EIS

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Subject: Material Science Laboratory

Attachments: 6_MSL_key_facility.doc

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Kirk, attached is the updated MSL NEPA Determination Document.

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LA-UR-01-3040

Title: ESH-20 NEPA Determination Document 6

TA-3 Materials Science Laboratory

Los Alamos

NATIONAL LABORATORY

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Tables

1.0 Introduction

This document describes the *National Environmental Policy Act of 1969* (NEPA) operational envelope for operations, capabilities, and parameters analyzed for Technical Area (TA) 03 Materials Science Laboratory, a key facility in the *Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory* (SWEIS; DOE 1999a). The principal buildings and structures for this key facility are shown in Table 1. The purpose of this document is to determine whether a proposed project for this facility has NEPA coverage in the SWEIS as implemented by the Department of Energy (DOE) in the Record of Decision (ROD) for the SWEIS. As long as the TA-03 Materials Science Laboratory operates within the bounds of the impacts projected by the SWEIS, the facilities are in compliance with NEPA. If there is potential to exceed projected impacts, further NEPA review would be required.

Table 1. Principal Buildings and Structures of TA-3 Materials Science Laboratory

Technical Area	Principle Buildings and Structures
TA-3	Materials Science Laboratory: 3-1698 Now called the MSC – materials science complex? Potentially includes buildings 32, 34, 1415, 1819, 2002

Under the Laboratory Implementation Requirement (LIR) entitled "NEPA, Cultural Resources, and Biological Resources (NCB) Process," (LANL 2000) proposed projects are screened by the authorized facility NCB reviewer as part of the NCB assessment. The screening requires the facility NCB reviewer to decide:

- if the project is new or modified from a previous determination and
- if DOE has already made a determination that covers the proposed project.

The Facility NCB Reviewer uses the Facility NEPA Determination Document (LANL 2000b) for screening. Table 2 summarizes the capabilities, and the operations examples for the capabilities, that were published in the SWEIS to estimate the impacts. If the facility NCB reviewer finds that the proposed activity is one of the capabilities in the SWEIS and is within one of the operations levels for that capability as shown by Table 2, the reviewer could determine that the proposed activity is covered by the SWEIS and does not require further NEPA analysis.

However, a proposal that does not match a capability description in Table 2 or that is not included with one of the operations levels for that capability in Table 2 could still be covered by the SWEIS. The SWEIS analysis is based on information in background documents prepared for each of the key facilities; these background documents provide more detailed descriptions of the ongoing and potential operations for each key facility. In addition, the levels of activity called the "operations envelope" for each of the capabilities reflects scenarios that were developed for each capability to provide an estimate for calculating potential impacts. The SWEIS was not intended to set stringent limits on the level of activity for a particular capability. In most facilities the operations envelope for every capability would not be reached at one time because of the ebb-and-flow-like nature of the work at LANL. Thus it would be possible to exceed the level for one capability and still be within the parameter limits for the facility or the LANL operations limit. If the proposal reviewer can demonstrate this, the proposal would still have NEPA coverage through the SWEIS. This document presents the procedure for a more detailed review and supporting information from the SWEIS and background documents.

Table 2. TA-3 Materials Science Laboratory [a, b]

Capability	Operational Examples
1. Materials Processing	1. Maintain seven research capabilities at 1995 levels: • Wet chemistry • Thermomechanical processing • Microwave processing • Heavy equipment materials • Single crystal growth • Amorphous alloys • Powder processing 1.2 Expand materials synthesis/processing to develop cold mock-up of weapons assembly and processing. 1.3 Expand materials synthesis/processing to develop environmental and waste technologies.
2. Mechanical Behavior in Extreme Environment	2. Maintain two research capabilities at 1995 levels: • Mechanical testing • Fabrication and assembly 2.2 Expand dynamic testing to include research and development for the aging of weapons materials. 2.3 Develop a new research capability (machining technology).
3. Advanced Materials Development	3.1 Maintain four research capabilities at 1995 levels of research: • New materials • Synthesis and characterization • Ceramics • Superconductors
4. Materials Characterization	4.1 Maintain four research capabilities at 1995 levels: • Surface science chemistry • X-ray • Optical metallography • Spectroscopy 4.2 Expand corrosion characterization to develop surface modification technology. 4.3 Expand electron microscopy to develop plasma source ion implementation.

a: Source: Modified from SWEIS 1998 Yearbook (LANL 1999).
b: Includes completion of the second floor of the Materials Science Laboratory.

2.0 Procedure

A proposed project can be screened by the Facility NCB reviewer or ESH-20 reviewer to determine if it is included in the descriptions in Table 2. Under that procedure, if a proposal does not clearly fit those descriptions of capabilities and operations levels, it will be referred to ESH-20 for review under this procedure, which requires more familiarity with SWEIS supporting documentation and projected additive impacts of other proposed work at LANL. The ESH-20 reviewer will use the data on TA-3 Materials Science Laboratory facilities and capabilities from the SWEIS document and the background documentation. The supporting documentation on the

TA-3 Materials Science Laboratory facilities and capabilities is presented in Sections 3 and 4 below.

A flow chart that summarizes the procedure for the ESH-20 reviewer to use in screening a proposal is presented in Attachment 1. Upon receiving a proposal, the reviewer should answer the following:

1. Is this a new capability? Review the detailed descriptions of the TA-3 Materials Science Laboratory and capabilities from the SWEIS (Section 3 of this document) and from the background documents (Section 4 of this document).
   a. If this is a new capability, go to 4.
   b. If this is not a new capability, go to 2.
2. Does the proposal fit within one of the operations levels for that capability in the SWEIS? Compare description to second column of Table 2.
   a. If the proposal is within the operations levels for that capability, go to 5.
   b. If the proposal is not within the operations examples, go to 3.
3. Is the proposal within the facility operations data envelope? Work with the facility manager and other Environment, Safety, and Health subject matter experts (SMEs) to calculate if the proposal is within the envelope of facility operations data (Table 3).
   a. If the proposal is within the facility operations data envelope, go to 5.
   b. If the proposal is not within the facility operations data envelope, go to 4.
4. ESH-20 will prepare a NERF to complete the NEPA process.
5. Proposal is covered by the SWEIS. Attach explanation/calculations to NCB Screening Checklist (Attachment 2) to complete the NEPA process.

