1 of 2

ENVIRONMENTAL ASSESSMENT
for the
RADIOACTIVE AND MIXED WASTE
MANAGEMENT FACILITY

Sandia National Laboratories/New Mexico

June 1993

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

MASTER

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**FINDING OF NO SIGNIFICANT IMPACT
RADIOACTIVE AND MIXED WASTE MANAGEMENT FACILITY
SANDIA NATIONAL LABORATORY, ALBUQUERQUE**

PROPOSED ACTION: The Department of Energy (DOE) has prepared an environmental assessment (EA) (DOE/EA-0466) under the National Environmental Policy Act (NEPA) of 1969 for the proposed completion of construction and subsequent operation of a central Radioactive and Mixed Waste Management Facility (RMWMF), in the southeastern portion of Technical Area III at Sandia National Laboratory, Albuquerque (SNLA). The RMWMF is designed to receive, store, characterize, conduct limited bench-scale treatment of, repackaging, and certify low-level waste (LLW) and mixed waste (MW) (as necessary) for shipment to an offsite disposal or treatment facility.

The RMWMF was partially constructed in 1989. Due to changing regulatory requirements, planned facility upgrades would be undertaken as part of the proposed action. These upgrades would include paving of road surfaces and work areas, installation of pumping equipment and lines for surface impoundment, and design and construction of air locks and truck decontamination and water treatment systems. The proposed action also includes an adjacent corrosive and reactive metals storage area, and associated roads and paving.

LLW and MW generated at SNLA would be transported from the technical areas to the RMWMF in containers approved by the Department of Transportation. The RMWMF would not handle nonradioactive hazardous waste.

ADDRESSES AND FURTHER INFORMATION:

For copies of the EA or information about the proposed action, contact:

Susan Lacy, NEPA Point-of-Contact
Kirtland Area Office
U.S. Department of Energy
P.O. Box 5400
Albuquerque, NM 87115
(505) 845-5542

For further information about the DOE NEPA process, contact:

Carol Borgstrom, Director
Office of NEPA Oversight
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585
(202) 586-4600 or (800) 472-2756

ENVIRONMENTAL IMPACTS: The completion of construction and operation of the RMWMF would have no significant impact on the following resources: Federal threatened or endangered species, state threatened or endangered species, floodplains, wetlands, cultural resources, groundwater, or surface water.

No releases of hazardous materials are anticipated from routine operations of the RMWMF. The greatest potential chemical exposure to workers could come from inorganic solvent fumes when waste drums are opened. However, virtually all exposure to such fumes would be eliminated by a proposed hooded ventilation system.

The maximum annual radiation dose to an off-site individual from operation of the RMWMF (at the Isleta Gate, with no residential population) would be 1.6×10^{-3} mrem/yr. The EPA National Emission Standard is 10 mrem/yr. The maximum annual dose to a facility worker, resulting from release of tritium during routine operations, would be 1.7×10^{-2} mrem/yr. Based on the information provided in the EA, the health risks of such exposures are trivial.

The maximum reasonably foreseeable accident involving the RMWMF would be an aircraft crash resulting in the destruction of the facility and a fire that consumes the combustible contents of the facility. The estimated probability of such an accident is 1.3×10^{-6} /yr. The calculated effective dose equivalent for the maximally exposed off-site individual from this accident would be 0.38 rem. The maximum dose to a facility worker from this accident would be 11 rem. The crash would also result in the death or injury of the aircraft crew, passengers, and RMWMF personnel. Taking account of the low probability of such an event and the magnitude of the consequences that are related to the proposed action, the total risk posed by the accident is small.

ALTERNATIVES CONSIDERED:

- o **No Action.** Under this alternative, LLW and MW would continue to be generated in the SNLA technical and test areas. The existing facilities for waste handling at the generator sites cannot, however, provide the functions required to satisfy applicable environmental and transportation requirements and the waste acceptance criteria of an off-site disposal facility.
- o **Decentralized Waste Management Facilities.** Under this alternative, all required waste storage, characterization, processing, packaging, and certification functions would be conducted at the point of generation rather than at a centralized RMWMF. Significant cost increases over those of the proposed action would result with no environmental benefit compared to the proposed action.

Three other alternatives to the proposed action were considered and rejected as unreasonable: (1) immediate shutdown of all facilities generating LLW; (2) development of an onsite shallow burial facility for LLW; and (3) use of alternative technologies for waste treatment, such as incineration.

DETERMINATION: Based on the analysis in the EA, the proposed completion of construction and operation of the RMWMF does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA. Therefore, preparation of an environmental impact statement for the proposed action is not required.

Issued at Washington D.C., April 23, 1993.

Peter N. Brush
Acting Assistant Secretary
Environment, Safety and Health

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ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ACRR	Annular Core Research Reactor
AIA	Albuquerque International Airport
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CDP	Census Designated Place
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CWMC	Consolidated Waste Management Complex
CY	Calendar Year
DBE	Design Basis Earthquake
DBF	Design Basis Fire
DOE	Department of Energy
DOE/AL	Department of Energy, Albuquerque Field Office
DOT	Department of Transportation
EA	Environmental Assessment
EDE	Effective Dose Equivalent
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FONSI	Finding of No Significant Impact
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation and Air Conditioning
HWSA	Hazardous and Solid Waste Amendment
I	Interstate
ICRP	International Commission on Radiological Protection
IDLH	Immediately Dangerous to Life or Health
KAFB	Kirtland Air Force Base
KTF	Kauai Test Facility
LDR	Land Disposal Restrictions
LET	Linear Energy Transformation
LLW	Low-Level Radioactive Waste
LPG	Liquid Petroleum Gas
MDL	Minimum Detectable Level
MW	Mixed Waste
MWL	Mixed Waste Landfill

ACRONYMS AND ABBREVIATIONS *(continued)*

NCRP	National Council on Radiation Protection and Measurements
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NM	Nuclear Material
NMED	New Mexico Environment Department
NRC	Nuclear Regulatory Commission
NSPS	New Source Performance Standards
NTS	Nevada Test Site
OSHA	Occupational Safety and Health Administration
PBFA II	Particle Beam Fusion Accelerator II
PEIS	Programmatic Environmental Impact Statement
POTW	Publicly Owned Treatment Works
RCRA	Resource Conservation and Recovery Act
RMWMF	Radioactive and Mixed Waste Management Facility
R&D	Research and Development
SDF	Strategic Defenses Facility
SMSA	Standard Metropolitan Statistical Area
SNL	Sandia National Laboratories
SNM	Special Nuclear Material
SOP	Standard Operating Procedure
SPR	Sandia Pulsed Reactor
SSB	Safety Storage Building
STL	Simulation Technical Laboratory
TLD	Thermoluminescence Dosimeter
TLV	Threshold Limit Values
TRU	Transuranic
TTR	Tonopah Test Range
TWA	Time-Weighted Average
UBC	Uniform Building Code
U.S.	United States
U.S.G.S.	U.S. Geological Survey
WAC	Waste Acceptance Criteria
WAF	Waste Assay Facility

CHEMICAL ABBREVIATIONS

Ag	Silver	^3H	Tritium
Am	Americium	Hg	Mercury
Ar	Argon	I	Iodine
As	Arsenic	Kr	Krypton
Au	Gold	Li	Lithium
Ba	Barium	Mn	Manganese
Be	Beryllium	N	Nitrogen
Bi	Bismuth	Na	Sodium
C	Carbon	Ni	Nickel
Cd	Cadmium	O	Oxygen
Ce	Cerium	Pb	Lead
Cf	Californium	Pm	Promethium
Cl	Chlorine	Po	Polonium
Cm	Curium	Pu	Plutonium
Co	Cobalt	Sr	Strontium
Cr	Chromium	Th	Thorium
Cs	Cesium	U	Uranium
Eu	Europium	Zn	Zinc
Fe	Iron		

UNIT ABBREVIATIONS

\$	American Dollars	m	meter
°C	Degrees Centigrade	mi	mile
Ci	Curie	person-rem	radiation dose
dBA	Unit of Measurement of Noise		equivalent to
erg	$1 \text{ gm-cm}^2/\text{sec}^2$		population
°F	Degrees Fahrenheit	ppm	parts per million
ft	feet	R	roentgen (unit of
gal	gallon		radiation exposure)
gm	gram	rad	unit of absorbed dose
ha	hectare (10,000 square meters)	rem	unit of radiation dose
			equivalent
hr	hour	sec	second
in	inch	x/q	ratio of air concentration to
°K	Kelvin		pollutant release
l	liter	yr	year
%	percent		
lb	pound		

SYSTEM INTERNATIONAL PREFIXES

<i>Exponent</i>	<i>Prefix</i>	<i>Symbol</i>
10^3	Kilo	K
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n

SECTION 1.0

PURPOSE AND NEED

1.0 PURPOSE AND NEED

Sandia National Laboratories/New Mexico (SNL/New Mexico) is a research and development (R&D) organization operated by Sandia Corporation, a prime contractor for the United States (U.S.) Department of Energy (DOE). The corporation, which is a wholly-owned subsidiary of American Telephone & Telegraph, provides service to the government on a nonprofit, no-fee basis. The major responsibilities are national security and energy projects. The primary mission of SNL/New Mexico is the design and development of non-nuclear portions of weapons systems, which includes designing the arming, fusing, and firing systems used in nuclear bombs and warheads. Safety, reliability, and survivability of weapon systems receive primary emphasis.

Nonweapon research programs include nuclear reactor safety studies for the U.S. Nuclear Regulatory Commission (NRC); development of safe transport and storage systems for nuclear materials; radioactive waste disposal techniques and site studies; pulsed power research; thermonuclear fusion research; solar energy research; vertical axis wind turbine research; and fossil fuel and geothermal energy research.

From 1957 to 1988, low-level radioactive waste (LLW) and mixed waste (MW) generated by various programs conducted by SNL/New Mexico were disposed of at the Mixed Waste Landfill (MWL) disposal site located in Technical Area III at SNL/New Mexico. This site is no longer available to accept LLW or MW for disposal due to DOE requirements prohibiting further disposal. While the onsite land disposal site is closed by DOE standards, formal closure under the Resource Conservation and Recovery Act (RCRA) will occur at a later date. SNL/New Mexico is currently preparing an Action Plan pursuant to the requirements of DOE Order 5820.2A (DOE, 1988c) for closure. SNL/New Mexico is currently following the RCRA Facility Inspection/Corrective Measures Study process. As a result, SNL/New Mexico needs a facility that could receive, characterize, process, repackage, certify, and store LLW and MW prior to shipment of the waste for offsite treatment or disposal. This capacity is required to meet storage and treatment regulations and offsite disposal facility requirements. At present, LLW and MW are stored under RCRA interim status at generator storage sites or in containers above the inactive MWL disposal site.

To meet this need, DOE is proposing to complete construction of and to operate a Radioactive and Mixed Waste Management Facility (RMWMF) at SNL/New Mexico that would serve as a centralized facility for receipt, characterization, compaction, limited bench-scale treatment (if necessary), repackaging, certification, and storage of LLW and MW generated at the site. The RMWMF would be used for extended storage until a low-level and mixed waste disposal site is identified that could accept these materials. The volume of low-level and mixed waste would vary depending on the storage time required before the waste could be shipped for disposal. In no case, however, would the total activity exceed the amounts listed in Table 2-3 for the RMWMF without prior DOE approval of a modification of the EA and the Safety Analysis Report. This facility would enable SNL/New Mexico to handle and store the waste in compliance with applicable requirements of Federal, State, and local environmental regulations, DOE Orders, and offsite waste acceptance criteria. In addition, the new facility would allow SNL/New Mexico to prepare the waste for shipment for treatment and disposal in accordance with specific requirements regarding waste certification, packaging, and transport.

RCRA is a primary factor in the proposed operation of the RMWMF. While RCRA applies only to hazardous waste, the State of New Mexico has received authority to regulate the hazardous portion of MW under RCRA from the U.S. Environmental Protection Agency (EPA). DOE submitted a RCRA Part A Permit Application to the State of New Mexico in September 1990. The Part B Permit Application will be prepared and submitted to the State when requested. SNL/New Mexico is currently operating under interim status.

SECTION 2.0

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Low-level waste and mixed waste are generated by weapons testing R&D as well as by nonweapons R&D activities conducted in the technical areas of SNL/New Mexico. LLW is waste that contains radioactivity and is not classified as high-level waste, transuranic (TRU) waste, spent nuclear fuel, or by-product material (DOE, 1988c). MW refers to waste containing a mixture of radioactive and hazardous contaminants as defined by RCRA. As the definition indicates, the classification of waste as LLW is not based explicitly on the activity levels of the waste, but on the source and concentration of TRU and other radionuclides. Thus, the concentration of non-TRU elements (and for gamma-emitters the external exposure rates) in LLW could vary significantly from trace levels to very high levels. TRU waste is categorized differently and TRU waste is defined as waste contaminated with alpha-emitting transuranic isotopes with half-lives greater than 20 years and concentrations greater than 100 nanocuries (nCi, or 10^{-9} Ci) per gram (gm) of waste. High-level waste and spent nuclear fuel are specifically excluded by this definition (DOE, 1986).

In order to minimize radiation exposures to both workers and the public, the methods for handling, treating, storing, and shipping LLW is strongly dependent on the activity levels of the waste. LLW and MW have historically been disposed of onsite at SNL/New Mexico by shallow-land burial at the mixed waste landfill (MWL) in Technical Area III. This disposal facility is scheduled for closure under the DOE Environmental Restoration (ER) Program and has not accepted LLW or MW for disposal since December 1988 (SNL, 1989c). Both LLW and MW are currently being stored onsite at generator locations and at the inactive disposal site until arrangements can be made for offsite disposal or treatment in a permitted facility. The current inventory of this waste is approximately 15,000 cubic feet (ft³). The Nevada Test Site (NTS) has been identified as a potential offsite disposal facility in the SNL/New Mexico draft Waste Disposal Site Application (SNL, 1989d). If NTS is unable to accept waste from SNL/New Mexico, another facility will be identified.

Because its present land disposal facility can no longer accept this waste, SNL/New Mexico must identify a means by which LLW and MW can be properly handled and stored. This section describes the waste generated at SNL/New Mexico and the proposed approach to handling it to ensure that all applicable Federal, State, and local requirements are met and that the health and safety of its employees and surrounding populace are assured.

The Proposed Action addressed by this EA is to complete construction and to operate a facility at SNL/New Mexico to store, process, package, and certify LLW and MW for offsite disposal. Also included as part of the Proposed Action are planned facilities upgrades consisting of:

- Installation of adjacent reactive metals and solvents storage containers;
- Paving of the main road and work surfaces to the facility gate;
- Installation of pumping equipment and lines for the surface impoundments;
- Design and construction of air-locks; and
- Design and construction of the truck decontamination and water treatment systems.

Alternatives to the Proposed Action analyzed by this EA are:

- No Action (continuation of current practice); and
- Decentralized LLW and MW management facilities located at points of waste generation.

Waste Generation at SNL/New Mexico

LLW and MW are generated at five major technical areas and several remote areas within SNL/New Mexico on Kirtland Air Force Base (KAFB) (Figure 2-1) and at several offsite facilities. Each technical area (Technical Areas I through V) has its own distinct operation.

Technical Area I is dedicated primarily to the design and development of weapons systems and weapons systems components. Many diverse operations are conducted in Technical Area I at several experimental laboratories. The generated waste includes:

- Residues from the preparation of samples of depleted uranium for electron microscopy;
- Liquid scintillation cocktail vials with tritium, swipes, and other material containing gamma contamination;
- Depleted uranium residues from machine shop operations;
- Classified weapons components with depleted uranium and trace amounts of tritium;
- Equipment contaminated with tritium and/or activation products;

Figure 2-1. SNL/New Mexico Technical Areas in Relation to KAFB

- Spent resins containing trace amounts of Cobalt-60 (^{60}Co); and
- Other waste with activation products or radioactive tracers (such as strontium or technetium).

MW composed of depleted uranium, oils, solvents, cadmium, beryllium, lithium, and lead is also generated.

Technical Area II is a small facility developed to support Technical Area I explosive testing needs. Most of the currently-generated radioactive waste from Technical Area II is tritium (^3H)-contaminated debris. This waste includes electronic components contaminated with lead, trace inorganic solvents, clean-up debris, decontamination materials, and contaminated equipment. Small volumes of short-lived, proton-activated metal waste are also generated in this area.

Technical Area III comprises 20 test facilities, which include extensive environmental test facilities (such as sled tracks, centrifuges, and a radiant heat facility). Activities are reviewed separately under the NEPA to determine compliance. Several operations in Technical Area III infrequently generate depleted uranium waste. This waste is usually in large pieces and is easily removed, thereby posing minimal impacts to the environment and workers. MW may also contain potentially-radioactive beryllium, lithium metals, and residues of explosive materials. All of these testing areas have strict safe distances to which they adhere. Both the public and workers are restricted from casual access. The inactive LLW and MW disposal site, scheduled for closure, is also located in the area. Some LLW and MW may be retrieved from this site and stored at the RMWMF during the closure process. All waste processed through the RMWMF would conform to spatial and activity limits identified in the yet to be developed Waste Acceptance Criteria for the RMWMF. The Waste Acceptance Criteria would be based on the RMWMF Safety Analysis Report (SNL, 1991a) and DOE Order 5820.2A (DOE, 1988c).

Facilities in Technical Area IV are designed for inertial confinement fusion and pulsed power research. Several accelerators are present in the area as well as a major new research facility, the Strategic Defense Facility, which contains a decontamination laboratory. The LLW produced in Technical Area IV generally consists of tritium-contaminated solid material and activated metals. MW may include inorganic solvents, lithium metal, salts, and leads.

Technical Area V facilities include electron beam accelerators, reactor facilities, an intense gamma irradiation facility, a glove box facility, and a hot cell facility. Most of the waste generated in this area is LLW consisting of contaminated equipment, high efficiency particulate air (HEPA) filters, and clean-up materials. The reactors produce waste contaminated with fission products and induced-activity. Other facilities generate enriched and depleted uranium-contaminated waste. Some resins contaminated with ^{60}Co and Cesium-137 (^{137}Cs) are also produced. MW may include lead, cadmium, and various solvents such as acetone, freon, and hexane. Uranium-contaminated lead and cadmium and contaminated resins are also generated.

The remote test areas outside the main technical areas are located south and east of Technical Area III and in several canyons on the west side of the Manzano Mountains. Waste consisting of weapons components and soils contaminated with depleted uranium is infrequently generated at these remote areas. MW may include beryllium, lithium, mercury, and lead. Offsite test facilities at the Tonopah Test Range (TTR), Yuma Proving Ground, Nevada Test Site (NTS), Kauai Test Facility (KTF), and White Sands Missile Range also infrequently generate waste that is the responsibility of SNL/New Mexico. Waste from these facilities may ultimately be packaged and stored at SNL/New Mexico prior to its disposal. The annual accumulation of waste from offsite locations totals less than 100 ft³/year (yr).

In summary, most of the LLW and MW generated by SNL/New Mexico activities is contaminated with low concentrations of fission products, induced-activity, or uranium-contaminated materials. Obsolete, low-level, encapsulated, beta-gamma sources, as well as depleted uranium shapes and waste from machining operations, comprise a small portion of the waste by volume. Tritium-contaminated materials make up the largest activity component of the waste. Most of the waste consists of contaminated equipment, combustible decontamination materials, and clean-up debris. Most of the currently generated tritium waste, as well as uranium waste, comes from facilities located in Technical Area I. Most of the induced-activity waste comes from Technical Area V facilities.

The classified waste generated at SNL/New Mexico consists primarily of tritium-contaminated equipment, classified uranium shapes, and classified components. Most of the accountable nuclear materials consist of depleted uranium although special nuclear materials (SNM), enriched uranium,

and other types of accountable nuclear material (NM), tritium, enriched lithium, are also generated from a number of SNL/New Mexico operations. The combined total volume of LLW and MW streams is highly variable (3,000-100,000 ft³/yr), but averages about 10,000 ft³/yr. Due to RMWMF Waste Acceptance Criteria, not all LLW and MW could be accepted. While past activities (pre-1988) have averaged approximately 10,000 ft³/yr, programmatic cutbacks in certain programs and waste minimization efforts have reduced this average to 3,000 - 4,500 ft³/yr (excluding decommissioning and decontamination and Environmental Restoration (ER) generated waste). The maximum amount that could be stored at any one time in the RMWMF is limited to 6,000 ft³/yr. A summary of combined LLW and MW generated in recent years is presented in Table 2-1.

The MW generated at SNL/New Mexico consists primarily of lead contaminated with fission products, ¹³⁷Cs and Cerium-144 (¹⁴⁴Ce), and activation products, Lithium-6 (⁶Li) and Sodium-24 (²⁴Na), depleted uranium, or other radioactive materials. MW will include low-level radioactive, TRU, and special case waste. Special case waste (including the 30,000 Ci of Strontium-90 (⁹⁰Sr) noted in Table 2-1) would not be processed at the RMWMF if it does not meet the Waste Acceptance Criteria (WAC). Radioactive waste solutions and debris, which may contain fission products and alpha contamination (< 100 nCi/gm), are generated in the Technical Area V hot cell facilities. The waste may contain SNM and NM, may be corrosive, and may have lead or solvent contamination. Radioactive sources (gamma-emitting, beta, and neutron sources) often contain lead, beryllium, or other hazardous materials.

Test units may contain depleted uranium, beryllium, lithium, or other hazardous components and may be classified or contain accountable NM. They may also contain trace amounts of high explosives or insensitive high explosives. Oils can be contaminated with depleted uranium and/or beryllium and, potentially, with solvents. Proton-activated metals may be contaminated with lithium (metal, nitrates, and hydroxide), solvents, or with other hazardous chemicals. Miscellaneous radioactive waste from decontamination activities may also contain hazardous materials. In addition, the continually changing nature of experiments at SNL/New Mexico would generate other forms of MW (SNL, 1988d).

LLW contaminated with lead comprises the major portion of MW at SNL/New Mexico. Some reactive waste, as well as a limited volume of solvents contaminated with radioactive materials,

Table 2-1

**Annual Generation of Low-Level Waste and
Mixed Waste at SNL/New Mexico***

<i>Fiscal Year</i>	<i>Main Radioactive Constituents**</i>	<i>Activity (Ci)</i>	<i>Volume (ft³)</i>	<i>Mass pound (lb)</i>
1987	U, ³ H, ⁶⁰ Co, ¹³⁷ Cs	530	33,845	2,020,854
1988	U, ³ H, ⁶⁰ Co, ¹³⁷ Cs	25	6,500	90,000
1989	U, ³ H, ⁶⁰ Co, ¹³⁷ Cs	6.5	1,254	37,620
1990	U, ³ H, ⁶⁰ Co, ¹³⁷ Cs	100	1,624	48,720
1991	U, ³ H, ⁶⁰ Co, ¹³⁷ Cs	10	3,284	98,520
1992†	U, ³ H, ⁶⁰ Co, ¹³⁷ Cs	250	6,000	180,000
	⁹⁰ Sr	30,000	106	4,994
1993†	U, ³ H, ⁶⁰ Co, ¹³⁷ Cs	250	6,000	180,000

* 1989 Waste Management Site Plan (SNL, 1988d) and 1991 Waste Management Site Plan (SNL, 1990).

** Isotope acronym not previously defined: U = uranium.

† Information for 1992 and 1993 is projected data based on past operations. Future waste management practices and new operations at SNL/New Mexico are expected to change these values. Specific information of annual generation of activity levels, volume, and mass is no longer produced. The SNL/New Mexico Waste Management Site Plan is no longer produced in favor of the *Site-Specific Plan, Implementation of Five-Year Plan for Environmental Restoration and Waste Management* (SNL, 1991b).

is also generated. The volume of MW varies greatly from year to year, but in fiscal year 1988 the volume of lead-contaminated waste alone was approximately 1,400 ft³, more than 20 percent of the volume of LLW generated that year (SNL, 1988d). The remaining MW forms constituted a relatively

small additional volume as compared with the lead-contaminated waste. Increased awareness and characterization of MW laboratory-wide is expected to increase the percentage of the waste classified as MW. In addition, more restrictive requirements may increase the percentage of waste that must be classified as MW. These factors, together with new waste forms resulting from planned facilities at SNL/New Mexico would result in a substantial increase in the percentage of radioactive waste that would be classified as MW. The future average annual volume of MW could comprise up to 80 percent of the projected total LLW plus MW volumes.

2.1 Alternative 1: No Action

Under the No Action Alternative, LLW and MW would continue to be generated in the SNL/New Mexico technical and test areas as in the past, and SNL/New Mexico would have no centralized waste handling facility for storage, characterization, segregation, repackaging, and certification of this waste. The existing storage sites at each waste generator location are currently listed on the RCRA Part A Permit. The State of New Mexico received authority to regulate MW under RCRA on July 25, 1990. Under the No Action Alternative, the generator sites would be identified as storage sites on the Part B Permit Application, but no additional waste handling or treatment capabilities would be added to the generator sites.

Because of the DOE decision to terminate onsite disposal of LLW and MW at SNL/New Mexico, it is necessary to ship SNL/New Mexico waste offsite for disposal. However, the existing facilities for waste handling at the generator sites cannot provide waste characterization, segregation, treatment, and packaging functions required to satisfy applicable environmental and transportation requirements and Waste Acceptance Criteria of the offsite disposal facility (SNL, 1989d). As a result, SNL/New Mexico would be in the position of generating and storing waste at generator or temporary storage sites with no means for shipping it to an offsite disposal facility.

2.2 Alternative 2: Decentralized Waste Management Facilities

Under this alternative, all required waste storage, characterization, processing, packaging, and certification functions would be conducted at the point of generation rather than at a centralized facility. Separate storage facilities for LLW and MW would be required in the waste generation areas

to prevent mixture of the two waste types. Waste would be stored for a sufficient time prior to packaging to optimize waste shipments. The treatment and packaging of waste would be conducted by staff assigned to each waste generation facility or, in some instances, by individuals serving more than one facility.

Each of these separate waste processing facilities would require compactors and shielded storage rooms, as well as appropriate ventilation and radiation monitoring systems. It is anticipated that the space requirement for the storage, processing, and packaging functions in the waste-generating areas would be provided from a reallocation of existing space, where possible, and the construction of new additions to each facility, where necessary. In many instances, construction of new facilities would be required in order to satisfy health and safety and RCRA requirements for permitting each of these separate facilities. Waste volumes for these facilities would be highly variable and difficult to predict because they are research and development facilities with a broad range of projects.

Significant cost increases over the Proposed Action would result from construction of these multiple facilities, the duplicate staff assigned, the increase in administrative burden of having to obtain separate RCRA permits, and the diffuse nature of the operations. Each waste-generating facility would be required to have a processing capability and the facility would have to be large enough to accommodate the largest volume and various types of waste anticipated.

2.3 Alternative 3: Proposed Action (Preferred Alternative)

The Proposed Action consists of the operation of a central RMWMF designed to receive, characterize, store, conduct limited bench-scale treatment, repackage, and certify LLW and MW (as necessary) for shipment to an offsite disposal or treatment facility. Waste shipped to an offsite disposal facility must satisfy the waste acceptance criteria of that facility. Offsite treatment and disposal facility waste acceptance criteria apply to waste form and other characteristics, contaminant types, package and concentration limits, and documentation. Future restrictions will be imposed on the nature of the waste by the published land disposal restrictions (LDR) which will require treatment of some waste prior to disposal. SNL/New Mexico would incorporate LDR requirements into the operating procedures (currently in preparation) used in the proposed facility as a means of compliance

with LDR requirements. It is not the intent of the RMWMF to satisfy all waste acceptance criteria for land disposal; some waste may need to be sent to an offsite treatment facility prior to its disposal. Rather, RMWMF operations would provide waste characterization information needed to determine whether the waste satisfies offsite disposal facility criteria and would provide some limited waste treatment. Although the RMWMF would not necessarily provide all treatment necessary to satisfy the LDR, no operations would be conducted at the facility which restrict any options for treatment or disposal. LLW and MW generated at SNL/New Mexico would be transported from the technical areas to the RMWMF in Department of Transportation (DOT)-approved containers, consistent with the guidance for onsite transportation of hazardous materials and hazardous waste (SNL, 1989b). Hazardous waste that does not contain radioactive contaminants will continue to be managed separately and will not be handled by the RMWMF. SNL/New Mexico has submitted a Part A Permit Application to the State of New Mexico and a Part B Permit Application will be prepared and filed when requested by the State. Both permits will include the MW storage and handling operations in the RMWMF, as well as existing storage and handling operations at the waste generator sites.

2.3.1 Description of the Radioactive and Mixed Waste Management Facility (RMWMF)

The RMWMF was constructed in 1989 in the southeastern portion of Technical Area III. An artist's rendering of the existing 7500 ft² steel and concrete facility is shown in Figure 2-2, and the interior layout of the facility is shown in Figure 2-3. Space was allocated for storage areas, a staging and packaging area, offices, and changing rooms. The design of the facility (with proposed construction modifications) incorporates all applicable requirements from RCRA, Occupational Safety and Health Administration (OSHA), and DOE Orders for the handling and storage of LLW and MW. Planned facilities upgrades, consisting of paving of the road surfaces and work areas, installation of pumping equipment and lines for the surface impoundment, design and construction of air-locks, and design and construction of the truck decontamination and water treatment systems would be completed upon conclusion of the NEPA process.

