.
activated	The process of inducing radioactivity by bombardment with nuclear radiation.
adjusted decibel (dBA)	A unit used to show the relationship between the interfering effect of a noise frequency, or band of frequencies, and a reference noise power level of minus 85 dBm.
airborne pollutant	Any substance, including but not limited to any particulate matter, fly ash, dust, fume, gas, mist, smoke, vapor, micro-organisms, radioactive material, any combination thereof or any decay or reaction product thereof.
AIRDOS-PC	Computerized methodology for calculating the effective dose equivalent values to maximally expose individuals, as required by 40 CFR Part 617-93 (a).
ALARA	As low as reasonably achievable. The term which describes an approach to radiation exposure control or management whereby the exposures and resulting doses are maintained as far below the limits specified for the appropriate circumstances as economic, technical, and practical considerations permit.
alluvial	Pertaining to or consisting of alluvium, or deposited by running water.
alluvium	The detrital materials eroded, transported, and deposited by steams; an important constituent of shelf deposits. Also known as alluvial deposit.

ambient air	The surrounding atmosphere as it exists around people, plants, and structures.
anechoic chamber	A room completely lined with a material that absorbas radio waves at a particular frequency or over a range of frequencies, used principally at microwave frequencies, for measuring radar beam cross sections.
beam	A flow of ionizing radiation that is divergent from a small source and restricted to a small solid angle.
bremsstrahlung	The electromagnetic radiation, or the process of producing the electromagnetic radiation, by the acceleration of a fast, charged particle, usually an electron. During bremsstrahlung-producing process, the electron can give up any amount of energy from near zero to its maximum kinetic energy. The resulting radiation has a continuous spectrum.
calcareous	Resembling, containing, or composed of calcium carbonate.
caliche	A secondary accumulation of opaque, reddish brown to buff or white calcareous material occurring in layers on or near the surface of stony soils in arid and semiarid regions of the southwestern United States.
carbon dioxide (CO_2)	A heavy colorless gas that does not support combustion, dissolves in water to form carbonic acid, is formed especially in animal respiration and in the decay or combustion of animal or vegetable matter, is absorbed from the air by plants in photosynthesis, and is used in the carbonization of beverages.
carbon monoxide (CO)	A colorless odorless very toxic gas that burns to carbon dioxide with a blue flame and is formed as a product of the incomplete combustion of carbon.

chronic	Persistent, prolonged, or repeated.
conjunctivitis	Inflammation of the conjunctiva. The conjunctiva is the delicate mucous membrane that lines the eyelids and covers the exposed surface of the eyeball.
Curie (Ci)	A unit quantity of any radioactive nuclide in which 3.7×10^{10} disintegrations occur per second.
decibel (dB)	A unit of measure describing the ratio of two powers or intensities, or the ratio of a power to a reference power.
dermatitis	Inflammation of the skin from any cause.
detached storage	Storage of liquid or solid oxidizing materials, either in the open or in a separate building, located away from all structures except those housing operations related directly to the production of the stored materials. The storage of gaseous oxidizing materials either in the open or in a separate building of noncombustible construction located away from all structures except those housing operations related to the production of the stored materials.
deuterium (D_2)	The hydrogen isotope that is of twice the mass of ordinary hydrogen and that occurs in water.
dielectric	A material that is an electrical insulator or in which an electric field can be sustained with a minimum dissipation of power.
diode	A two-electrode electron tube with a cathode and anode.
dose	A term denoting the quantity of radiation energy absorbed.
effluent	A liquid or gaseous waste discharge to the environment.

electronic component	A part of an electronic system that amplifies or controls voltages or currents without mechanical or other nonelectrical command. It can also switch currents or voltages without mechanical switches.
erosion	A natural process, including weathering, dissolution, abrasion, corrosion, and transportation, by which material is removed from the earth's surface.
explosion	A violent chemical reaction within a chemical compound or mixture evolving heat and pressure at a rapid rate.
exposure	A measure of the ionization produced by x- or gamma radiation. (The unit of exposure is the roentgen.)
facility boundary	The fence that surrounds and prevents uncontrolled access to the facility or facilities.
fire hazard	Any situation, process, material, or condition that may cause a fire or explosion or provide a ready fuel supply to augment the spread or intensity of the fire or explosion and that poses a threat to life or the property of others.
floodplain	The lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands. This includes, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year.
gamma-ray (γ)	Electromagnetic radiation of high energy photons emitted from the nuclei of radionuclides, which usually accompany other nuclear reactions, such as fission, neutron capture, and beta particle emission. Gamma-rays are identical with x-rays of the same energy, except that x-rays result from electron reactions and are not in the nucleus.