Table 3. TA-3 Materials Science Laboratory Operations Data

Parameter	Units [a]	SWEIS ROD
Radioactive Air Emissions:	Ci/yr.	Negligible
NPDES Discharge Volume:[b]	MGY	No outfalls
Wastes:		
Chemical	kg/yr	600
Low-level waste	m^3/yr	0
Mixed low-level waste	m^3/yr	0
TRU waste/Mixed transuranic waste	m^3/yr	0

a: Ci/yr. = curies per year; MGY = million gallons per year.
b: NPDES is National Pollutant Discharge Elimination System.

3.0 SWEIS Data for TA-3 Materials Science Laboratory

This section provides information directly from the SWEIS. Section 3.1 is a description of the TA-3 Materials Science Laboratory facilities from Chapter 2 of the SWEIS. Section 3.2 is a description of the capabilities at TA-55 at the time the SWEIS was written, while Section 3.3 is a description of the capabilities under the preferred alternative as selected under the Record of Decision.

3.1 SWEIS Description of Facilities

The Materials Science Laboratory (MSL, TA-3-1698) is located in an unrestricted access area at the southeastern edge of TA-3. The facility is a two-story modern laboratory of approximately 55,360 square feet of floor space (5,143 square meters) arranged in an H-shape. It is designed to accommodate scientists and researchers, including participants from academia and industry whose focus is on materials science research. The *Environmental Assessment for the Materials Science Laboratory* (DOE 1991) details the impacts of the new facility. The completion of the top floor of the MSL was planned and was included in the environmental assessment, but not funded in 1992. Completion of this floor is still desired but is not currently scheduled.

The MSL consists of 27 laboratories, 15 support rooms, 60 offices, 21 distinct materials research areas, and several conference rooms that are used by technical staff, visiting scientists and engineers, administrative staff, and building support personnel. It is constructed of precast concrete panels sealed to a structural framework, with concrete floors, drywall interior, casework, hoods, and a utility infrastructure. Safety controls throughout the complex include a wet-pipe sprinkler system, automatic fire alarms, chemical fume hoods, gloveboxes, HEPA-filtered heating, ventilation, and air conditioning, and safety showers. Limited quantities of radioactive isotopes are used at MSL. These include small quantities of solid sodium, zirconium, and depleted uranium.

Because of the diversity of research within MSL, a large variety of small quantities of nonradioactive, toxic, and hazardous materials are also used. This is similar to the corrosive and reactive chemicals typically used to synthesize and clean materials in wet chemistry or mechanical property laboratories. For example, semiconductor additives such as tantalum metal and tungsten compounds, along with chromic acid and perchloric acid for metallography activities, are used in gloveboxes or fume hoods. Other acids such as hydrofluoric, phosphoric, and sulfuric, are used in various materials preparation activities and in laser operations. Small amounts of typical laboratory organic chemicals such as acetone, methyl alcohol, and methyl ethyl ketone are also used in MSL activities.

3.2 SWEIS Description of Capabilities (Baseline)

There are four major types of experimentation supported at MSL: materials processing, mechanical behavior in extreme environments, advanced materials development, and materials characterization. These four areas, each of which are described below, contain over 20 capabilities that support materials research for DOE programs. Collaboration with private industry is also an important feature of much of the work performed at MSL.

3.2.1 Materials Processing

MSL supports the formulation of a wide range of useful materials through the development of materials fabrication and chemical processing technologies. The following synthesis and processing techniques represent some of the capabilities available in MSL for this area of research: wet chemistry, thermomechanical processing, materials handling, microwave processing, heavy equipment materials processing, single crystal growth synthesis, amorphous alloys, tape casting, inorganic synthesis, and powder processing. Some of the laboratories, housing heavy equipment for novel mechanical processing of powders and non-dense materials, are configured to explore net shape and zero-waste manufacturing processes. Several laboratories are dedicated to the development of chemical processing technologies, including recycling and reprocessing techniques to solve current environmental problems.

3.2.2 Mechanical Behavior in Extreme Environments

The mechanical testing laboratories contain equipment for subjecting materials to a broad range of mechanical loadings to study their fundamental properties and characterize their performance. The laboratories utilized for this major area of materials science include dedicated space for mechanical testing; mechanical fabrication, assembly and machining research; metallography; and dynamic testing. The mechanical testing laboratory offers capabilities to study multiaxial, high temperature, and high load behaviors of materials. The assembly areas consist of metal working and experimental assembly areas that house a variety of electrically or hydraulically powered machines that twist, pull, or compress samples. The most energetic of these is a gas launcher, which projects a sample against an anvil at very high velocities. The MSL dynamic materials behavior laboratory is utilized by researchers for the study of high deformation rate behaviors. The dynamic testing equipment allows materials to be subjected to high rate loadings, including impact up to 1.2 miles (2 kilometers) per second. The metallography area contains equipment for sectioning, mounting, polishing, and photographing samples.

3.2.3 Advanced Materials Development

The various laboratories are configured for the exploration of new materials for high strength and high temperature applications. Many of the laboratories support synthesis and characterization of single crystals, nanophase, and amorphous materials, as well as providing areas for ceramics research including solid state, inorganic chemical studies involving materials synthesis. A substantial amount of effort in this area is dedicated to producing new high-temperature superconducting materials. MSL also provides facilities for synthesis and mechanical characterization of materials systems for bulk conductor applications.

3.2.4 Materials Characterization

Materials characterization provides the ability to understand the properties and processing of materials and to apply that understanding to materials development. MSL contains a collection of spectroscopy, imaging, and analysis tools for characterizing advanced materials. The electron microscopy laboratory area has four microscopes to characterize subnanometer to micrometer structures, including chemical analysis and high-resolution electron holography. The optical spectroscopy laboratory allows ultrafast and continuous wave tunable resonance Raman scattering spectroscopy, high-resolution Fourier Transform Infrared absorption, and ultraviolet (UV) visible to near infrared (IR) absorption spectroscopy. The x-ray laboratory allows for the study of samples at temperatures up to 4,892°F (2,700°C) and pressures up to 80 kilobar. A metallography and ceramography support laboratory has the latest equipment for optical characterization. A laboratory area is provided to support surface-science study and corrosion characterization of materials.

