DOE/EA-1335

Environmental Assessment

for the

Microsystems and Engineering Sciences Applications Complex

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Department of Energy, Kirtland Area Office
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ACRONYMS

A/BC AQCB	Albuquerque/Bernalillo County Air Quality Control Board
AWNS	Acid Waste Neutralization System
CAA	Clean Air Act
CO	Carbon Monoxide
CSRL	Compound Semiconductor Research Laboratory
DI	Deionized (generally refers to purified water)
DOE	Department of Energy
EIS	Environmental impact statement
ES&H	Environment, Safety and Health
FSID	Facilities and Safety Information Document
HAP	Hazardous Air Pollutant
KAFB	Kirtland Air Force Base
kg	kilogram
L	liter
lb/lbs	pound/pounds (English)
MDL	Microelectronics Development Laboratory
MERC	MicroFab Emergency Response Center
MEMS	Microelectrical Mechanical Systems
MESA	Microsystems and Engineering Sciences Applications
MGY	million gallons per year
MT	metric tones
NAAQS	National Ambient Air Quality Standards
NORM	naturally occurring radioactive material
NPDES	National Pollutant Discharge Elimination System
OEL	occupational exposure limit
POTW	publicly owned treatment works
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
SLEP	Stockpile Life Extension Program
SNL/NM	Sandia National Laboratories/New Mexico

SWEIS	Site-Wide Environmental Impact Statement
TA	Technical Area
TPY	tons per year
UBC	Uniform Building Code
VOC	volatile organic compound
WIF	Weapons Integration Facility
WIF-C	Weapons Integration Facility – Classified
WIF-U	Weapons Integration Facility - Unclassified
yr	year

1.0 PURPOSE AND NEED FOR AGENCY ACTION

A primary mission of the U.S. Department of Energy (DOE) is to maintain the nation's nuclear weapons stockpile in a safe, secure, and reliable manner. Aging weapons contain dated and now unavailable technologies. Modernization of these weapon system components is integral to DOE's responsibility to meet its stockpile stewardship requirements for enhanced performance, and increased safety, security, and reliability in weapons systems. To meet this responsibility, there is a need to modernize key weapon components utilizing microelectronics available only at Sandia National Laboratories/New Mexico (SNL/NM). DOE has identified an increasing need to expand and modernize the existing microelectronics research and development facilities to improve processing capabilities and enhance the security environment surrounding these activities. Because of security, classification, and nonproliferation considerations, some weapon system components cannot be produced by the private sector.

2.0 NO ACTION AND PROPOSED ACTION ALTERNATIVES

This chapter describes the No Action Alternative, the Proposed Action, and alternatives considered but eliminated from detailed consideration. The No Action Alternative (Sections 2.1 to 2.3) would involve continued microsystems-related operations as described for the Expanded Operations Alternative in the Site-Wide Environmental Impact Statement for Sandia National Laboratories/New Mexico (SWEIS; DOE 1999). The Proposed Action (Sections 2.4 and 2.5) would consist of the construction and operation of state-of-the-art facilities that would satisfy the stated Purpose and Need. The Proposed Action was also described as an alternative configuration in the Expanded Operations Alternative in the SWEIS.

The Proposed Action involves renovation of and upgrades to the Microelectronics Development Laboratory (MDL), construction of three new facilities, relocation of the activities currently conducted at the Compound Semiconductor Research Laboratory (CSRL) and several other buildings to the new facilities, and demolition of the CSRL. Collectively, the new facilities would be known as the Microsystems and Engineering Sciences Applications (MESA) Complex.

SNL/NM is located within the boundaries of Kirtland Air Force Base (KAFB), which encompasses land owned by the United States Air Force and DOE and land managed by the U. S. Forest Service. KAFB is surrounded geographically by the City of Albuquerque to the north, Cibola National Forest and private land to the east, Isleta Pueblo to the south, and the Albuquerque International Sunport and University of New Mexico land held in trust by the State Land Office to the west.

Figure 2.1 shows the locations of the SNL/NM technical areas in relation to KAFB, the state of New Mexico, and Bernalillo County.

Alternatives considered but not evaluated in detail include the following:

- *Construction and operation of the MESA Complex at another DOE location* – As stated in the Purpose and Need for Agency Action, the need is to expand and modernize existing capabilities unique to SNL/NM. Siting the MESA Complex at another DOE location would not meet this need.
- *Construction and operation of the new MESA structures at another SNL/NM location* – Several configuration options were evaluated during the conceptual design process. The impacts of building elsewhere at SNL/NM would be essentially identical to those resulting from the Proposed Action or greater due to disturbance of previously undisturbed areas, and construction elsewhere would prevent the use of existing infrastructure and shared systems already present at the MDL. Therefore, this alternative was not evaluated in detail.

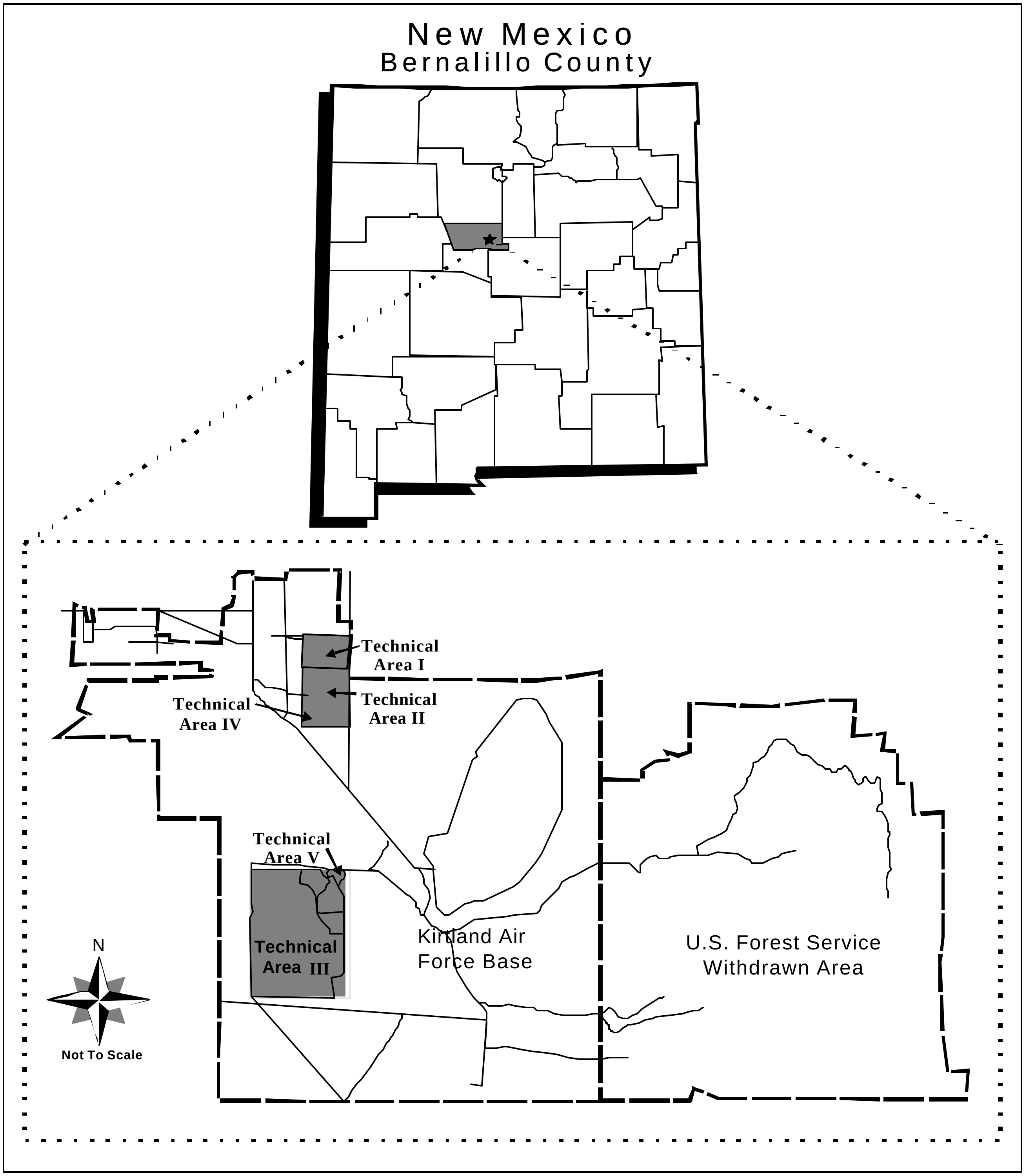

Figure 2.1
Location Map of the SNL/NM Technical Areas

2.1 No Action Alternative

Under the No Action Alternative, no new facilities would be constructed and the existing CSRL would not be demolished. Activities conducted at the MDL and CSRL would continue in essentially their current configuration, with some upgrades to equipment and processes and some minor interior renovations to the MDL. The MDL silicon-based production configuration (including research and development) would produce up to 7,500 wafers per year, using up to three shifts, under the No Action Alternative. The MDL is in Building 858 north, adjacent to 858 south (Figure 2.2), which contains offices and light labs. The light labs deal primarily with wafer test equipment, die packaging, scanning electron microscopy, device irradiation (using sealed radioactive sources), and device inspection.

The mission of the MDL is to provide the microelectronics research and engineering capabilities to support programs of national interest. The MDL contains 30,000 ft^2 of clean room, consisting of 22 independent bays separated by 8-ft-wide utility chases. The basement of the facility contains the Acid Waste Neutralization System (AWNS) used in the neutralization of process wastewater. The MDL includes the Safety Office, which has the equipment necessary to detect, notify, and respond to facility emergencies.