general public	The general populace. Does not include radiological workers.
guarded	Items such as equipment or wiring, that are covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of dangerous approach or contact by persons or objects.
hazardous areas	Any portion of a facility where activities present a health or safety hazard to workers or other personnel. The hazards could be either continuously or intermittently present.
hazardous material	Any substance or material that poses an unreasonable risk to health, safety, and/or property.
hazardous waste	A chemical or material that is specifically listed in RCRA or exhibits one of the four following characteristics of hazardous waste, as defined by RCRA, in order to be classified as hazardous: reactivity; corrosivity, ignitability; or toxicity (Toxicity Characteristic Leaching Procedure).
hydraulic gradient	With regard to an aquifer, the rate of change of pressure head per unit of distance of flow at a given point and in a given direction.
hohlraum	A reflecting shell around the x-ray source which acts to trap energy.
incompatible materials	Those materials that, when mixed with oxidizing materials, can cause hazardous reactions or can catalyze decomposition of the oxidizer.
interlock	A switch or other device that prevents activation of equipment when a protective door is open or some other hazard exists.

keV	Kilo-electron volt or one thousand volts. A unit of energy.
kJ	Kilojoules.
K-shell radiation	X-ray radiation emitted from the innermost shell of electrons surrounding the atomic nucleus.
Ldn	Level day-night. A noise rating developed by the EPA for specification of community noise from all sources.
low-level waste (LLW)	Radioactive waste that is not transuranic waste or high-level waste. Since no high-level waste is generated at SNL/NM, LLW is any waste that is not contaminated with transuranics to the extent that the 100 nCi/g (nanocuries per gram) limit is exceeded.
MA	Megampere. A unit of current equal to a million (10^6) amperes.
magnitude	A measure of the amount of energy released by an earthquake.
Marx generator bank	A device typically made up of several capacitors and resistors used to store large quantities of electrical energy.
Maximally Exposed Individual	MEI is any non-SNL/NM personnel who live or work on KAFB and are considered "members of the public."
metamorphosed rock	Rock that is formed from preexisting solid rock by mineralogical, structural, and chemical changes in response to extreme changes in temperature, pressure, and shearing stress.
micro(μ)	Equal to one-millionth part of a specified unit (or 10^{-6}).

mitigate	Used in conjunction with accident severity. Refers to measures that will reduce or lower the severity of an accident. These measures could be either specific design features or operating techniques.
mixed waste (MW)	Radioactive waste that is also contaminated with hazardous waste, as defined by the Resource Conservation and Recovery Act (RCRA).
MJ	Megajoule. A unit of work or energy equal to a million (10^6) joules.
MV	Megavolt. A unit of energy equal to a million (10^6) volts.
nanoseconds	One billionth of a second.
nitrous oxide (N_2O)	Colorless, sweet-tasting gas, boiling at minus 90°C; slightly soluble in water and soluble in alcohol; also known as laughing gas.
nonattainment area	For any air contaminant, an area that is designated "nonattainment" with respect to that contaminant within the meaning of Section 107(d) of the Clean Air Act (42 U.S.C. 7401 et seq.).
n	A unit of measure equal to one-billionth or (10^6), also referred to as nano.
ns	Nanosecond. A unit of time equal to one-billionth of a second, or 10^{-9} second.
offsite	Anything, such as roads, buildings, streams, and people, located outside or beyond the Kirtland Air Force Base (site) boundaries.

particulate	Of or relating to minute separate particles. Used in this context to describe particles which can be suspended in air and have the capability to be aspirated.
perched groundwater	Groundwater that is unconfined and separated from an underlying main body of groundwater by an unsaturated zone.
perennial	A plant that lives for an indefinite period, dying back seasonally and producing new growth from a perennating part.
pinch	A pinch is fundamentally the simplest of fusion devices. A plasma carrying a current is confined by the magnetic field of the current itself. There are two complementary geometries, the z-pinch and theta(θ)-pinch. A wire array or gas puff would be an example of a z-pinch plasma radiation source.
pH	The negative logarithm of the effective hydrogen-ion concentration or hydrogen-ion activity in gram equivalents per liter used in both expressing acidity or alkalinity on a scale whose values run from 0 to 14 with 7 representing neutrality; numbers less than 7 increasing acidity; numbers greater than 7 increasing alkalinity.
Plasma Radiation Source (PRS)	A source that produces soft x-rays by compressing and heating a metal or gas into very dense, hot radiating plasma.
ppm	Part per million. A unit measure of concentration equivalent to the weight/volume ratio expressed as µg/L or ng/mL.