3.3 SWEIS Description of MSL Activities – No Action Alternative

Under the No Action Alternative, the following activities would occur at this facility.

3.3.1 Materials Processing

LANL would continue research at the MSL at current levels of operation, including synthesis and processing techniques, wet chemistry, thermomechanical processing, microwave processing, heavy equipment materials, single crystal growth, amorphous alloys, and powder processing.

3.3.2 Mechanical Behavior in Extreme Environments

LANL would continue mechanical testing, dynamic testing, and fabrication and assembly research at current levels of operation.

3.3.3 Advanced Materials Development

LANL would continue research in materials, synthesis and characterization, ceramics, and superconductors at current levels of operation.

3.3.4 Materials Characterization

LANL would also continue activities in these six areas at current levels of operation: surface science chemistry, corrosion characterization, electron microscopy, x-ray, optical metallography, and spectroscopy.

3.4 SWEIS Description of MSL Capabilities (Preferred Alternative)

The following is the description of activities under the preferred alternative that was adopted in the ROD for the SWEIS (DOE 1999b)

3.4.1 Materials Processing

LANL would maintain seven of eight materials processing activities at current levels of research; these activities are: wet chemistry, thermomechanical processing, microwave processing, heavy equipment materials, single crystal growth, amorphous alloys, and powder processing. LANL would expand its materials synthesis/processing activity to develop cold mock-up of weapons assembly and processing and to develop environmental and waste management technologies.

3.4.2 Mechanical Behavior in Extreme Environments

In addition, LANL would continue mechanical testing, fabrication, and assembly at current levels of research. Dynamic testing would be expanded to include research and development on the aging of weapons materials, and a new research capability in machining technology would be developed.

3.4.3 Advanced Materials Development

LANL would continue activities in materials, synthesis and characterization, ceramics, and superconductors at current levels of research.

3.4.4 Materials Characterization

LANL would also continue four of its six materials characterization activities at current levels of operation. These are: surface science chemistry, x-ray, optical metallography, and spectroscopy. Corrosion characterization would be expanded to develop surface modification technology and electron microscopy would be expanded to develop plasma source ion implantation.

4.0 Background Document Information for TA-3 Materials Science Laboratory

This section presents information from the "Background Information for the Materials Science Laboratory (MSL) for Site Wide Environmental; Impact Statement Los Alamos National Laboratory (LANL 1996).

4.1 Background Document Description of Facilities

The Materials Science Laboratory (SM-1698) at the Los Alamos National Laboratory is located at the southeastern edge of the central Technical Area 3 (TA-3). The MSL is bounded on the west by Diamond Drive, on the north by buildings SM-32 and SM-34, on the east by the security fencing which surrounds the Sigma Complex (SM-66), and on the south by Pajarito Road. The MSL building and its corresponding access roads, parking lots, and landscape areas cover approximately a 7-acre site.

This facility is a two story modern laboratory of approximately 55,360 $ft^{2,}$ arranged in an 'H' shape. The MSL is constructed of precast concrete panels sealed to a structural steel framework, concrete floors, drywall interior, casework, hoods, and a utility infrastructure. Safety controls throughout the complex include a wet-pipe sprinkler system, automatic fire alarms, chemical fume hoods, gloveboxes, HEPA-filtered HVAC, and safety showers.

There are 27 laboratories and 21 distinct materials research areas in the building. These can be categorized into four major materials science experimental areas: materials processing, mechanical behavior in extreme environments, advanced materials development, and materials characterization. These four areas contain over 20 operational capabilities which support materials research activities related to energy, environment, nuclear weapons, and industrial competitiveness. Specific programs supported by the MSL include: Energy (microwave processing of materials, high temperature superconducting materials), Environment (wet chemistry samples, soil and water remediation, waste minimization), Nuclear Weapons (weapons aging, behavior of weapons materials, fracture in weapons materials), Industrial (CRADAs for 3M, General Electric, General Motors, Ford Motor Company), and Laboratory-Directed Research and Development (directed light fabrication, innovative composite material development). In addition, the facility contains 60 offices, 15 support rooms, and conference rooms that are utilized by technical staff, visiting scientists and engineers, administrative staff, and building support personnel.

The first floor contains: a high bay, materials characterization and processing laboratories in the east wing; materials synthesis, characterization, and processing laboratories in the west wing; and administrative and personnel interaction areas in the center. The second floor contains computer rooms in the east wing; additional materials synthesis, characterization, and processing laboratories in the west wing; and building services and additional personnel interaction areas in the center. Small offices are located along the exterior walls throughout a majority of the building.

Appropriate safety systems are designed into the building for those laboratories in which potentially hazardous activities occur. These systems include detection systems, warning lights, physical barriers, and appropriate exhaust ventilation systems The building is configured with service corridors connecting the laboratories so that materials can be transported, stored, and used within a ventilation zone that is separated from pedestrian corridors and staff offices. Some of the laboratories are provided with special features such as vibration isolation, electromagnetic shielding, and high efficiency particulate air filters. All laboratories contain a variable-air-volume ventilation system, as well as process cooling water, large capacity electrical circuits, and vacuum pump exhaust systems. The exhaust ventilation system is provided with an automated alarm system, to indicate off-normal conditions, which is actuated by a push switch.

The MSL was designed to accommodate a wide variety of chemicals, some of which are hazardous, toxic, and radioactive, which are in small amounts that are typical of many university and industrial materials research facilities. The various laboratories within MSL produce four liquid waste components: 1) sanitary, 2) acid/caustic, 3) nonflammable organic, and 4) flammable organic. Sanitary waste is drained into the existing LANL sewage system to the Sanitary Waste Treatment Facility near TA-46. The acid/caustic waste is drained through doubly-contained piping to the Radioactive Liquid Waste Facility at TA-50. The flammable and nonflammable organic wastes are collected in special bottles and eventually shipped to TA-54 for proper disposal.