The staging and packaging area contains a small laboratory for waste screening and sampling, two drum compactor rooms for separate compaction of LLW and MW, and an area for bench-scale solidification or neutralization of waste.

Figure 2-2. Radioactive and Mixed Waste Management Facility

Figure 2-3. Layout of the Radioactive and Mixed Waste Management Facility

The storage area contains separate areas for storage of uranium waste, tritium waste, and liquid waste, with LLW and MW segregated within these areas. The facility was designed and constructed to store LLW and MW that is classified or contains Category III quantities of accountable NM, as well as the unclassified waste. A portion of the staging/packaging area, as well as part of the storage area, is allocated for LLW with external exposure rates at the container surface greater than 10 milliroentgens/hour (mR/hr). This high-activity waste (greater than 10 mR/hr) would require more stringent controls on radiation exposure.

A negative pressure (below atmospheric) ventilation system was provided for both the storage and staging/packaging area, with individual exhaust fans for each compactor. Air would be exhausted from the building through a bank of HEPA filters equipped with prefilters to extend their life. Tritium in very limited quantities would be the only radioactive gaseous emission. Because of the minimal impact of these releases and operation under the As-Low-As-Reasonably-Achievable (ALARA) principle, no removal system was provided. All exhaust air from the facility would be discharged through a stack with a height of 30 ft above the facility roofline (SNL, 1988c).

An extensive air sampling and radiation monitoring system was provided in the facility design and construction as well as a high purity breathing-air system supplied from rack-mounted compressed air bottles fed by a compressor. The facility and associated structures have been enclosed in a security-fenced area with access controls and would have routine security patrols (SNL, 1988b).

Reactive waste and solvents contaminated with radioactive waste would be stored in commercially-available storage structures external to the RMWMF. These structures would provide protected storage and comply with the hazardous waste storage requirements (SSI, 1989). The current plan for facility upgrades includes road and site paving, the addition of airlocks, two 10-ton bridge cranes, a truck survey and decontamination station, a truck loading ramp, a covered shelter or building for storage of packaging materials, an outside work area for packaging large items, and a radioactively-contaminated water storage and treatment system (SNL, 1988a). The effects of construction and use of these features are included within the impacts described in Section 4.0.

No LLW and MW liquid effluents would be released directly to the groundwater from the RMWMF on a routine basis or in case of an accident. A small amount of tritium is expected to be

released to the air during normal operations at the RMWMF. The estimated maximum potential release of 5 to 10 Ci has been estimated to produce an individual dose approximately 10,000 times less than the EPA annual standard of 10 mrem (Section 4.5.2).

Potential accident scenarios were evaluated to assess the effects on surrounding populations of a massive facility failure, compactor fire, and a fire in the radioactive waste storage area. The results of this evaluation and the potential impacts of these abnormal events are discussed in Section 4.5.3. The RMWMF receives water from KAFB wellwater system, which is independent from the City of Albuquerque water system. Both systems extract water from the Rio Grande Basin aquifer.

A new 10-in polyvinyl chloride service line was extended to the facility from the existing 10-in tee, located north of Building 6911 (Figure 2-4). The new water line is a combination fire protection and potable water line. A 6-in main line for fire protection was extended into the building. From this line, a 2-in line provides potable water (SNL, 1988a; 1988b; 1988c).

2.3.2 Site Selection

A number of alternative sites for the facility (Figure 2-5) were evaluated by SNL/New Mexico before construction began. These included the preferred site adjacent to and west of the inactive chemical waste landfill (Site I); a second site adjacent to the inactive radioactive waste landfill (Site II); a third site north of the inactive chemical waste landfill (Site III); and a fourth site near the existing Hazardous Waste Management Facility in Area II (Site IV). The factors that were considered in site selection are summarized in Table 2-2. The factors included proximity to hazard control areas surrounding test facilities, security requirements due to the nature of the waste, consistency with future development plans for other SNL/New Mexico facilities, and future expansion of the radioactive waste management facility. All the alternative sites were located remote from KAFB and Albuquerque International Airport operations, making this an indirect factor in site selection. Site I was selected as the most desirable alternative based on criteria described above. This site meets the criteria in the Guidelines for Nuclear Facility Sites in DOE/TIC - 11603, Rev. I, *Nonreactor Nuclear Facilities: Standards and Criteria Guide*.

AREA 3 Southeast Quadrant

Figure 2-4. Detailed Map of Area III

Figure 2-5. Alternative Sites for the RMWMF

Table 2-2

Radioactive and Mixed Waste Management Facility Site Selection

<i>Site Selection Criteria</i>	<i>Sites*</i>			
	<i>Site I**</i>	<i>Site II</i>	<i>Site III</i>	<i>Site IV</i>
Site availability	1 [†]	4	1	1
Remoteness from residential areas	1	2	2	3
Additional costs (utilities, etc.)	3	2	2	1
Security	1	1	1	4
Consistent with future development	1	4	2	3
Future expansion possible	1	3	2	4
Proximity to hazard control area	1	4	3	3
Water drainage	1	2	4	3
Near waste generators	2	2	2	3

* Site I — Adjacent to and west of inactive chemical waste landfill,

Site II — Adjacent to existing radioactive waste landfill,

Site III — North of inactive chemical waste landfill, and

Site IV — Near Hazardous Waste Facility, Area II (Figure 2-4).

** Preferred site.

† 1--most desirable; 4--least desirable.

2.3.3 RMWMF Operations

LLW and MW generated in the technical and remote areas at SNL/New Mexico would be transported to the RMWMF in approved containers as required in the Onsite Transportation Manual (SNL, 1989b). It is estimated that approximately 75 percent of these shipments would be in 55-gal steel drums and 25 percent in 4 x 4 x 7-ft steel boxes. Each shipment would be accompanied by documentation identifying the characteristics and the amount of waste being shipped as required by both DOT and the EPA, as well as disposal facility requirements. A waste minimization and characterization program is being implemented in all facilities generating LLW and MW consistent with RCRA and DOE requirements (DOE, 1988c). Waste would be accepted from generators and segregated by waste type for storage, as necessary, while awaiting processing, final packaging, and certification. Standard Operating Procedures (RMWMF Startup and Shutdown and RMWMF Routine Operation Verification Procedure) would be in place before the start of operations at the facility. These procedures address control and monitoring of personnel exposure, facility operations, facility administration, waste management, equipment operations, and transportation. To ensure compliance with these procedures, a training program would be implemented that would identify personnel qualifications, personnel selection procedures, and training requirements and procedures.

Estimates were made of the hazardous and radioactive materials that might be handled by the RMWMF and, through a risk-based analysis (Section 4.5), limits were placed on that inventory (SNL, 1991a). It is currently estimated that one-half of the packages handled and stored at the RMWMF would contain MW. The maximum radionuclide inventory for the facility and the average and maximum container quantities are in Table 2-3. The same information for hazardous contaminants is in Table 2-4. Transportainers (approved containers for transportation) for reactives and solvent materials located outside the RMWMF (Building 6920) would contain an average of 3.25 ft³ and a maximum of 7.5 ft³ of reactives (lithium and/or sodium) contaminated with radionuclides. Table 2-5 is the inventory of reactive materials to be stored at the site. Average and maximum inventories for containers of liquid waste stored in the facility are expected to be less than those for the average drums listed in Table 2-3. Figure 2-6 illustrates the flow of LLW and MW through the facility. The waste flow is described in the following sections.

Table 2-3

Average and Maximum Container Inventories of Radioisotopes for the RMWMF*

<i>Isotope**</i>	<i>Facility Total</i>	<i>Average Drum</i>	<i>Maximum Drum</i>	<i>Average Box</i>	<i>Maximum Box</i>
³ H	1,500 Ci	2.3 Ci	34 Ci	34 Ci	69 Ci
¹⁴ C	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi
²² Na	250 Ci	383 mCi	5.7 Ci	5.7 Ci	11.5 Ci
²⁴ Na	250 Ci	383 mCi	5.7 Ci	5.7 Ci	11.5 Ci
³⁶ Cl	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi
⁵¹ Cr	25 Ci	38 mCi	574 mCi	574 mCi	1.1 Ci
⁵⁴ Mn	50 Ci	77 mCi	1.1 Ci	1.1 Ci	2.3 Ci
⁵⁶ Co	25 Ci	38 mCi	574 mCi	574 mCi	1.1 Ci
⁵⁷ Co	25 Ci	38 mCi	574 mCi	574 mCi	1.1 Ci
⁵⁸ Co	25 Ci	38 mCi	574 mCi	574 mCi	1.1 Ci
⁵⁹ Fe	50 Ci	3.4 Ci	52 Ci	52 Ci	103 Ci
⁶⁰ Co	2,250 Ci	77 mCi	1.1 Ci	1.1 Ci	2.3 Ci
⁶³ Ni	100 Ci	153 mCi	2.3 Ci	2.3 Ci	4.6 Ci
⁶⁵ Zn	25 Ci	38 mCi	574 mCi	574 mCi	1.1 Ci
⁸⁵ Kr	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi
⁹⁰ Sr	10 Ci	15 mCi	230 mCi	230 mCi	460 mCi
¹¹⁰ Ag	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi
¹²⁹ I	0.10 Ci	0.15 mCi	2.3 mCi	2.3 mCi	4.6 mCi
¹³³ Ba	5.00 Ci	7.7 mCi	115 mCi	115 mCi	230 mCi
¹³⁴ Cs	5.00 Ci	7.7 mCi	115 mCi	115 mCi	230 mCi
¹³⁷ Cs	1,000 Ci	1.5 Ci	23 Ci	23 Ci	46 Ci
¹³⁹ Ce	0.10 Ci	0.15 mCi	2.3 mCi	2.3 mCi	4.6 mCi
¹⁴⁴ Ce	0.10 Ci	0.15 mCi	2.3 mCi	2.3 mCi	4.6 mCi
¹⁴⁷ Pm	0.10 Ci	0.15 mCi	2.3 mCi	2.3 mCi	4.6 mCi
¹⁵² Eu	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi
¹⁹⁸ Au	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi
²⁰³ Hg	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi
²⁰⁷ Bi	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi
²⁰⁸ Pb	0.10 Ci	0.15 mCi	2.3 mCi	2.3 mCi	4.6 mCi
²¹⁰ Po	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi
²¹² Pb	10.0 Ci	15 mCi	230 mCi	230 mCi	460 mCi
²³² Th	0.10 Ci	0.15 mCi	2.3 mCi	2.3 mCi	4.6 mCi
²³³ U	3.78 Ci	5.8 mCi	87 mCi	87 mCi	0.17 Ci
²³⁴ U	5.00 Ci	7.7 mCi	115 mCi	115 mCi	230 mCi
²³⁵ U	1.50 Ci	2.3 mCi	34 mCi	34 mCi	69 mCi
²³⁸ U	10 Ci	15 mCi	230 mCi	230 mCi	460 mCi
²³⁸ Pu	2.00 Ci	3.1 mCi	46 mCi	46 mCi	92 mCi
²³⁹ Pu	2.00 Ci	3.1 mCi	46 mCi	46 mCi	92 mCi
²⁴⁰ Pu	2.00 Ci	3.1 mCi	46 mCi	46 mCi	92 mCi
²⁴¹ Pu	50.0 Ci	77 mCi	1.1 Ci	1.1 Ci	2.3 Ci
²⁴² Pu	0.10 Ci	0.15 mCi	2.3 mCi	2.3 mCi	4.6 mCi
²⁴¹ Am	0.10 Ci	0.15 mCi	2.3 mCi	2.3 mCi	4.6 mCi
²⁴⁴ Cm	0.10 Ci	0.15 mCi	2.3 mCi	2.3 mCi	4.6 mCi
²⁵² Cf	1.00 Ci	1.5 mCi	23 mCi	23 mCi	46 mCi

* Refer to Appendix D for Dose Conversion Factors.

** Isotope acronyms not previously defined: Ag-silver, Am-amerium, Au-gold, Ba-barium, Bi-Bismuth, C-Carbon, Cf-Californium, Cl-Chlorine, Cm-curium, Cr-Chromium, Eu-europium, Fe-iron, Hg-mercury, I-iodine, Kr-Krypton, Mn-manganese, Ni-nickel, Pb-lead, Pm-Promethium, Po-polonium, Pu-plutonium, Th-thorium, and Zn-zinc.

Table 2-4

Facility and Container Inventories of Hazardous Materials

<i>Material</i>	<i>Facility Total Kilograms (kg)</i>	<i>Average Drum (kg)</i>	<i>Maximum Drum (kg)</i>	<i>Average Box (kg)</i>	<i>Maximum Box (kg)</i>
Cadmium	2.2 x 10 ³	3.4	50	50	100
Lead	1.1 x 10 ⁴	17.0	250	250	500
Mercury	793	1.2	18	18	36
Arsenic	120	0.2	2.8	2.8	5.5
Beryllium	250	0.4	5.7	5.7	11.5

Table 2-5

Inventory of Reactive Materials at the Radioactive and Mixed Waste Management Facility Site

<i>Material</i>	<i>Average Drum</i>	<i>Maximum Drum</i>	<i>Total SSB*</i>	<i>Total Facility</i>
Lithium	4.6	69 kg	111 kg	111 kg
Sodium	8.4	126 kg	202 kg	202 kg

* SSB is Safe Storage Building - Each building holds 24 drums.

Figure 2-6. Flow of LLW and MW in the RMWMF

Arrival

When a waste shipment arrives at the RMWMF (to the east of the staging area, inside the facility fence), a determination would be made as to whether the waste meets the RMWMF requirements for acceptance and storage. All waste packages are surveyed for radiation and external contamination. The determination also includes, but is not restricted to, a review of the characterization data provided by the waste generator to establish type of waste, compatibility of the waste with storage requirements, completeness of the characterization data, compatibility of the waste with disposal site acceptance criteria, and suitability of the waste packaging including the size and fullness of the waste package. If the waste satisfies all relevant waste acceptance criteria (to be developed) for storage, it would be moved into the appropriate storage area. For example, reactive waste and solvents contaminated with radioactive waste would be stored in structures external to the RMWMF but within the facility fence line (about 40 ft NW of the RMWMF); other LLW and MW would normally be stored in the RMWMF.

If the waste cannot be accepted immediately for storage, the waste package would be transferred to the southeast bay doors and would temporarily be stored in the waste staging area. If the waste is high-activity waste, the waste package would be temporarily stored in the shielded, high-activity staging area. Once an adequate quantity of waste is accumulated in the staging area for a particular process or for repackaging, the waste packages would be moved from the staging area to the process area. All waste packages would be surveyed prior to handling to ensure compliance with Standard Operating Procedures (SOPs).

Waste Package Opening

Waste packages accepted into the staging area for some types of processing would normally require the opening of the package. Because the opening of a waste package has the potential for causing serious adverse health effects, all waste package opening would be done under strict administrative control. Waste packages would be either opened in glove boxes or in temporary containment tents. Appropriate personnel-protective equipment would be used and equipment would be available to repack, shield, or contain the waste immediately if any problems arise during waste package opening. Health physics surveillance would be continuous for all waste package opening.

activities and the Standard Operating Procedure for Package Opening, Segregation and Repackaging and Storage of Radioactive and Mixed Waste at the RMWMF would be strictly followed.

Compaction

Separate compactors are available for LLW and MW in the RMWMF. The MW compactor would be permitted under the RCRA Part B Permit for the facility. Waste accepted for compaction would be either kept in the original container or added to a container with compacted waste. Historically, about 20 percent of the waste generated at SNL/New Mexico is compactible. The waste accepted for compaction must be compactible and should not contain any hardware, aerosol or paint cans, or plastic bottles. Compaction would strictly follow the requirements contained in the Standard Operating Procedures for Waste Compaction.

Mixing/Solidification

A small amount of the waste accepted at the facility would require stabilization or solidification. Stabilization involves the addition of a fixative agent, such as cement, to powdered or granulated material (i.e., as metallic fines). Solidification refers to a similar process applied to liquid waste. These processes would only be performed on a bench-scale basis and would not require permitting separate from the RCRA Part B Permit for the facility. Bench-scale is a phrase used to describe a process which uses small amounts of material. Liquid volumes of solvents would be limited to less than 1 gal at any one time during the mixing/solidification process. The mixer and solidification equipment would be located in the southwest end of the facility. Waste packages containing waste to be stabilized or solidified would be moved to the west end and the process would be performed in a ventilated area under strict health and safety controls. The largest waste package accepted for these processes would be a 55-gal drum. Potential hazards during these processes include spills, exothermic reactions, splash hazards, and industrial hazards. To minimize these potential hazards, all mixing, solidification, and stabilization activities would be carried out in strict accordance with the Standard Operating Procedure for Processing and Stabilizing Radioactive and Mixed Waste at the RMWMF.

Neutralization

Some of the waste to be accepted at the facility would require neutralization. This would be done on a bench-scale basis only and would not require permitting separate from the RCRA Part A or B Permit for the facility. Volumes less than 1 gal may be neutralized at the facility; all larger volumes would be neutralized by the generator. Potential hazards during neutralization include spills, splashes, and reactions. To minimize the potential hazards, all applicable SOPs would be followed.

Repackaging

Repackaging necessarily involves package opening, which has been discussed previously. Once waste is repackaged in a container, the container would be closed and surveyed. If acceptable, the container would be transported to the waste storage area of the facility. All waste repackaging would be carried out in accordance with the requirements of the Standard Operating Procedures for Package Opening, Segregation and Repackaging and Storage of Radioactive and Mixed Waste at the RMWMF.

Storage Area Operations

The north half of the RMWMF is dedicated to temporary storage of radioactive and mixed waste awaiting transport to an offsite waste treatment or disposal facility. Storage operations would be conducted in accordance with all applicable DOE Orders, Federal and State regulations, compliance agreements if appropriate, and the Standard Operating Procedure for Storage of Radioactive and Mixed Waste (Reactive, Flammable, Classified, and Accountable) at the RMWMF.

When waste arrives at the RMWMF and meets all necessary facility and offsite shipping and disposal requirements or has been through the staging areas of the RMWMF and then meets these requirements, the waste would be stored in the dedicated storage area until an offsite disposal facility is available. High-activity waste would be stored in a shielded storage area located in the northeast section of the facility. Waste would be moved into and out of the high-activity storage area through the bay doors on the eastern side of the storage area. The western two-thirds of the storage area has been divided into sections for storage of different types of low-activity waste. There is a dedicated section for uranium storage, liquid storage, tritium storage, and miscellaneous storage. The liquid

storage area would be used to store liquid mixed waste, which could be sent offsite for treatment or disposal. All storage areas have been zoned and marked as appropriate, and all storage activities would comply with all health, safety, and regulatory requirements.

Waste would be processed for shipment to the offsite disposal facility as soon after receipt as possible to minimize potential storage hazards. A final certification of the waste would be performed at the RMWMF to document the characteristics of the waste in accordance with the offsite disposal facility requirements. In some instances MW may require treatment (incineration for solvent MW) by processes not available at the RMWMF to satisfy LDR, under RCRA requirements for acceptance at a disposal facility. This would necessitate shipment to an offsite treatment facility. All waste would be packaged and labeled for shipment in accordance with DOT regulations (SNL, 1989d).

2.4 Alternatives Considered and Eliminated From Detailed Analysis

Three alternatives to the Proposed Action were considered and rejected as unreasonable. First, immediate shutdown of all facilities generating LLW and MW would not be consistent with the mission assigned to SNL/New Mexico by the DOE. Additionally, such a shutdown would not completely obviate the need for waste treatment and packaging, as a considerable inventory of waste is currently in storage at many generating facilities at the site. In addition, closure of previously-used waste storage and disposal facilities may result in the recovery of some LLW or MW materials that require treatment or packaging for offsite disposal.

Second, alternate technologies for waste treatment at SNL/New Mexico, such as incineration, were considered. Incineration could reduce the volume of waste shipped for offsite disposal, but the benefits of waste reduction with this method would not offset the environmental impacts and economic costs of conducting that treatment at SNL/New Mexico. Thus, this alternative was rejected.

Third, the possibility of developing an onsite shallow burial facility for LLW was considered. MW would continue to be processed for treatment or disposal. However, LLW and MW processing, characterization, and certification comparable to that proposed for the RMWMF would still be necessary, so this alternative does not negate the need for a facility comparable to the RMWMF. This alternative was, therefore, rejected.

SECTION 3.0

DESCRIPTION OF THE EXISTING ENVIRONMENT

3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The RMWMF site is located in Technical Area III, one of five technical areas and several remote environmental test areas situated in the eastern half of KAFB (Figure 2-1).

More specifically, the site of the RMWMF is in T.9N R.4E Section 29 SE1/4 SE1/4. The physiographic setting of the site is an undissected alluvial surface with a gradual westward slope of approximately 2 percent. The soils range from a fine sandy loam to a gravelly sandy loam. The RMWMF has been constructed on 1.2 hectares (3 acres) within the 4-hectare (10-acre) area disturbed by construction activities. Existing roads bound the east and south sides of the site. Approximately 1.2 hectares (3 acres) of the site have been cleared of vegetation. The remaining area of natural vegetation is moderately disturbed by vehicle tracks and some debris. Although most of the area surrounding the RMWMF site is still relatively undisturbed, a variety of small structures and land disturbances exist east, northeast, and west of the site. The RMWMF site is part of the Technical Area III testing complex.

The nearest metropolitan population center to KAFB and SNL/New Mexico is Albuquerque, New Mexico, located along the northern base boundary. The Isleta Indian Pueblo and neighboring communities border KAFB to the south and represents the next nearest population center [population (4,460) personal communication with Isleta Census Bureau]. A total population of 571,677 people (1990 census) live within an 80 kilometer (km) [50 mile (mi)] radius of the site (SNL, 1992). Distances from the proposed site to the nearest KAFB housing and the nearest Albuquerque residential housing are approximately 9.2 km (5.8 mi) and 8.5 km (5.3 mi), respectively. The site lies about 2.8 km (1.8 mi) from the nearest KAFB boundary.

The existing environment is discussed with respect to the resource areas listed below:

- Earth Resources: Hydrology, Geology, Soils (Section 3.1);
- Atmospheric Conditions: Climate, Air Quality, Noise (Section 3.2);
- Biological Resources: Vegetation, Wildlife (Section 3.3);
- Cultural Resources (Section 3.4);
- Land Use: Existing Land Use, Transportation (Section 3.5); and
- Social and Economic Conditions (Section 3.6).

3.1 Earth Resources

3.1.1 Hydrology

Surface Water

Surface water flow from the proposed RMWMF site and SNL/New Mexico is generally toward the Rio Grande via Tijeras Arroyo (Figure 3-1). The site on the East Mesa is relatively flat, has a generally west-southwesterly ground surface slope, and contains no surface water or wetlands. The site is located above the flood plain and drains by sheet flow into small gullies during heavy precipitation events. Sheet flow ultimately enters Tijeras Arroyo, which is located about two miles to the north of the RMWMF, then proceeds to the Rio Grande (ERDA, 1977). Most of the water does not reach the river because of percolation and evapotranspiration enroute. There are no other surface drainages near the site. Tijeras Arroyo flows only during spring snowmelt or following localized thunderstorms (COE, 1979). The Rio Grande flows southward through the City of Albuquerque and lies approximately 11 km (7 mi) to the west of the proposed RMWMF site. Average flow in the Rio Grande from 1967 to 1977 was about 1.01×10^9 cubic meters (m^3)/yr (816,000 acre-ft/yr) (COE, 1979).

Groundwater

The underlying water table occurs at a depth of about 150 m (492 ft) in the basin fill material of the Rio Grande. These fan deposits and other alluvial material of Quaternary and Tertiary ages make up the subsurface reservoir. The existing groundwater reservoir is bounded on the east by the Sandia and Manzano Mountains and on the west by the Lucero uplift (ERDA, 1977). Groundwater below the site is not confined in a closed aquifer. Rather, it has a water table and moves with local hydraulic gradients relative to local permeabilities.

Groundwater reservoir characteristics were studied by the Water Resources Division of the U.S. Geological Survey in cooperation with the State Engineer of New Mexico (Reeder et al., 1967). The somewhat irregular water table slopes toward the Rio Grande on both sides of the river and has a slight downstream component. Overall gradient within the water table is about 2 m/km (10 ft/mi),

Figure 3-1. Surface Water Drainages in Vicinity of the Technical Areas at SNL/New Mexico

but there are local intrusions caused primarily by the presence of deep wells. In the middle part of the East Mesa, transmissivity is estimated at about 1240 m² [100,000 gallon (gal)/day/ft] with a storage coefficient of about 0.2 (COE, 1979).

Groundwater generally moves from north to south, parallel to flow in the Rio Grande (in the shallow zone that lies above an altitude of 1463 m or 4800 ft). Deep-zone groundwater (below an altitude of 1463 m or 4800 ft) generally moves from the northwest to the east and southeast (Kues, 1986).

The subsurface reservoir is recharged primarily from the Rio Grande and, to a lesser degree, at the foot of the mountains where coarse alluvium occurs at the openings of small canyons. Recharge is nearly nonexistent from percolation through soils overlying the water table. Moisture, in the form of rain or snowmelt, flows into gullies that feed Tijeras Arroyo and the Rio Grande, evaporates, or is transpired by the local vegetation. The significance of Tijeras Arroyo as a source recharge to the shallow groundwater zone is unknown (Kues, 1986).

Analytical results for groundwater collected from wells at SNL/New Mexico conform to EPA drinking water standards (Millard et al., 1987, 1988). Samples of groundwater collected from wells on the East Mesa are all considered fresh (Bjorklund and Maxwell, 1961). This consideration is based on the ratio of the dissolved solids content [in parts per million, (ppm)] to the specific conductance [micro-ohms per centimeter (cm)], an average of 0.7. The classification of this water with respect to salinity is less than 1000 ppm dissolved solids, or "fresh" as defined in Krieger et al., 1957. The low salinity is attributable to sediments underlying the East Mesa that are largely derived from hard rocks containing relatively small amounts of readily soluble material. The total dissolved solids of most East Mesa water samples is less than 300 ppm. Calcium, sodium, and bicarbonate represent the principal ions (Bjorklund and Maxwell, 1961).

3.1.2 Geology

SNL/New Mexico is located on the East Mesa, which lies along the eastern portion of the Albuquerque-Belen Basin, one of a series of basins comprising the Rio Grande trough. The Sandia and Manzano Mountains border the basin to the east, with the Lucero uplift and Puerco Plateau

representing the western boundary. Generally, the northern basin limits lie at the Nacimiento uplift, and the Socorro channel represents the southern basin limit. Basin deposits have been laid down in a sequence of complex layers since the late Miocene epoch (5 to 23 million years ago), when large-scale faulting, deepening of the basin, and tilting of the bordering mountains occurred.

Stratigraphy

Poorly consolidated cenozoic deposits resulting from erosion of the surrounding mountains, from the surrounding plateaus, and from sediments brought in by the ancestral Rio Grande make up the Albuquerque-Belen Basin. These deposits are known as the Santa Fe formation which underlies a relatively thin veneer of gravels known as the Ortiz Gravel. The Ortiz Gravel is predominantly an alluvial fan deposit while the Santa Fe formation consists of unconsolidated paleoconglomerates interfingering with river deposits of sand, clay, silt, and calcite deposits. This formation extends from about 100 ft below the surface to a depth of approximately 9,000 ft below SNL/New Mexico where it rests on mesozoic sedimentary rocks (Kelly, 1977). The Precambrian basement is encountered at a depth of approximately 12,000 ft.

No mineral claims are held on SNL/New Mexico and no minerals of commercial value or demand are known to exist at the proposed RMWMF site.

Seismology

Albuquerque and the surrounding area are located in Seismic Risk Zone 2, a region that can be expected to receive moderate earthquake damage (Figure 3-2). The amount of damage corresponds to Intensity VII of the Modified Mercalli Intensity Scale of 1931 (people fleeing buildings; damage to buildings varying depending on construction; and observations by auto 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. This earthquake had a magnitude of 4.7 on the Richter Scale. There has been no documented damage from earthquakes to SNL/New Mexico facilities (DOE, 1988b).

Figure 3-2. Seismic Risk Map of the United States

The basin in which SNL/New Mexico facilities are situated is bounded on the east and west by complex fault zones that generally underlie the surface but are exposed along the edges of the mountains. The series of faults at the face of the Sandia and Manzano Mountains have a vertical displacement of at least 6100 m (20,000 ft) which took place from Miocene to recent times. Several faults (e.g., Hubbel Springs, Manzano) show evidence of movement during the Holocene times, but there is no evidence of movement within historical times (Machette, 1982). The strongest seismic activity along the Rio Grande occurs in the mountains west of Socorro, New Mexico, 120 km (75 mi) south of Albuquerque. This seismic activity occurs along faults typically parallel and structurally related to the Albuquerque area faults.