prevention	Used in connection with accident probability to refer to the act of designing something so that an accident either cannot occur or is hindered from occurring. The act of prevention could be accomplished through either a specific design feature or operating techniques.
prompt radiation	The radiation produced when electrons (beta particles) of high speed (energy) lose their energy in passing through matter.
Qualitative Analysis	A nonmathmatical review of all factors affecting the safety of a product, system, operation, or person. All possible conditions, events, and their consequences are considered to determine whether they could cause or contribute to injury or damage. A qualitative analysis must precede a quantitative analysis.
Quantitative Analysis	A relativistic or probabilistic evaluation to establish frequencies of occurrence, magnitudes of risks, and costs involved.
radiation	The emission of particles or energy as a result of an atomic or nuclear process.
radioactive waste	A solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended, and of negligible economic value considering costs of recovery.
radiological worker	An individual who works with or around radiation, or who, in the course of completing a task, may be exposed to radiation (may also be called a radiation worker).
raster	A predetermined pattern of scanning lines that provides substantially uniform coverage of an area.

release	Any unintentional discharge to the environment. Environment is broadly defined as any water, land, or ambient air.
rem	The unit of radiation dose equivalent that takes into account different kinds of ionizing radiation and permits them to be expressed on a common basis. The dose equivalent in rems is numerically equal to the absorbed dose in rads multiplied by the necessary modifying factors.
Richter Scale	A scale of numerical values of earthquake magnitude ranging from 1 to 9.
risk	A measure of the product of the probability and the consequences of an accident expressed in either qualitative or quantitative terms.
ruderal	Growing on rubbish, or waste, or disturbed places.
Safety Analysis	A procedure to systematically identify the hazards of an operation, to describe and analyze the adequacy of the measures taken to eliminate, control, or mitigate identified hazards, and to analyze and evaluate potential accidents and associated risks.
sedimentary rock	A rock formed by consolidated sediment deposited in layers.
shot	A shot is stored electrical energy discharged into a series of pulse compression units until a pulse is attained. The pulse is transmitted to the central region of the accelerator where the current flows through either an array of wires, a cylindrical metal foil, or an inert gas puff. The shot produces an x-ray pulse.
site	The land area that the facility occupies. The area of land owned or controlled by the DOE for the principal purpose

	of constructing and operating a facility and by the site boundary.
site boundary	The perimeter of Kirtland Air Force Base or of the USAF/DOE controlled land in which the facility is contained.
somnolence	Sleepiness; could also be unnatural drowsiness.
stratigraphy	A branch of geology concerned with the form, arrangement, geographic distribution, chronologic succession, classification, correlation, and mutual relationships of rock strata, especially sedimentary.
sulfur hexafluoride	A colorless gas that is soluble in alcohol and ether, slightly soluble in water. It has a chemical symbol of SF_6 and is used as a dielectric in electronics.
terawatt (TW)	A unit of power which is equal to a million million (10^{12}) watts.
transformer oil	A high-quality insulating oil in which windings of large power transformers are sometimes immersed to provide high dielectric strength, high insulation resistance, high flash point, freedom from moisture, and freedom of oxidation.
transuranic (TRU) waste	Radioactive waste that contains TRU radionuclides (those with atomic number greater than 92) with half-lives greater-than 20 years, at concentrations greater than 100 nCi/g.
tritium (^3H)	A radioactive isotope of hydrogen with atoms of three times the mass of ordinary light hydrogen atoms.
underground testing	Nuclear weapons effects testing performed under the earth's surface using a nuclear device.

x-ray — A penetrating electromagnetic radiation, usually generated by accelerating electrons to high velocity and then suddenly stopping them by collision with a solid body, or by inner-shell transitions of atoms with atomic numbers greater than 10; their wavelengths range from 10^{-5} angstrom to 10^{3} angstroms, the average wavelength used in research being about 1 angstrom.

Appendix

Surveys and Consultations on Biological and Cultural Resources in TA-IV

QUIVIRA RESEARCH CENTER

3017 Commercial NE
Albuquerque, New Mexico 87107
(505) 344-2755

March 31, 1987

Mr. Rich Clark
Advanced Sciences, Inc.
7308 So. Alton Way, Suite K
Englewood, Colorado 80112

Dear Rich:

On March 31, 1987, QRC performed an archeological inventory 100% on-the-ground pedestrian survey on approximately 28 ac. of land at Sandia Base, Albuquerque, New Mexico, on the site of the proposed Strategic Defense Facility in T9N R4E Sec. 5. See map, attached, for location.