The MSL is located in a non-classified area adjacent to classified facilities that house a majority of the LANL materials scientists and engineers. The MSL is designed to accommodate a diverse group of scientists and researchers, including participants from academia and industry whose focus is on materials science research. The building is not intended to be a production facility, but rather a facility dedicated to research in similar fashion to buildings and activities at materials research laboratories found in a university atmosphere and in industry.

4.2 Comparison of Missions/Programs Under the Expanded Operations Alternative

The following sections describe the level of activity under the Expanded Operations Alternative, which was adopted in the SWEIS ROD. For each capability, the no action alternative is described, followed by any changes under the expanded operation alternative.

4.2.1 Materials Processing

The MSL supports the formulation of a wide range of useful materials through the development of materials fabrication and chemical processing technologies. The following synthesis and processing techniques represent some of the capabilities available in the MSL for this area of research: wet chemistry, thermomechanical processing, materials handling, microwave processing, heavy equipment materials processing, single crystal growth synthesis, amorphous alloys, tape casting, inorganic synthesis, and powder processing.

Some of the laboratories, housing heavy equipment for novel mechanical processing of powders and non-dense materials, are configured to explore net shape and zero-waste manufacturing processes. Several laboratories are dedicated to the development of chemical processing technologies, including recycling and reprocessing techniques to solve current environmental problems.

An **Expanded Operations** program would include the development of a cold mockup/setup of weapons assembly and related materials processing lines for the synthesis/processing capability. There would also be an increase in research activity, under the synthesis/processing capability, related to developing additional environmental science and waste technologies. All other capabilities under the materials processing area would have no expansion from the No Action alternative.

4.2.2 Mechanical Behavior in Extreme Environment

The LANL pre-eminence in structural materials and their mechanical behavior is emphasized by a suite of capabilities consolidated within MSL. Mechanical testing laboratories, including a gas launcher facility in the high bay within MSL, contain equipment for subjecting materials to a broad range of mechanical loadings to study their fundamental properties and characterize their performance. The laboratories utilized for this major area of materials science include dedicated space for mechanical testing; mechanical fabrication, assembly and machining research; metallography; and dynamic testing.

The mechanical testing laboratory offers capabilities to study multiaxial, high temperature, and high load behaviors of materials. The assembly areas consist of metalworking and experimental assembly areas that house a variety of electrically or hydraulically powered machines that twist, pull, or compress samples. The most energetic of these is a gas launcher, which projects a sample against an anvil at very high velocities. The MSL state-of-the-art dynamic materials behavior lab is utilized by researchers for the study of high deformation rate behaviors. The dynamic testing equipment allows materials to be subjected to high rate loadings, including impact up to 2km/sec. The metallography area contains samples sectioning, mounting, polishing, and photographing equipment.

An **Expanded Operations** program would include weapons materials aging research for the dynamic testing capability and advanced machining technology development for the mechanical fabrication and assembly capability. All other capabilities would have no expansion from the No Action alternative.

4.2.3 Advanced Materials Development

Advanced materials development is one of the core areas of expertise within the MSL. The various laboratories are configured for the exploration of new materials for high strength and high temperature applications. Many of the laboratories support synthesis and characterization of single crystals, nanophase, and amorphous materials as well as providing areas for ceramics research including solid state, inorganic chemical studies involving materials synthesis. A substantial amount of effort in this major materials science area is dedicated to produce new high-temperature superconducting materials. MSL provides unique facilities for synthesis and mechanical characterization of materials systems for bulk conductor applications.

Under the **Expanded Operations Alternative** none of the capabilities in this area would have expansion from the No Action alternative.

4.2.4 Materials Characterization

Materials characterization provides the ability to understand the properties and processing of materials and to apply that understanding to materials development. MSL contains a collection of spectroscopy, imaging, and analysis tools for characterizing advanced materials. The electron microscopy laboratory area has four microscopes to characterize subnanometer to micrometer structures, including chemical analysis and high-resolution electron holography.

Other laboratory areas are configured for spectrographic analysis based on a wide range of techniques. The optical spectroscopy laboratory, built around tunable titanium-doped sapphire lasers, allows ultrafast and continuous wave tunable resonance Raman scattering spectroscopy, high-resolution FTIR absorption, and UV-visible-near IR absorption spectroscopy. The x-ray laboratory contains a one-of-a-kind 16 kW rotating anode generator coupled with a high temperature theta-theta diffractometer and a Peltier-cooled solid-state detector. Samples can be studied at temperatures up to 2700°C and pressures up to 80 kbar.

A metallography/ceramography support laboratory is equipped with the latest equipment for optical characterization. A laboratory area is provided to support surface science-study and corrosion characterization of materials.

An **Expanded Operations** program would include the development of surface modification technology for the corrosion characterization capability and to develop a plasma source ion implantation utilizing the electron microscopy capability. All other capabilities would have no expansion from the No Action alternative.

4.3 Discussion of Operational Capabilities as they Support Programs

4.3.1 Laboratory-Directed Research and Development

4.3.1.1 Description

The Laboratory Directed Research and Development (LDRD) Program consists of research, scientific, and engineering projects, which are funded to strengthen and broaden LANL's scientific and technological base. Funding for this program is allocated in three major categories: program development, competency development, and individual projects. The operational capabilities at MSL support projects for all three of the categories under the LDRD Program. Operational capabilities in the materials science areas of materials processing, advanced materials development, and materials characterization primarily comprise the support for the LDRD program, with a minimal amount of support provided by those capabilities in the mechanical behavior in extreme environment area.