All buildings at SNL/New Mexico, including the RMWMF, have been built to the specifications of Seismic Risk Zone 2, as specified in the Uniform Building Code, 1985 Edition. The largest shock expected to occur in the project area over a 100-yr period would be predicted at a magnitude of 6.0 on the Richter Scale (Sanford et al., 1972).

3.1.3 Soils

The RMWMF has been constructed on the relatively level soils of East Mesa. East Mesa soils were formed in old unconsolidated alluvium, modified by wind, and are described as a portion of the Madurez-Wink Association (SCS, 1977). Two soils series are common to the site and vicinity. These are Embudo gravelly fine sandy loam and Wink fine sandy loam.

Embudo soils are deep, well-drained soils formed in alluvium derived from decomposed, coarse-grained, granitic rocks on old alluvial fans (SCS, 1977). Embudo soils are moderately alkaline. Runoff from these soils is medium with a moderate water erosion hazard.

Wink soils are deep, well-drained soils formed in old unconsolidated alluvium modified by wind (SCS, 1977). Wink soils are calcareous and moderately alkaline. Runoff from these soils is medium with a moderate water erosion hazard.

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.

3.2 Atmospheric Conditions

3.2.1 Climate

The general climate of Albuquerque is an arid continental type. Rainfall is scarce and averages approximately 20 cm (8 in) per year. Winters are characteristically very dry, whereas most moisture occurs during the summer months in the form of brief, but possibly heavy, thunderstorms (ERDA, 1977). The maximum observed precipitation in 24 hours occurred in September 1955 when 4.9 cm (1.92 in) were recorded (NOAA, 1988). Since thundershowers move with the prevailing winds aloft, thundershower activity could result in considerable precipitation upland from the RMWMF. Localized flooding may result from this concentrated activity and water may run high in arroyos in the area. Because Technical Area III is situated on ground higher than Tijeras Arroyo to the northwest and Arroyo Del Coyote to the northeast, precipitation at Technical Area III tends to run off, rather than collect in the area. Similarly, Tijeras Arroyo collects runoff from the mountains and diverts it from the area. Normal precipitation would not cause flooding at the RMWMF site. In addition, the site has been designed with proper grading and other measures to direct and control water runoff.

Temperatures are characteristic of high, dry, continental climates. Daytime temperatures average near 10 degrees Centigrade (°C) [50° Fahrenheit (°F)] during the winter. Daytime summer maximums are generally less than 31°C (90°F) except during July. The air is normally dry with an average annual humidity of about 46 percent. Sunshine is a predominant feature of the Albuquerque area and is recorded during approximately 75 percent of daylight hours.

Prevailing winds are from the east. Rapid cooling at night results in strong temperature inversions and strong drainage winds down Tijeras Canyon (Millard et al., 1987). The average hourly wind velocity at Albuquerque airport (1949-1958) ranges from 11.4 km/hr [7 miles per hour (mph)] in December to 17.7 km/hr (10.9 mph) during April. The annual surface wind speed and direction for Technical Area III of SNL/New Mexico are in Figure 3-3. Small tornadoes were observed in 1985 and 1987. Damage was light and no official wind readings were denoted. Based on climatological records, Albuquerque is classified as a region of low tornado occurrence with an annual probability of occurrence of approximately 5×10^{-6} per year (Coats and Murray, 1985).

Figure 3-3. Annual Surface Wind Speed and Direction of SNL/New Mexico

3.2.2 Air Quality

Routine release of radionuclides from SNL/New Mexico facilities is very small and is too low to be measured in public locations (DOE, 1988b). SNL/New Mexico is currently conducting a site-wide inventory of hazardous emissions.

Technical Area I is dedicated primarily to the design, research, and development of weapon systems and limited production of weapon system components. Generally, the only potential radioactive release from Technical Area I is tritium. Technical Area II is a small facility used for explosive testing. Small amounts of ⁸⁵Kr generated by explosive testing have been vented from the earth during fracture permeation tests. Due to the infrequent nature of testing operations, there have been no fracture permeation tests in Technical Area II since 1979 (DOE, 1988b).

Technical Area III, the location of the RMWMF, comprises 20 test facilities. No radioactive effluents are released through operations in this area.

A new facility in Technical Area IV, the Strategic Defenses Facility (SDF), is designed for inertial confinement fusion research and pulsed power research. The PT2 accelerator is located at this facility. A large accelerator, the Particle Beam Fusion Accelerator II (PBFA II), was completed in 1985. Gaseous tritium effluents may be released in the fusion research, starting in 1989. A large accelerator facility (Simulation Technical Laboratory) housing several pulsed-power accelerators, including HERMES III, was completed in 1986. HERMES III has been in operation since 1988.

Another new accelerator facility, SATURN, was completed in 1987. The maximum airborne releases from Technical Area V facilities for calendar year (CY) 1990 were calculated to be 5.3 Ci, primarily composed of Nitrogen-13 (¹³N) and Oxygen-15 (¹⁵O). The estimated dose to a hypothetical maximum exposed individual from existing facilities for CY 1990 is 5.0×10^{-5} mrem/yr (Hwang et al., 1991).

Technical Area V houses large electron-beam accelerators, three research reactors in two reactor facilities, an intense gamma irradiation facility (using ⁶⁰Co and ¹³⁷Cs), and a hot cell facility. A maximum of 0.20 Ci of tritium was released from 1990 operations. The airborne releases from the

reactor operations are composed of Argon-41 (^{41}Ar), tritium, ^{85}Kr , and ^{129}I . The reported releases from Technical Area V facilities for CY 1990 were extremely small (5.9 Ci, with an estimated dose to a hypothetical maximum exposed individual at 2.0×10^{-3} mrem/yr) and were not significantly different from releases of previous years (Millard et al., 1987, 1988, and 1989; Hwang et al., 1990 and 1991).

The calculated site boundary concentrations for gaseous radionuclides from 1990 releases are less than 0.004 percent of the EPA 10 mrem/yr emission standard (Millard et al., 1989). The maximum estimated dose to the maximum individual at the site boundary for CY 1990 is 2.7×10^{-4} mrem/yr. The maximum estimated population dose due to the release of gaseous radionuclides from SNL/New Mexico in CY 1990 was 2.6×10^{-2} person-rem over an 80 km (50 mi) radius, which includes the Albuquerque area. The corresponding individual and population doses due to natural background external penetrating radiation in the Albuquerque area [from the Thermoluminescence Dosimeter (TLD) measurements] are 99 mrem/yr and 44,500 person-rem based on the 1980 census population (Millard et al., 1989).

3.2.3 Noise

Noise levels in Technical Area III are currently at relatively low levels, consisting mainly of traffic noise, which is minimal, and occasional aircraft overflights. Actual quantitative measurements of noise levels have never been made in Technical Area III; however, there is not expected to be any net increase to Technical Area III noise levels due to the operation of the RMWMF.

The dominant source type of noise found at SNL/New Mexico is that of aircraft operations — both commercial and military — due to the location of the major east/west runways of Albuquerque International Airport (AIA) nearby SNL/New Mexico facilities. Military aircraft from KAFB share the runways of AIA with commercial aircraft. Aircraft noise is a periodic noise source with maximum noise levels associated with aircraft take-offs and landings.

Noise monitoring studies have been conducted on both SNL/New Mexico property and surrounding areas as part of: 1) an airport noise compatibility study (Greiner, 1990) and 2) a monitoring program conducted during the fall of 1990 to establish background/aircraft and Sandia

Technical Area operational noise (IT, 1990). Noise levels recorded ranged from 54 to 102 dBA for the northern section of SNL/New Mexico near Technical Area I, Technical Area II, and Technical Area IV east of the AIA east/west runway. Current Technical Area III noise levels, as measured at the RMWMF range in April 1992, from 64 to 72 dBA with an average of 66 dBA.

Because the RMWMF is located in an isolated area to the south of Technical Area III, noise levels at the RMWMF are likely to be less than those recorded in the northern sections of SNL/New Mexico closer to the airport runways.

3.3 Biological Resources

3.3.1 Vegetation

Plant species occupying the RMWMF site and vicinity represent the Grama-Galleta Steppe Section of the Colorado Plateau Province (Bailey, 1978) and comprise a Grassland Association. Although more than 50 grass species may be found within the onsite Grassland Association and surrounding environs, only a small number are abundant (Martin and Wagner, 1974). In addition to grasses, some shrubs and forbs also occur onsite.

The Grassland Association in the vicinity of the RMWMF site is in good condition. Grasses are estimated to comprise over 90 percent of the vegetative cover. The dominant species are sand dropseed (*Sporobolus cryptandrus*), Mesa dropseed (*S. flexuosus*), black grama (*Bouteloua eriopoda*) and galleta (*Hilaria jamesii*). Patches of burro grass (*Scleropogon brevifolius*) occur but are not extensive. Three-awn (*Aristida cf. longiseta*) and ring muhly (*Muhlenbergia torreyi*)/sand muhly (*M. arenicola*) are common grasses on the site (IT, 1989).

Shrubs, subshrubs, and forbs are sparse at the RMWMF site. Four-wing saltbush (*Atriplex canescens*) is the only shrub on the site, with only a few individuals exceeding the height of the grasses. Subshrubs are represented by broom snakeweed (*Gutierrezia sarothrae*), winterfat (*Eurotia lanata*), and plains yucca (*Yucca glauca*). Cacti observed on the site were prickly pear (*Opuntia phaeacantha*), club cholla (*O. clavata*), and pincushion cactus (*Coryphantha vivipara*) (IT, 1989).

3.3.2 Wildlife

The small size of the RMWMF site and the homogenous nature of the plant community do not support a high diversity of wildlife. Small mammals and birds are typically the most abundant species present at SNL/New Mexico. Common species of mammals include the desert cottontail (*Sylvilagus auduboni*), black-tailed jack rabbit (*Lepus californicus*), silky pocket mouse (*Perognathus flavus*), Ord's kangaroo rat (*Dipodomys ordii*), white-footed mouse (*Peromyscus leucopus*), and northern grasshopper mouse (*Onychomys leucogaster*) (Martin and Wagner, 1974).

Common bird species include the horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), thrashers including the crissal thrasher (*Toxostoma dorsale*) and sage thrasher (*Oreoscoptes montanus*), several species of sparrows, and mourning dove (*Zenaidura macroura*). Common predatory birds include the American kestrel (*Falco sparverius*) and marsh hawk (*Circus cyaneus*) (Martin and Wagner, 1974).

Extremely little wildlife activity was observed during a recent survey of the RMWMF site (IT, 1989). A coyote (*Canis latrans*) was heard approximately 1/4 to 1/2 mi to the west during the visit. Small to moderately large flocks of horned larks were observed. Signs of small mammal activity were few and limited to small burrows. The habitat type appears to support Ord's kangaroo rat and plains pocket mouse (*Perognathus flavescens*) (IT, 1989).

3.3.3 Threatened and Endangered Species and Species of Special Concern

No species of Federally-listed endangered or threatened plants or animals were observed at the RMWMF site. The New Mexico Natural Resources Department lists the State-endangered grama grass cactus (*Pediocactus papyracanthus*) as potentially occurring in the vicinity of the proposed site. However, this species was not observed at the RMWMF site during a recent survey (IT, 1989). The U.S. Fish and Wildlife Service concurs that threatened or endangered species are not likely to be negatively impacted by the RMWMF (Appendix C).

The bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), whooping crane (*Grus americana*), and meadow jumping mouse (*Zapus hudsonius*) are State-endangered species

considered likely to occur in Bernalillo County (New Mexico Department of Game and Fish, undated). These species, excluding the meadow jumping mouse, are also Federally-listed endangered species. Because none of the habitats preferred by these species occur in the vicinity of the RMWMF site, no Federal- or State-endangered species are expected to be impacted. It is possible that the threatened species of birds mentioned may migrate over the site; however, it is not expected that this facility would have any additional impact to these species that does not already exist in the Albuquerque area.

3.4 Cultural Resources

A pedestrian survey of the RMWMF site revealed no artifacts or cultural features (Chambers Group, 1989 (Appendix A). In addition, no sites on the National Register of Historic Places, or the State Register of Cultural Properties, or sites nominated to these registers are located within the RMWMF site. Laboratory of Anthropology records indicate that no archaeological sites have been reported in Section 29, T.9N, R.4E, where the RMWMF site is located.

The closest known cultural resource to the RMWMF site was recorded in KAFB Management Area B by the Center of Anthropological Studies. The site, which is recorded as a sheepherding complex dating to early New Mexico statehood, is about 1.9 km (1.2 mi) northeast of the RMWMF site (Chambers Group, 1989). Isolated occurrences of cultural resources — an obsidian chipped-stone core and a side scrapper — are situated about 683 m (2240 ft) and 719 m (2360 ft), respectively, from the RMWMF site.

Consultation with the State shows that the RMWMF would have no effect on previously-recorded historic properties (Appendix C).

3.5 Land Use

3.5.1 Existing Land Use

SNL/New Mexico is located at the base of the Manzano Mountains in Albuquerque, New Mexico. The SNL/New Mexico facilities exist on land owned by KAFB, land withdrawn from

the U.S. Forest Service Cibola National Forest, and land owned by DOE on behalf of the U.S. Government. SNL/New Mexico operations are conducted at five technical areas situated in the eastern half of the 190 km² (74 mi²) KAFB military reservation (Figure 2-1). In addition to the five technical areas, SNL/New Mexico has several remote environmental (engineering) test areas.

The main SNL/New Mexico complex consists of Technical Areas I and II. Technical Area I is located along the northern boundary of KAFB and is dedicated primarily to the design, research, and development of weapons system components. Technical Area II, located immediately south of Technical Area I, consists of a small facility used for explosive testing. Technical Area III is located 8 km (5 mi) south of Technical Area I and is comprised of 20 test facilities that include extensive environmental (engineering) test facilities. Technical Area IV is located south of the main SNL/New Mexico complex. This technical area is a new facility designed for inertial confinement fusion research and pulsed power research. In addition, Simulation Technology Laboratory (STL) has been completed and contains seven accelerators. Technical Area V abuts the northeast corner of Technical Area III. Technical Area V contains large electron-beam accelerators and research reactors. Other environmental test areas are located outside the five technical areas, south and east of Technical Area III and in the canyons on the west side of the Manzano Mountains. Most of this area is open space with various facilities located throughout.

Livestock grazing is not allowed at KAFB. In addition, the RMWMF site is restricted from any recreational activity including hunting, hiking, and off-road vehicle use. Visual resources are not addressed because the proposed RMWMF would conform to SNL/New Mexico building standards and would not differ significantly from existing buildings. Potential impacts to livestock, vistas, and recreation are considered insignificant.

When the RMWMF was originally sited, an investigation by the Environmental Restoration (ER) Program identified the 1.2-hectare (3-acre) area as vacant, unused land. No change in land ownership was needed for construction of the RMWMF or to convert the land to use associated with waste management. Subsequent to the ER initial determination, the ER Program included the land at and around the RMWMF site in a comprehensive environmental restoration list based on interviews conducted during 1987-89. The area was reported to have the potential for the presence of explosive and heavy metals residue. In October 1991, the ER Program informed RMWMF management that

the RMWMF site is an ER site and that a Remedial Facilities Investigation Workplan is being written in order to assess the site. In addition, the area is included in the Draft (August 1991) Hazardous and Solid Waste Amendment (HSWA) Part B Permit as an ER site. No other land uses are expected to be impacted or changed because of this project.

3.5.2 Transportation Network and Traffic Volumes

Albuquerque is bisected by two interstate highway systems, as well as an extensive network of local, State, and Federal roadways. Traversing east and west, Interstate 40 (I-40) is the main transportation route from Los Angeles, California, to the east coast. I-40 passes in close proximity to KAFB and within 8 km (5 mi) north of SNL/New Mexico Technical Area III. Interstate 25 (I-25) is a north-south route and passes 5.6 km (3.5 mi) west of the main SNL/New Mexico complex. Each highway carries a great volume of traffic, especially I-40, which provides one of five crossings of the Continental Divide in the interstate highway system.

Air transportation is also an integral part of the transportation system in the Albuquerque area. The Albuquerque International Airport consists of private, commercial, and military facilities at the west end of KAFB. These facilities are located approximately 8.9 km (5.5 mi) west of the main SNL/New Mexico complex.

Primary access into the proposed facility would be along restricted roadways in Technical Area III. These roadways would be paved as part of the Proposed Action.

3.6 Social and Economic Conditions

3.6.1 Demography

According to 1990 census figures, the City of Albuquerque had 571,677 inhabitants (Albuquerque, no date). Albuquerque is the major urbanized area in Bernalillo County and lies in the east-central portion of New Mexico. The combination of Bernalillo and Sandoval Counties comprises the Albuquerque Standard Metropolitan Statistical Area (SMSA). In 1990, the population of the Albuquerque SMSA reached 528,466 (Albuquerque, no date). The population of Bernalillo County

exceeded 480,577 with the remaining inhabitants residing in Sandoval County (47,889) (Albuquerque, no date). Population change within the SMSA has increased by 16 percent since 1980. Bernalillo County has experienced an increase of about 15 percent, while the Sandoval County population increased about 38 percent from 1980 to 1990. Moreover, since 1980 the City of Albuquerque has increased by 52,400 people. There were over 200,000 households in the Albuquerque SMSA as of 1990 (Albuquerque, 1991). This equates to a 24 percent increase in housing since 1980. The average household size was 2.55 people with a median age of approximately 30 years (Albuquerque, no date). SNL/New Mexico has about 8,400 employees.

The next nearest population to SNL/New Mexico is the Isleta Pueblo with a population of 4,460 at a distance of approximately 11.2 km (7 mi) to the southwest (Isleta, 1992). Torrance County is a rural and sparsely-populated (10,327) area that lies east of SNL/New Mexico in the Manzano Mountains (New Mexico, 1991). The total estimated population is 571,677 people within an 80 km (50 mi) radius of the site.

The military housing area and recreational facilities are in close proximity to SNL/New Mexico technical areas. The residential area is north and west of Technical Area III, where housing consists of detached or semi-detached family houses and some barracks. The Census Bureau defines this portion of KAFB as a Census Designated Place (CDP). As of 1990, the Sandia CDP had a population of 5,761. This figure represents an increase of nearly 500 people from 1980 to 1990 (Albuquerque, 1991). Air Force recreational facilities include, but are not limited to, a golf course, a skeet shooting range, and riding stables.

3.6.2 Economic Activities

The principal industry of the Albuquerque area is government-related. SNL/New Mexico is one of the top three employers in Albuquerque along with the public school system and KAFB. Various other national and State government agencies also have offices or regional headquarters in Albuquerque. Aside from the government sector, the basic industries of New Mexico are agriculture, ranching, construction, timber, oil and gas, service, and tourism. Agriculture is concentrated along the perennial streams of the area, especially the Rio Grande, with some dry farming on the mesas. Most of the land in New Mexico, other than in the mountains, is devoted to grazing cattle and sheep

on natural range grasses. In the immediate Albuquerque area, there is little grazing, and there is none at all on KAFB. Tourists are a major business in the Albuquerque area. A particular tourist attraction, in addition to the scenery, is a large number of Indian Pueblos within 80 km (50 mi) of Albuquerque.

SECTION 4.0

ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

The environmental consequences resulting from the construction (to date and planned as described in this EA) and the proposed operation of RMWMF are discussed in this section. The environmental impacts related to hydrology, geology, soils, air quality, noise, biological resources, cultural resources, land use, social, and economic conditions are presented. Cumulative effects of the Proposed Action and current SNL/New Mexico operations are summarized. Unavoidable adverse effects and the irreversible and irretrievable commitment of resources are discussed. The health and safety impacts for routine and abnormal events are followed by a comparison of Alternative 1 (No Action) and Alternative 2 (decentralized facilities) to the Proposed Action, Alternative 3.

4.1 Environmental Impacts of Construction

Short-term adverse impacts have resulted from the construction of the RMWMF. Site preparation and construction effects (soil disturbance, vegetation removal, wildlife displacement, potential soil erosion, dust generation, vehicle emissions, noise, and increased traffic) were minimal due to the small area required for the facility, the design of the facility, the isolated location of the facility site, and previous disturbances from Technical Area III testing activities. Additional impacts would be realized with the completion of construction activities at the RMWMF and the paving of the roadways to the RMWMF. The additional construction impacts are expected to be limited to the effects described above.

The RMWMF created temporary employment for a few construction workers. The planned facility upgrades discussed in Section 2.3.1 would also create temporary employment for a few construction workers. Operations employees would be transferred from other positions at SNL/New Mexico or brought in on a subcontractor basis.

Long-term impacts include the removal of 1.2 hectares (3 acres) of grassland habitat and some increased traffic to the new facility. Because the RMWMF was constructed on land owned by the DOE in an isolated location, these impacts are minimal. The facility conforms to SNL/New Mexico building standards and does not impact visual resources or recreation.

4.1.1 Earth Resources

Hydrology

A small amount of water (approximately 1000 gal/yr assuming 200 batches of 5 gal each) would be used in the solidification and bench-scale treatment of LLW and MW at the RMWMF. Any contaminated water generated from laboratory analyses, routine cleaning activities, decontamination, or stack condensation would be collected, contained, and analyzed in the facility for appropriate disposal.

No direct releases of contaminants present in LLW or MW would occur to groundwater or surface water as a result of normal facility operations or accident conditions. There are no underground tanks associated with the facility, other than the originally-installed septic tank which has been abandoned in place. The interior of the RMWMF is designed to collect any spilled liquids in floor drains and closed collection systems (SNL, 1988c). In the event of a spill of contaminated liquids within the facility, the liquid would be collected, contained, analyzed, and treated for appropriate disposal.

The property surrounding the facility would be fitted with a stormwater runoff (from adjacent facilities) and runoff (from the proposed facility) control system to provide drainage to a lined surface impoundment (SNL, 1988c). The impermeable liner, either natural or synthetic, would prevent water percolation to the subsurface. The water in the impoundment, when present, would be routinely monitored. Under normal conditions, all exterior drainage water collected in the impoundment would be allowed to evaporate.

In the event of a fire or other abnormal condition resulting in water accumulation exceeding the facility containment capacity, the excess water would be contained by the drainage and impoundment system. This water would then be analyzed following the event for appropriate action. Approximately five individuals would be employed at the RMWMF when operational. There would be a minimal increase in water usage and sewage generation.

Only short-term impacts resulted from water utilization during construction. Minimal amounts were used for structure development and dust suppression. Surface water runoff from extremely heavy precipitation events potentially could have increased sediment yields in area drainages. However, because the site was graded for runoff containment, there was no accumulation of sediment from the RMWMF during construction.

Geology

The RMWMF site, which lies in Seismic Risk Zone 2, has the potential for moderate seismic activity and resultant structural damage. Design criteria for the RMWMF specify design for Seismic Risk Zone 2 and the facility was constructed to these criteria (SNL, 1988a).

Soils

Long-term impacts to onsite soils resulted from destruction of soil profiles and soil properties due to construction activities, particularly clearing and leveling. 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 a building and future paved areas and roads.

Short-term impacts resulted from minimal wind erosion and generated dust, following vegetation cover removal. Dust suppression with water was used to control and minimize this impact.

4.1.2 Air Quality

Air quality was not significantly impacted by RMWMF construction and would not be significantly impacted by its operation (Section 4.2.1). Short-term effects included a minimal increase in the levels of dust and other air pollutants generated by construction activities, including topsoil removal and exhaust emissions from construction equipment.

Potential sources of radioactive air emissions from RMWMF operations include the drum compactor rooms, glove boxes, hoods, and tritium storage areas. These areas were designed and constructed to isolate potential sources of contamination and to incorporate the mitigation measures

necessary to protect health, ensure safe operations, and minimize environmental impacts (SNL, 1988c).

The facility is primarily a storage facility with some limited repackaging capabilities and nondestructive analysis and certification functions. The majority of LLW and MW packages accepted at the facility would already be packaged to DOT specifications by the generator. Some waste may be sampled for analysis of waste characteristics and then repackaged as appropriate. Two glove boxes and two fume hoods would be used to obtain samples for radioactive material characterization if necessary. During storage, all waste in the facility, which is primarily solid waste, would be contained in DOT-approved packaging (SNL, 1988c).

High-efficiency particulate aerosol (HEPA) filtration, prior to discharge into the main exhaust and filter system, is included in all locations that may be potential sources of particulate air emissions. The main exhaust has both HEPA and carbon absorber filters (SNL, 1988c). All HEPA filters would be periodically tested, in accordance with American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME) N509 and N510, and replaced as necessary. A stack monitoring system would be installed to monitor any potential radioactive air emissions (SNL, 1988c).

Noise levels increased over the short term because of heavy equipment use and other associated activities during the construction phase of the RMWMF. Because of its isolated location, operation of the RMWMF would have minimal impact on noise levels outside SNL/New Mexico Technical Area III. Minimal long-term noise impact is expected from routine operations.

4.1.3 Biological Resources

The construction of the RMWMF resulted in the disturbance of approximately 4 hectares (10 acres) with the facility occupying 1.2 hectares (3 acres). Long-term effects of this action are the loss of a small area of nonunique habitat to local flora and fauna populations.

Short-term impacts included the destruction of some vegetation during construction activities. Vegetation near the site was covered with dust, which would temporarily reduce plant productivity.

Relatively nonmobile wildlife populations, such as small mammals, were disrupted in the construction area. Wildlife species not affected directly by the construction activities were expected to have experienced increased competition in the surrounding areas and potential reductions in populations because of increased predation. Avian species were dispersed into surrounding areas and were expected to lose potential nesting areas because of loss of vegetation.

There are no Federal- or State-listed threatened or endangered species of plants or animals present on the site. Consequently, these species were not affected by RMWMF construction and would not be impacted by its operation. Furthermore, there is no critical habitat present. The site is located above the flood plain and there is no wetland habitat present.

4.1.4 Cultural Resources

There are no historic nor archaeological sites within the RMWMF project area. Therefore, no impacts to cultural resources resulted from construction of the facility and none would be expected during operation of the facility.

4.1.5 Land Use

When the RMWMF was originally sited, an investigation by the ER Program identified the 1.2-hectare (3-acre) area as vacant, unused land. No change in land ownership was needed for construction of the RMWMF or to convert the land to use associated with waste management. Subsequent to the ER initial determination, the ER Program included the land at and around the RMWMF site in a comprehensive environmental restoration list based on interviews conducted during 1987-1989. The area was reported to have the potential for the presence of explosive and heavy metals residue. In October 1991, the ER Program informed RMWMF management that the RMWMF site is an ER site and that a Remedial Facilities Investigation Workplan is being written in order to assess the site. The area is included in the Draft (August 1991) HSWA Part B Permit as an ER site. No other land uses are expected to be impacted or changed because of this project.

The volume of traffic into SNL/New Mexico was temporarily increased during the construction phase of the RMWMF. Heavy equipment and building materials were moved to the

construction site and workers were present. Construction traffic increased by approximately five vehicles per day. During the operational phase it is expected that traffic volumes would increase by five to ten vehicles per day with transportation of waste to the facility. The annual volume of waste would fluctuate but is not expected to create any traffic problems because of the isolated location of the facility.

4.1.6 Social and Economic Conditions

The RMWMF created temporary employment for a small number of construction workers and would eventually create permanent employment for approximately ten operation employees. Operation employees may be transferred from other current waste activities at SNL/New Mexico or brought in on a subcontractor basis.

Construction of the facility provided revenue for local contractors and added minimally to the local tax base and economy. Cost for construction of the facility as originally designed was approximately \$1.2 million. Additional construction required before the facility becomes operational is approximately an additional \$1 million.

4.2 Cumulative Effects

The cumulative effects of the current SNL/New Mexico nonradioactive and radioactive effluent released to the environment, as well as the anticipated incremental impact of the RMWMF, are presented in this subsection. Tritium in small quantities (< 10 Ci/yr) is the only potential radioactive or hazardous material that may be released as a result of normal, routine operations at the RMWMF. Nonroutine events are discussed in Section 4.5.

4.2.1 Air Emissions

SNL/New Mexico is subject to air pollution regulations including compliance with National Emission Standards for Hazardous Air Pollutants (NESHAPs). Air pollution regulations are administered at both the national and the city/county level.

For radionuclide emissions, a permit from the EPA, if required, is issued after compliance is demonstrated with NESHAPs for radionuclide emissions from a DOE facility (Section 4.5.1). Except for radionuclide NESHAPs, all air pollution permits are issued after compliance with the air quality control regulations for Albuquerque/Bernalillo County. For nonradionuclide emissions, compliance must be demonstrated with the emission standards for hazardous air pollutants of the Albuquerque/Bernalillo County Air Quality Control Board. This board imposes local requirements that are identical to Federal NESHAPs. Thus, for nonradionuclide emissions, local government has been granted full authority from EPA for the administration and enforcement of the NESHAPs program in Bernalillo County (Millard et al., 1989).