Survey methodology consisted of two archeologists walking parallel transects spaced 10-12 m. apart.

On-site flora are composed primarily of snakeweed (<u>Gutierrezia sarothrae</u>), and native grasses, but a few specimens of cactus (<u>Opuntia sp.</u>, <u>Cholla sp.</u>), fourwing saltbush (<u>Atriplex canescens</u>), Russian thistle (<u>Salsola kali</u>), and introduced elms occur. Cover ranges between approximately 35% and 50%. Ground visibility was good. Fauna sighted included jackrabbits, several flocks of doves, meadowlarks, and an owl.

Soil is sandy alluvium. Gravel is exposed in an excavated drain close to the north edge of the survey area and includes sandstone, limestone, very small amounts of quartzite and Sandia granite, and unidentified rock. The survey crew noted only two small pebbles of chert and, except for fine-grained limestone, no knappable stone.

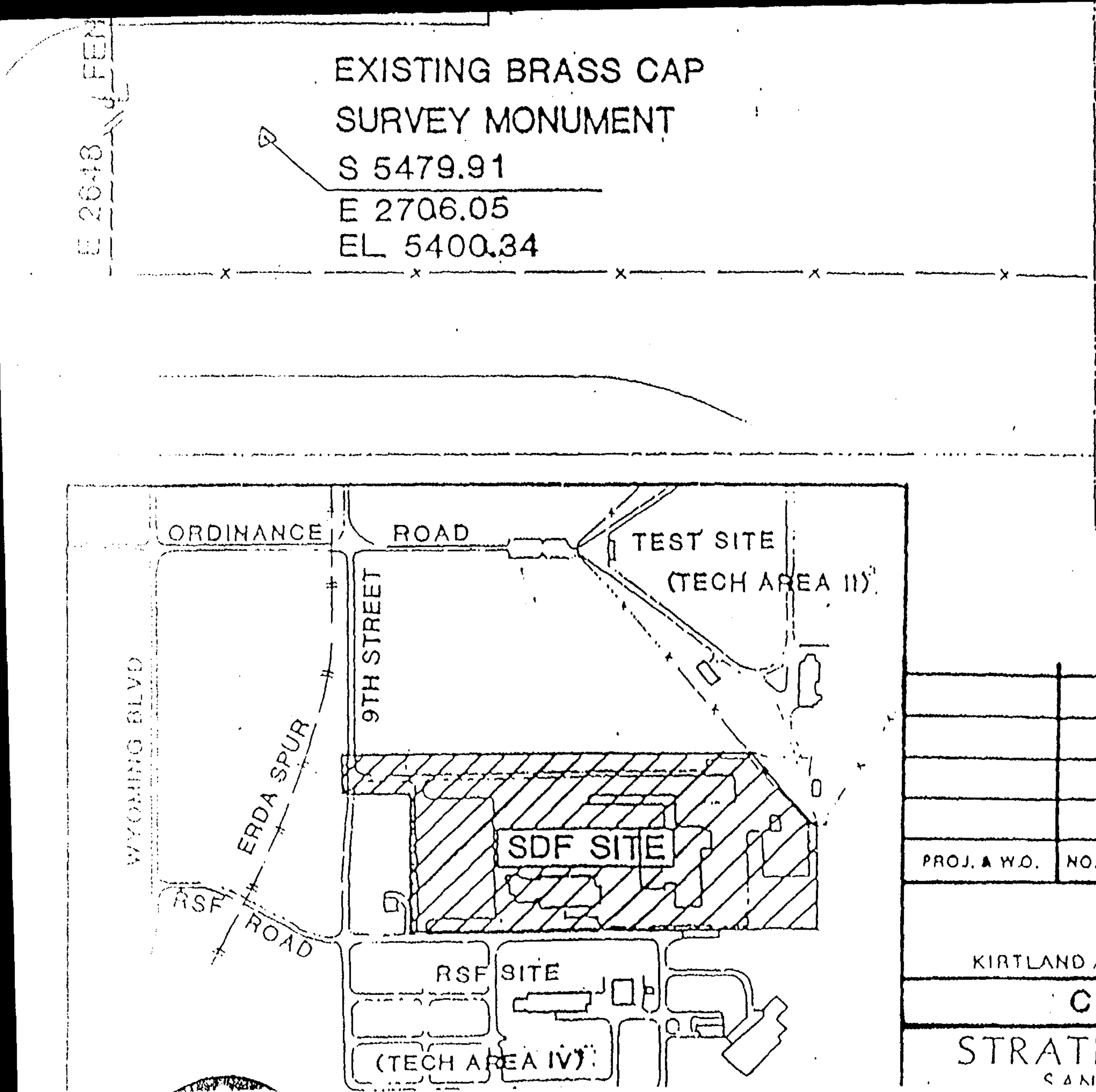
Bladed roads at the east and south sides of the survey area and other disturbed areas were inspected carefully for charcoal, fire-cracked rock, and other evidences of cultural deposition.