Also associated with the MDL are the following:

- A Mechanical Equipment Room (a single-story building connected to the MDL)
- A nitrogen generation plant
- A basement that contains the AWNS, utilities tunnels, and a protected distribution system
- Several chemical storage tanks, including a 6,500-gal tank of hydrochloric acid and another 6,500-gal tank of sodium hydroxide associated with the DI Water Plant and the AWNS
- A liquid hydrogen storage tank (4,500 gal)
- A hazardous gas bunker
- A support area that includes the Remote Safety Center
- A water scrubber system
- An exhaust fan room with three acid exhaust fans and two solvent exhaust fans
- Point of use burn boxes for controlled oxidation

A variety of processes are used to produce microelectronic and micromechanical devices that may vary according to the needs of a particular project. These processes can be grouped within the following four broad categories of processes:

- *Film deposition*—processes that prepare the surface of a silicon chip with conductive and nonconductive layers and polymers.

- *Photolithography*—processes that transfer a larger master pattern of components onto the film layers, similar to photographic processes in concept.
- *Etching*—processes that carve out the image created on the films and that can expose selected portions of the surface of the silicon chip.
- *Ion implantation*—processes that place electrically active chemicals of various types into the exposed portions of the silicon chip surface.

Acids and caustics and a wide variety of toxic and corrosive gases are used in clean rooms to clean, develop, and etch wafer surfaces and to create the films and chemical ions for implantation. While chemical quantities are less than those of a commercial manufacturing operation, the types of materials and chemicals used in these processes are generic to the semiconductor industry. Chemical air emissions occur during various points of the processes identified above. Small, sealed radioactive sources are also contained in equipment used in in the Gamma Cell 220 and the Shepard Cell for testing the ability of components to function when exposed to radiation.

The CSRL, located in Building 893, is used to investigate the physics of compound semiconductors and device structures. The facility also supports the fabrication of optoelectronic and digital compound semiconductor devices for both research and prototyping purposes. The CSRL is smaller than MDL, but the systems and processes are essentially similar to those in place at the MDL.

2.2 No Action Alternative Facility Renovation

The scope of work for the No Action Alternative would include architectural, mechanical and electrical modifications to the MDL cleanroom as a result of a new tool layout intended to allow processing of 8-inch wafers (the current configuration limits operations to the use of 6-inch wafers). No revisions to the existing exterior building shell of the MDL would be made. No demolition activities would be conducted under the No Action Alternative.

The north wing of the MDL contains utility support systems and support areas. Mechanical and process systems that would be modified or installed new as part of the upgrades include:

- The acid exhaust system
- Point-of-use ammonia scrubbers, make-up air distribution system, deionized (DI) water system
- Resin Bed regeneration chemical distribution systems
- Process chilled water system
- Nitrogen generation plant upgrades
- Specialty gas storage areas

Under the No Action Alternative, the Gamma Cell 220, which is used to test components for radiation hardness, would be replaced. The entire unit is returned to the manufacturer for reprocessing, and a new unit is installed. No expansion in capabilities is anticipated, and no hazardous or radioactive waste would be generated.

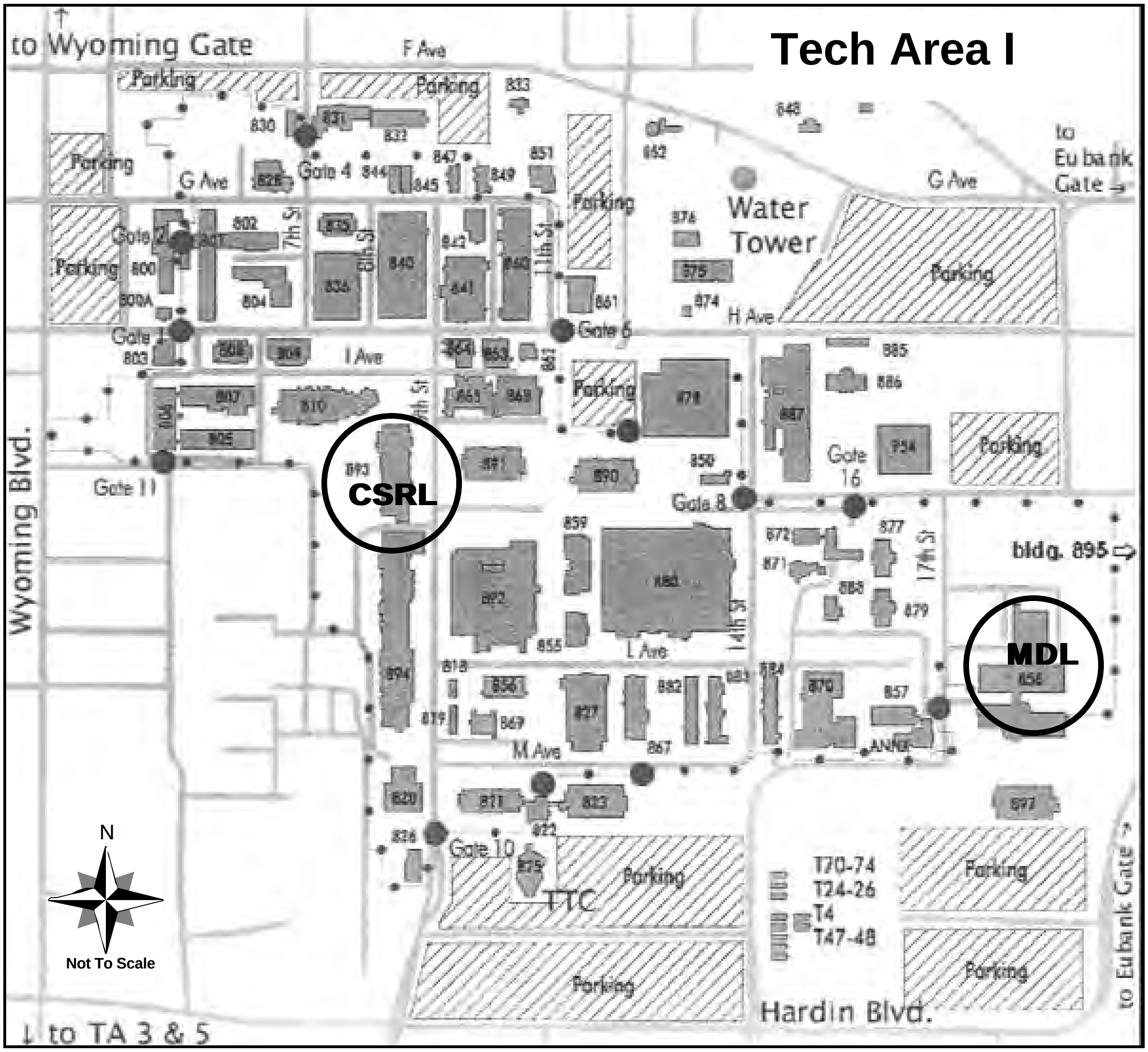

Figure 2.2
SNL/NM Technical Area 1

2.2.1 Waste Management

Under the No Action Alternative, replacement of the MDL Acid Exhaust System would result in the generation of approximately 941 kg (2070 lbs) of hazardous waste and 16,523 kg (36,350 lbs) of non-hazardous construction waste.

2.3 No Action Alternative Operations

Under the No Action Alternative, operations would proceed as described in Section 2.1.

Following is a description of environmental and human health and safety resources that would be routinely potentially affected under the No Action Alternative.

2.3.1 Air Emissions

Under the No Action Alternative, chemical air emissions would continue as described in the Expanded Operations Alternative in the SWEIS under the No Action Alternative. The emissions include hazardous air pollutants (HAPs), volatile organic compounds (VOCs), and criteria pollutants that are regulated by Federal and local laws. SNL/NM is not a major source for hazardous air pollutants as described in Title 20 New Mexico Administrative Code Chapter 11 Part 42 section 7.18, Major Source. Air emissions for both the MDL and the CSRL were included in the SNL/NM SWEIS (DOE, 1999) air quality analyses.

2.3.2 Water Use and Liquid Effluents

Water use by the existing operations under the No Action Alternative would be up to 291 million liters per year (L/yr) (77 million gallons per year [MGY]) for MDL (SNL/NM, 1998) and approximately 10.6 million L/yr (2.8 MGY) for the existing CSRL. The potable and process water systems provide potable water throughout the facilities and process water for the various laboratory users. Potable water would continue to be provided for the entire project under the No Action Alternative, and the baseline rate of water use and wastewater discharge would be the same as that evaluated in the Expanded Operations Alternative of the SWEIS (DOE, 1999).

Under the No Action Alternative, effluent discharges would continue at approximately 291 million L/yr (77 MGY) for the MDL and 10.6 million L/yr (2.8 MGY) for the CSRL.

2.3.3 Waste Management

Current operations generate non-hazardous and hazardous wastes as well as very minor quantities of low-level radioactive wastes. The majority of the wastes are currently generated in the MDL and CSRL. Non-hazardous waste consists of materials such as office paper, clean room attire, cardboard, plastic, glass, scrap metal, packaging materials, and wood. Under the No-Action Alternative, the 603 employees currently supporting associated programs would continue to generate solid waste at a rate of approximately 129.16 kilograms per year (kg/yr) (284.16 lbs/yr) per employee, for a total of 77,876 kg/yr (86 TPY or 171,348 lbs/yr). The majority of these waste materials are recycled through SNL/NM's recycling program. Remaining non-hazardous waste is removed and taken to the SNL/NM Solid Waste Transfer Facility, where it is sorted, baled and transported for disposal in local commercial and municipal landfills.