4.3.1.2 Discussion of Operational Capabilities that Support LDRD Programs

As indicated in the matrix of capabilities and programs (Table 4), the following operational capabilities support the LDRD Programs:

- Materials Processing area includes synthesis/processing, single crystal growth, amorphous alloys, and inorganic synthesis capabilities utilized for experimentation with innovative processing techniques for developing unconventional (high-strength and lightweight) materials.
- Mechanical Behavior area includes mechanical testing and dynamic testing capabilities utilized for testing high strain rate, studying materials structures at very high pressures, and static mechanical behavior of various metals, ceramics, and plastics.
- Advanced Materials Development area include developing and testing of new materials for high strength and high temperature, synthesis and characterization, ceramics research and high temperature superconductors.
- Materials Characterization area include surface chemistry, electron microscopy, X-ray, optical metallography, and spectroscopy capabilities utilized for examining microstructures of a wide variety of materials samples.

Table 4. Matrix of Capabilities and Programs for Materials Science Laboratory

Core Capabilities	**Programs Summary**				
	LDRD Program	Weapons Program	Energy Programs	Industrial (Non-DOE/DoD)	Environmental Waste Management
Materials Processing					
Synthesis/Processing	X		X		
Wet Chemistry		X	X	X	X
Thermomechanical processing		X		X	
Materials handling		X		X	
Microwave processing		X		X	
Heavy Equipment materials processing		X		X	
Single crystal growth	X		X		
Amorphous alloys	X		X		
Tape casting		X		X	
Inorganic synthesis	X				
Powder processing		X			
Mechanical Behavior In Extreme Environment					
Mechanical testing	X	X	X	X	
High pressure apparatus		X			
Dynamic testing	X	X	X	X	
Mechanical fabrication & assembly		X		X	
Core Capabilities	**Programs Summary**				
	LDRD Program	Weapons Program	Energy Programs	Industrial (Non-DOE/DoD)	Environmental Waste Management
Advanced Materials Development					
New materials for high strength & high temperature	X	X	X		
Synthesis & characterization	X	X	X	X	

Table 4 cont.

Ceramics				X	
High temperature superconductors	X		X	X	
Materials Characterization					
Surface Science chemistry	X		X	X	
Corrosion characterization		X	X	X	
Electron microscopy	X	X	X		
X-ray	X		X		
Optical metallography	X	X	X	X	
Spectroscopy	X				

4.3.1.3 Radioactive Materials

Limited quantities of radioactive isotopes may be used in MSL for tracer studies. The technique used in these tracer studies are similar in scope to procedures routinely performed in medical diagnosis and research in university laboratories, except much smaller quantities will be used in MSL. Small quantities of solid depleted uranium, used for material property studies, and short-lived tracer-style isotopes are used in the various laboratories within MSL. Other radioactive materials used for materials investigation activities include sodium and zirconium. The amounts of radioactive material used are common with other materials science research facilities, and are not considered a significant hazard.

4.3.1.4 Nonradioactive, Toxic, or Hazardous Substances

Because of the diversity of the research activities within MSL, there is a large variety of small quantities of nonradioactive, toxic, and hazardous materials used. This is consistent with corrosive and reactive chemicals, used to synthesize and clean materials, which are commonly found in wet chemistry or mechanical property laboratories. Semiconductor additives such as tantalum metal and tungsten compounds, along with chromic acid and perchloric acid for metallography activities, are used in gloveboxes or fume hoods. Other acids such as hydrofluoric, phosphoric and sulfuric, are used in various materials preparation activities and in laser operations. Small amounts of typical laboratory organic chemicals such as acetone, methyl alcohol and methyl ethyl ketone are also used in MSL activities.

4.3.1.5 Other Hazards

Because high strain rates can be encountered in some mechanical and dynamic testing, fragments of materials test samples could possibly become localized projectiles. Shields are provided to contain these projectiles, and where shields are impractical, personnel are excluded from the testing area during operation. A majority of the equipment utilized for dynamic testing is furnished with inherent safety features that provide a safe system shut-down in case of an accident. Direct gamma radiation, associated with operation of flash x-ray equipment, is controlled by appropriate shielding and administrative controls. Radiant and electrical hazards, associated with lasers and high voltage equipment (x-ray and spectroscopy) for materials characterization functions, and heat exposure and cutting hazards, associated with thermomechanical processing and assembly and machining research, are also evident within MSL.

4.3.2 Weapons Programs

4.3.2.1 Description

The Weapons Programs consists of various programs, within DOD and DOE, which utilize the operational capabilities of MSL. The capabilities at MSL provide research, development, and testing for various applications including weapons design evaluation, enhanced surveillance, weapons requalification, and manufacturing process development. Some of the programs include: Stockpile Management - evaluation of stockpile components and weapons design; Stockpile Stewardship - materials R&D in support of weapons design evaluation, process changes, materials life evaluations, and new manufacturing development; and Enhanced Surveillance - weapons materials aging, development of new technologies to characterize the materials aging process and dynamic behavior of aged materials.

4.3.2.2 Operational Capabilities that Support the Weapons Program

As indicated in the matrix of capabilities and programs (Table 4), the following operational capabilities support the Weapons Programs:

- Materials Processing area includes wet chemistry, heat treating, materials handling, microwave processing, heavy processing, tape casting, and powder processing capabilities utilized for advanced fabrication research.
- Mechanical Behavior area includes all capabilities utilized for dynamic deformation research, and support for the development and fabrication of sophisticated hardware from a variety of materials.
- Advanced Materials Development area includes new materials for high strength and high temperature, and synthesis and characterization capabilities utilized for non-nuclear weapons components.
- Materials Characterization area includes corrosion characterization, electron microscopy, and optical metallography capabilities utilized for characterization of materials in all areas of research.

4.3.2.3 Radioactive Materials

Limited quantities of radioactive isotopes may be used in MSL for tracer studies. The technique used in these tracer studies are similar in scope to procedures routinely performed in medical diagnosis and research in university laboratories, except much smaller quantities will be used in MSL. Small quantities of solid depleted uranium, used for material property studies, and short-lived tracer-style isotopes are used in the various laboratories within MSL. Other radioactive materials used for materials investigation activities include sodium and zirconium. The amounts of radioactive material used are common with other materials science research facilities, and are not considered a significant hazard.