No sites or isolated objects were located. SHPO and Laboratory of Anthropology records indicate no historic properties now on or pending nomination to the State or National Registers. Laboratory of Anthropology records indicate that no archeological sites have been reported in T9N R4E, Sec. 5. QRC recommends that archeological clearance be granted for this project.

Cordially,

Carol

Carol J. Condie, Ph.D.



TIT
SUBM
Date: ______

PROJ. & W.O.	NO.	DATE	REVISION

U.S. DEPARTMENT OF
SANDIA AREA OFF
KIRTLAND AIR FORCE BASE EAST

COMPOSITE SITE LAYOU

STRATEGIC DEFENSES FACI
SANDIA NATIONAL LABORATORIE

901788

STATE OF NEW MEXICO

OFFICE OF CULTURAL AFFAIRS
HISTORIC PRESERVATION DIVISION

REY CARRUTHERS
GOVERNOR

VILLA RIVERA, ROOM 101
228 EAST PALACE AVENUE
SANTA FE, NEW MEXICO 87503
(505) 827-8320

HELMUTH J. NAUMER
CULTURAL AFFAIRS OFFICER

THOMAS W. MERLAN
DIRECTOR

October 17, 1990

Mr. Albert R. Chernoff
Director, Management
Support Division
Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, NM
87115

Dear Mr. Chernoff:

The Historic Preservation Division has received a request for concurrence from your office on two archaeological survey reports. The first report is entitled "A Cultural Resources Survey and Review for Sandia National Laboratories, Area I, South of O Street, Kirtland Air Force Base, New Mexico." The second report is entitled "A Cultural Resources Survey and Review, For Sandia National Laboratories, Area IV, Kirtland Air Force Base, New Mexico." Both surveys were conducted by Chambers Group, Inc., of Albuquerque.

Neither survey area I nor survey area IV contains cultural resources that are eligible to the National Register of Historic Places. We concur that the information potential for the dump site in the southwest corner of Tech Area I has been exhausted through in field recordation and that the site is not eligible to the National Register. We also concur that any future development in Area I must include an evaluation of the existing structures for their eligibility to the National Register of Historic Places.

Thank you.

Sincerely,

Lynne Sebastian

Lynne Sebastian
Deputy State Historic Preservation Officer

DEC 15 1995
DOE/KAO rec'd

December 12, 1995

Department of Energy
Kirtland Area Office
P.O. Box 5400
Albuquerque, New Mexico 87115

Attention: Mr. Laskar

Thank you for the opportunity to comment on the New Mexico Environment Restoration Project at Kirtland Air Force Base. Upon review of the materials you sent, we see no need for further comment from our office at this time.

If you have any questions, please do not hesitate to call Karen Lightfoot, Endangered Species Botanist for the State of New Mexico.

Sincerely,

Karen S. Lightfoot

Karen S. Lightfoot

KSL/ajc

Department of Energy
Field Office, Albuquerque
Kirtland Area Office
P.O. Box 5400
Albuquerque, New Mexico 87115

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JAN 23 1995
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USFWS - NMESSO

JAN 18 1995

Field Supervisor
Ecological Services
U.S. Fish and Wildlife Service
3530 Pan American Highway N.E., Suite D
Albuquerque, New Mexico 87107

Threatened and Endangered Species Survey Information for the Sandia National Laboratories/New Mexico Environmental Restoration Project at Kirtland Air Force Base

Dear Sir:

This letter seeks comment and concurrence from the U.S. Fish and Wildlife Service with respect to federally listed and proposed threatened and endangered species that may be affected by the planned implementation of the Environmental Restoration (ER) Project by Sandia National Laboratories/New Mexico (SNL/NM) under contract with the U.S. Department of Energy/Albuquerque Operations Office. The purpose of the ER Project is to identify, investigate, and remediate hazardous waste sites that have resulted from the history of SNL/NM activities on Kirtland Air Force Base (KAFB), Bernalillo County, New Mexico.