Under the No Action Alternative, operations would continue to generate a total of approximately 8,649 kg/yr (19,028 lbs/yr) of hazardous waste. Hazardous waste is stored in less-than-90-day accumulation areas at or near the point of generation, as designated by the Resource Conservation and Recovery Act (RCRA), 40 Code of Federal Regulations (CFR) 262.34, prior to being transported to the hazardous waste management facility. Hazardous wastes include acids (hydrofluoric, nitric, sulfuric), activated charcoal, edge bead removers, photoresists, syringes, mercury arc lamps, lapping solutions, various plating solutions, pump oils, and contaminated wipes.

The projections of hazardous waste generation provided here for the No Action Alternative differ from those identified in the SNL/NM Sitewide Environmental Impact Statement (SWEIS) because the SWEIS estimates were based solely upon the preliminary concepts of the Complex and its operations available at that time. The estimates provided here are based on both revised and new information on the required tools, laboratories, and processes that has become available as the MESA proposal has matured. Although these amounts exceed the projections presented in the SWEIS, they remain within the capacity of SNL/NM's Hazardous Waste Management Facility for processing and disposal.

Activities conducted at the Gamma Cell 220 and the Shepard Cell involve exposure of microelectronic components to radiation from sealed sources. These operations typically result in the generation of less than 1 kg/yr (2.2 lbs/yr) of low-level radioactive waste resulting from irradiation of components.

Zirconium heating elements (called thermal annealers) are used in high-heat growth vessels. These elements are shipped to SNL containing the zirconium which is a naturally occurring radioactive material (NORM), and must therefore be disposed of as low-level radioactive waste. Operations generate approximately 381 kg (838.2 lbs) of such waste per year, and this generation would continue under the No Action Alternative.

2.3.4 Human Health and Safety

Worker health and safety precautions and controls for current operations are implemented according to the SNL Environment, Safety and Health (ES&H) Manual (SNL, 2000b) and supplemental job-specific procedures. Each major piece of process equipment has an operating procedure.

Operations that employ laser and x-ray hazards are performed using appropriate administrative controls and engineered barriers. These controls include, but are not limited to, operator training and shielding of personnel according to current requirements, including equipment housing that shields operators from laser beam or x-ray exposure. Workers involved in operations conducted in the Gamma Cell 220 and the Shepard Cell are protected by engineered controls such as radiation barriers, lead shielding, and alarm systems. Administrative controls, including use of dosimeters and training, are also employed as part of an-as-low-as-reasonably-achievable (ALARA) program. The dose rate to employees would be less than 10 mrem in an hour, and less than 100 mrem total effective dose equivalent in a year.

2.4 Proposed Action Construction and Demolition Activities

Construction activities under the Proposed Action would include construction and renovation of the facilities described in the following sections and shown in Figure 2.3, as well as construction of infrastructure elements in support of these facilities (roads, sidewalks, utility hook-ups, etc.). The Proposed Action construction and facilities are presented as described in the Conceptual Design Report for MESA (SNL, 2000a). Demolition activities would involve decontaminating, decommissioning, and demolishing the existing CSRL, which is currently beyond its design life. Existing CSRL operations would be relocated to the new MESA facilities. Upgrades and modifications to the MDL described under the No-Action Alternative would also be performed under the Proposed Action.

The MESA Complex is expected to be about 377,000 gross square feet (GSF) in size and is divided into three facilities (SNL, 2000a):

- Microsystems Fabrication (MicroFab) facility - 87,650 GSF, with an 8,200 GSF renovation to the existing MDL. New buildings include the single-story Microfab Cleanroom, the single-story connection to the MDL containing the process support laboratories, and the single-story Central Utility Building (CUB1).
- Microsystems Integration Laboratory (MicroLab) - 128,185 GSF. Buildings include the three story Workspace building; the one story, high bay, Design and Education Center ; and the three story Laboratory building.
- Weapons Integration Facility – This would include two buildings: a classified (WIF-C) portion of approximately 114,340 GSF (two components, three and four stories, plus a single-story Central Utility Building [CUB2]) and an unclassified portion (WIF-U) of approximately 37,745 GSF (two stories).

Demolition of the CSRL would be accomplished under the existing SNL/NM program for decontamination, decommissioning, and demolition of surplus facilities. Prior to demolition, the facility would be surveyed, and samples would be taken to assess the presence and/or location of hazardous materials, wastes, or contaminated building materials. Such materials would be segregated from the construction wastes, characterized, and package for treatment and/or disposal as appropriate.

Under the Proposed Action, the MDL bulk storage tanks for the DI Water Plant and AWNS would also be decontaminated, decommissioned and demolished under the existing SNL/NM program.

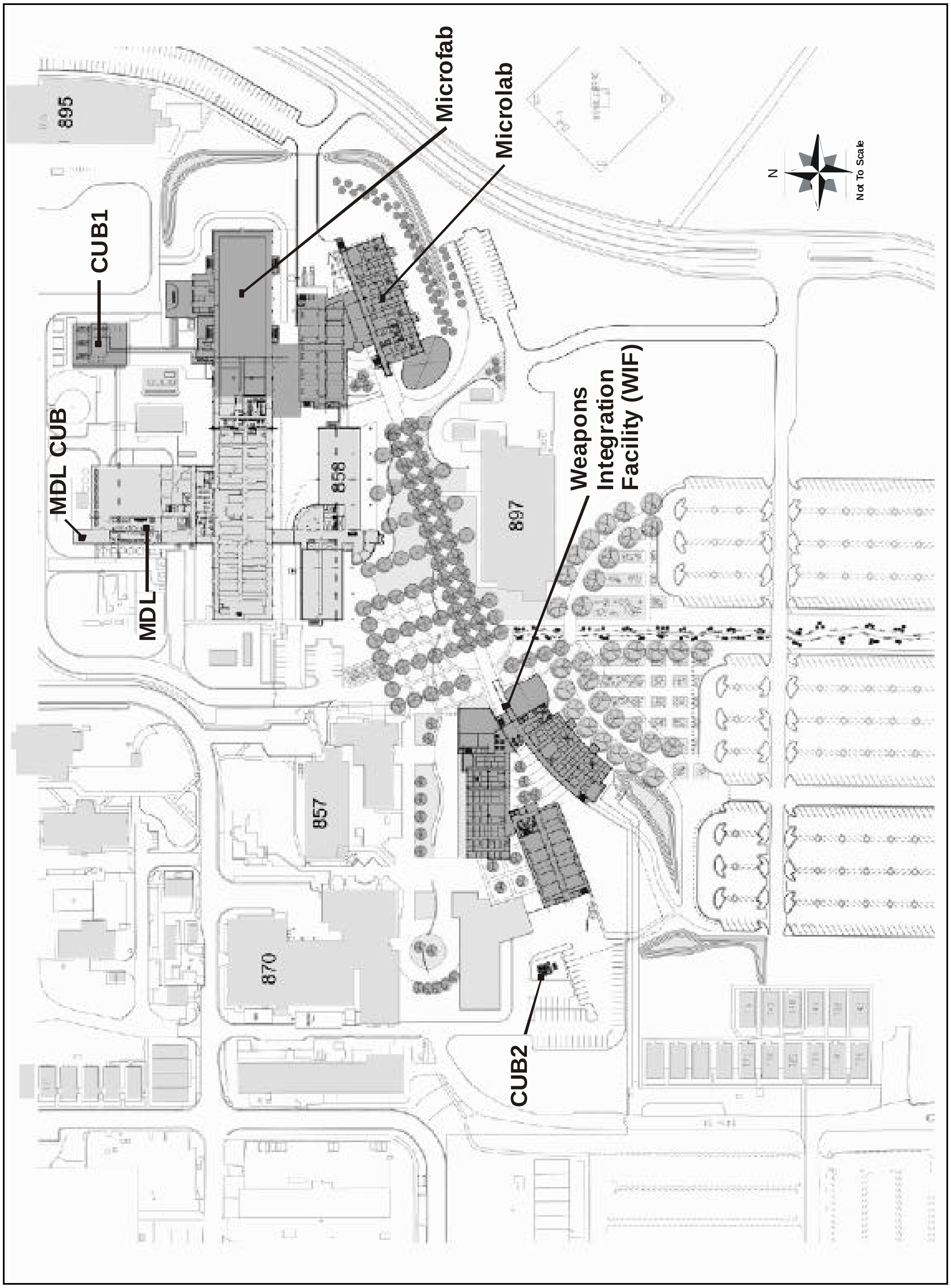

Figure 2.3
MESA Facilities

2.4.1 MicroFab Facility

There would be six main functional blocks of area for the MicroFab facility: 1) MicroFab Cleanroom, 2) MicroFab Support Labs, 3) Process Support, 4) Circulation, 5) Central Utility Building (CUB1) and 6) MicroFab Service Yard. The MDL, which is part of the MicroFab, is described in Section 2.1. A description of each functional block follows.

2.4.1.1 MicroFab Cleanroom

The MicroFab cleanroom work spaces would be used for new semiconductor device prototyping and microsystem research. The Microfab cleanroom work spaces would be used for new semiconductor device prototyping, microsystem research, and development. Access to these workspaces would require donning approved cleanroom apparel following protocol procedures.

Highly flexible workspace for the MESA Complex means the ability to accommodate different lab layouts, while at the same time providing different levels of cleanliness. Functionally, the cleanroom interior and its perimeter would be without structural columns. This would allow unrestricted layout of the movable cleanroom partition system, and also would allow personnel exit doors and equipment move-in doors to be located wherever the interior layouts of the labs dictate. Process utilities, gases, chemicals, and exhaust systems would also be configured so that they are available to the process tools as they are added, altered, or relocated with minimum disruption to surrounding areas. The cleanroom air supply system would have the ability to supply cleanroom bays anywhere within the cleanroom envelope without major modifications.