4.3.2.4 Nonradioactive, Toxic, or Hazardous Substances

Because of the diversity of the research activities within MSL, there is a large variety of small quantities of nonradioactive, toxic, and hazardous materials used. This is consistent with corrosive and reactive chemicals, used to synthesize and clean materials, which are commonly found in wet chemistry or mechanical property laboratories. Semiconductor additives and metallic compounds such as nickel carbonyl and thallium, along with perchloric acid used for metallography activities, are used in gloveboxes or fume hoods. Noxious gases, such as fluorine and chlorine, are used in various materials preparation activities and in laser operations. These gases are secured in ventilated cabinets that are exhausted to the main stacks. Small amounts of iron carbonyl, nickel carbonyl, and silane are used in laser thin film vapor deposition activities. No carcinogens are used within MSL.

4.3.2.5 Other Hazards

Because high strain rates can be encountered in some mechanical and dynamic testing, fragments of materials test samples could possibly become localized projectiles. Shields are provided to contain these projectiles, and where shields are impractical, personnel are excluded from the testing area during operation. A majority of the equipment utilized for dynamic testing is furnished with inherent safety features that provide a safe system shut-down in case of an accident. Direct gamma radiation, associated with operation of flash x-ray equipment, is controlled by appropriate shielding and administrative controls. Radiant and electrical hazards, associated with lasers and high voltage equipment (x-ray and spectroscopy) for materials characterization functions, and heat exposure and cutting hazards, associated with thermomechanical processing and assembly and machining research, are also evident within MSL.

4.3.3 Energy Programs

4.3.3.1 Description

The MSL operational capabilities support those programs/projects within the Energy Program that fall principally in the business area of science and technology. Within the science and technology business area, energy program activities contribute to a wide spectrum of fundamental and advanced research in the materials science arena. Operational capabilities in the materials science areas of materials processing, advanced materials development, and materials characterization primarily comprise the support for activities in the Energy Programs. For example, synthesis and processing of amorphous materials for optical and solar devices, and advanced materials research of high temperature superconductors. Additional support is provided by those capabilities in the mechanical behavior in extreme environment area for mechanical and dynamic testing of materials and components of projects associated with the Energy Programs.

4.3.3.2 Operational Capabilities that Support the Energy Programs

As indicated in the matrix of capabilities and programs (Table 4), the following operational capabilities support the Energy Programs:

- Materials Processing area include synthesis/processing, wet chemistry, single crystal growth, and amorphous alloys capabilities utilized for developing unconventional (high-strength and lightweight) materials for programs in Energy Research and Energy Efficiency analysis.
- Mechanical Behavior area include mechanical testing and dynamic testing capabilities utilized for materials testing associated with Energy Research and Energy Efficiency programs.

- Advanced Materials Development area include making new materials for high strength and high temperature, synthesis and characterization, and high temperature superconductors for various programs in Energy Research
- Materials Characterization area include surface chemistry, corrosion characterization, electron microscopy, X-ray, and optical metallography capabilities utilized for examining microstructures of a wide variety of materials used in Energy Research and Energy Efficiency programs.

4.3.3.3 Radioactive Materials

Limited quantities of radioactive isotopes may be used in MSL for tracer studies. The technique used in these tracer studies are similar in scope to procedures routinely performed in medical diagnosis and research in university laboratories, except much smaller quantities will be used in MSL. Small quantities of solid depleted uranium, used for material property studies, and short-lived tracer-style isotopes are used in the various laboratories within MSL. Other radioactive materials used for materials investigation activities include sodium and zirconium. The amounts of radioactive material used are common with other materials science research facilities, and are not considered a significant hazard.

4.3.3.4 Nonradioactive, Toxic, or Hazardous Substances

Because of the diversity of the research activities within MSL, there is a large variety of small quantities of nonradioactive, toxic, and hazardous materials used. This is consistent with corrosive and reactive chemicals, used to synthesize and clean materials, which are commonly found in wet chemistry or mechanical property laboratories. Semiconductor additives such as tantalum metal and tungsten compounds, along with chromic acid and perchloric acid for metallography activities, are used in gloveboxes or fume hoods. Other acids such as hydrofluoric, phosphoric and sulfuric, are used in various materials preparation activities and in laser operations. Small amounts of typical laboratory organic chemicals such as acetone, methyl alcohol and methyl ethyl ketone are also used in MSL activities.

4.3.3.5 Other Hazards

Because high strain rates can be encountered in some mechanical and dynamic testing, fragments of materials test samples could possibly become localized projectiles. Shields are provided to contain these projectiles, and where shields are impractical, personnel are excluded from the testing area during operation. A majority of the equipment utilized for dynamic testing is furnished with inherent safety features that provide a safe system shut-down in case of an accident. Direct gamma radiation, associated with operation of flash x-ray equipment, is controlled by appropriate shielding and administrative controls. Radiant and electrical hazards, associated with lasers and high voltage equipment (x-ray and spectroscopy) for materials characterization functions, and heat exposure and cutting hazards, associated with thermomechanical processing and assembly and machining research, are also evident within MSL.

4.3.4 Industrial (Non-DOE/DOD) Programs

4.3.4.1 Description

Through a number of initiatives, the MSL facility has collaborated with federal, state, and local governments, educational institutions, and industry on developing and analyzing numerous technological advances. A majority of the R&D work performed is supported through Cooperative Research and Development Agreements (CRADA's) and the Advanced Manufacturing Industrial Partnership Programs with companies from industry. All of the current materials science capabilities have been utilized at one time or another for various projects. Examples of such efforts include the effort with the National Center for Manufacturing Science to develop a model and methodology to predict heat treatment distortion in automatic transmission components.

4.3.4.2 Operational Capabilities that Support the Industrial Programs

As indicated in the matrix of capabilities and programs (Table 4), the following operational capabilities support the Industrial Programs:

- Materials Processing area includes wet chemistry, heat treating, materials handling, microwave processing, heavy processing, and inorganic synthesis capabilities utilized for experimentation with innovative processing techniques for developing unconventional (high-strength and lightweight) materials for several CRADAs.
- Mechanical Behavior area includes mechanical testing and dynamic testing capabilities utilized for testing high strain rate, studying materials structures at very high pressures, and static mechanical behavior of various metals, ceramics, and plastics for several CRADAs. In addition the CRADAs are supported by mechanical fabrication and assembly research capabilities.
- Advanced Materials Development area includes synthesis and characterization, ceramics, and high temperature superconductors capabilities for making new materials associated with various CRADAs.
- Mechanical Characterization area includes surface chemistry, electron microscopy, X-ray, optical metallography, and spectroscopy capabilities utilized for examining microstructures of a wide variety of materials samples.