There are currently four airborne radionuclide sources at SNL/New Mexico. In 1988, NESHAPs applications were submitted to and approved by the EPA for two accelerators. One was for the Hermes III accelerator, which has been in operation in Technical Area IV since February 1988. The second was for the PT2 accelerator, an emissions source associated with the SDF project. In 1989, a NESHAPs application was submitted and approved by the EPA for the third source, PBFA II, a particle-beam fusion accelerator used for inertial confinement fusion research (SNL, 1989a). All three accelerators are located in Technical Area IV. The fourth source of radionuclide emissions at SNL/New Mexico is the Technical Area V reactor facilities: the Annular Core Research Reactor (ACRR) and the Sandia Pulsed Reactor (SPR) (SNL, 1989a).

The RMWMF could be expected to contribute a maximum of approximately 5 to 10 Ci of tritium from normal operations to the annual air emissions at SNL/New Mexico. It is estimated that this quantity of tritium emanates annually from the inactive radioactive disposal site during disposal operations. Because disposal operations at the radioactive waste disposal site have been discontinued and subsequent disposal of LLW and MW would occur offsite, the contribution from the RMWMF would not create an increase in site-wide releases. Therefore, a NESHAPs permit for modification would not be required.

A summation of the expected dose from each of these sources and the projections for each receptor site is provided in Table 4-1. Calculated contributions by the RMWMF to the cumulative annual dose to individuals at these receptor sites, based on an annual tritium release of 10 Ci, average less than 1 percent of the total.

Table 4-1

**Summation of Dose Approximations at Selected Receptor Sites
From Current and Projected SNL/New Mexico Radionuclide Air Emissions***

Receptor Site	Location	Whole Body Dose Approximations**					Total
		HERMES III†	PT2†	PBFA II††	Reactor‡	RMWMF‡‡	
1	NW Base Housing - W. Penna. Ave. & S. Gibson (N.W. Site Boundary)	3.69×10^{-5}	4.80×10^{-4}	3.15×10^{-6}	1.75×10^{-4}	2.5×10^{-5}	7.20×10^{-4}
2	Four Hills - TLD Station (NE Site Boundary)	2.15×10^{-6}	2.80×10^{-5}	1.62×10^{-7}	9.50×10^{-5}	4.7×10^{-5}	1.72×10^{-4}
3	N Base Housing - N of Gibson & E of Wyoming (N Site Boundary)	3.04×10^{-5}	3.95×10^{-4}	2.14×10^{-6}	2.46×10^{-4}	5.6×10^{-5}	7.30×10^{-4}
4	NW DOE Complex - TLD Station (NW Site Boundary)	2.41×10^{-5}	3.13×10^{-4}	1.98×10^{-6}	1.56×10^{-4}	3.0×10^{-5}	5.25×10^{-4}
5	Mountain View - W of KAFB (West Community)	4.90×10^{-8}	6.42×10^{-7}	3.61×10^{-9}	5.00×10^{-5}	2.1×10^{-5}	7.17×10^{-5}
6	Tijeras - E of KAFB (East Community)	2.40×10^{-8}	3.15×10^{-7}	1.75×10^{-9}	1.90×10^{-5}	1.0×10^{-5}	2.93×10^{-5}
7	Isleta Gate - TLD Station						
<p>* SNL, 1989a.</p> <p>** All doses in mrem/yr.</p> <p>† Small quantities of ^{13}N, ^{15}O, ^{11}Cl, and ^{39}Cl at projected maximum operations level.</p> <p>†† Small quantities of ^{13}N and ^{15}O at projected maximum operations levels.</p> <p>‡ SNL/New Mexico reactor operations releases of ^{41}Ar for 1987.</p> <p>‡‡ Projected routine releases of ^3H (Appendix D).</p> <p>§ No residential population.</p>							

The largest total individual dose from all routine releases at SNL/New Mexico, including the RMWMF, to a single receptor site at the southern KAFB boundary (Receptor Site 7, Isleta Gate) is calculated to be approximately 1.94×10^{-3} mrem/yr (Section 4.5.2). However, there are no residences at this location which is on the northern edge of the Isleta Pueblo with no permanent residents and restricted traffic. The projected dose represents a very small percentage (0.02 percent) of the EPA annual standard of 10 mrem/yr for a receptor site (EPA, 1989). This projected total individual dose is less than 1 percent of the NESHAPs for radionuclides and, therefore, no EPA air permit is required. SNL/New Mexico is currently in compliance with all emission standards for radioactive air pollutants.

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 would incur an extremely small risk from exposures at any of the rates and locations indicated in Table 4-1.

The associated cumulative population dose per year from the RMWMF and all other SNL/New Mexico facilities was calculated to be 1.09 person-rem. 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 6×10^{-4} excess cancer fatalities per year of exposure in the affected population from the cumulative SNL/New Mexico site dose. This population dose estimate is a conservative value and is calculated by the Albuquerque area population (571,677) which resides at the location having the highest calculated individual dose (Isleta Gate); all exposure to the population occurs at that location.

No increases in CO, SO₂, NO_x, or other hazardous material emissions were noted from the construction or are expected from routine operation of the RMWMF. Radiolytic generation of gases (including hydrogen) has been observed for some high-activity waste such as ion-exchange resins (internal dose rate > 100,000 rads). However, the volume of gas is small and the primary concern relates to package integrity rather than any explosive hazards (NRC, 1985). For the LLW stored at the RMWMF, radiolytic gas generation would be negligible since any organics and resins would be in small quantities and would be associated with radionuclides emitting low-dose radiation. SNL/New Mexico is currently in compliance with all emission standards for nonradioactive air pollutants (Hwang et al., 1991).

4.2.2 Water Effluent

SNL/New Mexico has maintained an environmental monitoring program for radioactive liquid effluent since February 1959. The objectives of this surveillance program are to detect the release and migration of radioactive material from SNL/New Mexico operations and to determine if population exposures above normal background radiation levels occur. The monitoring program also provides a check on the effectiveness of radiological safety systems which are in effect at SNL/New Mexico. Radioactive discharges to the environment are kept in compliance with the ALARA principle and in accordance with interim DOE guidelines for environmental protection. Water is monitored for radionuclides, primarily cesium, tritium, and uranium. Gross alpha and gross beta screening analysis are also performed on water samples.

Concentrations of ^{137}Cs and ^3H in regional surface and wellwaters are less than minimum detectable levels (MDL) and well below the DOE concentration guides. Gross alpha concentrations in wellwaters (potable and monitoring) averaged 3×10^{-3} pCi/ml while gross beta concentrations in wellwaters averaged 3×10^{-3} pCi/ml and 6×10^{-3} pCi/ml. Uranium concentrations averaged 1.9×10^{-3} $\mu\text{g/ml}$ in wellwater samples. Surface water uranium concentrations averaged $40 \pm 57 \times 10^{-6}$ mg/ml for the three locations sampled (Millard et al., 1989). The RMWMF would not directly release any radioactivity to ground or surface waters.

SNL/New Mexico nonradioactive water effluent sources consist of potential releases to groundwater, wastewater, and storm sewers. Although these sources are small and the potentials for release are kept low by adherence to stringent administrative policies, a program to monitor these releases in compliance with environmental regulations was started in 1986. SNL/New Mexico has a monitoring program for nonradioactive effluents, which is expanded as needed and in compliance with changing regulations (Hwang et al., 1991). The program includes monitoring of groundwater, wastewater, and storm water; sanitary wastewater would be discharged from the RMWMF into the sanitary sewer system.

As detailed in Section 4.1.1, there would be no liquid process effluent from the facility under either normal or abnormal conditions. Within the facility, all areas which might generate potentially contaminated liquids are served by a closed collection system for all sinks and drains. Liquid

collected by this system is analyzed for both radioactive and hazardous contaminants before determining the appropriate method of treatment and/or disposal. The decision as to the appropriate method would depend on the type of contamination, the volume of contaminated liquid, and the applicability of existing bench-scale treatment capabilities at the RMWMF. Any spilled liquids are similarly collected by a closed collection system and analyzed for proper disposal. All liquids showing unacceptable levels of contamination and meeting discharge permit requirements would be released through the sanitary sewage system. Exterior storm discharge or unplanned water releases from the facility (such as water from fire fighting) would be collected by a runoff control system and diverted to a lined, closed impoundment. The water would be routinely monitored for possible contaminants and would normally be allowed to evaporate or discharge to the surface if uncontaminated. Should contamination be detected, an appropriate means of treatment and disposal would be determined as described above for contaminated liquids. This determination would be based on the nature and extent of contamination, on the volume of contaminated water, and on the applicability of bench-scale treatment processes at the RMWMF.

4.3 Unavoidable Adverse Effects

The proposed operation of RMWMF may result in a small increase in monitored air emissions at SNL/New Mexico. Overall, with the elimination of "old" landfill disposal practices for LLW and the offsite disposal of the waste, total emissions may be reduced.

Groundwater usage from the KAFB water system increased slightly during construction. Soils were moved and disrupted during construction, resulting in the removal of approximately 1.2 hectares (3 acres) of vegetation and habitat. Some plant loss and animal displacement resulted. Dust and noise levels were elevated temporarily during construction. However, dust was controlled with water.

4.4 Irreversible and Irretrievable Commitment of Resources

Materials (steel and concrete) and energy used for construction and future energy requirements for the RMWMF operation are considered nonrenewable resources. These resources were used or would be used and are irretrievably committed as a result of the RMWMF project.

Few renewable resources were lost as a result of the RMWMF construction. Some habitat disturbances (4 hectares [10 acres]) occurred at the site during construction. Recovery of desert communities is extremely long. However, assuming these areas would be reclaimed following decommissioning of the facility, no irreversible impact on the biological resources is foreseen. No other irreversible or irretrievable impacts are expected.

4.5 Health and Safety

In this section, the potentials for health effects from the operation of the RMWMF are identified, discussed, and assessed. Effects are analyzed for routine releases of radioactivity and for credible abnormal events involving LLW and MW. There would be no routine releases of hazardous materials from the RMWMF. Effects of accidents described are reported from a radiological standpoint. Doses to workers from accidental chemical exposures are reported for the base case accident analysis and the reactive storage area fire and are considered to bound all other accidents.

4.5.1 Calculation of Radiological Dose Commitments

Radiological dose commitments are calculated to assess the effects of radiation exposure on the human body. Nationally-accepted calculation methodologies (Appendix D) are used in this analysis to estimate radiation doses. The Appendix D methodology is required by EPA to demonstrate compliance with 40 CFR 61 Subpart H (EPA, 1989).

The technique used for calculating doses from radioactive air releases results in effective dose equivalents based on the AIRDOS-EPA model (ORNL, 1979), internal dose conversion factors (ICRP, 1978 and EPA, 1989), and external dose conversion factors (Dunning et al., 1980). Doses to humans have been calculated for the four most significant airborne radionuclide pathways: inhalation, ingestion, air submersion, and ground-deposition surface exposure.

The dose from routine releases are evaluated for three receptor groups:

- Maximally-exposed individual (public), located 2.8 km (1.8 mi) south of the RMWMF at the KAFB boundary (Isleta Gate);

- Local individual residents (public) at six additional public receptor sites surrounding KAFB and the RMWMF; and
- Maximally-exposed worker located 120 m (394 ft) south of the RMWMF.

For abnormal events, doses were calculated for the following receptor groups:

- Maximum onsite individual, located approximately 305 m (1000 ft) north north-east of the RMWMF at the nearest SNL/New Mexico facility;
- Maximum offsite individual located at a distance of 2.8 km at the Isleta Gate; and
- Workers inside the facility.

These groups are defined below.

The ***maximally-exposed individual*** is a hypothetical member of the public whose location and habits are selected so that this individual receives the maximum exposure to released contaminants. For routine releases it is assumed that this individual lives continuously on the SNL/New Mexico boundary where the air concentrations of radioactive material have been calculated to be a maximum and where the individual grows, raises, and consumes food. The closest location where this might occur is 2.8 km (1.8 mi) south of the RMWMF at the Isleta Gate entrance to KAFB. For abnormal events, the maximally-exposed individual is also assumed to be at the nearest site boundary (Isleta Gate). The maximally-exposed individual for abnormal events, both public and workers, is assumed to receive no dose contribution from ingestion of food or prolonged exposure to groundshine from radionuclide deposition since both exposures are avoidable. The maximally-exposed individual is affected only by inhalation and air submersion in the radioactive plume following an accident.

The ***local individual residents*** are assumed to be at selected public receptor sites located close to the RMWMF where people live or work. For these seven targeted locations, an individual's dose is assessed.

For calculating routine exposures, the ***maximally-exposed worker*** is one onsite at the point where the air concentration of radioactive material is calculated to be maximum (120 m (394 ft) south of the RMWMF). For accidents, the locations of onsite individuals and workers are at the nearest normally occupied onsite facility, 305 m (1000 ft) north north-east of and inside the RMWMF.

4.5.2 Effects From Routine Releases

The RMWMF is primarily a storage facility with limited repackaging and waste treatment capabilities. Potential sources of air emissions include the drum compactor rooms, glove boxes, ventilation hoods, and tritium storage areas. These areas were designed to isolate potential releases and incorporate mitigation measures to minimize environmental effects. As indicated in Table 2-3 (Section 2.3.3), tritium is the only gaseous radionuclide expected to be present in the facility. There have not been any other radionuclides identified that could be detected as having a life-time risk from long-term exposure or worker exposure. Potential exposures to workers could result from bench-scale testing and opening of containers to perform tests on the contents. Additionally, workers would have a potential exposure to gamma and x-rays from material stored in steel drums. The ventilation air flow from both the storage and staging areas passes through HEPA filters before being released to the environment, and the filters would effectively remove particulates entrained in the air. Compaction is the only operation in the facility which could be expected to release particulates to the ventilation air. The gaseous radionuclides would pass through the HEPA filters unabated. It is estimated that approximately 5 to 10 Ci of tritium could be released annually (Section 4.2.1) and would be the only radionuclide release from the facility.

The effects of routine nonradiological releases were analyzed. As indicated in Table 2-4 (Section 2.3.3), the hazardous material inventory of the facility would consist of various metals. Only small quantities of volatile hazardous compounds are expected to be present in the facility. Metals would, therefore, occur as particulates in the ventilation air stream and would have passed through the HEPA filters preventing release to the atmosphere. This would result in, at most, negligible releases of hazardous constituents.

Table 4-2 summarizes the expected radiological doses and risks (50-yr committed effective dose equivalent) for local individual residents resulting from an annual routine release of 10 Ci of tritium. The maximum individual dose (Table 4-2, Isleta Gate location, with no residential population) was 1.60×10^{-3} mrem. The second largest dose to an individual receptor was 5.6×10^{-5} mrem at the north base housing. All receptor location doses were below the regulatory standard and would convey extremely small risk. The relative contribution of the RMWMF to the total cumulative annual doses to individuals at these receptor locations is discussed in Section 4.2.1.

Table 4-2

**Annual Radiological Doses and Health Effects to the Public
From Tritium Releases During Routine Operations
of the Radioactive and Mixed Waste Management Facility
and From Projected Operations as Compared to Natural Background Radiation**

<i>Receptor*</i>	<i>Individual Dose (mrem)</i>				<i>Health Effects From Operations of RMWMF**</i>
	<i>Back-ground Dose** (mrem)</i>	<i>From Expected SNL/New Mexico Operations†</i>	<i>From RMWMF Operations††</i>	<i>Standard‡ (mrem)</i>	
NW Base Housing	99	7.20×10^{-4}	2.5×10^{-5}	10	1.25×10^{-11}
Four Hills	99	1.72×10^{-4}	4.7×10^{-5}	10	2.35×10^{-11}
N Base Housing	99	7.30×10^{-4}	5.6×10^{-5}	10	2.80×10^{-11}
NW DOE Complex	99	5.25×10^{-4}	3.0×10^{-5}	10	1.50×10^{-11}
Mountain View	99	7.17×10^{-5}	2.1×10^{-5}	10	1.05×10^{-11}
Tijeras	99	2.93×10^{-5}	1.0×10^{-5}	10	5.00×10^{-12}
Isleta Gate§	99	1.94×10^{-3}	1.6×10^{-3}	10	8.00×10^{-10}
<i>(SUM) TOTAL</i>					8.95×10^{-10}

* See Table D-5 for a more detailed description of receptor locations.

** Natural background radiation (Millard et al., 1989).

† Doses from 1989a.

†† Doses and effective dose equivalents from the inhalation of tritium.

‡ EPA, 40 CFR 61.92

** Health effects expressed as excess mortality from all forms of cancer per year of exposure, based on 5 excess cancer fatalities per 10^7 person-mrem (NRC, 1991).

§ Isleta Gate is the maximum individual dose receptor location for routine releases.

The primary hazard to radiation workers at the RMWMF would be radiation exposure from the radioactive and mixed waste. The maximum dose to a facility worker resulting from release of tritium during routine operations is calculated to be 1.7×10^{-2} mrem/yr. This dose is based on the conservative assumption that the individual remains at the maximum exposure location continuously for the entire year. For normal operations, facility worker exposures to radiation would be

administratively limited by shielding, ventilation control, and SOPs to less than 500 mrem/yr, which is well below the DOE criterion of 5 rem/yr (DOE, 1988a). Worker exposures to chemicals, noise, and other non-radiological exposures would be administratively limited to below threshold limit values (TLV)/time weighted average (TWA) levels. Additional hazards to workers include possible injury from waste handling and common industrial operations. SOPs would be prepared and approved before the facility is operational and then strictly followed to ensure compliance with health and safety requirements and procedures. Training programs would be instituted to ensure workers' awareness of these requirements and procedures.

The health effects for a population exposed to a radiation dose are estimated as excess cancer fatalities resulting from the calculated population dose. It is conservatively estimated that there will be from 1.7 to 5 excess cancer fatalities for every 10,000 person-rem (5.0×10^{-7} health effects per person-mrem). While normally applied to population dose, this factor can be used to calculate the expected health effects to an individual (Table 4-2). The dose to the maximally-exposed individual (Isleta Gate) is calculated to result in an increased chance of latent cancer fatality per year of exposure of 8.00×10^{-10} from operations of the RMWMF and an increased cancer fatality frequency of 8.95×10^{-10} from all SNL/New Mexico operations including the RMWMF (Table 4-2). Routine releases of hazardous materials would be very small. The greatest volume of hazardous material present in the facility consists of solid lead and beryllium chips. These materials pose no threat to either public receptors or workers on a routine basis and minimal routine releases would result from their presence in the facility. The greatest potential exposure to workers would come from inorganic solvent fumes when waste drums are opened. However, the hooded ventilation system would eliminate virtually all exposure to such fumes.

4.5.3 Effects From Abnormal Events

The effects from abnormal events that could reasonably occur are described in this section. Additionally, a maximum abnormal event was evaluated. A qualitative analysis was performed, considering both natural phenomenon and operational accidents, to identify accidents with a probability greater than 10^{-6} per year, which were of a sufficiently serious nature to warrant evaluation of their consequences (SNL, 1991a). Accidents with a probability of occurrence ranging from 10^{-6} to 10^{-8} are realistically bounded by the base case accident. An accident scenario specific to

a tornado that destroys the RMWMF was not analyzed because the probability is extremely small $\approx 5 \times 10^{-6}$ per year (Coats and Murray, 1985) and the consequences would be less than the aircraft crash. Thus, the tornado accident is bounded (smaller fatality risk) by the scenario presented for the aircraft crash.

For activities such as emergency rescue and recovery, the guidance and requirements of DOE Order 5480.11, "Radiation Protection for Occupational Workers," will be followed and RMWMF personnel trained to those requirements. For clean-up activities, the RMWMF Contingency Plan will be implemented and doses to workers controlled per 5480.11 limits for routine work activities.

The following accidents were selected for evaluation:

1. Earthquake and fire;
2. Aircraft crash;
3. Helicopter crash;
4. Multiple container fire;
5. Processing area fire;
6. Laboratory fire;
7. Storage area fire;
8. Tritium storage area fire;
9. Uranium storage area fire;
10. Liquid storage area fire;
11. Liquid storage area spill;
12. Reactive storage area fire;
13. Solvent storage area fire;
14. Liquid Petroleum Gas (LPG) pipe rupture and explosion;
15. LPG tank rupture and explosion;
16. Site blackout; and
17. Ventilation system failure.

All other abnormal events that might result in offsite consequences were found to have an extremely low probability (and therefore not reasonably foreseeable) and/or to result in only minor consequences that are bounded by the events listed above.

The probability of an aircraft crash was calculated as 1.27×10^{-6} per year; therefore, the accident was analyzed and included in the risk assessment. The effects of the aircraft crash with a subsequent fire engulfing the entire facility were determined to provide an upper bound on all reasonably foreseeable accidents for the RMWMF (SNL, 1991a).

Base Case Accident

The facility is designed to withstand the designated design basis earthquake (DBE), consistent with the requirements of DOE Order 6430.1A (DOE, 1989). However, an earthquake of a significantly greater magnitude, one that would result in structural damage to the facility, has a probability of 1×10^{-4} /yr and is selected as the base case accident. For this scenario, it was assumed that the damage to the building results in the rupture of LPG gas lines, leading to a fire. A severe earthquake that also results in a destructive facility fire is estimated to have an annual probability of 5×10^{-5} /yr. The anticipated maximum radioactive materials inventory of the RMWMF is given in Table 2-3 and was assumed to be present in the facility at the time of the earthquake and fire. It is reasonable to conclude that not all containers would rupture and not all of the radioactive material in the ruptured containers would be associated with combustible waste material. Therefore, 50 percent of the entire inventory in all containers was assumed to be involved in the fire (SNL, 1991a). The release fraction of respirable radioactive material is taken as 1 percent as suggested by Elder, et al., 1986 for most radioactive materials. The tritium, iodine, and krypton release is assumed to be 100 percent, because tritium is expected to be present as water vapor, iodine is expected to be present in a volatile form, and krypton is a gas (SNL, 1991a). Uranium is usually in the form of large masses of metal and a release fraction of respirable material of 10^{-3} (0.1 percent) is used based on the experimental work of Elder and Tinkle, 1980, and NRC guidance for regulatory analysis on emergency planning (NUREG-1.145, Rev.1, McGuire, 1988) which suggest 0.1 percent for uranium and actinides in a fire.

The resulting source term for radioactive materials for this accident is presented in Table 4-3. The assumptions that 50 percent of the building inventory would be involved in the fire and that the entire fractional release would occur within the two-hour period are highly conservative. In addition, the release fractions used for the analysis are conservative (over-estimation of the release) by factors of 20 to 70 (Ayer et al., 1988).

Table 4-3
Source Term Estimates for Base Case Accident

<i>Isotope</i>	<i>Facility Total Inventory (Ci)</i>	<i>Release Fraction Percent</i>	<i>Source Term (Ci)</i>
³ H	1,500.00	1.00	7.5 x 10 ⁺²
¹⁴ C	1.00	0.01	5.0 x 10 ⁻¹
²² Na	250.0	0.01	1.3 x 10 ⁰
²⁴ Na	250.0	0.01	1.3 x 10 ⁰
³⁶ Cl	1.00	0.01	5.0 x 10 ⁻¹
⁵¹ Cr	25.0	0.01	1.3 x 10 ⁻¹
⁵⁴ Mn	50.00	0.01	2.5 x 10 ⁻¹
⁵⁶ Co	25.0	0.01	1.3 x 10 ⁻¹
⁵⁷ Co	25.0	0.01	1.3 x 10 ⁻¹
⁵⁸ Co	25.0	0.01	1.3 x 10 ⁻¹
⁵⁹ Co	2,250	0.01	1.1 x 10 ⁺¹
⁶⁰ Co	50.0	0.01	2.5 x 10 ⁻¹
⁶³ Ni	100	0.01	5.0 x 10 ⁻¹
⁶⁵ Zn	25.0	0.01	1.3 x 10 ⁻¹
⁸⁵ Kr	1.00	1.00	5.0 x 10 ⁻¹
⁹⁰ Sr	10.0	0.01	5.0 x 10 ⁻²
¹¹⁰ Ag	1.00	0.01	5.0 x 10 ⁻³
¹²⁹ I	0.10	1.00	5.0 x 10 ⁻²
¹³³ Ba	5.00	0.01	2.5 x 10 ⁻²
¹³⁴ Cs	5.00	0.01	2.5 x 10 ⁻²
¹³⁷ Cs	1,000	0.01	5.0 x 10 ⁰
¹³⁹ Ce	0.10	0.01	5.0 x 10 ⁻⁴
¹⁴⁴ Ce	0.10	0.01	5.0 x 10 ⁻⁴
¹⁴⁷ Pm	0.10	0.01	5.0 x 10 ⁻⁴
¹⁵² Eu	1.00	0.01	5.0 x 10 ⁻³
¹⁹⁸ Au	1.00	0.01	5.0 x 10 ⁻³
²⁰³ Hg	1.00	0.01	5.0 x 10 ⁻³
²⁰⁷ Bi	1.00	0.01	5.0 x 10 ⁻³
²⁰⁸ Bi	0.10	0.01	5.0 x 10 ⁻⁴
²¹⁰ Po	1.00	0.01	5.0 x 10 ⁻³
²¹² Pb	10.0	0.01	5.0 x 10 ⁻²
²³² Th	0.10	0.01	5.0 x 10 ⁻⁴
²³³ U	3.78	0.001	1.9 x 10 ⁻³
²³⁴ U	5.00	0.001	2.5 x 10 ⁻³
²³⁵ U	1.50	0.001	7.5 x 10 ⁻⁴
²³⁸ U	10.00	0.001	5.0 x 10 ⁻³
²³⁸ Pu	2.00	0.01	1.0 x 10 ⁻²
²³⁹ Pu	2.00	0.01	1.0 x 10 ⁻²
²⁴⁰ Pu	2.00	0.01	1.0 x 10 ⁻²
²⁴¹ Pu	50.00	0.01	2.5 x 10 ⁻¹
²⁴¹ Am	0.10	0.01	5.0 x 10 ⁻⁴
²⁴² Pu	0.10	0.01	5.0 x 10 ⁻⁴
²⁴⁴ Cm	0.10	0.01	5.0 x 10 ⁻⁴
²⁵² Cf	1.00	0.01	5.0 x 10 ⁻³

* Source term was determined by applying the release fraction to 50 percent of the facility total inventory.

Table 4-3
Source Term Estimates for Base Case Accident (Continued)

<i>Facility Total</i>				
<i>Hazardous Material</i>	<i>Volume (ft³)</i>	<i>Mass (Kg)</i>	<i>Release Fraction Percent</i>	<i>Source Term (Kg)</i>
Cadmium	9	2.2 x 10 ³	0.01	1.1
Lead	66	1.1 x 10 ⁴	0.01	5.5
Mercury*	2.1	793	1.00	4.0
Arsenic	0.75	120	0.01	0.06
Beryllium	4.5	250	0.01	0.13
<i>Reactive Material</i>	<i>Volume (ft³)</i>	<i>Mass (Kg)</i>	<i>Release Fraction Percent</i>	<i>Source Term (Kg)</i>
Lithium	7.4	111	1.00	0.55
Sodium	7.4	202	1.00	1.01

* The release fraction used for mercury is 10 times greater than that of the other hazardous materials.

Similar assumptions were made concerning the release of nonradioactive hazardous contaminants, with a release fraction of 0.1 percent used for most of these contaminants. For lead, which is present primarily as shielding in waste containers and as discarded shielding from experiments at SNL/New Mexico, it was unreasonable to assume that the entire building inventory was released in the fire. A significant fraction of the large, thick pieces of lead would be unaffected by the fire. Since mercury boils at 356°C, it is expected to be more volatile; a release fraction of 1 percent is used for mercury. In addition, it was conservatively assumed that the exterior storage structures for reactive metals was involved in the fire. The resulting fire among partially-deactivated reactive metals and solvent-contaminated waste would consume 50 percent of the waste and not be filtered in any way. The release fraction of lithium and sodium (with associated radioactive material) is, therefore, taken as 1 percent. The resulting source term of hazardous constituents is present in Table 4-4.

Table 4-4**Hazardous Material Source Term Estimated for Base Case Accident**

<i>Material</i>	<i>Facility Total (gm)</i>	<i>Source Term (gm)</i>
Arsenic (As)	1.20×10^5	60
Beryllium (Be)	2.50×10^5	125
Cadmium (Cd)	2.20×10^6	1,100
Lead (Pb)	1.10×10^7	5,500
Lithium (Li)	1.11×10^5	550
Mercury (Hg)	8.00×10^5	4,000
Sodium (Na)	2.00×10^5	1,000

The atmospheric transport and doses resulting from this accident were calculated using the EPA-approved methodology (Appendix D). The maximum doses were calculated for an onsite individual (assumed to be located approximately 305 m (1000 ft) to the north north-east at the closest adjacent SNL/New Mexico facility) and for public receptors at the nearest non-restricted access location (Isleta Gate). In performing this calculation, it was assumed that downwind individuals onsite would be evacuated from the path of the airborne plume within 30 minutes (SNL, 1991c), thereby limiting their exposure. Offsite individuals were assumed to receive the full two-hour exposure. The calculated consequences for this severe accidental event are presented in Table 4-5. The calculated effective dose equivalent (EDE) for the maximum offsite individual is 0.38 rem and 1.3 rem for the maximum onsite individual. The calculated air concentrations for hazardous contaminants are presented in Table 4-5, as are the immediately dangerous to life or health (IDLH) values and TLV for those contaminants.

Earthquake and Fire

The DBE for the RMWMF is an earthquake with a peak acceleration of 0.22 gravitational pull (g), which has an estimated annual probability of exceedance of 1×10^{-3} , or an expected

Table 4-5

Calculated Consequences of Base Case Accident

<i>Receptor</i>	<i>EDE (Rem)</i>	<i>Guidelines^{*,**} (Rem)</i>	<i>Health Effect[†]</i>	<i>Accident Probability</i>	<i>Risk^{††}</i>
Maximum onsite individual	1.3	25	6.5×10^{-4}	5×10^{-5}	3.3×10^{-8}
Maximum offsite individual	0.38	25	1.9×10^{-4}	5×10^{-5}	9.5×10^{-9}

<i>Hazardous Materials</i>	<i>Air Concentration (mg/m³) Onsite</i>		<i>Offsite</i>	
	<i>Calculated</i>	<i>IDLH[‡]</i>	<i>Calculated</i>	<i>TWA-TLV^{‡‡}</i>
Arsenic	1.1×10^{-2}	Ca [§]	7.6×10^{-4}	0.2
Beryllium	2.2×10^{-2}	Ca [§]	1.6×10^{-3}	0.002
Cadmium	0.19	Ca [§]	1.4×10^{-2}	0.05
Lead	0.95	Ca [§]	7.0×10^{-2}	0.15
Lithium	0.10	55	7.0×10^{-3}	0.025 ^{¶¶}
Mercury	0.70	10	5.1×10^{-2}	0.05
Sodium	0.17	250	1.3×10^{-2}	2.0

* The siting limit used is the emergency exposure limit for protection of health and property as stated in DOE Order 5480.11 (DOE, 1988a).

** The siting guideline for non-reactor nuclear facilities is 25 Rem (EDE), DOE Order 6430.1A-0200-1.3 (DOE, 1989).

† Excess mortality from all forms of cancer was calculated on the basis of 5×10^{-4} excess fatalities per person-rem.

†† Calculated as health effects times probability.

‡ The onsite concentration guideline for hazardous materials is the IDLH value (NIOSH, 1987).

‡‡ The offsite concentration guideline for hazardous materials in the American Conference of Governmental Industrial Hygienists (ACGIH) TWA-TLV (ACGIH, 1991).

§ "Ca" is the designation for a potential carcinogen, therefore, no quantitative IDLH is defined.

¶¶ TWA-TLV for lithium hydride.

occurrence time of once every 1,000 yr. The analysis of the facility design indicates that the facility would withstand a seismic load 20 percent in excess of the Uniform Building Code (UBC, 1982) design criteria and, thus, would withstand the DBE. An earthquake with a peak acceleration well in excess of the DBE has a frequency in the range of 5×10^{-5} per year.

The probability of a severe earthquake (beyond the DBE) that results in building and structural failures is, therefore, credible and included in this risk assessment for completeness. The accident scenario includes collapse of the facility walls, collapse of the entire facility roof, and partial damage to the concrete walls around the high-activity storage area and staging area. Because the propane heaters are located near the ceiling level of the facility, rupture of the gas supply line to the heaters is assumed during the earthquake and collapse of the facility roof. Falling roof beams and severed electric cables are assumed to offer an ignition source for the leaking propane and, thus, a fire is assumed to ensue and engulf 50 percent of the combustible contents of the entire facility. It is expected that the earthquake would also rupture the line from the LPG storage tank to the facility, thus, limiting the quantity of gas in the building. However, it is assumed that there would be sufficient gas to initiate ignition of the combustible waste in ruptured containers with subsequent involvement of 50 percent of the waste in the facility.

The risk associated with this accident is extremely low because the probability of occurrence is small and the consequences, based on conservative analysis, are also low. If this event occurs during working hours, there would be a fatality risk to RMWMF personnel. Since it is assumed the RMWMF would be occupied only during daytime work hours, the risk of this event is reduced by a factor of 3.4 (50 hours in one week) to account for the probability of occupancy. The reasonably foreseeable radiological impact of this event can be estimated by assuming an injured facility person remains in the area for approximately 30 minutes before being rescued or provided respiratory protection. In this case, personnel are assumed to be exposed to the ground level plume centerline concentrations at a distance of about one-half the width of the facility or 10 meters for 30 minutes. The dose estimate for this event is 11 rem, the probability is approximately 10^{-5} /yr (SNL, 1991a).

Aircraft Crash

The combined military and commercial air traffic in the KAFB area is significant and, because the RMWMF is located 8.5 km south south-east of the main east-west runway, the probability of an aircraft crash into the facility is considered. Should such an accident occur involving a medium to large aircraft, the consequences are expected to be similar to those assessed for the complete facility destruction by earthquake and fire. The death or injury of the aircraft crew, passengers, and any RMWMF personnel would be an additional consequence of this event.

The methodology of Smith, 1983 was used to estimate the probability of a large aircraft or high performance aircraft (military) crash into the RMWMF, which could result in the destruction of the facility and a fire that consumes the combustible contents of the facility.

Of 228,767 total operations at the airport during 1987, a total of 36,567 were listed under the category of military; 70,000 were listed under the air carrier category; 42,000 were listed under air transport; and 80,200 were listed under general aviation. Approximately 70 percent of the air transport operations and 20 percent of the general aviation operations were estimated to be large aircraft. Large aircraft in the air transport and general aviation categories were assumed to have similar crash dynamics as air carriers and were, therefore, added to the number of air carrier operations to arrive at a figure of 115,440 "air carrier type" operations per year. This value was used in the probability calculation and results in a probability estimate of $1.3 \times 10^{-6}/\text{yr}$. Therefore, the expected time interval between military or air carrier crashes into the RMWMF is estimated to be nearly 10^6 yr.

Although the probability of an aircraft crash and the risk associated with the results are lower than that estimated for the base case accident, the aircraft crash accident is estimated to result in greater consequences. The facility worker consequences of the aircraft crash are similar to those for the severe earthquake and fire. Potential fatalities plus some serious radiological consequences are possible. However, the probability must again be reduced by a factor of 3.4 for considerations of facility occupancy which puts the frequency of this event below $10^{-6}/\text{yr}$. The maximum worker dose is 21 rem, but the fatality risk is less than 1.1×10^{-8} (SNL, 1991a).

Helicopter Crash

The RMWMF is used as a landmark for helicopter training flights. Therefore, the probability of a helicopter crash involving the facility is estimated to be higher than the probability of a crash involving fixed wing airport traffic. However, the extent of damage to the RMWMF from a helicopter would be less than that resulting from an aircraft crash. Accurate data on the frequency of helicopter traffic in the area of RMWMF is not available nor is there a useful database on a helicopter crash frequency. Without such data, the probability of a helicopter crash cannot be calculated. For this analysis, a probability is assumed that is twice the magnitude of that for the large fixed wing aircraft ($2.5 \times 10^{-6}/\text{yr}$). It is estimated that a helicopter crash and subsequent fire would involve 50 percent of the radioactive and hazardous material inventory. Thus, the risk to onsite workers and the public would be similar to that posed by the design base accident (earthquake and fire). The accident could result in death or serious injury to personnel in the facility at the time of the crash. The risk to RMWMF personnel from a helicopter crash is determined by assuming one-half the consequences of and twice the probability of the aircraft crash. Although this event is also assigned a probability below $10^{-6}/\text{yr}$, the estimated dose consequences are calculated to be approximately 11 rem and the risk is less than 5.5×10^{-9} fatalities/year (SNL, 1991a).

Multiple Container Fire

The multiple container fire for the RMWMF involves the contents of several containers during waste unloading operations. The accident scenario is based on a delivery truck loaded with two boxes and 12 drums outside the staging area with the bay door opened. The forklift ruptures the truck gasoline tank, with the leaking gasoline igniting causing the rupture of the waste containers and subsequent ignition of the combustible waste. It is further assumed that the:

- Manual fire-fighting procedures are inadequate;
- Automatic fire protection system does not bring the fire under control; and
- Fire department arrives in time to prevent spread of the fire to the facility, but not in time to prevent loss of material from the containers on the truck.

The postulated release is at ground level with no attenuation by HEPA filters or building hold up. The release fractions for the scenario are identical to those used in the severe earthquake evaluation; however, evacuation of nearby facilities is not assumed. The exposure for the maximum exposed onsite individual is taken as two hours, the full duration of the fire.

It is anticipated that RMWMF personnel would quickly realize the hazards associated with the multiple container fire and take appropriate actions to protect health and safety. Assuming anyone near the fire would evacuate or don respirators within five minutes (or if injured would be rescued within five minutes), the inhalation time is short. Since it is expected that the fire would begin slowly and increase in intensity over the two hours of burn, the concentration of airborne radionuclides used to calculate worker dose in the initial five minutes is a factor of ten lower than the average concentration achieved for the entire two-hour burn. The amount of waste material assumed to be involved is the same as before, two boxes and 12 drums. Assuming a minimum distance of 10 m and a release fraction of 1 percent over the fire duration of two hours, the calculated dose to the facility worker is 0.15 rem (SNL, 1991a).

Processing Area Fire

A fire in the process area is assumed to involve a maximum content box. The accident scenario involves the ignition of combustible waste in an open box in a temporary greenhouse as a result of an electrical discharge. Initial fire-fighting efforts by facility personnel are assumed to be ineffective, and it is also assumed that the greenhouse fails. A further assumption is made that the fire is extinguished by the automatic fire protection system before it could spread to other containers. The area around the accident site would, thus, become contaminated. The main exhaust HEPA filter system is not affected by the fire; therefore, the release is from the facility stack after reduction by filtration on the order of 10^{-3} .

The worker dose for this accident is estimated by using the similar assumptions as before: five minutes inhalation exposure, 1 percent release from a maximum box over two hours, reduced radionuclide concentration (1/10) during the initial five minutes. In this scenario, concentrations are determined by assuming the released material is uniformly mixed in the volume of air in the processing area. Using a process area volume of 45,000 ft³, a concentration of each radionuclide was

calculated. The dose estimate for a five-minute exposure to these concentrations is 0.13 rem (SNL, 1991a).

Laboratory Fire

Waste containers would be sampled elsewhere in the facility and the samples taken to the laboratory for further processing. The laboratory would have no facilities for chemical analysis and samples requiring such analysis would be packaged and transferred to other facilities to be analyzed. The more likely fire in the laboratory would be the result of the spill and subsequent ignition of a combustible organic material (a solvent). The quantities of such materials in the laboratory would be administratively limited to two liters each. The radionuclide content of a sample would be a small fraction of a container inventory. The postulated fire would not affect the HEPA filters and, therefore, any release would be from the stack after filtration. The probability of a fire in the laboratory is relatively high (0.1 to 1.0/yr), but the consequences of such a fire are minimal with the effects limited to minor damage to or contamination of the laboratory.

The amount of material involved in the laboratory fire is extremely small (100 gm). The air volume of the laboratory is 1,800 ft³. The analysis for worker impact uses similar assumptions as the Multiple Container Fire, except the factor of ten reduction in the initial five minutes is not applied because the source is assumed to be open and immediately available for release in a fire. A five-minute exposure would produce 8.0×10^{-3} rem to the RMWMF worker (SNL, 1991a).

Storage Area Fire

The scenario for a storage area fire involves a forklift or drum handling accident resulting in ignition of combustible waste inside the facility with the doors closed. It is assumed that the entire high-activity storage area becomes involved in the fire before the fire protection measures extinguish the fire. The fire does not cause exhaust HEPA filter failure so that the release is from the facility stack after reduction by filtration.

The inventory involved is equivalent to 35 drums, 10 percent of the maximum storage capacity for the high-activity storage area. The release fractions are identical to those used in the

severe earthquake and fire accident analysis. The source term to the facility is taken to be 1 percent of 35 drums and the release from the facility is reduced by a factor of 10^3 for filtration. With an air volume of 25,000 ft³ in the high-activity storage room, a five-minute worker exposure was calculated for this postulated source term using similar assumptions as the Multiple Container Fire and the combustion of waste in 35 drums. The reduction of 1/10 to the early release is applied here since the fire must start slowly. The RMWMF worker dose is 0.28 rem (SNL, 1991a).

Tritium Storage Area Fire

The scenario for a tritium storage area fire is similar to that of the storage area fire. Since there would be fewer drums and boxes in this area than in the general storage areas, it is assumed that the maximum content drum becomes involved in the fire before fire protection measures extinguish the fire. As for the other fire scenarios, it is also assumed that the fire does not burn long enough to reach the HEPA exhaust filters, therefore, the effluent is filtered through the facility heating, ventilation, and air conditioning (HVAC) system and the release is from the facility stack.

The presence of sealed metal containers in the tritium storage area acts as a deterrent to the fire. No containers should be open in this area and any open containers would have to occur through rupture by truck, forklift, or internal pressure caused by the fire. Since the area is small, it is assumed that fewer containers are available to be ruptured. In addition, the tritium storage area has its own radiation monitor and multiple alarms would prompt a more rapid response from personnel. Because of these mitigating factors, the maximum onsite individual dose would be 1.1×10^{-2} rem and the maximum offsite individual dose would be 4.9×10^{-4} rem.

In assessing worker impacts, the door to the tritium storage area is assumed to be open; therefore, the air dilution volume is that associated with the general storage area (35,000 ft³) plus the tritium storage area (3,000 ft³) or 38,000 ft³. The source-term assumptions are: one maximum drum, 100 percent tritium release, 1 percent of all other radionuclides, and reduced release in the initial five minutes. The calculated RMWMF worker dose resulting from a five-minute exposure is 2.9 rem (SNL, 1991a).

Uranium Storage Area Fire

Initiation of a fire in the uranium storage area of the RMWMF is again assumed by postulating a forklift accident in the uranium storage area. The fire would not reach the HEPA filters and, therefore, release would occur through the facility stack.

Assuming that 10 percent of the maximum numbers of containers (10 drums) in the uranium storage area become involved in this fire, the release fraction should be less than that for any other fire accident scenario considered here. Uranium is stored in the facility almost entirely in the form of large shapes on which a fire would have less effect than it would on combustible LLW composed of a combination of different substances. The reduced surface area and combustibility of large uranium shapes should be less affected by the fire. Therefore, the release fraction will be assumed to be less than that assumed for a general storage area fire and would occur through the stack.

In assessing the worker impacts, the parameters used to estimate concentrations are an air volume of 35,000 ft³ and release fractions similar to the other fire accidents. The calculated dose for the RMWMF worker dose is 5.5×10^{-2} rem (SNL, 1991a).

Liquid Storage Area Fire

The majority of liquid waste to be handled at the RMWMF is radionuclide-contaminated ion exchange resins containing about 30 percent water. Initiation of a fire in the liquid storage area is by a forklift or drum handling accident, as with the other storage area fires. The fire would not reach the HEPA filters and, therefore, release would occur through the facility stack.

The inventory available for release from a fire in the liquid storage area would be small relative to that in other storage areas because resins would contain a small fraction of the waste stored at the facility. Resin waste is less susceptible to fire damage than combustible LLW because of the large amount of water present. It is estimated that a fire would evaporate the contaminated water but that the fire would be brought under control before the organic resins would sustain any appreciable fire damage. The radionuclide release resulting from a fire in the liquid storage area would be less than that estimated for a general storage area fire and the releases would occur through the stack.

Therefore, the estimated concentrations are developed using the same assumptions as those for the uranium storage area fire except the source is from one average drum. The calculated RMWMF worker dose is 5.5×10^{-3} rem.

Liquid Storage Area Spill

To assess a liquid storage area spill, it is assumed that a forklift accident could result in the rupture of up to three liquid waste containers. It is estimated that less than 0.1 percent of the radionuclides in the water phase would be released because of evaporation before the spill is cleaned up and that none of the resin-bound radionuclides would be released. The release would be filtered through the stack.

It is conservatively assumed that 30 percent of the radionuclides in three average waste drums is associated with the water and that 0.1 percent of these are released to the facility in respirable size during evaporation of the water. This source term is attenuated by a factor of 10^3 for filtration before release from the facility stack. Thus, the risk of a fatal cancer associated with a liquid drum spill is more than 10,000 times *lower* than that for the earthquake and fire scenario.

The airborne release from a spill is much smaller than from a fire. The parameters used in this accident analysis are three average drums, 30 percent in spilled liquid, 0.1 percent release in two hours, 35,000 ft³ of air volume, and five minutes exposure time. Since this accident does not involve fire, no reduction of release is assumed for the initial five minutes. The calculated RMWMF worker dose is 5.0×10^{-3} rem (SNL, 1991a).

Reactive Storage Area Fire

Waste containing lithium and sodium would be stored in a safety storage building outside the RMWMF. The waste would be packaged in DOT-approved containers when stored in the RMWMF complex. Lithium waste normally would be deactivated before packaging in waste containers. A forklift could possibly rupture a waste container leading to a spill of its contents. Since it is unlikely that anything that would react with metallic sodium would be present, it is assumed that the amount of material becoming airborne from such an accident is negligible.

A fire in a Safety Storage Building is assumed to have results less than for the earthquake/fire scenario. One in 24 waste containers is assumed to rupture with subsequent fire involvement of the reactive material (lithium or sodium), as well as failure of the storage building fire suppression system. If water was mistakenly used to fight the fire, it would react with the metallic sodium to produce hydrogen gas which would fuel the fire and make control of it more difficult. A release fraction of 1 percent of the sodium and the associated contaminants in one drum is used in the accident analysis.

The likelihood of this event is estimated to be 10^{-2} to 10^{-4} per year. It has been conservatively assumed that the single drum contains a radionuclide inventory equal to a maximum drum (Table 2-3) and a sodium inventory of 126 kg or a lithium inventory of 69 kg (Table 2-5).

The sodium concentration at the onsite location (305 m away at the nearest SNL facility) was estimated using AIRDOSE and found to be 0.21 mg/m^3 . The lithium accident would give 0.12 mg/m^3 (305 m away at the nearest SNL facility). These concentrations are about the same as the earthquake and fire concentrations.

Since the reactive materials are in the Safety Storage Buildings and not in the RMWMF, the postulated fire accident would generate a source term directly to the atmosphere. Assuming a reduced release for the initial five minutes of the fire and a facility worker exposure of five minutes at a distance of ten meters, the estimated dose to the RMWMF workers is 5.0×10^{-2} rem. The lithium concentration at this distance is estimated at 13 mg/m^3 and sodium concentrations at 24 mg/m^3 (SNL, 1991a).

Solvent Storage Fire

Solvent-contaminated waste in the Safety Storage Building may be involved in accidents similar to the reactive materials. A drum handling accident or spontaneous combustion is assumed to result in a container fire that releases 1 percent of the content of a maximum drum to the atmosphere. Since the contaminated solvent drums are assumed to have the same inventory of radionuclides as the reactive material drums, the calculated consequences are the same as the reactive materials accident.

The probability of this event occurring with disabled confinement and fire suppression system is estimated to be relatively small, 10^{-2} to 10^{-4} /yr.

Explosion of Liquid Petroleum Gas Pipe

Although an LPG pipe explosion requires a sequence of unlikely initiating events, it is still a reasonably foreseeable accident. The initiating event is assumed to involve a break in the LPG lines from some cause (earthquake or mechanical failure) such that the LPG mixes with air in the 4 to 14 percent range required to sustain an explosion.

Assuming ignition of the propane air mixture through sparking of mechanical tools or other means, the resulting explosion would then take place primarily near the propane radiant heaters and piping near the roof of the facility. The explosion is assumed to cause failure of the system (including standby exhaust systems) and a multiple-container fire is initiated in the high-activity storage area. The release then takes place through the breached roof. The consequences for this scenario are about a factor of 10 lower than those for a severe earthquake and fire.

The potential consequences of an explosion in the facility include RMWMF worker fatalities. Additionally, worker radiation exposures are possible depending on the scenario. Assuming workers would be able to evacuate or don respiratory protection within five minutes, concentrations are estimated by assuming 1 percent release of the ruptured containers over a two-hour period and an early reduced release rate (1/10) before the contaminated waste becomes fully involved in the fire. The source is 10 percent of 350 drums or 35 drums. The dose consequences to a RMWMF worker is 0.28 rem (SNL, 1991a).

Explosion of Liquid Petroleum Gas Tank

The explosion in this case is caused by a postulated accident between a vehicle and the LPG tank at the southwest corner of the facility, 65 ft from the main building. The greatest possible severity accident was assumed in which the facility walls were breached at the southwest corner during normal waste processing operations. The processing area was also assumed to be in use with waste containers open. Under these assumptions the release fraction would involve a small number of

containers and would bypass the stack, venting through the damaged facility roll-up door and walls. An additional consequence would involve the death of the vehicle driver, if any, and that of personnel working in the southern extremity of the facility. The maximum consequence of an LPG tank explosion, therefore, would be less than those for the severe earthquake and fire.

The RMWMF worker consequences of this event include potential fatalities. The radiological consequences are calculated using the assumptions that the initial source involved is 34 average drum equivalents and that high airborne radionuclide concentrations are generated instantly by the explosive force on the open containers. No reduction in release for a slow-starting fire is included. Workers that survive the explosion are expected to be unable to evacuate or don respirators. The five-minute inhalation time allows for rescue operations only. The calculated worker dose is 1.5 rem.

Although this estimated dose consequence is relatively high, the probability of this event is expected to be quite low, 10^{-4} to 10^{-6} per year. If deemed necessary, the risk of this event could be reduced further by administrative controls that limit process operations during periods when vehicle traffic is in the vicinity of the LPG Tank (SNL, 1991a).

Site Blackout

If the normal electric power supply to the RMWMF should be interrupted, the standby diesel generator would provide a backup source of electricity. The annual probability of the diesel generator failing during a loss of offsite power has been estimated as unlikely, approximately 10^{-2} . For purposes of this analysis, loss of offsite power is assumed to occur at least once annually.

A conservative estimate of the consequences of a site blackout could be made by assuming a 30-minute unfiltered release of the maximum amount of loose material that could be expected during normal operations. The normal operation effluent is estimate as 0.1 percent of the content of containers being compacted. All other processes are expected to involve normally contained materials. Since the material must diffuse out of the compactor, the compactor room, the process area, and through small leaks around doors, etc., a factor of 0.5 is applied to the estimated release to account for losses during the lengthy transport. The consequences of this accident are approximately 100 times lower than the earthquake and fire scenario.

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The consequences of a site blackout event include loss of ventilation and slow diffusion of loose material from inside confinement structures to the processing area. Since standard operating procedures call for respiratory protection or evacuation, no RMWMF worker impact is expected.

Ventilation System Failure

Release of hazardous and radioactive materials from the RMWMF during processing operations is controlled by the HEPA-filtered ventilation system. Should this system fail for any reason, alarms would notify operators and the backup ventilation system would be automatically activated. The annual probability of both systems failing was estimated as unlikely, approximately 10^{-2} .

The consequences of both systems failing are similar to those for the site blackout scenario. Airborne activity will cause some facility contamination and the slow diffusion of radioactive material out of the confinement structures may result in minor contamination. The dose consequences and risk factors estimated for this event are identical to those for the site blackout scenario.

The consequences of this event on facility workers are expected to be similar to those estimated for the site blackout scenario. No RMWMF worker impact is expected, because any loose material will diffuse slowly and workers will evacuate quickly (SNL, 1991a).

4.5.4 Summary of Accidents

Table 4-6 summarizes the estimated cancer fatality risk of the RMWMF for radiation exposure of the maximum onsite and offsite individual; Table 4-7 summarizes the estimated cancer fatality risk for workers. The exposures and fatality risks for workers (onsite) and the public (offsite) have been estimated purposely on the high side by the calculations through the disallowance of mitigating factors. The fatality risk values were determined by multiplying together the estimated probability (in events/year), the estimated dose consequences (in rem), and the conversion factor of

Table 4-6

**Estimated Fatality Risk From Radiation Exposure of
Radioactive and Mixed Waste Management Facility**

<i>Accident</i>	<i>Estimated Annual Probability*</i>	<i>Onsite EDE (rem)</i>	<i>Offsite EDE (rem)</i>	<i>Fatality Risk (cancer fatalities/yr)</i>	
				<i>Onsite</i>	<i>Offsite</i>
Earthquake and Fire	5.0×10^{-5}	1.3	3.8×10^{-1}	3.3×10^{-8}	9.5×10^{-9}
Aircraft Crash	1.3×10^{-6}	2.6	7.6×10^{-1}	1.7×10^{-9}	4.9×10^{-10}
Helicopter Crash	2.5×10^{-6}	1.3	3.8×10^{-1}	1.6×10^{-9}	4.8×10^{-10}
Multi-Container Fire	1.0×10^{-2}	6.5×10^{-1}	1.9×10^{-1}	3.3×10^{-6}	9.5×10^{-7}
Processing Area Fire	1.0×10^{-2}	4.7×10^{-4}	1.4×10^{-4}	2.4×10^{-9}	7.0×10^{-10}
Laboratory Fire	1.0×10^{-1}	1.2×10^{-7}	3.4×10^{-8}	6.0×10^{-12}	1.7×10^{-12}
Storage Area Fire	1.0×10^{-2}	5.5×10^{-4}	1.6×10^{-4}	2.8×10^{-9}	8.0×10^{-10}
Tritium Storage Area Fire	1.0×10^{-2}	1.1×10^{-2}	3.2×10^{-3}	5.5×10^{-8}	1.6×10^{-8}
Uranium Storage Area Fire	1.0×10^{-2}	1.6×10^{-4}	4.6×10^{-5}	8.0×10^{-10}	2.3×10^{-10}
Liquid Storage Area Fire	1.0×10^{-2}	1.6×10^{-5}	4.6×10^{-6}	8.0×10^{-11}	2.3×10^{-11}
Liquid Storage Area Spill	1.0×10^{-2}	1.4×10^{-6}	4.2×10^{-7}	7.0×10^{-12}	2.1×10^{-12}
Reactive/Solvent Storage Area Fire	1.0×10^{-2}	2.2×10^{-1}	6.5×10^{-2}	1.1×10^{-6}	3.3×10^{-7}
Explosion of LPG Pipe	1.0×10^{-5}	1.4×10^{-1}	4.2×10^{-2}	7.0×10^{-10}	2.1×10^{-10}
Explosion of LPG Tank	1.0×10^{-4}	1.3×10^{-1}	3.8×10^{-2}	6.5×10^{-9}	1.9×10^{-9}
Site Blackout	1.0×10^{-1}	1.2×10^{-2}	3.5×10^{-3}	6.0×10^{-7}	1.8×10^{-7}
Ventilation System Failure	1.0×10^{-2}	1.2×10^{-2}	3.5×10^{-3}	6.0×10^{-8}	1.7×10^{-8}

* Where a range of probabilities was estimated for an accident, the highest probability value was used to provide a conservative estimate of risk.

Table 4-7

Summary of Radiation Effects on RMWMF Workers From Accidents

<i>Accident</i>	<i>Estimated Annual Probability*</i>	<i>RMWMF Workers Dose (rem)</i>
Severe Earthquake and Fire	$2.0 \times 10^{-05**}$	$1.1 \times 10^{+01}$
Aircraft Crash	$< 1.0 \times 10^{-06**}$	$2.1 \times 10^{+01}$
Helicopter Crash	$< 1.0 \times 10^{-06**}$	$1.1 \times 10^{+01}$
Multi-Container Fire, Doors Open	1.0×10^{-02}	1.5×10^{-01}
Process Area Fire	1.0×10^{-02}	1.3×10^{-01}
Laboratory Fire	1.0×10^{-01}	8.0×10^{-03}
Storage Area Fire	1.0×10^{-02}	2.8×10^{-01}
Tritium Area Fire	1.0×10^{-02}	2.9×10^0
Uranium Area Fire	1.0×10^{-02}	5.5×10^{-02}
Liquid Storage Fire	1.0×10^{-02}	5.5×10^{-03}
Liquid Storage Spill	1.0×10^{-02}	5.0×10^{-03}
Reactive/Solvent Storage Figure	1.0×10^{-02}	5.0×10^{-02}
Site Blackout	1.0×10^{-01}	0.0
Ventilation System Failure	1.0×10^{-02}	0.0
LPG Line Rupture	1.0×10^{-03}	2.8×10^{-01}
LPG Tank Explosion	1.0×10^{-04}	1.5×10^0

* Where a range of probabilities was estimated for an accident, the highest probability value is given.

** The estimated probability of this event is slightly lower for RMWMF personnel than for non-facility persons.

5.0 x 10⁻⁴ cancer fatalities per person-rem (NRC, 1991). The highest risk events appear to be the multiple container fire and the reactive materials storage area fire. Each of these accidents are expected to be further mitigated by administrative controls, emergency response, and design features.