The cleanroom sector would contain three levels: the subfab, the fab, and the fan deck. The three levels are considered one story in the Uniform Building Code (UBC). Above the cleanroom would be the level called the “fan deck,” which would house recirculation fans that serve the cleanroom and makeup air handlers that pressurize and replenish air exhausted from the cleanroom. Both the subfab and fan deck would be utility support areas and cannot contain any occupied areas. The subfab would contain process support systems that serve the cleanroom above. The cells of the waffle slab would have popouts to allow process utility lines to pass through the waffle to the process tools above.

2.4.1.2 MicroFab Support Labs

Included in this block of space would be the gowning, scanning electron microscope (SEM) spaces, Characterization Lab, and Probe Test. The cleanliness of these labs is not as critical as the cleanroom; however, direct access to the cleanroom would be required. Personnel and product (i.e. wafers that are in development) need to flow freely between the cleanroom and the MicroFab support labs without having to don and doff cleanroom gowns. Toilets and locker rooms would be adjacent to gowning areas.

2.4.1.3 Process Support

The support sector would contain spaces that are needed near the cleanroom for efficient operations and research but do not need either direct clean access to the cleanroom or to the process services supplied from the subfab. Included in this block of space would be the chemical storage and gas dispensing areas, backend processing, high purity fit-up, fire riser, MicroFab Emergency Response Center (MERC) room and a communications systems access room within the MERC. These areas would functionally support the research activities of the cleanroom, and with the exception of the Back End processing lab, would not be clean areas. However, product would need to flow from the Back End processing laboratory to the cleanroom.

2.4.1.4 Circulation

The circulation block would include the non-clean horizontal and vertical circulation required for personnel, materials, and equipment to reach the various areas of the facility. This would include aisles, halls, corridors, stairs, a dumbwaiter and an equipment-sized elevator. An equipment move-in aisle would also be located at the perimeter of the cleanroom to allow the research tools to be moved into the cleanroom spaces. Guided visitors would utilize the south equipment aisle during tours to view the internal operations of the cleanroom.

2.4.1.5 Central Utility Building (CUB1)

This block of space would be a building containing chillers, pumps, electrical switchgear, motor control centers, and other mechanical equipment servicing the MicroFab. Cooling towers would be located on the roof of the CUB1.

2.4.1.6 MicroFab Service Yard

This block of space would include the electrical yard consisting of a generator, 15kV switchgear, CUB1 transformers, gas cylinder storage, access roads for service and emergency vehicles, property protection fence, hydrogen storage tanks, the silane/toxic mixes dispensing area, liquid nitrogen tank, a less-than-90-day hazardous waste accumulation building, and the CUB. A utility trench would connect utilities between the existing MDL CUB, the new MicroFab CUB1, and the MicroFab facility. Site-wide utilities would also use this trench to feed the MicroFab facility.

2.4.2 MicroLab Facility

The MicroLab would consist of three primary, specialized buildings:

- A three-story Workspace Building
- A single-story, high bay, Design and Education Center
- A three-story Laboratory Building

These buildings would be organized to create an integrated facility with the MicroFab for the Microsystems operations. A one story workspace would link the MicroLab to the MicroFab.

2.4.2.1 Workspace Building

The Workspace Building would be located south of the Laboratory Building. The building would provide a working environment that is similar in space allocation, layout, natural light, and amenities as that of the existing MDL (see Section 2.1). The northern extent of the Workspace Building would be limited to allow for the potential future expansion of the laboratory to the east. This component would provide workspace for 274 microsystems personnel and the Microsystems Center Director and staff.

2.4.2.2 Design and Education Center

The Design and Education Center would be a separately expressed, high volume facility divided internally into two basic functional zones. These zones would be separated by a lounge space that would be connected directly to the MicroLab's main entrance lobby.

The first functional zone, located on the north within the oval, would be the Education Center, an unclassified, specialized classroom to conduct courses for Microsystems personnel and others to stay abreast of advances in Microsystems technology. Used to educate new employees, internal defense program experts, weapons designers, students, and professionals about microsystems, the Education Center would also be used as an orientation room for visitors prior to tours of the Microsystems facilities. The second functional zone, located on the south, would be the Design Center, an unclassified space with advanced, high powered computers to support collaboration between micro-systems designers and their weapons customers. The Design Center would incorporate advanced computing capabilities for specialized microsystems development. The center would provide direct access to the latest Microelectrical Mechanical Systems (MEMs) design tools.

2.4.2.3 Laboratory

The three story, light laboratory component would be laid out for a direct connection to the existing MDL office areas to the west and the MicroFab to the north. Labs would be of a modular design. The laboratory modules would be arrayed on both sides of a long, central service corridor providing efficiency and allowing for the separation of staff access and internal lab functions.

The light laboratories would be used for characterization of photonic devices and semiconductors; analysis; sensor development; device assembly; planarization; electro- and magnetic chemistry; X-ray; laser measurements; electrical and optical experiments, MEMs processing, optical electronics, plasma diagnostics, customer demonstrations, laser-electro optics, laser spectrography, and research and development.

2.4.3 Weapons Integration Facility (WIF)

The WIF would consist of specialized building components organized to create an integrated facility that promote interaction and collaboration between the classified and unclassified functions while also maintaining required security. The WIF-Classified (WIF-C) facilities would include a three-story classified light laboratory, a four story classified workspace building, a single-story Views Corridor structure, and a 1,600 GSF Central Utility Building (CUB2). The WIF-Unclassified (WIF-U) facilities would include a two story, unclassified workspace building and a single-story building housing the Visualization Laboratory.

2.4.3.1 Weapons Integration Facility – Classified (WIF-C)

The three story, light laboratory component is laid out for a direct connection to the workspace areas of WIF-C, to the north. Labs would be of a modular design. The laboratory modules are arrayed on both sides of a long, central service corridor providing efficiency and allowing for the separation of staff access and internal lab functions. The four-story workspace building would support 254 personnel and the Computational and Engineering Sciences Center Director and Staff. WIF-C would also include the one-story, 1,600 GSF CUB2.

The Views Corridor and associated server room are used for advanced scientific visualization and component design. The space is classified for the collaboration of the MESA engineers, technologists, and analysts.

2.4.3.2 Weapons Integration Facility – Unclassified (WIF-U)

The two-story workspace building would include workspaces to support 118 personnel, a lounge/breakroom, and building support spaces.

The purpose of the Visualization Laboratory is for the development and prototype deployment of computation and visualization tools. This lab requires a high degree of networking capabilities and the associated computer server. It would be located in the unclassified WIF area to allow external partners to closely team with Sandia researchers and developers.

2.4.4 Construction/Demolition Air Conformity

Bernalillo County has been designated as a maintenance area for carbon monoxide (CO) and is in attainment for other federally regulated pollutants. Trucks and construction equipment would generate CO emissions. Estimated hours of operation for diesel and gasoline engines and subsequent CO emissions that would result from project construction are included in Table 2.1.

The New Mexico Administrative Code, Title 20, Part 11.04, (20 NMAC 11.04), entitled *General Conformity,* implements Section 176(c) of the Clean Air Act (CAA), as amended (42 U.S.C 7401 et seq.), and regulations under 40 CFR 51, Subpart W, with respect to conformity of general Federal action in Bernalillo county. Regulation 20 NMAC Part

11.04.11.1.2, paragraph B, establishes the emission threshold of 100 TPY of CO at SNL/NM that would trigger the requirement to conduct a conformity analysis. Based on the proposed schedule, construction activities are anticipated to last approximately 3 years. As shown in Table 2.1, carbon monoxide releases in any given year are anticipated to be substantially below the 100 TPY threshold; therefore a conformity analysis is not required.

Demolition activities would last approximately one month. As shown in Table 2.2, these activities would generate a total of approximately 0.04 tons of carbon monoxide over this time. Therefore, a conformity analysis is not required.

Table 2.1 – Carbon Monoxide Emissions Related to Construction

Equipment	Estimated Hours of Project Operation	CO Generated Pounds per hour (lbs/hr)*	Estimated Total Pounds per year (lbs/yr) of CO
Year 1			
Gasoline Engines:	1,575	0.48	756
Diesel Engines	68,740	0.11	7,561
Total lbs/yr			8,317
Total TPY			4.16 TPY
Year 2			
Gasoline Engines:	0	0.48	0
Diesel Engines	38,500	0.11	4,235
Total lbs/yr			4,235
Total TPY			2.12 TPY
Year 3			
Gasoline Engines:	0	0.48	0
Diesel Engines	9,100	0.11	1,001
Total lbs/yr			1,001
Total TPY			0.5 TPY

*CO emission factors are based on Environmental Protection Agency National Vehicle and Fuel Emission Laboratory (Ann Arbor, Michigan) average emission rates for idling vehicles (EPA's AP-42, 5th Edition, January 1995). CO emissions for light duty trucks are estimated at 219 grams/hr, for heavy duty gas vehicles at 245 grams/hr, and for heavy-duty diesel vehicles at 50 grams/hr. Calculations are based on a conversion factor of 0.035 ounce per gram (grams x 0.035) divided by 16 (ounces per pound) times hours of operation divided by 2,000 (pounds per ton) to obtain tons/year for the project.

Table 2.2 – Carbon Monoxide Emissions Related to Demolition

Equipment	Estimated Hours of Project Operation	CO Generated Pounds per hour (lbs/hr)*	Estimated Total Pounds per year (lbs/yr) of CO
Gasoline Engines:	0	0.48	
Diesel Engines	640	0.11	70.4
Total lbs/yr			70.4
Total TPY			0.04 TPY

*CO emission factors are based on Environmental Protection Agency National Vehicle and Fuel Emission Laboratory (Ann Arbor, Michigan) average emission rates for idling vehicles (EPA's AP-42, 5th Edition, January 1995). CO emissions for light duty trucks are estimated at 219 grams/hr, for heavy duty gas vehicles at 245 grams/hr, and for heavy-duty diesel vehicles at 50 grams/hr. Calculations are based on a conversion factor of 0.035 ounce per gram (grams x 0.035) divided by 16 (ounces per pound) times hours of operation divided by 2,000 (pounds per ton) to obtain tons/year for the project.

2.4.5 Construction/Demolition Water Use and Liquid Effluents

Water use would increase slightly during Proposed Action construction activities due to additional construction personnel onsite and water requirements related to installation and adjustments in the mechanical and plumbing systems of the buildings proposed for modification.

2.4.6 Construction/Demolition Waste Management

It is anticipated that construction activities would result in the generation of non-hazardous wastes (primarily construction debris and sanitary wastewater). Construction debris would consist of packaging material including wood crates, cardboard, and plastic; scrap material such as electrical wire, insulation, gypsum drywall, floor tile, carpet, scrap metal, and empty adhesive and paint containers; and concrete debris resulting from the wash-down process following pours. Approximately 3.36 million kg (3695 tons or 7.39 million pounds) of construction waste would be generated by construction activities related to the Proposed Action.

The CSRL is in Building 893, which is a 127,574 GSF single-story building with an equipment penthouse on the roof. The building is constructed with a concrete slab foundation, concrete masonry unit exterior walls, concrete columns and beams as the primary roof support, masonry unit exterior walls and wallboard interior walls, concrete and tile floors, suspended acoustical ceiling, a bar joist/metal deck, and a hypalon fabric roof.

Demolition of the CSRL is anticipated to generate up to 2,300 tons of standard construction waste, primarily concrete, steel, and plastics. Current plans are to dispose of this waste in the Kirtland Air Force Base construction waste landfill; alternatively, the waste could be transported to the City of Albuquerque Cerro Colorado or Rio Rancho construction waste landfills. Materials would be recycled as appropriate.

The CSRL demolition activities would also generate approximately 45,455 kg (50 tons or 100,000 lbs) of asbestos waste, which would be removed and managed according to existing SNL/NM asbestos management processes. Asbestos waste would be transported to the Kerrs Mountainair Monofill facility for disposal.

Some hazardous wastes (for example, chemically contaminated piping, fume hoods, exhaust ducts, scrubbers, etc.) may be generated during decontamination, decommissioning, and demolition of the CSRL. While waste quantities cannot be accurately estimated prior to the initial survey, a facility of this size might be expected to contain approximately 22 kg of solid hazardous waste and approximately 200.6 L (53 gallons) of liquid hazardous waste, most of which would be sulfuric acid and sodium hydroxide from the AWNS. Waste would be segregated, characterized, and prepared for treatment or disposal as appropriate through SNL/NM's hazardous waste management program.

The major components of the MDL's Bulk Storage System consist of the 6000 gallon HCL and NaOH tanks and the double contained piping used to transfer the chemicals to both the de-ionization plant for de-ionization of the Cation, Anion and mixed beds and the acid-waste neutralization (AWN), for acid neutralization. In addition, there are miscellaneous pumps, valves and fittings used throughout the system. Both the HCl and NAOH will be emptied prior to dismantling by consuming the chemicals during normal DI water de-ionization and AWN neutralization processes. This drawdown, of the bulk chemicals, will minimize or eliminate any need to dispose of large quantities of either HCl or NaOH.

Once the new EDI unit is installed in the MDL's DI water plant, the bulk storage system would be dismantled and decontaminated. A decontamination unit will be constructed to decontaminate all components of the system as they are removed. The piping will be cut into small sections and along with the valves and fittings will be decontaminated and disposed of as construction waste. The two 6000 gallon tanks will be decontaminated and sent to reapplication. If the tanks can not be reused they will be sectioned and disposed of as construction waste. The water used for decontamination will be sent to the MDL's AWN system and will not be sent out as hazardous waste.

Under the Proposed Action, replacement of the MDL Acid Exhaust System would result in the generation of approximately 941 kg (2070 lbs) of hazardous waste and 16,523 kg (36,350 lbs) of non-hazardous construction waste.

2.4.7 Construction Worker Health and Safety

Construction activities would incorporate all applicable health and safety standards common to each of the construction disciplines employed in the project and would follow all Occupational Health and Safety Administration (OSHA) standards for health and safety practices. The potential for worker exposure to hazardous materials is anticipated to be minimal.

2.5 Proposed Action Operations

Under the Proposed Action, the operations currently conducted at the CSRL (described in Section 2.1) would be relocated to the facilities described in Section 2.4 and more fully integrated with the operations of the existing MDL. The production capacity of the MESA Complex (including research and development) would remain at approximately 7,500 silicon/specialty alloy wafers per year.

It is estimated that approximately 650 employees would be located at the MESA complex, most of which would be relocated from several existing SNL/NM facilities. Table 2.3 provides the locations of the projected occupants. Approximately 131 weapons design personnel, currently located in Buildings 807, 836, 891, and 877 would be relocated to the MESA Complex, primarily to the WIF. Microsystems personnel at MESA would include approximately 263 employees currently working in Buildings 807, 893 (CSRL), 891, 857, 858 (MDL), and 897. Approximately 195 computational and engineering sciences (C&ES) personnel would be relocated to MESA, primarily to the WIF. Directors and staff (14 total employees) would be located at the MicroLab and WIF-C, and 45 new employees resulting from program growth would be located throughout the MESA complex (SNL, 2000a).

Table 2.3 – MESA Personnel (SNL, 2000a)

	MicroLab/MicroFab	**WIF-C**	**WIF-U**	**Total MESA**
Microsystems	212	11	0	**223**
Microsystems Partners	20	0	20	**40**
C&ES	25	82	38	**145**
C&ES Partners	0	0	50	**50**
Weapons	0	131	0	**131**
Directors and Staff	7	7	0	**14**
Growth	10	25	10	**45**
Total	**274**	**256**	**118**	**648**

2.5.4 Air Emissions

An initial estimate of air emissions data related to the Proposed Action was evaluated in the SNL/NM SWEIS (DOE, 1999). The Conceptual Design Report for MESA (SNL, 2000a) and process-specific information were used by SNL/NM to make more refined estimates of the chemical inventories and potential emissions.

For the purpose of this assessment, air emissions were evaluated according to the same methodology used for the SNL/NM SWEIS (Section 2.3.1). Under the methodology, chemicals that could cause air quality impacts at SNL/NM were identified through a progressive series of screening steps. Each successive step reduced the number of pollutants to only those chemicals that became chemicals of concern. The evaluation identified 15 chemicals that did not pass the initial screen. Emissions factors were developed for each chemical based on specific process knowledge regarding the equipment by which the chemicals would be used. These 15 chemicals and the associated data are provided in Table 2.4.

Note that total emissions are provided by facility rather than as a total. The methodology used is a point-of-emissions screening, which assumes that a hypothetical "receptor" is present at the stack and inhales 100% of the emissions. It is conservative, therefore, to consider the buildings separately, as each building would have one *or more* stacks from which chemicals could potentially be emitted.

The additional personnel required for program growth would be transferred from other SNL/NM operations. The proposed action will not involve hiring of new employees, and therefore would not result in an increase of carbon monoxide (CO) emissions from employee vehicles. Consequently, an air conformity analysis is not required.

Table 2.4 – Total Potential Air Emissions for MESA Operations

Chemical	MicroLab Emission (g/s)	MicroFab Emission (g/s)	TA[1] Emission (g/s)	MDL Emission (g/s)
Phosphine	NP[2]	6.30E-06	NP	3.78E-04
Arsine	NP	9.45E-06	NP	2.21E-05
Hydrogen Peroxide 37-39%	NP	1.52E-04	NP	NP
Hydrogen Peroxide 30%	NP	6.50E-04	1.34E-02	4.35E-04
Nitric Acid	3.18E-02	2.38E-02	9.14E-04	2.09E-02
Phosphoric Acid	1.07E-04	6.88E-03	1.07E-02	5.35E-03
Sodium Hydroxide	NP	1.88E-02	NP	0.00E+00
Potassium Hydroxide	NP	1.85E-02	2.80E-03	2.88E-04
Sulfuric Acid	NP	1.27E-03	9.80E-03	3.24E-03
1-Methyl 2-pyrrolidinone	5.70E-03	2.05E-02	2.46E-01	3.56E-02
Aluminum oxide anhydrous	NP	NP	NP	0.00E+00
Arsenic Trichloride	NP	5.56E-06	NP	NP
Chlorine	1.89E-04	1.89E-03	1.26E-03	3.62E-03
Ammonium Fluoride	NP	NP	1.96E-03	9.81E-03
Ammonium Hydroxide (29%)	NP	NP	1.44E-03	4.07E-03

[1]The Transition Area (TA) is a part of the MicroFab that is isolated from the rest of the facility for the purpose of avoiding cross-contamination among cleanroom processes.
[2]Not Present

2.5.5 Water Use and Liquid Effluents

The tool set proposed for the MicroFab portion of the MESA Complex includes industry standard continuous flow rinse bath design for the wet benches. Use of this tool set (equipment) would result in an increase in the projected water consumption and associated discharges for the MicroFab, and consequently for the MESA Complex overall.

Water conservation measures would be identified during the detailed design phase of the project. Current estimates indicate that water use for the Proposed Action would be approximately 375 million L/yr (99 MGY) with reasonably foreseeable water conservation efforts under normal operating conditions.

Wastewater would be produced through water use in restrooms, plating bath rinse water, chemical clean rinse water, soap and other cleaning solutions, process cooling water with rust inhibitors, and water from air handler condensation. All discharges from SNL/NM facilities are required to be below City of Albuquerque wastewater discharge standards. Routine discharges are periodically sampled to demonstrate compliance. These policies and procedures would remain in place under the Proposed Action. Wastewater generation would increase in proportion to water use under the Proposed Action. Process water recycling would result in a net discharge of wastewater of approximately 299 million L/yr (79 MGY) under normal operating conditions.

2.5.6 Waste Management

Operations under the Proposed Action would generate non-hazardous and hazardous wastes as well as very minor quantities of low-level radioactive wastes. The majority of the wastes are currently generated in the MDL and CSRL. Non-hazardous waste consists of materials such as office paper, cardboard, clean room attire, plastic, glass, scrap metal, packaging materials, and wood. Under the Proposed Action, MESA personnel would generate approximately 83,698 kg/yr (92 TPY or184,136 lbs/yr). This represents an increase of approximately 5,813 kg/yr (6.4 TPY or 12,788 lbs/yr), or approximately 7.5 %. Materials would be recycled as appropriate.

Under the Proposed Action, MESA activities would generate approximately 12,135 kg/yr (13.35 TPY or 26,697 lbs/yr) of hazardous waste, an increase of approximately 40% over the amount that would be produced under the No Action Alternative.

Activities conducted at the Gamma Cell 220 and the Shepard Cell would involve exposure of microelectronic components to radiation from sealed sources. These operations typically result in the generation of less than 1 kg/yr (2.2 lbs/yr) of low-level radioactive waste.

Zirconium heating elements (called thermal annealers) are used in high-heat growth-reactors (these are chemical reaction vessels, not nuclear reactors). These elements are shipped to SNL containing the zirconium which is a NORM, and must therefore be disposed of as low-level radioactive waste. Under the Proposed Action, approximately 477 kg (1049.4 lbs) of such waste would be generated annually.

2.5.7 Human Health and Safety

Worker health and safety protection would include modernized engineered controls in addition to the worker health and safety measures discussed in section 2.3.4.

3.0 AFFECTED ENVIRONMENT

The following sections include discussion of the local environment currently and potentially affected by construction and operation of the MESA Complex. A number of other resources, summarized below, were considered but are not discussed in detail because they would not be substantially impacted by the Proposed Action or No Action Alternative. The buildings and facilities that would be constructed and/or modified under the Proposed Action are located in an industrially developed area of TA-I at SNL/NM. Surrounding areas have been disturbed as a result of development of the area.

- *Biological Resources*–Previous surveys identified no threatened or endangered species. The site has been extensively disturbed by facility development and activity.
- *Cultural Resources*– The site of the proposed action has been completely surveyed for the presence of historic properties, such as archaeological sites or historic buildings. No known historic properties are present in the area affected by the proposed action.
- *Surface Water*– Natural water flow has already been interrupted by the previous site disturbances.
- *Socioeconomics*–Construction of the facility will require the services of architectural, engineering, and construction firms; however, such support will be temporary. New and upgraded facilities would be staffed primarily with existing personnel. No substantial long-term increases in employment or substantial increases in funding would result

3.1 Air

SNL/NM is located along the eastern margin of the regional area known as the Albuquerque Basin. The geography of this area, which consists of mountains, canyons, and the Rio Grande valley, greatly influences the meteorological conditions. Temperature inversions occur during the winter months, restricting dispersion and dilution of air pollutants in the basin area by trapping the pollution near the surface. The most important implication of meteorological variation across SNL/NM, however, is the effect of wind variability on transport and dispersion of pollutants. Wind characteristics vary across SNL/NM based on proximity to topographical and urban features. The mountains and canyons to the east create the predominant wind directions at SNL/NM. Dispersion occurs as a result of wind patterns developing from the complex interactions of the numerous geographic features. When constituents are emitted to the atmosphere, they are carried away from the source by wind transport and diluted by mixing with the ambient air.

Meteorological monitoring commenced at SNL/NM in January 1994. The 8-tower meteorological monitoring network consists of six 10-meter towers, one 60-meter tower, and one 50-meter tower. All towers are instrumented at the 3- and 10-meter levels. Instrumentation is also installed at the top of the tall towers. Meteorological variables measured at all tower levels include wind speed, wind direction, and temperature. Relative humidity, precipitation, and atmospheric pressure are also measured.

SNL/NM is located in the Albuquerque Middle Rio Grande Intrastate Air Quality Control Region. Under the national ambient air quality standards (NAAQS), Bernalillo County is currently in maintenance status for the CO NAAQS. Depending on emission levels, modification to existing sources or construction of new sources emitting CO may require a general or transportation conformity analysis as well as additional levels of controls to comply with the NAAQS. In addition, modification to existing sources or construction of new sources emitting the other criteria pollutants for which a pre-construction permit must be obtained are required to comply with the NAAQS.

SNL/NM manages air quality through the Environmental Management and Integrated Training Department. Compliance programs are divided between the Air Quality Compliance (AQC) Program, the Radiological National Emission Standards for Hazardous Air Pollutants (NESHAP) Program, and the Clean Air Network (CAN) Program, all of which are monitored by the Environmental Management and Integrated Training Department. Meteorological data and ambient air monitoring data assist the Environmental Management and Integrated Training Department in assessing the impact of emissions.

3.2 Water Resources

SNL/NM, southeast and adjacent to the city of Albuquerque, overlies the eastern portion of the main aquifer of the Albuquerque Basin and borders some of the most productive parts of the groundwater system that is currently the sole source for drinking water for the Albuquerque metropolitan statistical area (MSA). SNL/NM has instituted a management plan with matching water conservation goals as part of its total environmental management program. Some of the water protection programs routinely monitor water discharges and groundwater. Monitoring data is used to help assess SNL/NM’s effect on water quality.

The groundwater at SNL/NM is the source of drinking water for SNL/NM, KAFB, and adjacent portions of the city of Albuquerque and Pueblo of Isleta. Groundwater characteristics vary within the vicinity of KAFB. These characteristics include aquifer type, hydraulic properties, horizontal groundwater-flow directions, vertical hydraulic gradients, trends in water-level decline resulting from water supply pumping, and groundwater geochemistry. Many of these characteristics are directly related to the geologic media that provide the local framework for the regional aquifer.

Groundwater withdrawal from city of Albuquerque and KAFB water supply wells has resulted in significant changes to the groundwater flow regime in the aquifer system over the past 30 years, as discharge exceeds recharge. Water level declines have been occurring within the Albuquerque Basin since the 1960s, when significant increases in groundwater withdrawal began.

The surface water system within KAFB consists primarily of ephemeral drainages, including Tijeras Arroyo, Arroyo del Coyote, and an unnamed drainage south of Arroyo del Coyote. Storm water from TA-I is collected in a storm sewer system consisting of curb and gutter open channels, and underground pipes. The northwest portion of the TA-I system discharges into the KAFB storm sewer system. The remainder of TA-I storm water discharges directly to Tijeras Arroyo. Floods and runoff occur most commonly during the summer thunderstorm season (July through September), when approximately 50 percent (3.75 to 5 inches) of the average annual precipitation of 7.5 to 10 inches falls.

SNL/NM produces both sanitary and industrial effluents that are discharged to the city of Albuquerque’s sanitary sewer system. Sanitary effluents include wastewater from rest rooms, cafeterias, and other domestic activities. Industrial discharges originate from laboratory processes, general manufacturing, and experimental activities. SNL/NM monitors all its liquid effluent discharges and strives to minimize toxic pollutants through pollution prevention and waste minimization tactics. All discharges from SNL/NM facilities are required to be below City of Albuquerque wastewater discharge standards. Routine discharges are periodically sampled to demonstrate compliance. Non-routine (batch) discharges require approval from the City of Albuquerque prior to discharge. Discharges into the publicly owned treatment works (POTW) are regulated by the City of Albuquerque Public Works Department, Liquid Waste Division. All wastewater is treated by the city in accordance with National Pollutant Discharge Elimination System (NPDES) permit requirements before being discharged into the Rio Grande. Wastewater is currently produced by discharge from restrooms as well as microelectronics research, development, and production processes.

3.3 Population

SNL/NM is located in the Albuquerque, New Mexico metropolitan area, which is projected to reach a population of 700,000 by the year 2000. It is the fifth largest private employer in New Mexico and the third largest in Bernalillo County, providing employment for approximately 7580 people as of the end of FY97.

The facilities and infrastructure to be constructed, modified, and/or demolished are located in TA-I of SNL/NM. It is the most developed and populated of the tech areas at SNL/NM, with an employee population of approximately 6663.

3.4 Site Services

Security is provided by the SNL/NM Protection Services Department, which consists of dispatchers, an offensive force, and a defensive force. In addition, the SNL/NM Emergency Management Team provides planning for emergency preparedness and response, including the analysis of potential impacts of unmitigated and mitigated releases of chemicals and radioactive materials from accidents that could affect SNL/NM personnel and operations, natural phenomenon events, and security-related events. Fire protection is provided by the U.S. Air Force (USAF), which operates five fire stations located throughout KAFB.

The Occupational Health Programs Department services SNL/NM's medical needs by providing medical assistance and treatment of sick or injured personnel.

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes and compares the environmental consequences of the No Action Alternative and the Proposed Action for the MESA Complex. Descriptions of the No Action and Proposed Action alternatives are provided in Chapter 2 of this EA, and affected aspects of the environment are discussed in Chapter 3. The following sections compare potential environmental consequences of the two alternatives. Other aspects of the environment were considered in the scoping of the analysis; however, only those potentially affected by the proposed project are discussed in this chapter.

The Proposed Action and No Action alternatives would both result in air emissions, waste generation, process and facility water use, and discharge of liquid effluents into the Albuquerque sanitary sewer system. Table 4.1 comparatively summarizes air emissions and other waste volumes related to operations under the No Action Alternative and the Proposed Action. The issues summarized in the table are addressed in the following sections.

Table 4.1 – Comparison of Estimated Annual Emissions, Water Use, and Wastes for the No Action and Proposed Action Alternatives

Emissions and Wastes	No Action Alternative	Proposed Action
Construction and Demolition		
Air Emissions/Conformity		
Construction - Year 1	NA	4.16 TPY
Construction - Year 2	NA	2.12 TPY
Construction - Year 3	NA	0.50 TPY
CSRL Demolition	NA	0.04 TPY
Hazardous Waste		
Acid Exhaust System Upgrade	941 kg (1 ton)	941 kg (1 ton)
CSRL Demolition	NA	22 kg (48.4 lbs) + 200.6 L (53 gal)
Bulk Storage Tank Demolition	NA	None
Total Construction/Demolition	NA	963 kg (1.1 tons) + 200.6 L (53 gal)
Asbestos	NA	45,455 kg (50 tons)
Non-Hazardous Waste		
Acid Exhaust System Upgrade	16,523 kg (36,350 lbs)	16,523 kg (18 tons)
CSRL Demolition	NA	2.1 million kg (2,300 tons)
Bulk Storage Tank Demolition	None	None
Total Construction/Demolition	16,523 kg (36,350 lbs)	2.12 million kg (2,328 tons)
Operations		
Air Emissions	Passes screen (see Section 4.3.1)	Passes screen (see Section 4.6.1)
Hazardous Waste	8,649 kg/yr (9.51 TPY)	12,135 kg (13.35 TPY)
Low-Level Radioactive Waste	382 kg (840.4 lbs)	477 kg (1,049.4 lbs)
Water Use	302 million L/yr (79.8 MGY)	375 million L/yr (99 MGY)
Wastewater Discharge	302 million L/yr (79.8 MGY)	299 million L/yr (79 MGY)
Non-hazardous Waste[1]	77,876 kg/yr (85.67 TPY)	83,698 kg/yr (92.07 TPY)

[1] Includes recycled materials discussed in Section 2.3.3.

4.1 No Action Alternative

Microelectronics operations would continue under the current configuration under the No Action Alternative. Facilities, infrastructure, equipment, and staffing level would be maintained, and any environmental consequences associated with current operations would continue to exist.

4.2 No Action Alternative Facility Renovation Activities

No new construction is associated with the No Action Alternative. Planned renovations to the MDL allowing for conversion from current processes utilizing 6-inch silicon wafers to processes utilizing 8-inch wafers would be completed. Effects on air quality, water use, or human health resulting from construction would remain unchanged. Minor quantities of renovation-related waste would be generated by these activities.

4.2.1 Waste Management

Under the No Action Alternative, replacement of the MDL Acid Exhaust System would result in the generation of approximately 941 kg (2070 lbs) of hazardous waste and 16,523 kg (36,350 lbs) of non-hazardous construction waste. This waste would be handled through existing waste management procedures, and would not adversely affect SNL/NM's waste management system.

4.3 No Action Alternative Operations

Description of the projected environmental effects of the No Action Alternative is based on information available from the SNL/NM SWEIS (DOE, 1999), the FSID (SNL, 1998) chapters for the MDL and the CSRL, and the Conceptual Design Report for MESA (SNL, 2000). The following sections are organized according to environmental issues. Discussion of each issue is inclusive of effects or potential effects of all associated operations and emissions, and is not facility- or process-specific.

4.3.1 Air Emissions

The SWEIS examined approximately 465 chemicals used at SNL/NM as potential components of routine emissions (Section 5.3.8 of the SWEIS). Occupational Exposure Limits (OELs; a time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect) were identified for each of these chemicals, and a "screening" value of the OEL divided by 100 (for conservatism) was established for determining whether emissions factors for each chemical should be developed. This "screening" value is called the Threshold Emission Value (TEV). The initial screening was based on total inventory (in essence, this screening assumed that the entire quantity of a given chemical would be emitted). A chemical passed the screen if a theoretical release of the entire inventory did not cause the TEV to be exceeded. Facility-specific emissions factors were developed for those chemicals that did not pass the initial screening. After applying facility-specific emissions factors, chemicals were screened again to determine whether the TEV was exceeded. Chemicals also passed this screen if the TEV was not exceeded. All of the chemicals used at the MDL and CSRL passed either the first or the second test, and no further analysis was required. The SWEIS concluded that normal operations at SNL/NM, including the No Action Alternative for this environmental assessment, would not likely result in degradation of air quality.

4.3.2 Water Use and Liquid Effluents

Water use was estimated only as a total for SNL/NM and for key facilities in the SNL/NM SWEIS. Water use at the MDL and the CSRL represents the majority of water-consumption for current activities related to MESA, and is estimated at 302 million L/yr (79.8 MGY; 291 million L/yr [77 MGY] for the MDL and 10.6 million L/yr [2.8 MGY] for the CSRL) for the No Action Alternative. The No Action Alternative would not result in a change in water use.

4.3.4 Waste Management

The No Action Alternative would not result in changes to existing waste storage, transportation, or other related processes are anticipated under the No Action Alternative. Waste volumes that would be generated under the No Action Alternative, including non-hazardous, hazardous, and low-level radioactive waste are described in Section 2.3.3 and summarized in Table 4.1. All wastes would continue to be managed by SNL/NM's waste management program.

4.3.5 Human Health and Safety

Current operations utilize hazardous chemicals and other substances that may affect human health and safety.

Air is the primary pathway for possible worker or public exposure; however, no adverse human health effects would be expected to occur from HAP exposure resulting from the No Action Alternative. The chemicals and solvents used in the current processes are common industrial materials.

Engineering and administrative controls are enforced at the MDL and CSRL to ensure that workers are not exposed to chemicals beyond the permissible exposure limits (PELs) established by the OSHA. Hazards from chemicals in the facility are controlled through engineered barriers, such as fume hoods, local exhaust ventilation, closed containers, closed loop systems, and volume limits. Potential scenarios for accidental exposure to chemicals would continue to be handled in accordance with provisions outlined in the SNL/NM ES&H Manual, Chapter 6, Industrial Hygiene (SNL, 2000b).

According to the SNL/NM SWEIS (DOE, 1999), impacts for the entire SNL/NM workforce are projected to be zero fatalities per year and 1 or 2 confirmed chemical exposures annually. No measurable effects on worker health and safety are anticipated to result from chemical exposure under the No Action Alternative.

4.4 Proposed Action

Under the Proposed Action, the MicroFab, MicroLab, WIF-C, and WIF-U would be constructed. Renovations to the MDL that would be performed under the No Action Alternative would also be performed under the Proposed Action. Current operations would be expanded, activities currently performed at the CSRL would be relocated to the MESA Complex, and CSRL would be demolished. The following sections summarize potential environmental consequences associated with the Proposed Action.

4.5 Proposed Action Construction and Demolition Activities

Modifications, renovation, and construction of facilities necessary for implementation of the Proposed Action would result in short-term environmental effects, including noise generated by construction, fugitive dust, and safety and security issues associated with construction personnel on the site. However, these effects would be minimal and confined to relatively small areas for short periods of time.

4.5.1 Construction/Demolition Air Conformity

No discernible changes in air quality are anticipated as a result of Proposed Action construction activities. CO emissions from equipment used for construction would affect air emissions under the Proposed Action. However, construction-related CO emissions are projected to be less than 4.16 TPY during the year of greatest activity, and demolition-related CO emissions are projected to be approximately 0.04 tons over a period of approximately one month, which is less than the 100 TPY threshold requiring a conformity analysis; therefore, a conformity analysis is not required. Water would be used for dust suppression as appropriate.

4.5.2 Water Use and Liquid Effluents

Water use during construction for installation of equipment and dust suppression would occur during the construction process. The short-term increase in water use due to construction activities is anticipated to be negligible in comparison to SNL/NM's site-wide water use.

4.5.3 Waste Management

Generation and proper management of construction wastes related to the MESA Complex Proposed Action would not exceed the capacity of existing waste management systems. Typical construction debris, as identified in Section 2.4.5, would be generated from demolition and building renovations and modifications under the Proposed Action. Demolition of the CSRL would result in the generation of approximately 2.1 million kg (2,300 tons or 4.6 million lbs) of standard construction waste.

Construction projects are common at SNL/NM; wastes associated with construction are considered routine and are managed according to prescribed procedure. Waste generated during construction of the Proposed Action would be stored in dumpsters prior to disposition. Current plans call for disposal of standard construction waste in the Kirtland Air Force Base construction waste landfill.

It is anticipated that approximately 22 kg (48.4 lbs) of solid hazardous waste and 200.6 L (53 gallons) of liquid hazardous waste would be generated from demolition of the CSRL. These wastes would be managed through SNL/NM's hazardous waste program. Demolition of the bulk acid and base storage tanks for the MDL AWNS is not anticipated to generate substantial quantities of hazardous waste. Upgrades to the MDL Acid Exhaust System would generate approximately 941 kg (1 ton) of hazardous waste. Construction and demolition activities related to the Proposed Action would therefore generate approximately 963 kg (1.1 tons) of hazardous waste in total. This waste would be managed through existing waste management processes and would not adversely affect SNL/NM's waste management systems.

As much as 45,455 kg (50 tons or 100,000 lbs) of asbestos-containing materials may be present in the CSRL. Any asbestos encountered during the demolition activities would be removed according to SNL/NM asbestos management procedures. Current procedures involve disposal of asbestos at the Kerrs Environmental Mountainair Monofill Facility.

4.5.4 Health and Safety

Little effect on worker health and safety is anticipated as a result of construction and demolition activities associated with the Proposed Action. Workers would likely have limited if any exposure to chemical hazards during expansion of the MDL, demolition of the bulk storage tanks, and demolition of the CSRL. Hazards would be limited to those commonly associated with construction activities and would be analyzed prior to performing the work. Worker protection measures, including hazard training, work procedures, and the use of personal protective equipment (PPE), would be enforced.

4.6 Proposed Action Operations

Implementation of the Proposed Action would result in a minor expansion of current operations and relocation of activities currently performed at the CSRL. The following sections describe the environmental consequences of increased production that could result from implementation of the Proposed Action.

4.6.1 Air Emissions

Chemical emissions identified under the No Action Alternative would also be generated under the Proposed Action. This would include all HAP chemicals used by the Proposed Action.

Anticipated air emissions and the resulting consequences were analyzed using the same methodology used for the analyses supporting the SNL/NM SWEIS (DOE 1999). With the completion of the Conceptual Design Report for MESA (SNL, 2000a), more precise projections of chemical inventories and the resulting air emissions are possible. A list of chemicals projected to be present at the MESA complex was evaluated to determine whether release of the entire inventory of each chemical would exceed the TEV. The initial screening identified 15 chemicals for which process knowledge would be needed to determine whether additional air emissions modeling would be required. For each of these chemicals, an emission rate was calculated based on process knowledge, equipment specifications, and other specific information. In all cases, these refined emission estimates were below the threshold emission values; therefore, additional dispersion modeling was not required, and no degradation of air quality is anticipated. The emissions from facilities at which chemicals are used in large quantities as well as the TEV for each chemical are provided in Table 4.2.

Table 4.2 – Air Quality Second-Level Screening Results For the Proposed Action

Chemical	MicroLab Emission	Microfab Emission	TA[1] Emission	MDL Emission	TEV
Phosphine	NP[2]	6.30E-06	NP	3.78E-04	1.65E-03
Arsine	NP	9.45E-06	NP	2.21E-05	1.89E-03
Hydrogen Peroxide 37-39%	NP	1.52E-04	NP	NP	1.65E-02
Hydrogen Peroxide 30%	NP	6.50E-04	1.34E-02	4.35E-04	1.65E-02
Nitric Acid	3.18E-02	2.38E-02	9.14E-04	2.09E-02	5.91E-02
Phosphoric Acid	1.07E-04	6.88E-03	1.07E-02	5.35E-03	1.18E-02
Sodium Hydroxide	NP	1.88E-02	NP	0.00E+00	2.36E-02
Potassium Hydroxide	NP	1.85E-02	2.80E-03	2.88E-04	2.36E-02
Sulfuric Acid	NP	1.27E-03	9.80E-03	3.24E-03	1.18E-02
1-Methyl 2-pyrrolidinone	5.70E-03	2.05E-02	2.46E-01	3.56E-02	9.46E-01
Aluminum oxide anhydrous	NP	NP	NP	0.00E+00	1.77E-02
Arsenic Trichloride	NP	5.56E-06	NP	NP	2.36E-05
Chlorine	1.89E-04	1.89E-03	1.26E-03	3.62E-03	1.77E-02
Ammonium Fluoride	NP	NP	1.96E-03	9.81E-03	2.96E-02
Ammonium Hydroxide (29%)	NP	NP	1.44E-03	4.07E-03	2.13E-01

[1]The Transition Area (TA) is a part of the MicroFab that is isolated from the rest of the facility for the purpose of avoiding cross-contamination among cleanroom processes.
[2]Not Present

Note that screening is performed by facility rather than as a total. The methodology used is a point-of-emissions screening, which assumes that a hypothetical "receptor" is present at the stack and inhales 100% of the emissions. It is conservative, therefore, to consider the buildings separately, as each building would have one or more stacks from which chemicals could potentially be emitted.

4.6.2 Water Use and Liquid Effluents

The water use resulting from the Proposed Action would be approximately 375 million L/yr (99 MGY) under normal operational conditions, an increase of approximately 72.7 million L/yr (19.2 MGY) over the No Action Alternative. Water use under the Proposed Action would represent an increase in SNL/NM's total water use from approximately 1.87 billion L/yr (495 MGY) under the SWEIS Expanded Operations Alternative (excluding MESA) to 1.95 billion L/yr (514.2 MGY), or approximately 4%.

Liquid effluent generated by the Proposed Action, with recycling, would be approximately 299 million L/yr (79 MGY), a decrease of approximately 3.0 million L/yr (0.8 MGY) resulting from water recycling efforts. This represents a decrease in SNL-wide effluent generation of less than 1%.

The capacities of the water supply and effluent discharge systems are 7.57 billion L per year (2 billion gallons per year) and 3.22 billion L per year (840 MGY), respectively. Both water use and liquid effluent generation will be less than half the capacity of the systems; therefore, the increase in water use would not substantially affect current or projected water supply to SNL/NM, and decreased liquid effluent would not affect SNL/NM's ability to discharge wastewater. No modifications to either system, other than routine connections between the systems and the facilities, would be required. Both the increase in water use and the decrease in effluent discharge would be minor.

4.6.3 Waste Management

Nonhazardous solid waste volumes would increase to 83,698 kg/yr (92 TPY or 184,136 lbs/yr), an approximately 7.5% increase in waste volume compared to waste generation under the No Action Alternative. However, collection and disposal of these wastes would remain within the capacity of existing facilities and operations.

Hazardous waste volumes would be approximately 12,135 kg/yr (13.35 TPY or 26,697 lbs/yr) kg/yr, an increase of approximately 40 percent over volumes estimated for the No Action Alternative. Management of this quantity of waste remains within the capacity of existing hazardous waste management systems at SNL/NM.

Low-level radioactive waste would increase from 382 kg/yr (838.4 lbs/yr) to 478 kg/yr (1,049 lbs/yr), nearly all of which would be zirconium, a NORM. The additional low-level radioactive waste represents a minor increase, and would not adversely affect SNL's waste management system.

4.6.4 Human Health and Safety

The Proposed Action would not result in substantially increased risks to workers and the public. Analysis of human health impacts in the SNL/NM SWEIS supports the conclusion that any increase in human health risk would be a result of a larger employee population, rather than introduction of new or unique hazards. Impacts expected would be zero fatalities per year, approximately 326 nonfatal injuries/illnesses per year, and 1 or 2 confirmed chemical exposures per year (DOE, 1999).

However, the increase in employee population (an additional 45 employees) resulting from the Proposed Action would be relatively minor. Modernization would include engineered controls to enhance worker safety; therefore, hazards to workers – and the resulting impacts including injuries and exposure-related illness – would likely decrease slightly under the Proposed Action.

4.7 Cumulative Effects

Cumulative effects of SNL/NM operations, including the Proposed Action, were evaluated as part of the cumulative impact analysis in the SNL/NM SWEIS, Chapter 6 (DOE, 1999a). This analysis, which evaluated SNL/NM operations in the context of other DOE, DoD, Federal, State, and local activities, is incorporated by reference in this environmental assessment. The consequences of the Proposed Action represent only a fraction of the impacts of these activities, and would not add substantially to the cumulative impacts evaluated in the SWEIS. Therefore, the effects of the Proposed Action, when combined with the effects resulting from common issues of actions taken by DOE, DoD, Federal, State, and local entities, do not result in cumulatively significant effects.

4.8 Abnormal Occurrences

Abnormal occurrences in the form of accidents were assessed in the SNL/NM SWEIS. The bounding accident for the MESA project was an aircraft crash into one of the facilities. The accident analysis concluded that hazardous chemicals released by the crash, especially arsine (which is flammable),and phosphine (which is pyrophoric), would be consumed in the fire resulting from the crash. The analysis concluded that such an accident would not result in off-site impacts.

Review of the currently projected chemical inventory provided no indication that changes in the quantity or type of chemicals would affect the findings of the initial accident analysis. Therefore, the SWEIS accident analysis remains valid for both the No Action Alternative and the Proposed Action, and no off-site effects would be anticipated.

5.0 REFERENCES

SNL (Sandia National Laboratories/New Mexico), September 1998, *Facilities and Safety Information Document*, Sandia National Laboratories, Albuquerque, New Mexico.

SNL (Sandia National Laboratories/New Mexico), 2000a, *Conceptual Design Report for MESA*, Sandia National Laboratories, Albuquerque, New Mexico.

SNL (Sandia National Laboratories/New Mexico), 2000b, *Sandia National Laboratories Environment, Safety and Health Manual*, Corporate Policy Requirement (CPR) 400.1.1, MN471001, Issue CT, June 29, 2000.

U. S. Department of Energy, October 1999, *Sandia National Laboratories/New Mexico Final Site-Wide Environmental Impact Statement*, *Albuquerque, New Mexico*, DOE/EA-0576, U. S. Department of Energy Office of Defense Programs, Washington, D.C.

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EH-42

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

MICROSYSTEMS AND ENGINEERING SCIENCES APPLICATIONS (MESA) COMPLEX
At
SANDIA NATIONAL LABORATORIES, NEW MEXICO

The United States Department of Energy (DOE) has prepared an environmental assessment (EA) for the Microsystems and Engineering Sciences Applications (MESA) Complex at Sandia National Laboratories, New Mexico. The EA analyzes the potential effects of constructing several new facilities and upgrading existing facilities for the purpose of consolidating operations currently conducted at several facilities at SNL/NM and modernizing the Laboratories' capabilities in microsystems design and production. The EA analyzes effects on health, safety, and air quality that may result from construction and operation and associated cumulative effects. A detailed description of the proposed action and its environmental consequences is presented in the EA.

Based on the analysis presented in the EA and the concerns of interested stakeholders, the DOE finds that there would be no significant impacts associated with the proposed action. DOE makes this Finding of No Significant Impact pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.), the Council on Environmental Quality implementing regulations (40 CFR 1500), and the DOE NEPA regulations (10 CFR 1021). The proposed action does not constitute a major federal action that would significantly affect the human environment within the mandate of NEPA. Therefore, no environmental impact statement is required for this proposal.

Signed in Albuquerque, New Mexico this 16th day of October, 2000

Michael J. Zamorski
Area Manager
Kirtland Area Office