At this time, 241 potentially contaminated sites have been identified and investigated, of which 89 are now proposed for corrective action. Eleven of these sites are proposed for *in situ* bioremediation. The remaining 78 sites are proposed for soil excavation, treatment, and backfilling, followed by reclamation to restore vegetative cover at sites where vegetation is removed. One site consists of eleven abandoned mine shafts and adits, several of which are collapsed. If found to be contaminated, the remaining mines may be sealed rather than excavated. The 78 sites comprise a total of about 1,300 acres, ranging in size from less than 1 acre to about 420 acres and are distributed throughout an area approximately contained by the following townships: T.9N, R.4E; T.9N, R.4½E; and T.9N, R.5E.

Biological surveys for sensitive species have been conducted at all SNL/NM ER Project sites. The habitats at the sites proposed for corrective action include grassland, piñon-juniper woodland, and small areas of riparian scrubland and woodland. None of these sites contain wetland habitat. No federally listed or proposed threatened or endangered species were found during these surveys. In September, 1993, two canyons in the Manzanita Mountains that contain SNL/NM ER Project sites (Sol se Mete and Lurance Canyons) were visited by Roger W. Skaggs to assess the habitat for the potential occurrence of the Mexican spotted owl (*Strix occidentalis lucida*). Favorable habitat conditions for this species were

these surveys: the grama grass cactus (*Pediocactus [Toumeya] papyracanthus*), Wright's pincushion cactus (*Mammillaria wrightii* var. *wrightii*), and visnagita cactus (*Neolloydia intertexta* var *intertexta*). Eleven of the 78 sites proposed for corrective action were found to contain one or more of these species, typically as a few sca red individuals or in discrete populations. These 11 sites comprise approximately 900 of the 1,300 acres contained in the corrective action sites, of hich about half (420 acres) is represented by a single site in which a 100% survey found only one grama grass cactus.

To mitigate the impacts to these plants, areas of vigorous populations have been apped and these areas will avoided during the corrective action. Also, whenever possible, isolated individuals found in areas to be excavated will be transplanted to equivalent habitat. Because of the difficulty in finding these plants, it is highly probable that a small number of these plants will be destroyed through this proposed action. Based on the abundance and wide distribution of these species on KAFB, as indicated by the sensitive species survey results, it is our opinion that these losses will not significantly impact the continued existence of these species o AFB.

Please advise us of any concerns that your agency may have regarding impacts to stat listed endangered plant species that may result from the proposed action or of your concurrence that this action does not pose additional threats to these species. A copy of the sensitive species survey report for the SNL/NM ER Project is available upon request. A draft Environmental Assessment for this project is currently being completed and will be available in early 1995.

If your require additional information on this matter, please contact Susan Lacy of my staff at (505) 845-5542. Thank you for your assistance in this matter.

George K. Laskar

George K. Laskar
Assistant Area Manager
Environment, Safety, and Health

cc:
T. A. Wolff, SNL 7258, MS 1037

Department of Energy
Field Office, Albuquerque
Kirtland Area Office
P.O. Box 5400
Albuquerque, New Mexico 87115

JAN 18 1995

Director
New Mexico Energy, Minerals and
Natural Resources Department
Forestry and Resource Conservation Division
Villagra Buildling
Santa Fe, New Mexico 87503

State Endangered Plant Species Survey Information for the Sandia National Laboratories/New Mexico Environmental Restoration Project at Kirtland Air Force Base

Dear Sir:

This letter seeks comment and concurrence from the Forestry and Resource Conservation Division, New Mexico Energy, Minerals and Natural Resources Department with respect to state listed endangered plant species that may be affected by the planned implementation of the Environmental Restoration (ER) Project by Sandia National Laboratories/New Mexico (SNL/NM) under contract with the U.S. Department of Energy/Albuquerque Operations Office. The purpose of the ER Project is to identify, investigate, and remediate hazardous waste sites that have resulted from the history of SNL/NM activities on Kirtland Air Force Base (KAFB), Bernalillo County, New Mexico.

At this time, 241 potentially contaminated sites have been identified and investigated, of which 89 are now proposed for corrective action. Eleven of these sites are proposed for *in situ* bioremediation. The remaining 78 sites are proposed for soil excavation, treatment, and backfilling, followed by reclamation to restore vegetative cover at sites where vegetation is removed. One site consists of eleven abandoned mine shafts and adits which may be sealed rather than excavated if found to be contaminated. These 78 sites comprise a total of about 1,300 acres, ranging in size from less than 1 acre to about 420 acres and are distributed throughout an area approximately contained by the following townships: T.9N, R.4E; T.9N, R.4½E; and T.9N, R.5E.

Biological surveys for sensitive species have been conducted at all SNL/NM ER Project sites. The habitats at the sites proposed for corrective action include grassland, piñon-juniper woodland, and small areas of riparian scrubland and woodland. None of these sites contain wetland habitat. Your agency's 1992 "Inventory of Rare and Endangered Plants of New Mexico" was used in these surveys as the guidance for determining the status of the plant species found on these sites. Three state-listed endangered plant species (List 1) were found during

not found in either canyon. Based on discussions with Dr. Scott Altenbach of the University of New Mexico, the spotted bat (*Euderma maculatum*) and the occult little brown bat (*Myotis lucifugus occultus*), both C2 candidate species, are potential users of mine shafts and adits in this area; however, due to the unsafe nature of these mines, surveys for these species were not made. Individuals and populations of the grama grass cactus (*Pediocactus papyracanthus*), another C2 candidate species, have been found at nine of the ER Project sites. Efforts will be made in the ER Project to protect vigorous populations of this species where they are known to occur and to mitigate the loss of scattered individuals by transplanting.

Please advise us of any concerns that your agency may have regarding impacts to federally listed and proposed threatened and endangered species that may result from the proposed action or your concurrence that this action does not pose additional threats to these species. A copy of the sensitive species survey report for the SNL/NM ER Project is available upon request. A draft Environmental Assessment for this project is currently being completed and will be available in early 1995.

If your require additional information on this matter, please contact Susan Lacy of my staff at (505) 845-5542. Thank you for your assistance in this matter.

George K. Laskar

George K. Laskar
Assistant Area Manager
Environment, Safety, and Health

cc:
T. A. Wolff, SNL 7258, MS 1037

NO EFFECT FINDING

The described action will have no effect on listed species, wetlands, or other important wildlife resources.

Date 1/27/95

Consultation # 2-22-95-I-115

Approved by R. Mark Wilson

U.S. FISH and WILDLIFE SERVICE
NEW MEXICO ECOLOGICAL SERVICES FIELD OFFICE
ALBUQUERQUE, NEW MEXICO

Gary E. Johnson

DIRECTOR AND SECRETARY
TO THE COMMISSION
Gerald A. Maracchini

STATE OF NEW MEXICO
DEPARTMENT OF GAME & FISH

Villagra Building
PO Box 25112
Santa Fe, N.M. 87504

February 1, 1995

Re: State threatened or endangered species for the Sandia National Laboratories/New Mexico Environmental Restoration Project at Kirtland Air Force Base

Mr. George K. Laskar, Asst. Area Manager
Environment, Safety and Health
Department of Energy
Field Office, Albuquerque
Kirtland Area Office
P.O. Box 5400
Albuquerque, NM 87115

Dear Mr. Laskar:

The Department of Game and Fish (Department) has reviewed your letter concerning environmental restoration at Kirtland Air Force Base by Sandia National Laboratories/New Mexico and the Department of Energy. It is the Department's understanding that the environmental restoration would entail identification, investigation and remediation of 241 potentially contaminated sites located on the Base, of which 89 are now proposed for corrective action. Eleven of these sites are proposed for *in situ* remediation, while the remaining sites will be excavated, treated and reclaimed. These activities would occur in grassland, pinon-juniper, and small areas of riparian scrubland and woodland. Furthermore, it is our understanding that none of these activities will occur in wetlands and that your survey found no state listed endangered species.

Based on this information, the Department foresees no adverse effects to state listed threatened or endangered species. Your letter mentioned possible concern for the Spotted Bat, Euderma maculatum. While the Spotted Bat does use caves for hibernacula,

it does not appear that this species winters in Bernalillo County. Furthermore, it appears the Spotted Bat prefers crevices in cliffs near water during active months. We suggest contacting Homer Milford of the Abandoned Mine Land Bureau for information on gating mine shafts or adits in order to preserve potential bat habitat. His address is:

Mr. Homer Milford
Environmental Coordinator
Abandoned Mine Land Bureau
Energy, Minerals and Natural Resources Dept.
2040 South Pacheco St.
Santa Fe, NM 87505
(505)827-5970

We also suggest contacting Robert Sivinski or Karen Lightfoot of the Forestry and Resources Conservation Division concerning information on state listed threatened or endangered plants. The address is:

Forestry and Resources Conservation Division
Energy, Minerals and Natural Resources Dept.
P.O. Box 1948
Santa Fe, NM 87504-1948
(505)827-7865

Finally, we recommend the use of native species during revegetation in order to enhance wildlife habitat. We have enclosed a listing of state listed threatened or endangered species for your information.

Thank you for the opportunity to comment on this environmental restoration project. Please send a copy of the sensitive species survey report to John McKay at the Conservation Services Division. If you have any further questions, please contact John McKay at 827-1210.

Sincerely,

Jerry Maracchini by JM

Jerry A. Maracchini
Director

JAM/cjm

Enclosure

xc: Andrew Sandoval (Conservation Services Division Chief, NMGF)
Jim Bailey (Conservation Services Asst. Div. Chief, NMGF)
Dan Pursley (Northwest Area Operations, NMGF)

ERNALILLO COUNTY Status List of T&E, Proposed & Candidate Species: 18 JAN 1995

OMMON NAME............................	SCIENTIFIC NAME..............................	FEDERAL END.	FED.... THREAT.	FED.. PROP.	FED... CAND.	STATE END.	STATE.. THREAT.
o Grande Silvery Minnow	Hybognathus amarus	X	-	-	-	-	X
exas Horned Lizard	Phrynosoma cornutum	-	-	-	X	-	-
hite-faced Ibis	Plegadis chihi	-	-	-	X	-	-
ld Eagle	Haliaeetus leucocephalus alascanus	X	-	-	-	-	X
rthern Goshawk	Accipiter gentilis (2 ssp.)	-	-	-	X	-	-
rruginous Hawk	Buteo regalis	-	-	-	X	-	-
erican Peregrine Falcon	Falco peregrinus anatum	X	-	-	-	X	-
ooping Crane	Grus americana	X	-	-	-	X	-
stern Snowy Plover	Charadrius alexandrinus nivosus	-	-	-	X	-	-
untain Plover	Charadrius montanus	-	-	-	X	-	-
xican Spotted Owl	Strix occidentalis lucida	-	X	-	-	-	-
rthern Beardless-tyrannulet	Camptostoma imberbe ridgwayi	-	-	-	-	X	-
uthwestern Willow Flycatcher	Empidonax traillii extimus	-	-	X	-	-	X
ggerhead Shrike	Lanius ludovicianus (3 ssp.)	-	-	-	X	-	-
cult Little Brown Bat; Myotis	Myotis lucifugus occultus	-	-	-	X	-	-
otted Bat	Euderma maculatum	-	-	-	X	-	X
adow Jumping Mouse	Zapus hudsonius luteus	-	-	-	X	-	X
sert Bighorn Sheep	Ovis canadensis mexicana	-	-	-	-	X	-
Common Name (millipede)	Toltecus chihuanus	-	-	-	X	-	-

Distribution List:

30	MS0184	D. Dilley, DOE/KAO (30 Copies)
1	MS0314	E. Schindwolf, 2425
1	MS0353	J. Martin, 7300
1	MS0807	I. Alexander, 13917
15	MS1037	T. Wolff, 7315
1	MS1106	A. Sharpe, 9342
1	MS1110	R. Allen, 9222
1	MS1152	J. Weber, 9543
1	MS1153	M. Buttram, 9323
1	MS1165	J. Powell, 9300
1	MS1165	P. Raglin, 9304
1	MS1166	R. Pomquest, 9661
10	MS1170	J. Zawadzkas, 9302
1	MS1170	B. Knowles, 9302
1	MS1170	J. Sullivan, 9302
1	MS1174	A. Watts, 2526
1	MS1177	D. Horschel, 9661
1	MS1178	J. Ramirez, 9310
1	MS1178	R. Hamil, 9512
1	MS1179	M. Heddemann, 9308
1	MS1182	B. Turman, 9521
1	MS1184	J. Boyes, 9539
1	MS1186	J. Quintenz, 9502
1	MS1187	T. Mehlhorn, 9533
1	MS1187	K. Matzen, 9571
1	MS1190	D. Cook, 9500
1	MS1190	M. Harris, 9536
1	MS1192	G. Donovan, 9536
1	MS1193	J. Maenchen, 9531
1	MS1193	D. Bloomquist, 9536
1	MS1194	D. McDaniel, 9573
1	MS1196	R. Leeper, 9577
1	MS1304	J. Halpern, 7511
1	MS1311	S. Hwang, 7575
1	MS1311	T. Culp, 7575
1	MS1347	J. Copland, 7582
2	MS0100	Document Processing,
1	MS0619	Print Media, 12615
5	MS0899	Technical Library, 4414,
1	MS9018	Central Technical Files, 8523-2

4/19/96