4.3.4.3 Radioactive Materials

No quantities of radioactive material are used for capabilities supporting industrial programs.

4.3.4.4 Nonradioactive, Toxic, or Hazardous Substances

Because of the diversity of the research activities within MSL, there are a large variety of small quantities of nonradioactive, toxic, and hazardous materials used. This is consistent with corrosive and reactive chemicals, used to synthesize and clean materials, which are commonly found in wet chemistry or mechanical property laboratories. Semiconductor additives such as tantalum metal and tungsten compounds, along with chromic acid and perchloric acid for metallography activities, are used in gloveboxes or fume hoods. Other acids such as hydrofluoric, phosphoric and sulfuric, are used in various materials preparation activities and in laser operations. Small amounts of typical laboratory organic chemicals such as acetone, methyl alcohol and methyl ethyl ketone are also used in MSL activities.

4.3.4.5 Other Hazards

Because high strain rates can be encountered in some mechanical and dynamic testing, fragments of materials test samples could possibly become localized projectiles. Shields are provided to contain these projectiles, and where shields are impractical, personnel are excluded from the testing area during operation. A majority of the equipment utilized for dynamic testing is furnished with inherent safety features that provide a safe system shut-down in case of an accident. Direct gamma radiation, associated with operation of flash x-ray equipment, is controlled by appropriate shielding and administrative controls. Radiant and electrical hazards, associated with lasers and high voltage equipment (x-ray and spectroscopy) for materials characterization functions; and heat exposure and cutting hazards, associated with thermomechanical processing and assembly and machining research, are also evident within MSL.

4.3.5 Environmental Science and Waste Technologies Program

4.3.5.1 Description

The Environmental Science and Waste Technologies Program consists of chemistry and materials science research in the areas of environmental remediation (soil and water remediation), waste management (development of chemistry techniques related to waste treatment and characterization technologies), waste minimization (examining alternative chemical processes and optimizing technologies that reduce waste generation), and environmental technology (developing world-class scientific and technical solutions to environmental problems throughout the world).

4.3.5.2 Operational Capabilities that Support the Environmental Science and Waste Technologies Programs

As indicated in the matrix of capabilities and programs (Table 4), the following operational capabilities support the Environmental Science and Waste Technologies Programs:

- Materials Processing area include the wet chemistry capability utilized to develop chemical processes to remediate contaminated solutions and soils. Chemistry techniques are also used to examine alternative industrial chemical processes which reduce the generation of waste.
- Mechanical Behavior area includes no capabilities.
- Advanced Materials Development area includes no capabilities.
- Materials Characterization area includes capabilities which are currently used on domestic and international programs to optimize technologies to minimize air pollution. For example, programs to modify brick manufacturing techniques in Mexico and to improve fuel injector technology for U.S. automobile engines.

4.3.5.3 Radioactive Materials

Small quantities of radioactive materials (depleted uranium) are currently used in the capabilities supporting Environmental Science and Waste Technologies programs. Future work in developing remediation chemistry techniques would be limited to tracer quantities.

4.3.5.4 Nonradioactive, Toxic, or Hazardous Substances

Because of the diversity of the research activities within MSL, there is a large variety of small quantities of nonradioactive, toxic, and hazardous materials used. This is consistent with corrosive and reactive chemicals, used to synthesize and clean materials, which are commonly found in wet chemistry or mechanical property laboratories. Semiconductor additives such as tantalum metal and tungsten compounds, along with chromic acid and perchloric acid for metallography activities, are used in gloveboxes or fume hoods. Other acids such as hydrofluoric, phosphoric and sulfuric, are used in various materials preparation activities and in laser operations. Small amounts of typical laboratory organic chemicals such as acetone, methyl alcohol and methyl ethyl ketone are also used in MSL activities.

4.3.5.5 Other Hazards

Because high strain rates can be encountered in some mechanical and dynamic testing, fragments of materials test samples could possibly become localized projectiles. Shields are provided to contain these projectiles, and where shields are impractical, personnel are excluded from the testing area during operation. A majority of the equipment utilized for dynamic testing is furnished with inherent safety features that provide a safe system shut-down in case of an accident. Direct gamma radiation, associated with operation of flash x-ray equipment, is controlled by appropriate shielding and administrative controls. Radiant and electrical hazards, associated with lasers and high voltage equipment (x-ray and spectroscopy) for materials characterization functions, and heat exposure and cutting hazards, associated with thermomechanical processing and assembly and machining research, are also evident within MSL.

5.0 References

DOE 1991: “Environmental Assessment for the Materials Science Laboratory and Finding of No Significant Impact” US Department of Energy, DOE/EA-0493, Los Alamos, New Mexico.

DOE 1996: “Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management,” US Department of Energy, Albuquerque Operations Office DOE/EIS-0236 (September 1996).

DOE 1999a: “Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory,” US Department of Energy, Albuquerque Operations Office DOE/EIS-0238 (January 1999).

DOE 1999b: “Record of Decision: Site Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory in the State of New Mexico,” 64FR50797, Washington, D.C. (September 19,1999).