4.5.5 Transportation

SNL/New Mexico operates under a DOE-approved manual governing the onsite transportation of hazardous materials and waste (SNL, 1989b). The approved procedures ensure that all onsite transfers and movements of hazardous materials are performed at safety levels equivalent to DOT regulations. Offsite movements of hazardous materials are performed in compliance with DOT regulations, the impacts of which would be extremely small based on the assessment of transportation impacts in an Environmental Impact Statement by the NRC (NRC, 1977b).

4.6 Comparison of Environmental Impacts

The No Action Alternative (Alternative 1) is potentially expected to have a much greater effect on the environment than the Proposed Action (Alternative 3). The existing operational waste management facilities are less isolated and have less confinement than those of the Proposed Action to complete and operate the RMWMF. Moreover, the existing operational facilities do not have safety features, such as HEPA filtration, which would be included under the Proposed Action. The existing facilities at the generator sites are included in the existing RCRA Part A Permit and will ultimately be permitted to store mixed waste under the Part B Permit (Section 2.1). However, the No Action Alternative does not allow for any facility upgrades to allow waste treatment at the generator sites and the various generator sites do not currently have the full range of capabilities that are required to prepare the waste for transportation and/or disposal. Thus, some waste could not be disposed of, making it necessary to store such waste permanently at the generator site or at some other location at SNL/New Mexico. Such permanent storage would be in violation of the RCRA Permit and could lead to package deterioration and eventual release of contaminants to the environment. Similarly, Alternative 2 (decentralized facilities) would probably have greater impact on the environment than the Proposed Action because of increased potential for releases of nonhazardous materials, such as air particulates. In addition, the consequence of the maximum abnormal event are likely to be greater for

Alternative 2 than for the Proposed Action, since the location of the decentralized sites are in densely-populated worker locations and closer to public residences.

Neither the RMWMF nor decentralized facilities would threaten or result in any adverse impacts to any endangered species or cultural resources. The commitment of resources would be greater for decentralized facilities than it would be for the Proposed Action. The costs associated with the construction, permitting, and staffing of decentralized facilities would also be greater than the Proposed Action.

SECTION 5.0

MITIGATION MEASURES

5.0 MITIGATION MEASURES

Because the environmental impacts of the Proposed Action are expected to be minimal, mitigation required to counteract the potential environmental impacts related to the construction and routine operations of the proposed RMWMF would be negligible. Adverse effects related to construction activities are routinely mitigated by SNL/New Mexico. These include the application of water to disturbed soil areas to control dust and the construction of containment structures to control potential surface runoff. These practices would be continued during the paving of the roadway and any other construction on the RMWMF site.

Long-term effects from the removal of vegetation were unavoidable but were restricted within the proposed site. Reclamation and revegetation of the RMWMF site after closure would minimize long-term impacts on the environment.

A small amount of tritium is expected to be released as an air emission from routine operation of the RMWMF. No contaminated liquid effluents are expected to be discharged. The facility is designed to mitigate any potential liquid or atmospheric effluent releases. The facility ventilation exhaust is filtered and contaminated liquids generated at the facility would be contained within the facility. Only sanitary sewage would be discharged to the facility sanitary sewage system. A lined impoundment would contain surface runoff from precipitation events. Worker exposure to LLW and MW would be thoroughly monitored and strictly controlled.

The following is a discussion of the environmental regulations applicable to the RMWMF. Compliance with these regulations has served to mitigate, in part, the environmental effects from the construction of the RMWMF and would serve to mitigate the effects of the anticipated operation of the RMWMF.

5.1 Environmental Regulations

The completion of construction and the proposed operation of the RMWMF would comply with environmental regulations for expected emissions, effluents, and waste. Regulatory compliance would include the following areas:

- Air emissions;
- Soil disturbance;
- Septic system and sanitary discharge;
- Storm water containment; and
- LLW and MW.

5.1.1 Air Emissions

The facility would comply with the ambient air quality standards of the Albuquerque/Bernalillo County Air Quality Control Board. The NESHAPs for nonradioactive pollutants are incorporated as an Air Quality Control Regulation of the Albuquerque/Bernalillo County Air Quality Board. This regulation imposes local requirements identical to those of NESHAPs, including control of toxic substances as mandated by the Clean Air Act. In addition, the New Source Performance Standards (NSPS) of 40 CFR 60 (EPA, 1984), as amended through March 14, 1984, have been adopted by the City of Albuquerque. These NSPS limit emissions from new industrial plants.

Only small releases of tritium are expected on a routine basis from the RMWMF. Radionuclide emissions are monitored at SNL/New Mexico and are subject to EPA regulations. Emissions of radionuclides to the air from DOE facilities are limited to an effective dose equivalent of 10 mrem/yr to the public (40 CFR 61.90-97). The release of tritium from routine operations at the RMWMF is expected to be considerably less than this limit. The estimated radionuclide emissions from all sources at SNL/New Mexico including the RMWMF would contribute, at a maximum, less than 0.01 percent of the 10 mrem/yr limit (Section 4.2.1).

All locations within the RMWMF, which may be potential sources of particulate air emissions, would be filtered twice: prior to discharge into the main exhaust system and, again, from the main exhaust system to the atmosphere. A stack monitoring system would monitor emissions.

5.1.2 Soil Disturbance

Dust from construction activities was and would be suppressed with water.

5.1.3 Sewage System Discharge

The RMWMF would not release any radioactive or hazardous waste constituents to groundwater under normal operations. Sewage wastewater from the facility would discharge to the sanitary sewer system.

5.1.4 Storm Water Containment

No storm water discharge is expected from the RMWMF. All runoff from the facility area would be contained in an impoundment lined with an impermeable material. Water in the impoundment would be monitored as part of the surveillance and reporting program for the RMWMF. The impoundment is sized to prevent overflow based on precipitation, evaporation, and events similar to water flow from fire fighting activities.

5.1.5 Low-Level Waste and Mixed Waste

Only small releases of tritium into the environment are anticipated from the operation of the RMWMF. SNL/New Mexico Department 7043 administers radioactive and mixed waste management programs. Compliance is maintained for regulations promulgated by the EPA, the DOE, and the DOT. Annual waste management site plans are prepared to describe the program and provide a list of generated waste (SNL, 1988d).

The RMWMF was designed to meet the requirements of DOE Order 5820.2A for waste reduction, segregation, minimization, and characterization (DOE, 1988c). The facility serves a major role in the implementation of those requirements for the entire LLW and MW management program at SNL/New Mexico. Noncompatible waste received at the facility is segregated according to RCRA criteria after characterization. A waste minimization program has been implemented at SNL/New Mexico which applies to all waste generators, including the RMWMF. The only routine LLW or MW generated at the facility would be personnel protective equipment from the collection of contaminated liquids from the analytical laboratory, and occasional decontamination of waste packages, and from the periodic change out of filters or other equipment contacted by radioactive or hazardous contamination. These systems are all designed to restrict the intermixing of LLW and MW

and to minimize the amount of waste generated. The RMWMF contributes to the goals of minimizing final waste volumes from all SNL/New Mexico facilities through waste compaction and packaging. There are no underground storage tanks in the facility. The RMWMF was designed and constructed to prevent the release of contaminated liquid through structural spill containment and separate closed collection systems for the liquid storage, laboratory, and decontamination areas. A closed runoff/runoff system controls exterior drainage in the vicinity of the facility and minimizes the generation of potentially-contaminated drainage water. All drainage water is collected in a lined impoundment basin (Section 4.3.3).

Mitigation of exposure to external penetrating radiation will be provided by using training and administrative procedures, as well as shielding where necessary. Personnel will wear dosimeters for monitoring of external radiation and will participate in a medical surveillance program. In addition to regular bioassay for radionuclides and hazardous contaminants, any personnel potentially exposed to unusual releases or radionuclides (including tritium) will undergo bioassay to determine exposure.

5.2 Mitigation for Adverse Effects

Adverse effects related to construction activities are routinely mitigated with standard practices at SNL/New Mexico. These include applying water to soil surfaces to control dust and controlling surface water runoff to contain erosion and sedimentation. These practices were and would be used during construction.

Long-term effects, such as the removal of grassland habitat, are unavoidable. Reclamation and revegetation of the RMWMF site upon its closure would minimize long-term impacts to the environment.

SECTION 6.0

REVIEW OF ENVIRONMENTAL PERMITS

6.0 REVIEW OF ENVIRONMENTAL PERMITS

SNL/New Mexico and DOE/Albuquerque Field Office (DOE/AL) have initiated consultations with regulatory authorities responsible for various environmental protection programs applicable to the RMWMF (Appendix C).

6.1 Resource Conservation and Recovery Act (RCRA), Part A

DOE/AL notified the State of New Mexico of its intent to construct the RMWMF at SNL/New Mexico. The State responded that the DOE/AL notification letter was sufficient under the State hazardous waste program and a formal construction permit was not required to build this facility (Appendix C). SNL/New Mexico submitted a RCRA Part A Permit Application to the State of New Mexico in September 1990.

6.2 Septic Tank Permit

A permit application to the New Mexico Environment Department (NMED) was filed for the septic tank associated with the RMWMF and an NMED number was assigned, AD 890010 (Appendix C). A Liquid Waste System Registration was also submitted for the tank. These are no longer needed as the septic tank has been abandoned and sewer pipelines are connected to the sanitary sewer system.

6.3 Sanitary Discharges

The City of Albuquerque regulates sanitary discharges through the Albuquerque Sewer Use and Wastewater Control Ordinance which regulates discharges to the publicly-owned treatment works (POTW) through issuance of wastewater discharge permits. The permit would be identical to several other wastewater discharge permits held by SNL/New Mexico. These permits require monitoring and reporting of specified parameters.

6.4 Cultural Resources Clearance

SNL/New Mexico entered into consultation with the State of New Mexico concerning whether or not construction and operation of the RMWMF would have any effect on cultural resources. Results of the consultation indicate that no previously-recorded historic properties would be affected by the RMWMF (Appendix C).

6.5 Threatened and Endangered Species Clearance

Letters were sent to the State of New Mexico and the U.S. Fish and Wildlife Service to seek consultation and approval with regard to impacts on State- and Federally-listed species. Results of the consultation indicate that construction and operation of the RMWMF would have no effect on State- or Federally-listed species (Appendix C).

6.6 National Emission Standards for Hazardous Air Pollutants (NESHAPs) Application

The Radioactive Waste Management Operation would be transferred from the inactive disposal site to the RMWMF upon its completion. An application for approval to construct a facility that modifies an existing source of radionuclides does not need to be filed if the effective dose equivalent for this modification is projected to be less than 1 percent of the EPA Standard of 10 mrem/yr (EPA, 1989). The largest dose from the RMWMF to a single receptor is expected to be approximately 8.00×10^{-4} mrem/yr or 0.01 percent of the NESHAPs standard of 10 mrem/yr (Section 4.2.1).

SECTION 7.0

AGENCIES AND PERSONS CONTACTED

7.0 AGENCIES AND PERSONS CONTACTED

**Director
New Mexico Energy, Minerals
and Natural Resources Department
Forestry Division
Villagra Building
Santa Fe, New Mexico 87503**

**Director
New Mexico Department of Game and Fish
Villagra Building
Santa Fe, New Mexico 87503**

**John C. Peterson, Field Supervisor
Ecological Services
U.S. Fish and Wildlife Service
Suite D, 3530 Pan American Highway NE
Albuquerque, New Mexico 87107**

**C. Kelley Crossman, Program Supervisor
State of New Mexico
Health and Environment Department
Environmental Improvement Division
Hazardous Waste Bureau
P.O. Box 968
Santa Fe, New Mexico 87504-0968**

**Thomas W. Merlan
State Historic Preservation Officer
State of New Mexico
Office of Cultural Affairs
Historic Preservation Division
Villa Rivera, Room 101
228 East Palace Avenue
Santa Fe, New Mexico 87503**

**Steven W. Sares
Project Manager
International Technology Corporation
2340 Alamo Street, Suite 306
Albuquerque, New Mexico 87106**

SECTION 8.0

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SECTION 9.0

GLOSSARY

9.0 GLOSSARY

<i>Absorbed Dose</i>	The energy imparted to matter by ionizing radiation per unit mass of irradiated material at the place of interest. The unit of absorbed dose is the rad.
<i>AIRDOS</i>	An EPA-approved computer code for calculating exposure of individuals according to respirable release fraction of a hazardous material including radiation material.
<i>Building 6911</i>	Research facility north of the RMWMF; nearest onsite facility.
<i>Building 6920</i>	Radioactive and Mixed Waste Management Facility (RMWMF).
<i>Carcinogen</i>	A substance that causes or induces cancer.
<i>Certified Waste</i>	Waste that has been confirmed to comply with disposal site waste acceptance criteria.
<i>Characterization</i>	A term applied to waste and to the procedure by which it is sampled, categorized, and labeled for and before processing, storage, or transport.
<i>Checked</i>	Visual surveillance each day the facility is operated to assure all systems are operating within required ranges and recorded.
<i>Chemical Reactivity</i>	The ability of a gaseous oxidizing material to react chemically with other material, including water. The tendency of two or more chemicals to react to form one or more products differing from the reactants.
<i>Ci, μCi, nCi</i>	Curie, microcurie, and nanocurie; special unit of radioactivity. One curie is 3.7×10^{10} nuclear transformations per second. One microcurie equals 10^{-6} curies, while one nanocurie equals 10^{-9} curies; 10 nCi/g equals one part per million.
<i>Classified Waste</i>	RCRA, Section 246.101: Waste material that has been given security classification in accordance with 50 U.S.C. 401 and Executive Order 11652.
<i>Closure</i>	RCRA, Section 270.2: The act of securing a Hazardous Waste Management facility pursuant to the requirements of 40 CFR Part 264.
<i>Combustible</i>	Capable of undergoing combustion.

<i>Combustion</i>	A chemical process that involves oxidation sufficient to produce light or heat.
<i>Committed Dose Equivalent</i>	Dose Equivalent is the product of absorbed dose in rad (or gray) in tissue and a quality factor. It is expressed in units of Rem or sievert. Committed Dose Equivalent is the predicted total dose equivalent to a tissue or organ over a 50-yr period after a known intake of a radionuclide into the body. It does not include contributions from external dose.
<i>Compaction</i>	Reduction of waste volumes by hydraulic press, in the cases where such reduction would not itself cause a hazard.
<i>Confinement System</i>	A system to prevent the release of radioactive and hazardous materials to the environment by the imposition of physical barriers and seals. A facility structure and a sealed 55-gal drum are both confinement systems.
<i>Decontamination</i>	RCRA, Section 259.10: The process of reducing or eliminating the presence of harmful substances, such as infectious agents, so as to reduce the likelihood of disease transmission from those substances.
<i>Design Basis Accidents (DBAs)</i>	Postulated accidents, natural forces, and resulting conditions for which the confinement structure, systems, components, and equipment must meet their functional goals. These safety class items are those necessary to assure the safe capability to shut down operations, maintain the plant in shut-down condition, and maintain integrity of the final confinement barrier of radioactive or other hazardous materials; to prevent or mitigate the consequences of accidents; or to monitor releases that could result in potential offsite exposures. For the RMWMF, the DBA is the earthquake and fire accident scenario with a reoccurrence interval of once every 1,000 years.
<i>Design Basis Earthquake (DBE)</i>	An earthquake that is the most severe design basis accident of this type. It produces the vibratory ground motion for which safety class items are designed to remain functional. For the RMWMF, the DBE is that defined by Seismic Zone 2 in the Uniform Building Code (UBC).
<i>Design Basis Fire (DBF)</i>	A fire that is the most severe design basis accident of this type. In postulating such a fire, failure of automatic and manual fire suppression provisions shall be assumed except for those safety class items/systems that are specifically designed to remain available (structurally or functionally) through the event.
<i>Dose Equivalent</i>	The product of absorbed dose in tissue, a quality factor, and other modifying factors. Absorbed dose (expressed in units of rad) is the energy imparted to matter by ionizing radiation per unit mass of

<i>Dose Equivalent (continued)</i>	irradiated material at the place of interest in that material. A quality factor is the principal modifying factor used to calculate the dose equivalent from the absorbed dose. Dose equivalent is expressed in units of Rem.
<i>Facility Boundary</i>	The fence that surrounds and prevents uncontrolled access to the facility or facilities.
<i>Fire Protection System</i>	Any fire alarm device, system, or combination designed and installed for detecting, controlling, or extinguishing a fire and alerting occupants and/or the fire department.
<i>Fires</i>	<p>The basic type of fires are Classes A, B, C, and D:</p> <p><i>Class A Fires</i> occur in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics.</p> <p><i>Class B Fires</i> occur in flammable liquids, oils, greases, tars, oil base paints, lacquers, and flammable gases.</p> <p><i>Class C Fires</i> involve energized electrical equipment where the electrical nonconductivity of the extinguishing media is of importance. (When electrical equipment is de-energized, extinguishers for Class A or B fires may be used safely.)</p> <p><i>Class D Fires</i> occur in combustible metals, such as magnesium, zirconium, sodium, lithium, and potassium.</p>
<i>Flood Plain</i>	The lowland and relatively flat areas adjoining inland and coastal waters including flood-prone 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.
<i>Gamma Ray</i>	Electromagnetic radiation emitted in the process of unclear transition or radioactive decay.
<i>General Public</i>	The general populace; does not include radiation workers.
<i>Generator</i>	RCRA, Sections 144.2; 146.3; 270.2: Any person, by site location, whose act or process produces hazardous waste identified or listed in 40 CFR 261.
<i>Hazardous Material</i>	Any substance or material that poses an unreasonable risk to health, safety, and/or property.
<i>High Efficiency-Particulate Air Filter (HEPA)</i>	Filters used in the nuclear industry, with a typical efficiency of being capable of removing about 99.97 percent of all particles as small as 0.3 μm from air passed through the filter.

<i>High-Level Waste (HLW)</i>	The high radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of TRU waste and fission products in great enough concentrations to require permanent isolation.
<i>IDLH</i>	Immediately Dangerous to Life or Health "...represents a maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes, without experiencing any escape-impairing or irreversible health effects." Where the notation "C" appears, NIOSH has recommended that the substance be treated as a potential human carcinogen; IDLHs are not listed for those substances.
<i>Low-Level Waste (LLW)</i>	Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel. Test specimens of fissionable material irradiated for research and development may be regarded as LLW only if the concentration of transuranic is less than 100 nCi/gm.
<i>Maximum Offsite Individual</i>	The hypothetical offsite receptor located in the closest occupied facility outside of the facility being analyzed, at 100 meters in the direction of the maximum atmospheric dilution factor, or at the distance inside the site boundary at which the maximum dose occurs, whichever is further, for which consequences are calculated.
<i>Mitigation</i>	Used in conjunction with impact severity. Refers to measures that will avoid or minimize the severity of an event. These measures could be administrative controls, specific design features, or operating techniques.
<i>Mixed Waste</i>	Waste containing both hazardous (chemically toxic) and radioactive components.
<i>Non-Reactor Nuclear Facility</i>	A facility where operations do not meet the definition of a nuclear reactor facility. Non-Reactor Nuclear Facilities include radioactive material facilities. The RMWMF is a non-reactor nuclear facility.
<i>Nuclear Criticality</i>	A self-sustaining chain reaction caused by a critical mass of fissionable material in the correct geometry. Critical mass is the smallest mass of fissionable material that will support a self-sustaining chain reaction under specified conditions.
<i>Offsite</i>	Anything, such as roads, buildings, streams, and people, located outside or beyond the restricted public access boundaries.
<i>Person-rem</i>	Unit of estimating dose from radiation exposure to a population. Equal to the average individual dose times the number of people in the population exposed.

<i>Population Dose</i>	Population dose is expressed in person-rem and is used in estimating possible effects to a human population exposed to known hazardous materials, such as radioactivity. Equal to the average individual dose (in rems) times the number of people exposed.
<i>Probability</i>	The annual probability of occurrence of a single accident or event sequence.
<i>Public</i>	The population that could be exposed to an incident occurring from operations at the RMWMF. The population would include visitors at the RMWMF or in the vicinity of KAFB, off-duty workers and other personnel, and the general population around the facility.
<i>Rad</i>	The unit of absorbed dose equal to 100 ergs/gm (0.01 J/Kg) in any medium.
<i>Radiation Worker</i>	An individual who works with or around radiation or who, in the course of completing a task, may be exposed to radiation.
<i>Radioactive Waste</i>	Solid, liquid, or gaseous materials of negligible economic value that contains radionuclides in excess of threshold quantities except for radioactive material from post-weapons test activities.
<i>Radiolysis</i>	Chemical decomposition by the action of radiation.
<i>Reactive Materials</i>	Materials which exhibit chemical reactivity to a degree which is considered hazardous or dangerous (see <i>Chemical Reactivity</i>).
<i>Release Fraction</i>	The fraction of the total inventory of radioactive or hazardous particulate or vapor released to the atmosphere during an accident.
<i>Risk</i>	A measure of the product of the probability and the consequences of an accident expressed in either qualitative or quantitative terms.
<i>Segregated Storage</i>	Liquid or solid oxidizing materials stored in the same room with incompatible materials physically separated by space. The spacing is maintained by using sills or curbs or by using intervening storage of nonhazardous, compatible materials.
<i>Site</i>	The land area that a 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.
<i>Site Boundary</i>	The perimeter of restricted public access zone in which the facility is contained.
<i>Solidification</i>	Immobilization of material that is composed of liquids or is found in other semi-liquid physically mobile states.

<i>Stabilization</i>	The process by which powders or small fines are combined with other materials to make them less mobile.
<i>Threshold Limit Value - Time Weighted Average (TLV-TWA)</i>	The time-weighted average concentration for a normal 8-hr work day and a 40-hr work week to which nearly all workers may be repeatedly exposed, day after day, without adverse side effect.
<i>Transuranium Radionuclide</i>	Any radionuclide having an atomic number greater than 92.
<i>Transuranic Waste (TRU)</i>	Waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/gm at the time of assay. High-level waste and spent nuclear fuel are specifically excluded by this definition (DOE, 1986).
<i>Tritium</i>	A radioactive isotope of hydrogen represented by the symbol ^3H or T. The tritium atom consists of a central nucleus, containing one proton and two neutrons, and an external orbital electron.
<i>Waste Streams</i>	Typical and average quantities of waste by category produced by a facility or organization annually.

APPENDIX A

***CULTURAL RESOURCE SURVEY
OF THE RMWMF SITE***

Chambers Group, Inc.

2021 Girard Blvd., SE. Suite 205
Albuquerque, NM 87106
(505) 242-1344
Fax: (505) 242-1650

December 18, 1989
(Report 8067N)

Mr. Michael Norte
Division 7821
Sandia National Laboratories
Albuquerque, New Mexico 87185-5800

Dear Mr. Norte:

I am enclosing five copies of the archaeological survey report titled A Cultural Resource Survey of 3.4 Acres Site Currently Under Construction as a Radioactive Mixed Waste Facility at Sandia National Laboratories, Kirtland Air Force Base, New Mexico. It is our opinion that construction of the facility will have no effect on any significant cultural resources.

Please feel free to call if you have any questions.

Sincerely,

Kenneth J. Lord, Ph.D.
Principal Investigator

KJL/rkd

enclosure

**A CULTURAL RESOURCE SURVEY OF A 3.4 ACRE SITE
CURRENTLY UNDER CONSTRUCTION AS A RADIOACTIVE MIXED WASTE FACILITY
AT SANDIA NATIONAL LABORATORIES,
KIRTLAND AIR FORCE BASE,
NEW MEXICO**

by

Steven R. Hoagland

submitted to

**SANDIA NATIONAL LABORATORIES
Division 7821
Albuquerque, New Mexico 87185-5800**

submitted by

**Kenneth J. Lord, Ph.D.
Principal Investigator**

**CHAMBERS GROUP, INC.
2021-205 Girard Blvd., SE,
Albuquerque, New Mexico 87106**

December 18, 1989

ABSTRACT

An archaeological survey of approximately 3.4 acres of property situated on Sandia National Laboratories, Kirtland Air Force Base, Bernalillo County, New Mexico, yielded no cultural resources. The area surveyed is located on the western piedmont of the Manzano Mountains, south of Albuquerque, New Mexico. The project area is being utilized for construction of a Radioactive Mixed Waste Facility (Building 6920). The entire construction site has been severely disturbed by blading and leveling, and as of the survey date the building was approximately 95% completed. No artifacts or cultural features were observed within the 3.4 acre facility site.

This area, however, is thought to be an unlikely location to find significant cultural resources. Most of the known archaeological sites located on the piedmont are situated along major drainages. Arroyo del Coyote is the closest named drainage, with a portion situated two miles northeast of the project locale.

Two previous intensive cultural resource surveys which came as close as 46 m (150 ft) to the south and 305 m (1,000 ft) to the east of this construction site, tend to support this observation. Neither survey located any historic or prehistoric sites within the vicinity. The lack of sites recorded from the area, suggests that the likelihood of sites ever having been located within the Radioactive Mixed Waste Facility Site would be extremely remote. The low density of isolated occurrences (IO) located in the project vicinity also supports this assumption as IOs tend to occur in higher frequencies within the vicinity of historic or prehistoric sites.

Due to the project location and previous disturbance, cultural resource clearance is recommended for completion of the Radioactive Mixed Waste Facility and associated infrastructures.

INTRODUCTION

Chambers Group, Inc. (CGI) has completed a cultural resources survey on approximately 3.4 acres of Department of Energy property located on Sandia National Laboratories (SNL), Kirtland Air Force Base (KAFB), New Mexico. This survey was performed under the authorization of a State of New Mexico Survey Permit No. 89-029. The survey was requested Mr. Michael Norte with Sandia National Laboratories on December 11, 1989. Fieldwork was conducted on December 14, 1989, by Steven R. Hoagland, Archaeologist. Dr. Kenneth J. Lord served as CGI's Principal Investigator.

The project area is scheduled for construction of Building 6920 to serve as a Radioactive Mixed Waste Facility. Building 6920 is currently 90 to 95% complete, and is situated on approximately 0.2 acres of the project area. To facilitate construction of this structure and in preparation for associated infrastructures, the remaining acreage has been bladed and leveled.

This project site is located about 46 m (150 ft) north of the southern boundary of SNL Area III, and about 75 m (246 ft) west of Sandia's Chemical Dump and Disposal Area fence. In more general terms, the Radioactive Mixed Waste Facility is located on the western piedmont of the Manzano Mountains south of Albuquerque, New Mexico. It is situated about 4.8 k (3 mi) south from the portion of Arroyo del Coyote that is 1 k (0.6 mi) southeast from its confluence with Tijeras Arroyo. Tijeras arroyo is the major piedmont drainage in the area, flowing southwest down toward the Rio Grande River from Tijeras Canyon which divides the Sandia from the Manzanita and Manzano Mountains. The project area is depicted on the Hubbell Spring, New Mexico, 7.5 min series topographic quadrangle map (see Figure 1). The legal description is:

T9N R4E SEC 29: SE1/4 SE1/4 SW1/4 SE1/4;
SW1/4 SW1/4 SE1/4 SE1/4

UTM coordinates for the corners of the construction site are as follows:

NW corner:	Zone 13	3870785 mN;	359530 mE
NE corner:		3870785 mN;	359670 mE
SE corner:		3870690 mN;	359670 mE
SW corner:		3870690 mN;	359530 mE

The present survey was conducted in accordance with existing environmental legislation for the protection of natural and cultural resources as outlined by the State of New Mexico Cultural Properties Act of 1969 (revised 1978) and Federal legislation such as the Executive Order No. 11593 (1972), the Environmental Policy Act of 1969 (91 stat 852), and the National Historic Preservation Act of 1966. This legislation was passed in response to interest of the scientific community and many segments of the American public in recognition that the material remains of prior cultures are a limited non-renewable aspect of the environment and contain data of intrinsic historic and social significance.

No sites on the National Register of Historic Places, or the State Register of Cultural Properties, or sites nominated to these registers are located within the project area.

MODERN ENVIRONMENT

The Radioactive Mixed Waste Facility is located on the Albuquerque East Mesa, which is situated in the eastern portion of the Albuquerque-Belen Basin. The basin is bounded to the east by the Sandia, Manzanita and Manzano Mountains, to the west by the Lucero Uplift and Pueblo Plateau, by the Nacimiento Uplift to the north and by the Socorro Channel to the south. The upper part of the basin is composed of a complex sequence of Santa Fe Formation gravel, sand, silt, clay and caliche deposits. This sequence is underlain by sedimentary rocks which extend to a depth of about

10,000 feet below sea level (Sandia National Laboratories, Site Development Plan 1984).

More specifically, the Radioactive Mixed Waste Facility is located on the western piedmont of the Manzano Mountains directly south of Albuquerque, New Mexico. The piedmont slopes gently westward toward the Rio Grande River with Tijeras Arroyo and its tributaries being the main drainage for this area. The construction site is situated at an elevation of 1649 m (5410 ft) above sea level.

The climate in this area is generally mild and dry with large diurnal and seasonal variations in temperature. The mean annual air temperature is about 58 to 60 degrees with the frost free season varying from 170 to 195 days. Most of the annual rain falls between July and September, measuring about 8 inches per year on the mesa and 20 inches in the mountains.

Soils in the vicinity of the project site are: Tijeras gravelly fine sandy loam with slopes of 1 to 5%, and Madurez loamy fine sand with slopes of 1 to 5%. The Tijeras loam consists of deep well drained soils formed in decomposed granitic alluvial fans. Typically the surface layer is a six inch thick yellowish brown gravelly fine sandy loam. The subsoil is frequently a 15 inch thick deposit of brown sandy clay loam that has some accumulation of lime in the lower portions. The substratum is a pale brown very gravelly loamy sand and gravelly sandy loam with lime in the upper portions. The gravel is derived from granite and is fine and angular. This soil is moderately alkaline (Hacker 1977).

The Madurez loamy fine sand is composed of deep, well drained soils that formed on piedmonts in old unconsolidated alluvium modified by wind. In a representative profile the surface layer is a four inch thick deposit of brown fine sandy loam. The subsoil is an approximate 17 inch thick deposit of brown sandy clay loam and light brown fine sandy loam. This soil becomes calcareous approximately 13 inches below surface and moderately alkaline

throughout. The substratum is a pink, pinkish-gray, and light brown sandy loam to a depth of 60 inches or more below surface (Hacker 1977).

Runoff is slow to moderate for these soils and the hazard of wind erosion is moderate to severe. Permeability is moderate with the available water capacity ranging from three to nine inches. The effective rooting depths are 60 inches or more. These soils are used for range, wildlife habitat, watershed and community development (Hacker 1977).

Currently, due to extensive blading to level the facility area, there are only a few small tumbleweeds situated within the construction site. The plant community usually supported by Tijeras and Madurez soils is dominated by grasses that cover about 15 percent of the soil surface. Indian ricegrass and black grama are the most abundant grasses observed in the area. Other grasses supported by these soils include sand dropseed, spike dropseed, mesa dropseed, giant dropseed, bush muhly, New Mexico feathergrass, three-awn, blue grama, alkali sacaton, fluffgrass and galleta. Also found in association are broom snakeweed, broom dalea, pricklypear cactus, small soapweed, cholla cactus, winterfat, catclaw mimosa and range ratany. Annual plants, which increase in years of above average precipitation, are tansymustard, Indian paintbrush, woolly Indian-wheat, lambsquarters, Russian-thistle, fiddleneck, daisy, loco, verbena and bladderpod. Woody plants are frequently located in the drainageways with Apache-plume, fourwing saltbush, winterfat, wolfberry and Mormon-tea being the dominant shrubs. If the plant community is disturbed annual plants and woody plants such as wolfberry, tea bush, and small soapweed increase. Sand dropseed and galleta grasses, broom snakeweed, catclaw and cactus also increase significantly with rubber rabbitbrush and mesquite invading the plant community in places (Hacker 1977).

SURVEY METHODOLOGY

Ms. Cathy Roach with Sandia National Laboratories met with Mr. Hoagland and accompanied him to the project area where she proceeded to define the limits of the existing construction site. The construction site was traversed east and west at twelve to fifteen meter intervals until one hundred percent coverage was effected. As there was almost no vegetation present, visibility was excellent. No collections were made.

PREVIOUS ARCHAEOLOGICAL RESEARCH

Two previous intensive cultural resource surveys conducted by the Center of Anthropological Studies came as close as 150 ft to the south and 1000 ft to the east of this construction site. Both of the resultant survey reports and the Archaeological Records Management System Site Report (ARMS) requested from the Laboratory of Anthropology, Museum of New Mexico, indicate there have been no archaeological sites previously recorded from within the vicinity of this construction site. A cultural resources overview will not be presented in this document since no potentially significant remains were located. An existing cultural resources overview prepared for the Middle Rio Grande Valley (Cordell 1979) does, however, include the Albuquerque-Belen Basin. This overview provides information on the region in general. Stuart and Gauthier (1981) also discusses the cultural resources of the region in a more abbreviated form.

The closest known cultural resource to the Radioactive Mixed Waste Facility construction site, was recorded from KAFB Management Area B by the Center of Anthropological Studies (CAS) (Rodgers 1980). A large portion of the western boundary of KAFB Area B corresponds with the eastern boundary of SNL Area III. The Radioactive Mixed Waste Facility is situated about 305 m from this joint boundary. The site (L&A 48096; NM 0:2:2:3) is situated approximately 1.9 k

(1.2 mi) northeast of the Radioactive Mixed Waste Facility construction site. It is recorded as a sheepherding complex dating to the early New Mexico Statehood period (1912 to 1931).

Isolated occurrences 14 and 38 are the closest cultural resources recorded from Area B. They are situated about 683 m (2,240 ft and 719 m [2,360 ft] respectively) to the southeast of the construction site. IO 14 is recorded as an obsidian chipped stone core and IO 38 is listed as being a chipped stone side scraper.

The area situated directly south of SNL Area III is KAFB Area I (West). This area, of which a portion is situated about 46 m (150 ft) south of the Radioactive Mixed Waste Facility, was also previously surveyed by CAS (Franklin and Rodgers 1981). The closest site to the project area that was recorded during the I (west) survey was the historic McCormick Ranch site (LA 47906; NM 0:2:2:5). It is located approximately 3.2 k (2 mi) west of the project area.

Of the 983 IOs recorded from Area I (west), nine locales containing prehistoric artifacts were situated within a half mile (0.8 k) of the Radioactive Mixed Waste Facility (Franklin and Rodgers 1980:25). The closest was located about 122 m (400 ft) from the southern Area III boundary and about 171 m (560 ft) south of the facility. CAS collected all of the recorded IOs and have them, along with a legal description and UTM location for each, on file at the Center. Without the exact location and description, it was impossible to determine which isolated finds were collected from within a half mile of this project site. It is most probable, however, that the IOs in question were lithic artifacts as they accounted for 98.5% of the isolated finds. It is also probable that these artifacts were the by-product of chipped stone tool manufacturing (i.e. cores, flakes, angular debris, etc.) as this category accounted for 95.1% of the isolated lithic artifacts (Franklin and Rodgers 1981:24). Most of these artifacts were tertiary flakes (86.8%) which are pieces of chipped stone which

were produced during tool manufacturing, and that retain no evidence of the stones original cortex. Also, the majority of lithics collected by CAS were produced from local cherts which occur as nodules outcropping from the Maderia and Sandia limestone Formations deposited in the mountains situated on and to the east KAFB. Franklin and Rodgers (1981:52) indicate that these cherts comprise 94.7% of all lithics collected as IOs.

SURVEY RESULTS

No significant prehistoric or historic cultural resources were located within the Radioactive Mixed Waste Facility construction site. The entire project location has been previously disturbed by parking and facility foundation preparation and from construction of the facility.

Even though the facility site has been severely disturbed, it is fairly unlikely that significant cultural resources would have ever been located within the project area. Most of the known sites located on the piedmont are situated near or along one of the major drainages. The closest large drainage to the project area is a portion of Arroyo del Coyote located approximately 3.2 k (2 mi) to the northeast.

The lack of sites recorded from the vicinity of the southern and eastern boundaries of SNL Area III, tend to support the assumption that it is unlikely that archaeological sites were ever located within the Radioactive Mixed Waste Facility project local. The low density of isolated occurrences recorded from the vicinity, also suggests that there was very little possibility of sites being located within the project area. Isolated occurrences tend to occur in higher frequencies within the vicinity of historic or prehistoric sites. Due to the project location and the disturbance from previous project construction, it is unlikely that subsurface cultural deposits would be present.

RECOMMENDATIONS

It is the opinion of the author based on the current and previous surveys and the observed previous disturbance, that the continued construction of the Radioactive Mixed Waste Facility and associated infrastructures, will have no effect on any significant cultural resources. If subsurface cultural resource manifestations are located during facility construction, work must be halted, and a qualified archaeologist notified. With this stipulation, cultural resource clearance is recommended for construction of the Sandia National Laboratories, Radioactive Mixed Waste Facility

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APPENDIX B
THREATENED AND ENDANGERED
SPECIES SURVEY

DECEMBER 11, 1989

Mr. Ted Wolff
Sandia National Laboratories
Division 3202
P.O. Box 5800
Albuquerque, New Mexico 87185

REPORT OF THE THREATENED AND ENDANGERED SPECIES ASSESSMENT
FOR THE RADIOACTIVE AND MIXED WASTE MANAGEMENT FACILITY

Dear Mr. Wolff:

This letter reports the results of an on-ground survey of the Radioactive and Mixed Waste Management Facility (RMWF) site at Sandia National Laboratories, Albuquerque, Bernalillo County, New Mexico, for the purpose of assessing impacts to federal and state listed threatened and endangered species. I visited the RMWF site on December 8, 1989, accompanied by yourself and Mr. Tony Roybal of Sandia National Laboratories.

Due to the time of year of the visit, general wildlife activity was low and plant species identification was often limited to vegetative characteristics on dried, above-ground tissues. Please note that closely related species with similar vegetative characters (e.g., grass species in the genera Sporobolus, Aristida, and Muhlenbergia) are presented here as probable identifications.

Physical Description of the Site

The site of the RMWF is in T.9N R.4E Section 29 SE1/4 SE1/4. The physiographic setting of the site is an undissected alluvial surface with a gradual westward slope of approximately 2%. The soils range from a fine sandy loam to a gravelly sandy loam. The estimated maximum extent of the disturbance associated with the RMWF is 10 acres. Existing roads bound the east and south sides of the site. Approximately 3 acres of the site has been cleared of vegetation. The remaining area of natural vegetation is moderately disturbed by vehicle tracks and some debris. Although most of the area surrounding the RMWF site is still undisturbed, a variety of small structures and land disturbances exist east and northeast of the site.

Biological Description of the Site

The RMWF site is located within a well developed grassland association in good condition. Grasses are estimated to comprise over 90% of the vegetative cover. The dominant species are sand dropseed (Sporobolus cryptandrus), mesa dropseed (S. flexuosus), black grama (Bouteloua eriopoda) and galleta (Hilaria jamesii). Patches of burro grass

Regional Office

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(Scleropogon brevifolius) occur, but are not extensive. Three-awn (Aristida cf. longiseta) and ring muhly (Muhlenbergia torreyi)/sand muhly (M. arenicola) are common grasses on the site.

Shrubs, subshrubs and forbs are sparse at the RMMF site. Four-wing saltbush (Atriplex canescens) is the only shrub on the site, with only a few individuals exceeding the height of the grasses. Subshrubs are represented by broom snakeweed (Gutierrezia sarothrae), winterfat (Eurotia lanata) and plains yucca (Yucca glauca). Cacti observed on the site were prickly pear (Opuntia phaeacantha), club cholla (O. clavata) and pincushion cactus (Coryphantha vivipara).

Very little wildlife activity was observed at the site. A coyote (Canis latrans) was heard approximately 1/4 to 1/2 mile to the west during the visit. Small to moderately large flocks of horned larks (Eremophila alpestris) were observed. Signs of small mammal activity were few and limited to small burrows. The habitat type probably supports Ord's kangaroo rat (Dipodomys ordii) and plains pocket mouse (Perognathus flavescens).

Threatened and Endangered Species Assessment

Based on the location of the RMMF site and the habitat type, the development of this facility will not impact any wildlife species currently listed as threatened or endangered by the U.S. Fish and Wildlife Service or the New Mexico Department of Game and Fish.

Special attention was given to the possible existence of the State-protected grama grass cactus (Pediocactus papyracantha) in the undisturbed vegetation. This species was not observed at the site. The appropriate agencies are being notified of these conclusions for concurrence.

Please contact me at (505) 887-8294 (WIPP Office) or (505) 262-8800 (Albuquerque Office) if additional information is required.

Sincerely,

N. Timothy Fischer
Environmental Scientist

APPENDIX C

CORRESPONDENCE

INTERNATIONAL
TECHNOLOGY
CORPORATION

DECEMBER 13, 1989

Director
New Mexico Energy, Minerals and
Natural Resources Department
Forestry Division
Villaque Building
Santa Fe, New Mexico 87503

Dear Sir:

This letter seeks consultation and approval from the New Mexico Energy, Minerals and Natural Resources Department with regard to impacts to state listed endangered plants resulting from the construction of a Radioactive and Mixed Waste Management Facility (RMWMP) at Sandia National Laboratories, Albuquerque, New Mexico. The geographic location of this project is in Bernalillo County, T.9N R.4E Section 29 SE 1/4 SE 1/4.

The RMWMP will require a maximum of 10 acres of surface disturbance, with approximately 3 acres enclosed by a chain link fence, containing a 6406 square foot building for the handling and storage of low level radioactive waste and mixed waste. The site is located in a grassland association, dominated by sand dropseed (*Sporobolus cryptandrus*), galleta (*Hilaria jamesii*), and black grama (*Bouteloua eriopoda*).

We understand that the grama-grass cactus (*Padinocactus bursacanthus*) is the only endangered plant species which could potentially occur in this habitat type. We have searched the site for this species and found none. Please advise us of your concurrence with this finding.

If you require more information on this matter, please contact me at 887-8294 (Carlsbad, New Mexico).

Sincerely,

Tim Fischer
Environmental Scientist

Regional Office

5301 Central Avenue, N.E. • Suite 700 • Albuquerque, New Mexico 87108 • (505) 262-8800

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DECEMBER 13, 1989

Director
New Mexico Department of Game and Fish
Villagra Building
Santa Fe, New Mexico 87503

Dear Sir:

This letter seeks consultation and approval from the New Mexico Department of Game and Fish with regard to impacts to state listed endangered wildlife resulting from the construction of a Radioactive and Mixed Waste Management Facility (RMWF) at Sandia National Laboratories, Albuquerque, New Mexico. The geographic location of this project is in Bernalillo County, T.9N R.4E Section 29 SE 1/4 SE 1/4.

The RMWF will require a maximum of 10 acres of surface disturbance, with approximately 3 acres enclosed by a chain link fence, containing a 6406 square foot building for the handling and storage of low level radioactive waste and mixed waste. The site is located in a grassland association, dominated by sand dropseed (*Sporobolus cryptandrus*), galleta (*Hilaria jamesii*), and black grama (*Bouteloua eriopoda*).

We have consulted the recent issue of the Handbook of Species Endangered in New Mexico and the list of Sensitive Wildlife in New Mexico. It is our belief that the construction of this facility will not impact any of the listed endangered species or sensitive species. Please advise us of your concurrence with this finding.

If you require more information on this matter, please contact me at 887-8294 (Carlsbad, New Mexico).

Sincerely,

A handwritten signature in dark ink, appearing to read 'Tim Fischer'.

Tim Fischer
Environmental Scientist

Regional Office

8301 Central Avenue, N.E. • Suite 700 • Albuquerque, New Mexico 87108 • (505) 262-8800

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DECEMBER 13, 1989

Mr. John C. Peterson, Field Supervisor
Ecological Services
U.S. Fish and Wildlife Service
Suite D, 3530 Pan American Highway NE
Albuquerque, New Mexico 87107

Dear Mr. Peterson:

This letter seeks consultation from the U.S. Fish and Wildlife Service in compliance with Section 7 of the Endangered Species Act for the construction of a Radioactive and Mixed Waste Management Facility (RMWF) at Sandia National Laboratories, Albuquerque, New Mexico. The geographic location of this project is in Bernalillo County, T.9N R.4E Section 29 SE 1/4 SE 1/4.

The RMWF will require a maximum of 10 acres of surface disturbance, with approximately 3 acres enclosed by a chain link fence, containing a 6406 square foot building for the handling and storage of low level radioactive waste and mixed waste. The site is located in a grassland association, dominated by sand dropseed (*Sporobolus cryptandrus*), galleta (*Hilaria jamesii*), and black grass (*Bouteloua eriopoda*).

We believe that construction of this facility will not impact any Federally listed threatened or endangered species or critical habitat. Please advise us of your concurrence with this finding.

If you require more information on this matter, please contact me at 887-8294 (Carlsbad, New Mexico).

Sincerely,

A handwritten signature in cursive script, appearing to read 'Tim Fletcher'.

Tim Fletcher
Environmental Scientist

Regional Office

6301 Central Avenue, N.E. • Suite 700 • Albuquerque, New Mexico 87108 • (505) 262-8800

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GOVERNOR
GARREY CARRUTHERS

State of New Mexico

STATE GAME COMMISSION

GERALD MAESTAS, CHAIRMAN
ESPAÑOLA

RICHARD A. ALLGOOD
SILVER CITY

CHRISTINE DIGREGORIO
GALLUP

BOB JONES
DELL CITY, TX

JW. JONES
ALBUQUERQUE

DIRECTOR AND SECRETARY
TO THE COMMISSION
BILL MONTOYA

DEPARTMENT OF GAME AND FISH

VILLAGRA BUILDING
SANTA FE
87503

April 23, 1990

Mr. Tim Fischer, Environmental Scientist
International Technology Corporation
5301 Central Avenue, N.E., Suite 700
Albuquerque, New Mexico 87108

Dear Mr. Fischer:

This letter acknowledges receipt of your request seeking consultation and approval from the Department of Game and Fish with regard to impacts to state-listed endangered or other sensitive species of wildlife resulting from the construction of a Radioactive and Mixed Waste Management Facility (RMWMF) at Sandia National Laboratories in Albuquerque. The RMWMF will require a maximum of 10 acres of surface disturbance, with approximately 3 acres enclosed by a chain link fence, containing a 6406 square foot building for the handling and storage of low-level radioactive and mixed waste.

The department concurs with your finding that the construction of the RMWMF facility will not affect any state-listed threatened or endangered wildlife, and hereby issue a finding of no significant impact.

Thank you for affording the Department of Game and Fish the opportunity to review and comment on this project. If you have any questions, please contact Andrew Sandoval (827-7952) of this office.

Sincerely,

A handwritten signature in black ink, appearing to read "Bill Montoya", with a horizontal line extending to the right.

Bill Montoya
Director

BM/avs

cc: Wain Evans (Assistant Director, NMGF)
Dan Pursley (NW Area Supervisor, NMGF)

**UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE**

**Ecological Services
Suite D, 3530 Pan American Highway, NE
Albuquerque, New Mexico 87108
January 17, 1990**

RECEIVED

JAN 22 1990

IT CORP.-ALBUQUERQUE

**Mr. Tim Fisher
International Technology Corporation
5301 Central Avenue, NE, Suite 700
Albuquerque, New Mexico 87108**

Dear Mr. Fisher:

This responds to your letter dated December 13, 1989, requesting information on species Federally listed or proposed to be listed as threatened or endangered. The proposed action involves construction of a Radioactive and Mixed Waste Management Facility at Sandia National Laboratories, Albuquerque, New Mexico. The geographic location is in Bernalillo County, SE1/4, SE1/4, Section 29, R4E, T9N.

We have used the information in your request to narrow the list of threatened or endangered species occurring in the project area to those which may be affected by the proposed action. Our data indicate no threatened or endangered species would be affected by the proposed action.

Wetlands, riparian vegetation and other sensitive wildlife habitat on or near the site should also be protected. If impacts cannot be avoided, a mitigation plan should be developed to compensate for fish and wildlife losses.

We suggest you contact the New Mexico Department of Game and Fish and the New Mexico Energy, Minerals and Natural Resources Department for information about plants and animals of State concern.

If we can be of further Assistance, please call Charlie McDonald at (505, 883-7877 or FTS 474-7877.

Sincerely yours,

**John C. Peterson
Field-Supervisor**

cc:

**Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals and Natural Resources Department,
Forestry Division, Santa Fe, New Mexico
Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife
Enhancement, Albuquerque, New Mexico**

United States Government

Department of Energy

Albuquerque Operations Office

memorandum

DATE: JUN 31 1994
REPLY TO:
ATTN OF: MSD:ESHB:RPG0126
SUBJECT: Mixed Waste Management Facility, Sandia National Laboratories (SNL),
Albuquerque
TO: N. R. Ortiz, Director, 3200, SNL

Attached is the State of New Mexico Office of Cultural Affairs Historic Preservation Division's determination that completion of the Mixed Waste Management Facility will have no effect on any previously recorded historic properties.

If there are any questions or if additional information is needed, please contact R. F. Gonzales, of this office, at 845-6091.

Thomas B. Hyde
Chief, Environment Safety and
Health Branch
Management Support Division

Attachment

cc w/attachment:
J. G. Themelis, DHD
T. A. Wolff, 3202, SNL
H. E. Norte, 7821, SNL
J. G. Smith, 3202, SNL
G. E. Chavez, 3202, SNL

GARREY CARRUTHERS
GOVERNOR

STATE OF NEW MEXICO
OFFICE OF CULTURAL AFFAIRS
HISTORIC PRESERVATION DIVISION

VILLA RIVERA, ROOM 101
220 EAST PALACE AVENUE
SANTA FE, NEW MEXICO 87503
(505) 827-4320

THOMAS W. MERLAN
DIRECTOR

HELMUTH J. NAUS
CULTURAL AFFAIRS OFFICER

January 22, 1990

Mr. Albert R. Chernoff
Director
Management Support Division
Albuquerque Operations Office
Department Of Energy
Post Office Box 5400
Albuquerque, New Mexico 87115

Re: Mixed Waste Management Facility, Sandia National Laboratories

Attn: Mr. R. F. Gonzales

Dear Mr. Chernoff:

At your request, I have reviewed the results of a cultural resources survey of the area affected by construction of the Mixed Waste Management Facility at Sandia National Laboratory, Kirtland Air Force Base, New Mexico. The results of this survey are described in *A Cultural Resource Survey of a 3.4 Acre Site Currently Under Construction as a Radioactive Mixed Waste Facility at Sandia National Laboratories, Kirtland Air Force Base, New Mexico* by Steven R. Hoagland, Chambers Group, Inc.

According to the survey report, the described facility is approximately 95% complete, and the project area of effect has been disturbed to an extent that precludes the identification of significant archaeological or historical sites. It is therefore impossible for me to comment on the possible effects of this undertaking on historic properties in accordance with the provisions of 36 CFR Part 800.

However, since no properties entered in or determined eligible for inclusion in the National Register of Historic Places are located in the vicinity of this undertaking, completion of the Mixed Waste Management Facility will have no effect on any previously recorded historic properties.

Thank you for informing me of the results of the described survey effort. Please contact this office with any questions you may have regarding my comments on this matter.

Sincerely,

Department of Energy
Albuquerque Operations Office
P O Box 5400
Albuquerque, New Mexico 87115

DEC 20 1988

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

State of New Mexico
Health and Environment Department
Environmental Improvement Division
Hazardous Waste Bureau
Attn: Mr. Kelley Crossman
P. O. Box 968
Santa Fe, New Mexico 87504-0968

Dear Mr. Crossman:

The purpose of this letter is to notify you of our intention to undertake construction of a Radioactive and Mixed Waste Management Facility at Sandia National Laboratories, Albuquerque (SNLA). SNLA intends to begin construction of this facility during the month of February 1989. The Radioactive and Mixed Waste Management Facility (RMWMF) will be utilized to package and store radioactive and mixed waste for transportation to off-site treatment and/or disposal facilities. SNLA has ceased burial of mixed waste at its low-level radioactive waste landfill and this facility is necessary for packaging and storage of the mixed waste stream generated at the laboratory. Our long-range plans also call for discontinuance of radioactive waste burial at SNLA as well.

The RCRA Part A for SNLA will be amended to include mixed waste operations within six months of the State of New Mexico receiving RCRA mixed waste authority. The facility will be built to meet storage building requirements already specified under RCRA. We do understand that construction approval does not automatically confer RCRA permit status for the RMWMF. It is critical that the facility be built during this fiscal year and the current budget schedule because the budget cycle for requesting and securing approval for construction at a future date could require several years.

K. Cro: sman

- 2 -

If you require any further information, please call Sue E. Umshler, of my staff, at 844-7671.

Sincerely,

A handwritten signature in dark ink, appearing to read "A. R. Chernoff", with a long horizontal flourish extending to the right.

Albert R. Chernoff
Director, Management
Support Division

cc:

R. Brown, USEPA, Region VI

J. Themelis, EHD/AL

P. Stanford, 0100, SNLA

S. Wallace, 0132, SNLA

G. Smith, 3314, SNLA

A handwritten signature in dark ink, appearing to read "Gloria", written in a cursive style.

memorandum

Albuquerque Operations Office

DATE:

REPLY TO
ATTN OF:

MID:LSH:SMU

SUBJECT: Construction of Mixed Waste Facility, SNLA

TO: P. M. Stanford, Controller, 0100, SNLA

The attached letter from the NMEID is for your information and records.

The NMEID has stated that our letter will suffice for notification under the State hazardous waste program. In addition, they advise that we apply the requirements of HMR-5 to the design and operation of this unit. Because of their staff limitations, a formal construction permit will not be required by the NMEID to build this facility. Further, they advise that the Part A and Part B RCRA permit applications will have to be modified when the State receives formal RCRA mixed waste authorization.

Please review the design of this facility for compliance with HMR-5 before construction begins, if possible. Also, we urge that construction be started as expeditiously as possible. Thank you for your excellent cooperation in this matter.

If we can be of further assistance, please call Sue E. Umsler of my staff at 844-7671.

(Handwritten signature)
Albert R. Chernoff
Director, Management
Support Division

Attachment

cc w/attachment:

S. Wallace, 0132, SNLA

G. Smith, 3314, SNLA

G. Millard, 3314, SNLA

P. Sarnau, E1WMD

J. Threlis, E1D

NEW MEXICO
HEALTH AND ENVIRONMENT

DEPARTMENT

ENVIRONMENTAL IMPROVEMENT DIVISION
Harold Runnels Bldg.-1190 St. Francis Drive
Santa Fe, New Mexico 87503

Richard Mazzullo
Director

GARREY CARLITHERS
Governor
CARLA L. MUTH
Secretary
MICHAEL J. BURKHART
Deputy Secretary

December 27, 1988

Mr. Albert R. Chernoff, Director
Management Support Division
D.O.E. Albuquerque Operations Office
P.O. Box 5400
Albuquerque, NM 87115

RE: SANDIA LABORATORY MIXED WASTE
NM5890110518

Dear Mr. Chernoff:

The Environmental Improvement Division has received your letter of December 20, 1988 regarding the construction of a new facility to package and store radioactive and mixed waste. We are pleased to note that SNLA has ceased the disposal of mixed waste on-site and understand the concurrent need to provide a proper storage unit. The Hazardous Waste Management Regulations (HWMR-5) require a permit prior to construction of a new facility but the hazardous waste program does not have sufficient staff time to process such a permit in time to meet your requirements. While the State has not yet applied for and received authorization to operate the RCRA mixed waste program for EPA, the HWMR-5 do apply to mixed wastes as a state program under the Hazardous Waste Act (Section 74-4-1 et. seq. NMSA). Thus, you should make every effort to apply the requirements of HWMR-5 to the design and operation of this new unit.

This new storage unit will need to be added to your RCRA Part A notification as noted in your letter. At this time your letter will suffice for notification under the State hazardous waste program. Additionally, the unit will have to be included in your RCRA Part B permit application when the State receives RCRA mixed waste authorization.

If you have any questions, please call me at 827-2923.

Sincerely,

C. Kelley Crossman

C. Kelley Crossman
Program Supervisor
Hazardous Waste Section

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

MAY 2 1961

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

State of New Mexico
Health and Environment Department
Environmental Improvement Division
ATTN: Tito Madrid
4131 Montgomery N. E.
Albuquerque, NM 87109

Dear Mr. Madrid:

Enclosed for your approval, please find a completed registration form for a new septic tank that is being constructed for the new Mixed Waste Facility at our facility, Sandia National Laboratories, Albuquerque, Technical Area III. Please review this permit and return your renewal to this office. Thank you for your consideration of this application.

If you require further information, please call Sue E. Umshler of my staff at 844-7671.

Sincerely,

Original Signed By
Albert R. Chernoff

Albert R. Chernoff
Director, Management
Support Division

Enclosures

cc w/enclosures:

K. Lambert, EID
G. Smith, 3202, SNLA
P. Stanford, 0100, SNLA
S. Wallace, 0132, SNLA
G. Yeager, 3202, SNLA
J. Themelis, EID

memorandum

Albuquerque Operations Office

DATE: AUG 22 1989

REPLY TO

ATTN OF: MSD:ESHB:SEU

SUBJECT: City of Albuquerque Inspection for Wastewater Permits, Registration of Septic Tank for the Mixed Waste Facility, and NMEID Approval of Discharge for Solar Catalytic Experimental Apparatus
TO: N. R. Ortiz, Director ES&H, 3200, SNL

Attached are copies of various letters from the City of Albuquerque and the New Mexico Environmental Improvement Division (NMEID) for your information and files. The attached documents are as follows:

1. City of Albuquerque, dated July 10, 1989, regarding Annual Inspection Response. Thank you for your efforts and the resulting status of complete compliance with City requirements for the subject wastewater permits. The letter also confirms the commitment by the City to complete the permit for the Microelectronics Development Lab. Please note the requirement that will be enclosed with that permit approval—completion of the scaffold for equipment setup to monitor the discharge. Also, the City will be sending additional reporting requirements and procedures for pH excursions.
2. NMEID, dated 7-14-89, Registration of an Unpermitted Individual Liquid Waste System. This is a copy of the signed copy of the registration form by the NMEID for the septic tank at the Mixed Waste Facility.
3. NMEID, dated 7-21-89, letter approving the discharge of effluent from the proposed solar catalytical experimental apparatus. They are not requiring a Discharge Plan for this effluent discharge, but have stipulated that any actual pollution of water or ground water will require remediation and that any changes in the action may require a modified Notice of Intent.

Thank you for your assistance with successful completion of the inspection, registration, and notification of these subject activities. If we can provide additional information or assist with preparations, please call Sue E. Umshler of my staff at 844-7671.

Albert R. Chernoff
Director, Management
Support Division

Attachments

cc w/attachments:
P. Stanford, 0100, SNLA
G. Smith, 3202, SNLA
G. Yeager, 3202, SNLA

LOT PLAN. Diagram the liquid waste system (birdseye view). Show setback distances to property lines, buildings, water lines and wells, other liquid waste systems, canals, arroyos, watercourses, and lakes. Include the following landmarks within 200 feet of the system:

- proposed and/or existing buildings, driveways, water lines and wells, and other liquid waste systems;
- the direction of groundwater movement, location of any surface water, irrigated areas, arroyos, rock outcrops, or sloping area;
- property lines and dimensions of the parcel where the system is located.

V. FURTHER NOTES. Include any further information which may be pertinent. This tank was earlier issued

EID Permit # A0890010; because it was covered before CID inspection Roger
Chavez (CID) and Betty Tanya (EID) agreed that a registration
form should be submitted in lieu of a permit

VI. AFFIDAVIT. The foregoing information is correct, complete and true to the best of my knowledge. I understand that registration of this system does not relieve me from complying with all applicable provisions of the New Mexico Uniform Plumbing Code and the New Mexico Liquid Waste Disposal Regulations.

As Owner 7/11/89
 Owner Date

VII. EID USE ONLY

The information recorded on this form indicates that the system described apparently MEETS
☐ DOES NOT MEET the requirements in effect at the time of its installation or the requirements of Part 2 of the current Liquid Waste Disposal Regulations, whichever are less stringent. [A favorable judgment on apparent compliance does not certify the system's functional adequacy or actual compliance with the regulations.]
 In no way is the owner or user of this system relieved of complying with the Liquid Waste Disposal Regulations.

Daniel Vigil 7/11/89
 Environmentalist Date
 Acting District Manager

REGISTRATION
OF AN UNPERMITTED
INDIVIDUAL LIQUID WASTE SYSTEM

EID Registration Number
AD89065R

SYSTEM OWNER'S NAME - Last, First and Middle U.S. DOE, Albuquerque Operations, Manag. Sup. Div.		HOME PHONE	BUSINESS PHONE 846-3110
MAILING ADDRESS - Street or P.O. Box, City, State and Zip Code P.O. Box 5400, Kirtland AFB, NM 87115, Attn: A.R. Cheneff			
LOCATION OF SYSTEM - Street address, and directions to site if needed Sandia National Laboratories / Tech. Area III, Bldg. 6920		COUNTY Bernalillo	
DATE OF SYSTEM INSTALLATION 5/89		SUBDIVISION, Block and lot	TOWNSHIP-RANGE-SECTION 7N 4E 29 00C
INSTALLER'S NAME AND FIRM Bernadette Plumbing and Heating Co., Inc. (Lic # 1707; Type NM 98)		PHONE 344-3012	
MAILING ADDRESS - Street or P.O. Box, City, State and Zip Code 4915 Pan American Pl. NE, Albuquerque, NM 87109			

Note: This form is used to record information concerning individual liquid waste systems which were initially installed without a valid EID Permit. It is intended to serve as a record of the system's existence, with as many details about its construction as may be available at the time, but in no way is it construed as the equivalent of a Permit. If the system is to be modified or enlarged, a Permit must be obtained.

I. BUILDING USE AND DESIGN FLOW

Residential: ☐ Single family, with _____ bedrooms ☐ Multiple family, with _____ units with _____ bedroom/unit

All Others: Office/Work area; Table 1 (Gal/Day/Employee, Office)
specify type of establishment & no. and type of wastewater flow sizing units (see instructions)

Gallons per Day: Residential _____ All others 12 employee x 20 GPD = 240 GPD
number of sizing units times flow per sizing unit

II. SITE INFORMATION

Water Sources: ☒ Off-site or ☐ On-site ☐ Public or ☐ Private ☐ Shared

Lot Size: 1920 Acres Plat Date: _____
square feet or acres

Suitable Area: _____ ☐ Surface water ☐ Slopes over 15% ☐ Rock outcrops ☐ Irrigation
square feet or acres

Depth from Surface to Seasonal high water table 482 ft Rock, caliche, or highly permeable material 220 ft
inches or feet

Soil Type: ☒ Coarse sand or gravel ☐ Fine sand ☐ Sandy loam or sandy clay ☐ Clay with considerable sand or gravel ☐ Clay with small amount of sand or gravel

III. SYSTEM DESIGN

Treatment Unit: ☒ Septic tank ☐ Other - specify _____

Size 1000 Gal. (Rio Rancho Concrete Products Corp)
capacity in gallons or gallons per day (State Cert 19-6-136)

Leaching Area: (approximate) Trench or Bed 108 = width 1.5 x length 24 (ft) x 24 (ft) x 24 (ft)
square feet trench 1 trench 2 trench 3 (etc.)
Perc. test result 2 1/2 in/min

Other - specify _____ = Area = 240 GPD x (1/2) x .32 = 108 ft²
square feet specify type and dimensions (attach plans for alternative systems)

Depths: Gravel below drain pipe 12" Ground surface to bottom of leaching area 40"
inches or feet inches or feet

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

JUL 11 1989

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

State of New Mexico
Health and Environment Department
Environmental Improvement Division
District I
Mr. Dan Vigil
Acting Environmental Manager
4131 Montgomery N.E.
Albuquerque, New Mexico 87109

Dear Mr. Vigil:

On May 9, 1989, we submitted for your approval, a registration form for a new septic tank that was being constructed at our facility, Sandia National Laboratories; Albuquerque (SNL). An EID Permit Number (AD890010) was assigned. However, the Construction Industries Division (CID) portion of the permit could not be completed, because the SNL contractor prematurely covered the newly-installed tank. It has been agreed in discussions with Molly Jasper, EID and Roger Cherryholmes, CID, that a Liquid Waste System Registration form would be submitted for this tank.

The purpose of this letter is to transmit that registration form for your records.

Thank you for your assistance in correctly registering this tank. If you require any further information, please call Sue E. Umshler, of my staff, at 844-7671.

Sincerely,

Albert R. Chernoff
Director, Management
Support Division

Enclosure:

cc w/enclosure:
J. Themelis, EID/AL
G. Smith, 3202, SNL
G. Yeager, 3202, SNL

cc w/o enclosure:
P. Stanford, 0100, SNL
N. Ortiz, 3200, SNL

Sandia National Laboratories

Albuquerque, New Mexico 87105

date: June 30, 1989

to: A. R. Chernoff, AL/MSD

from: J. G. Yeager, 3202

subject: Septic Tank Registration for SNL Mixed Waste Management Facility,
Building 9920

Enclosed is a Liquid Waste System Registration Form for the septic tank associated with SNL's Mixed Waste Management Facility, Building 9920. The form should be reviewed and signed by A.R. Chernoff in the "Owner" block in Section VI. The signed form should be sent to the address below:

Dan Vigil, Acting District I Environmental Manager
New Mexico Environmental Improvement Division
4131 Montgomery N.E.
Albuquerque, New Mexico 87109

As noted in Section V ("Further Notes"), a permit application for this septic tank was submitted earlier to the New Mexico Environmental Improvement Division (EID). An EID Permit Number (AD890010) was assigned; however, the Construction Industries Division (CID) portion of the permit could not be completed, because the SNL contractor prematurely covered the newly-installed tank. It was agreed in discussions with Molly Jasper (EID) and Roger Cherryholmes (CID) that a Liquid Waste System Registration form would be submitted for the tank.

Please contact Gary Yeager at 846-5735 if you have any questions about this submittal.

Enclosure

Copy to (w/o enclosure):
S. E. Umshler, AL/MSD
0100 P. M. Stanford
3202 D. B. Dionne
3202 R. D. Gomez
7844 M. L. Whipple

APPENDIX D

***METHODS USED TO CALCULATE
RADIOLOGICAL DOSES AND
HAZARDOUS CHEMICAL AIR CONCENTRATIONS***

APPENDIX D

METHODS USED TO CALCULATE RADIOLOGICAL DOSES AND HAZARDOUS CHEMICAL AIR CONCENTRATIONS

D.1 Airborne Releases

The AIRDOS-EPA Air Dispersion Model

The computer code AIRDOS-EPA (Moore et al., 1979) was used to calculate dose commitments resulting from the air transport of radionuclides and hazardous chemicals released from point sources. AIRDOS-EPA is one of the codes approved by the EPA for demonstrating compliance with the NESHAPs, 40 CFR 61, Subpart H. The code is designed to estimate radionuclide or chemical concentrations and intake rates through inhalation of air and ingestion of meat, milk, and produce. To obtain radiation dose commitments, the quantity of each radionuclide that contributes to radiation exposure is multiplied by the specific dose factor, dispersion factor, and exposure or uptake rate. In addition, external radiation doses that result from groundshine and immersion in contaminated air are calculated. The total dose commitment is then determined by summing the component doses received by each pathway and each radionuclide.

The computer code calculates pollutant concentrations at downwind locations using a modified Gaussian model for plume dispersion to simulate the horizontal and vertical dispersion of radionuclides released either at ground level or through a stack. AIRDOS-EPA calculates the effects of the particle size, gravitational fall, scavenging effect of precipitation, and dry deposition processes in determining the depletion and fallout of pollutants from the plume.

D.2 Plume Rise

The plume rise is the height above the stack to which the plume ascends before dispersing downwind. Plume rise is usually dominated by either buoyancy, caused by a large temperature difference between the plume and ambient air, or momentum, caused by a high stack exhaust velocity. For the RMWMF, the plume rise during routine operations is extremely small since the

exhaust is neither hot (buoyant) nor of great speed. Consequently, the plume rise is conservatively taken to be zero above the stack exhaust point, 55 ft above ground level. For accident scenarios involving a fire, the conservative assumption is made that the walls of the facility are no longer standing and that the release of materials is at ground level with no plume rise.

D.3 Meteorological Data

The radiological exposure to the residents and workers surrounding the RM caused by radionuclide releases from normal operations (routine releases) and from post accidents, are substantially reduced as a result of dispersion and dilution in the atmosphere. The most important mechanism for the transport of contaminants is wind, which can carry these releases to potential human receptor locations. For the Proposed Action (Alternative 3), the wind data [stability array (STAR) data] used in the AIRDOS-EPA code are from five consecutive years (1960-1964) of site-specific Albuquerque data average for those years. The wind speed data are segregated into seven different stability classes and sixteen wind direction sectors (Table D-1). The data used for routine releases shown in Table D-2 are derived by averaging over all stability classes. Worst-case conditions were assumed in calculating the effects of accidents, so no wind frequency data were used in the calculation of doses and concentrations from accident scenarios. During accident conditions, a wind direction was selected so that 100 percent of the released material was conveyed to the locations of local residents, the maximally-exposed individual or worker. This was done for each of the seven receptor locations at SNL/New Mexico and the maximally-exposed locations. In addition, light winds (1 m/sec) and F-stability were used in the accident scenarios to maximize the resulting effects. Other meteorological data used by AIRDOS-EPA include an annual average mixing height of 1190 m and annual precipitation rate of 20.5 cm with an average air temperature of 286° Kelvin (56° Fahrenheit).

D.4 Dispersion Coefficients

Horizontal and vertical dispersion coefficients, σ_y and σ_z , are used to calculate dispersion factors for pollutant concentrations in air. The AIRDOS-EPA code uses dispersion coefficients recommended by G.A. Briggs of the Atmospheric Turbulence and Diffusion Laboratory at Oak Ridge, Tennessee, (Moore et al., 1979). These values are different functions of the downwind

Table D-1

**Average Wind Speeds in Each Sector and Stability Class
for SNL/New Mexico (m/sec)**

<i>Sector</i>	<i>Stability Class</i>						
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>
1-N	1.82	2.21	3.59	5.69	3.50	1.59	0.00
2-NNW	1.78	1.96	3.18	4.63	3.36	1.77	0.00
3-NW	1.36	1.72	2.79	5.16	3.29	1.78	0.00
4-WNW	1.53	1.52	3.24	7.10	3.46	1.73	0.00
5-W	1.36	1.48	3.61	7.65	3.60	1.55	0.00
6-WSW	1.32	1.64	2.74	5.92	3.50	1.50	0.00
7-SW	1.29	1.56	2.84	4.11	3.54	1.64	0.00
8-SSW	1.83	1.83	2.89	4.46	3.85	1.78	0.00
9-S	1.67	1.78	3.27	5.53	3.99	1.86	0.00
10-SSE	1.80	1.84	3.29	5.60	3.77	1.83	0.00
11-SE	1.81	1.93	3.33	6.32	3.73	1.66	0.00
12-ESE	1.79	2.10	3.62	6.51	3.53	1.57	0.00
13-E	1.68	2.20	3.70	6.31	3.43	1.54	0.00
14-ENE	1.78	2.45	3.94	6.01	3.50	1.60	0.00
15-NE	1.84	2.37	3.92	5.68	3.41	1.51	0.00
16-NNE	1.72	2.52	4.02	6.11	3.56	1.61	0.00

distance in each of the Pasquill stability categories A through F. The AIRDOS-EPA dispersion coefficients are most suitable for long-term releases of two hours or more (routine releases).

Table D-3 shows the dispersion coefficient formula for each stability class.

Table D-2

**Wind Direction Frequency of Occurrence
Averaged Over all Stability Classes**

<i>Sector</i>	<i>Frequency</i>
1-N	0.091
2-NNW	0.054
3-NW	0.083
4-WNW	0.081
5-W	0.053
6-WSW	0.027
7-SW	0.040
8-SSW	0.048
9-S	0.129
10-SSE	0.064
11-SE	0.056
12-ESE	0.053
13-E	0.048
14-ENE	0.053
15-NE	0.064
16-NNE	0.055

AIRDOS-EPA was used to analyze routine releases as prescribed in 40 CFR 61 and was modified for accident analysis as documented in Section D.5. Only one dispersion code was used throughout the analysis. Using one code ensures that differences in results are attributable to differences in the routine releases and accident scenarios and not to differences in computer models.

Table D-3

**Formulas Recommended by
Briggs* for σ_y and σ_z in Open-Country Conditions****

<i>Pasquill Type</i>	σ_y (m)	σ_z (m)
A	$0.22x(1 + 0.0001x)^{-1/2}$	$0.20x$
B	$0.16x(1 + 0.0001x)^{-1/2}$	$0.12x$
C	$0.11x(1 + 0.0001x)^{-1/2}$	$0.08x(1 + 0.0002x)^{-1/2}$
D	$0.08x(1 + 0.0001x)^{-1/2}$	$0.06x(1 + 0.0015x)^{-1/2}$
E	$0.06x(1 + 0.0001x)^{-1/2}$	$0.03x(1 + 0.0003x)^{-1}$
F	$0.04x(1 + 0.0001x)^{-1/2}$	$0.016x(1 + 0.0003x)^{-1}$

* Moore et al., 1979.

** Values of x are downwind distances in meters.

D.5 Accident Scenarios

Accidental releases from abnormal events, whether manmade or natural, have very low probabilities of occurrence and are of limited duration. All accidental releases examined in this assessment exhibit a release function of two hours or less. With this special set of circumstances, assumptions normally used for long-term operational releases are invalid. Accidental releases could occur at any time of the year and any time of the day or night. The ambient conditions hypothesizing that a release will occur at the most inopportune time provides a basis for calculating the greatest effect that would result from the accidental release. The following list summarizes the worst-case conditions and assumptions used in assessing consequences from abnormal events:

- F-category for atmospheric stability;
- 1 m/sec wind speed;
- Wind direction towards the highest impact location; and
- Plume centerline air concentration (accident analysis only).

These assumptions result in a conservatively high estimate of exposure. No actual wind data are used in the analysis. Assuming worst-case wind direction allows 100 percent of the contaminant to be conveyed to the areas with maximum impact. The small wind speed value of 1 m/sec (3.28 ft/sec) during F-stability provides a maximum air concentration, as recommended by the NRC (NRC, 1983) for use in estimating the radiological consequences of a nuclear accident.

D.6 Atmospheric Dispersion Factors

The AIRDOS-EPA code calculates sector-average air concentrations for operational releases and plume-centerline values for releases from abnormal events. The X/Q values (ratio of air concentration, X in gm/m³ to pollutant release rate Q, in gm/sec) for abnormal events are larger, in general, than routine values because all the assumed meteorological conditions discussed in Section D.5 act to increase air concentrations. Routine releases occur over a long period of time such that changes in the wind direction greatly enhance dispersion. Under those conditions, only a fraction of the release inventory is transported in a single direction and X/Q values are consequently smaller. The X/Q values as reported in this document also incorporate dry deposition of particulate material in the plume which results in a smaller X/Q than obtained by simply calculating X/Q using the standard Gaussian model.

Public Receptors

Table D-4 lists the X/Q values for particulates for the maximally-exposed individual and other receptor locations of interest in this analysis. For routine releases, X/Q is primarily a function of the distance to the site boundary and the frequency of occurrence of wind direction. The wind speed in different sectors and the stability class also contribute but to a lesser extent. The X/Q for the maximally-exposed individual (routine release) has a value of 4.96×10^{-6} sec/m³. For accidental releases, the X/Q for the maximum individual, public, was calculated to be 9.2×10^{-5} sec/m³. For

Table D-4

**X/Q Values for Routine and Accident
Release Conditions**

			X/Q Values		
Description		Distance From RMWMF (m)	Direction From RMWMF	Routine (sec/m³)	Accident (sec/m³)
Routine Receptors					
1.	NW Base Housing	9,700	NNW	6.56x10 ⁻⁸	N/A*
2.	Four Hills	8,500	NNE	4.18x10 ⁻⁸	N/A
3.	N Base Housing	9,200	N	1.06x10 ⁻⁷	N/A
4.	NW DOE Complex	9,100	NNW	7.2x10 ⁻⁸	N/A
5.	Mountain View (2nd St. & Desert Rd.)	11,900	W	4.18x10 ⁻⁸	N/A
6.	Tijeras	18,100	NE	1.26x10 ⁻⁸	N/A
7.	Isleta Gate	2,800	S	4.96x10 ⁻⁶	N/A
Facility Worker		120	S and E	5.84x10 ⁻⁵	N/A
Accident Receptors					
1.	Maximum Individual Public (Isleta Gate)	2,800	S	N/A	9.2x10 ⁻⁵
2.	Worker	305	NNE	N/A	4.95x10 ⁻³
* N/A - not applicable					

routine and accident releases, the maximum public individual is assumed to be located due south of the RMWMF at a distance of 2.8 km at the Isleta Gate. The Isleta Gate location is the closest non-restricted access location to the RMWMF site. Table D-4 shows the location of X/Q values for all receptor locations.

Worker Receptors

X/Q values for particulates were also calculated for maximum individual workers (onsite) for both routine and accident releases. For routine releases, a maximum X/Q value of $5.84 \times 10^{-5} \text{ sec/m}^3$ was found to occur 120 m south and east of the RMWMF. For accident releases, Stability Class C was found to result in the greatest X/Q value for special cases involving air concentration and radiation exposure close to an elevated release point (the RMWMF ventilation exhaust). For the accident scenario involving a fire, a maximum ground-level X/Q value was found to be $4.95 \times 10^{-3} \text{ sec/m}^3$ at a distance of 305 m. (**NOTE:** When calculating doses, the X/Q value for workers at 305 m from the site was reduced by a factor of four since it was assumed that workers at that location would be evacuated within 30 minutes or one-fourth of the total release period of two hours.

D.7 Calculation of Dose Commitments

The calculation of the radiation doses received by individuals can be based on as many as four independent pathways. The pathways considered in calculating dose from routine and accident releases include external and internal exposure mechanisms. The following pathways were assumed to contribute, where applicable, to the total dose received by members of the public and onsite personnel:

- Inhalation of the cloud of radionuclides;
- Ingestion of contaminated plants, animals, and milk (maximum individual dose from routine release only);
- External exposure from immersion in a radioactive cloud; and
- External exposure from radioactivity deposited on the ground.

The dose commitments calculated in this document (often referred to as "doses") are designed to assess the effects of radiation exposure on the human body. The methodology used here has been promulgated by the regulatory agencies. In this analysis, the four most significant pathways for human exposure have been examined. The total dose is determined by summing the component dose received from each relevant pathway and each radionuclide.

Ingestion and Inhalation

The ingestion pathway is designed to assess the effects that a persistent long-term radiological release may have on the environment. Radionuclides are delivered to plants and animals via atmospheric deposition and brought to human receptors via a complex path through the food chain. The methodology used by AIRDOS-EPA is described in Regulatory Guide 1.109 (NRC, 1977a).

The International Commission on Radiological Protection (ICRP) has developed a standard for normalizing the health risk from cancer induction and genetic defect (ICRP, 1978 and CFR, 1989) resulting from internal exposure (inhalation and ingestion) of radionuclides. The ICRP model provides a single index of risk that accounts for 19 organs affected by internal irradiation. ICRP dose conversion factors for 50-yr committed effective dose equivalents for the inhalation and ingestion pathways are shown in Table D-5 for some of the more prevalent radionuclides expected in the RMWMF inventory.

When the whole body is uniformly irradiated, the probability of the occurrence of cancer and genetic effects is assumed to be proportional to the dose equivalent to the whole body, and the risk may be represented by a single value. However, truly uniform whole body exposures are rare. Non-uniform or partial body exposures usually occur when irradiation is from radionuclides deposited in various tissues and organs. (Even with external irradiation, there are differences arising with depth in the body and orientation of the body in the generally non-uniform radiation field.) In some of these cases, the dose equivalents for various tissues, from a single exposure, can differ markedly. Tissues also vary in their sensitivity to radiation-induced cancer. The effective dose equivalent concept provides a means for handling these non-uniform irradiation situations.

The effective dose equivalent is the sum of the weighted dose equivalents for irradiated tissues or organs. It takes into account the different mortality risks from cancer and the risk of severe hereditary effects in the first two generations associated with irradiation of different organs and tissues.

The absorbed dose from external irradiation is received at the time the tissue is exposed to the radiation. However, the irradiation from internally deposited radionuclides, the absorbed dose will be

Table D-5

**Fifty Year Committed Effective Dose Equivalent Conversion Factors
for Inhalation and Ingestion of Selected Radionuclides***

<i>Radionuclide</i>	<i>Inhalation (rem/uCi)</i>	<i>Ingestion (rem/uCi)</i>
³ H	6.30 x 10 ⁻⁵	6.30 x 10 ⁻⁵
⁶⁰ Co	2.94 x 10 ⁻²	2.58 x 10 ⁻²
⁹⁰ Sr	1.30 x 10 ⁰	1.33 x 10 ⁻¹
¹²⁹ I	1.80 x 10 ⁻¹	2.80 x 10 ⁻¹
¹³⁷ Cs	3.22 x 10 ⁻²	5.03 x 10 ⁻²
²¹⁰ Po	8.10 x 10 ⁰	8.00 x 10 ⁰
²³² Th	1.63 x 10 ³	2.80 x 10 ⁰
²³³ U	1.30 x 10 ²	2.62 x 10 ⁻¹
²³⁴ U	1.30 x 10 ²	2.62 x 10 ⁻¹
²³⁵ U	1.20 x 10 ²	2.57 x 10 ⁻¹
²³⁸ U	1.20 x 10 ²	2.57 x 10 ⁻¹
²³⁸ Pu	4.6 x 10 ²	3.80 x 10 ⁰
²³⁹ Pu	5.1 x 10 ²	4.30 x 10 ⁰
²⁴⁰ Pu	5.1 x 10 ²	4.30 x 10 ⁰
²⁴¹ Pu	1.1 x 10 ²	8.6 x 10 ⁻²
²⁴¹ Am	5.2 x 10 ²	4.5 x 10 ⁰
²⁴⁴ Cm	2.74 x 10 ²	2.3 x 10 ⁰

* ICRP, 1978, and FR, 1989

distributed temporally depending on the effective half-life of the radionuclide involved. The absorbed dose rate from internally deposited radionuclides depends upon the amount of radioactive material (activity) in the body. The distribution of the absorbed dose within the tissues of the body will vary with the route of entry, the chemical and physical properties of the radionuclide, the type and energy

of the radiations emitted, the sites of deposition in tissues, the mass and density of the tissues, the rates of deposition and clearance from the body. To take into consideration the varying time distributions of radiation dose, the ICRP defined the committed dose equivalent in a particular organ or tissue as the total dose equivalent averaged throughout that organ or tissue in the 50 years after intake of a radionuclide into the body. The committed effective dose equivalent is assumed to be a measure of the risk that will result from that intake (NCRP, 1987).

Immersion and Deposition

Direct external radiation exposure results in a whole-body radiation dose. There are two primary sources of direct radiation; immersion in a radioactive cloud and radiation from radionuclides deposited on the ground. Dose conversion factors for the effective dose rate for external exposure to cloud immersion and ground-plane surface depositions were taken from Dunning et al. (1980).

D.8 Regulatory Compliance

The DOE has adopted occupational radiation protection standards for DOE environmental activities (DOE, 1988a). This standard incorporates current guidance from the National Council for Radiation Protection and Measurements (NCRP) and from the ICRP. The EPA has promulgated air emission standards, 40 CFR 61, Subpart H, which regulate the dose to the public from air emissions from DOE facilities under authority of the Clean Air Act. Table D-6 lists the radiation protection standards for DOE facilities.

D.9 Calculation of Dose to the Maximally-Exposed Individual

The maximally-exposed individual is a person whose location and habits maximize the radiation dose received. For routine releases, this person is assumed to live continuously at the site boundary, where the air concentration of radionuclides at ground level would be the highest and, therefore, would render the highest dose. Furthermore, this person is assumed to grow and raise all food in the same immediate area. The location of the maximum individual is primarily determined by the joint contributions of the direction in a given sector. Average wind speed and stability data for a

Table D-6

**Radiation Protection Standards for
DOE Facilities From Routine Release**

<i>Human Receptor</i>	<i>Radiation Dose Commitment</i>	<i>Agency/Standard</i>	<i>Annual Limit</i>
Maximally-Exposed Individual*	Effective dose equivalent	EPA, 40 CFR 61 (Subpart H)	10 mrem**
		DOE Order 5400.5	100 mrem†
Workers	Effective dose equivalent	DOE Order 5480.11	5000 mrem†

-
- * Standards are applicable to any offsite member of the public exposed to releases from normal operations and do not apply to unplanned or potential abnormal releases of radionuclides.
 - ** Standards are for exposure from the air pathway only (FR, 1989).
 - † Limits are for exposure from all pathways.
-

given sector may also influence the location. At the RMWMF site, the south sector at a distance of 2.8 km was found to yield the highest air concentrations at the site boundary. Residents are not actually present at this location.

Dose commitments to the maximally-exposed individual for accident scenarios are calculated using a plume-centerline method because the contaminated plume does not fill the width of the sector involved. Consistent with the assumption of worst-case conditions, the maximally-exposed individual is assumed to reside at the midpoint of the plume-centerline, which renders the maximum exposure. Other worst-case assumptions include a wind speed of 1 m/sec, a constant wind direction towards the maximum individual location, F-stability class, and a minimal release height. For this analysis, maximum exposure occurs at the KAFB boundary in an area where members of the public have unrestricted access (the Isleta Gate).

During an accidental release, the contaminated plume is brought directly to the maximum individual location. Resulting doses are assessed for the inhalation and air submersion pathways only and acute short-term effects can be expected. It is reasonable to assume that the resident individual would move if the surrounding environment were to become unhealthful. Consequently, the ingestion and deposition or groundshine pathways are excluded from the effects of accidental radioactive releases.

D.10 Calculation for the Maximally-Exposed Worker

Worker doses have been quantitatively assessed for routine and accident releases occurring during operations of the proposed RMWMF. Doses were assessed outside the RMWMF where the releases could expose occupational personnel. Only inhalation and air submersion doses were calculated. Doses were calculated from the same atmospheric releases used to assess maximum individual and local resident exposures. During routine releases, the location of the maximally-exposed worker is south and east of the 55-ft stack at a distance of 120 m. Under accident conditions, the maximally-exposed worker is at the nearest onsite facility, Building 6911, located 305 m (1000 ft) north north-east of the RMWMF.

Exposure to workers from accident events was assumed to last for 30 minutes. It was judged that it would be sufficient for evacuation personnel to remove nearby workers to a safe area. Since the release is assumed to last two hours, an exposure period of 30 minutes would subject the exposed person to one-quarter of the resulting dose of the passing radioactive plume.

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