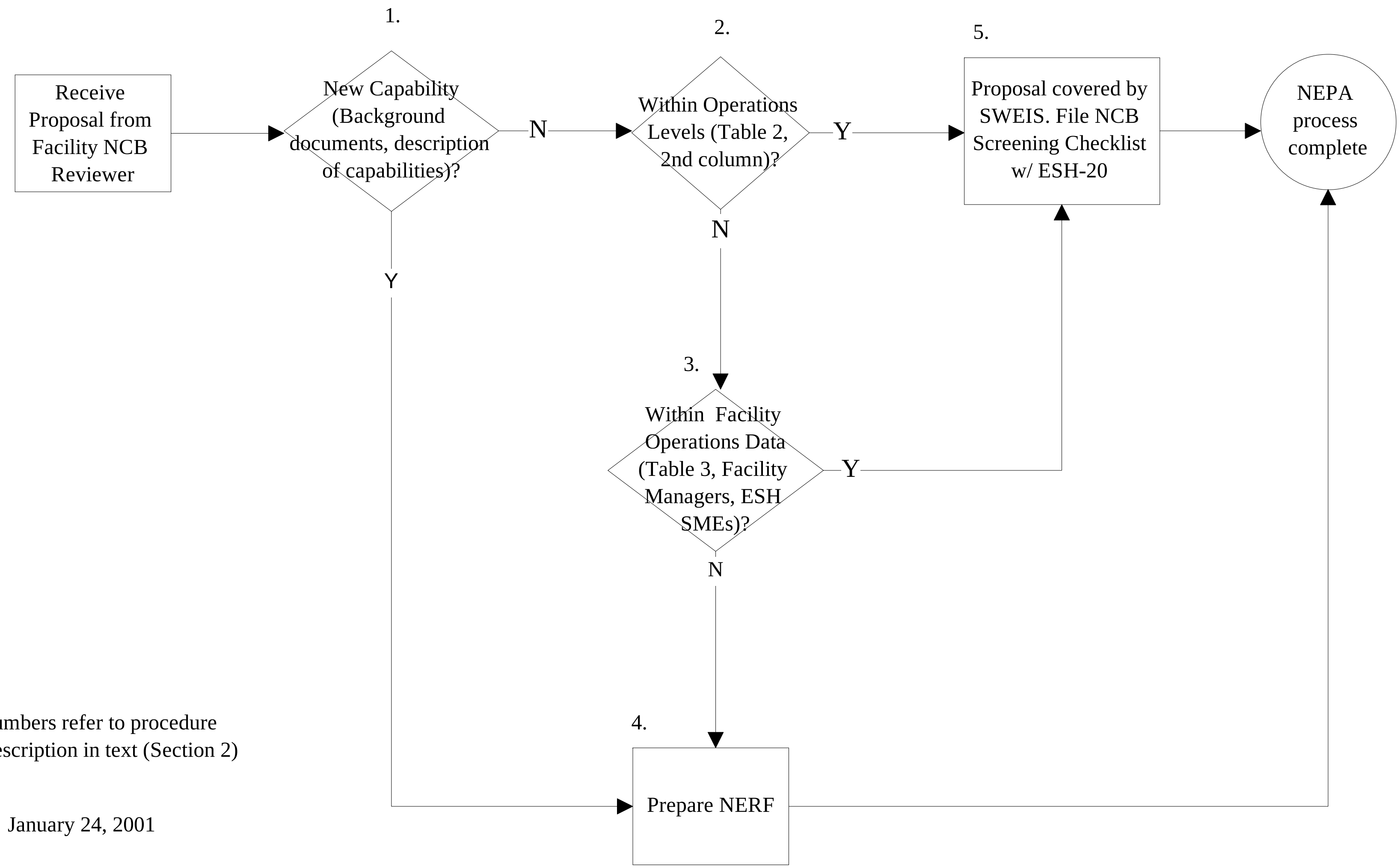
LANL 1996: “Background Information for the Materials Science Laboratory for the Site-Wide Environmental Impact Statement,” transmitted to Mr. Thomas Anderson, GRAM, Inc., by Doris Garvey, Project Leader, Site-Wide Environmental Impact Statement (December 2, 1996).

LANL 1999: “SWEIS 1998 Yearbook: Comparison of 1998 Data to Projections of the Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory,” Los Alamos National Laboratory LA-UR-99-6391 (December 1999).

LANL 2000a: “NEPA, Cultural Resources, and Biological Resources (NCB) Process Laboratory Implementation Requirement,” Los Alamos National Laboratory LIR 404-30-02.0 (01/20/2000).

LANL 2000b: “Facility NCB Reviewer Determination Document 6, TA-3 Materials Science Laboratory.”

Attachment 1: ESH-20 Screening Flow Chart



Numbers refer to procedure description in text (Section 2)

January 24, 2001

Attachment 2: NCB Screening Checklist

REVIEWER: DATE:

PROJECT TITLE:

PROJECT IDENTIFIER/Reference No:

DESCRIPTION/Comments:

Air or water emissions to environment: Yes ☐ No ☐

Describe issue or resolution:

LOCATION: FMU No: FMU No:

TA:__ Building:_____ TA:__ Building:_____ TA:__ Building:_____
TA:__ Building:_____ TA:__ Building:_____ TA:__ Building:_____
Other: _____

CRITERIA:

2a. 1. Schedule or location modified to avoid T&E concerns?	Yes ☐	No ☐
2. After project modification is there an unresolved T&E issue?:	Yes ☐	No ☐
3. For T&E buffer areas, map of project footprint is attached or has been sent to ESH-20?	Yes ☐	No ☐
2b. Floodplain issue:	Yes ☐	No ☐
2c. Wetland issue:	Yes ☐	No ☐
Wetland BMPs implemented?	Yes ☐	No ☐
2d. Modifications to a historic building:	Yes ☐	No ☐
2e. Archaeological resources affected:	Yes ☐	No ☐
Sites within project area were avoided (notify ESH-20 and provide map):	Yes ☐	No ☐

3a. NEPA Documentation:

CX (specify): LAN-__-_____ LAN-__-_____
Site-wide EIS (specify): Facility NCB Document No.: _____ Operations Level (Use Table 2): _____

3b. Conditions that preclude a cx or SWEIS reference:

Connected action:	Yes ☐	No ☐
Extraordinary circumstances	Yes ☐	No ☐
Siting/expansion - Treatment, Storage, Disposal facility?	Yes ☐	No ☐
Uncontrolled releases of contaminants	Yes ☐	No ☐

Reviewed by ESH-20 NCB staff:

NEPA:	Name	Date	Comment:
Biological Resources:	Name	Date	Comment:
Cultural Resources:	Name	Date	Comment:
Other:	Name	Date	Comment: