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Design Analysis Review Summary

Complete only applicable items.

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Page: 1 Of: 1

2. DESIGN ANALYSIS TITLE
Industrial/Military Activity-Initiated Accident Screening Analysis

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Donald A. Kalinich D A K	2-8-99
6. CHECKER (Printed Name and Signature) S. F. Alex Deng /**	7. DATE 9/1/99

8. Due Date:	10. Review			Comments		11. Backcheck *	
9. Discipline	Name (Print)	Initial	Date	Yes	No	Initial	Date
DESIGN/REP SUR	LEONARD SWANSEN	LS	9/22/99		✓	MD	9-24-99
DESIGN/WP	JOHN MASSARI	JM	9/23/99		✓	JM	9/24/99
LICENSING	JACKIE BESS	JEB	9/21/99	✓		JEB	9/24/99
REQMTS/SE	JOHN D. BIGBEE	JDB	9/17/99	✓		JDB	9-24-99
QATSS	STEVE SWENNING	SS	9/21/99	✓		SS	9/27/99

12. REMARKS

ANALYSIS INITIATED AS B00000000-01717-0200-00177 REV 00B

ANALYSIS WAS INITIATED UNDER PROCEDURE QAP-3-9, REV 08, DESIGN ANALYSIS

** Compliance check by JAMES A. KAPPES JK 9/13/99

*Initial and date indicate that all mandatory comments were satisfactorily resolved and appropriately incorporated.

13. CONCURRENCE

DONALD A. KALINICH / D A K — Originator Name/Signature — 9-28-99 — Date

S. F. ALEX DENG / S F Deng — Checker Name/Signature — 9/28/99 — Date

THOMAS D. DUNN / Thomas D Dunn — LDE Name/Signature — 9/29/99 — Date

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Design Analysis Cover Sheet

Complete only applicable items.

(1.) QA: L

Page: 1 Of: 34

2. DESIGN ANALYSIS TITLE	
Industrial/Military Activity-Initiated Accident Screening Analysis	
3. DOCUMENT IDENTIFIER (Including Rev. No.)	4. TOTAL PAGES
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	Printed Name	Signature	Date
7. Originator	Donald A. Kalinich		10-6-99
8. Checker	S. F. Alex Deng		10/6/99
9. Lead Design Engineer	Thomas Dunn		10/7/99
10. Department Manager	Dealis Gwyn		10/13/99

11. REMARKS

This analysis contains the following TBVs/TBDs: TBD-419, TBD-420, TBV-690, TBV-1034, TBV-1243, TBV-1372.

Analysis was initiated as B00000000-01717-0200-00177, REV 00B.

Analysis was intiated under Procedure QAP-3-9, REV 08, *Design Analysis*

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ANL-WHS-SE-000004 REV 00	
4. Revision No.	**5. Description of Revision**
00	Initial Issue. Analysis was initiated as B00000000-01717-0200-00177 REV 00B.

CONTENTS

FIGURES

1. PURPOSE

Impacts due to nearby installations and operations were determined in the *Preliminary MGDS Hazards Analysis* (CRWMS M&O 1996) to be potentially applicable to the proposed repository at Yucca Mountain. This determination was conservatively based on limited knowledge of the potential activities ongoing on or off the Nevada Test Site (NTS). It is intended that the Industrial/Military Activity-Initiated Accident Screening Analysis provided herein will meet the requirements of the *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants* (NRC 1987) in establishing whether this external event can be screened from further consideration or must be included as a design basis event (DBE) in the development of accident scenarios for the Monitored Geologic Repository (MGR).

This analysis only considers issues related to preclosure radiological safety. Issues important to waste isolation as related to impact from nearby installations will be covered in the MGR performance assessment.

2. QUALITY ASSURANCE

This analysis is subject to the requirements of the *Quality Assurance Requirements and Description* (QARD) (DOE 1998) as determined by procedures QAP-2-0, *Conduct of Activities*, and NLP-3-18, *Documentation of QA Controls on Drawings, Specifications, Design Analyses, and Technical Documents.*

This analysis is performed in accordance with QAP-3-9, *Design Analysis*. The analysis determines whether nearby installations and operations need to be considered as sources of potential DBEs requiring detailed accident analysis. These detailed analyses could identify quality-affecting items subject to QA controls

This document uses both accepted and existing data as defined in NLP-3-15, *To Be Verified (TBV) and To Be Determined (TBD) Monitoring System.* According to NLP-3-15 data that will be used as part of a verified design package to be released to another organization need to be controlled as TBV or TBD. Since the results of this analysis could impact other organizations, all existing data will be controlled with TBVs or TBDs.

3. METHOD

The approach used in this analysis is defined in NUREG-0800 (NRC 1987). Section 2.2.1 and Section 2.2.2 of NUREG-0800 address identification of potential hazards in the vicinity of a nuclear power plant site, however, this same methodology can be applied to other nuclear facilities. The methodology involves identifying facilities within specified criteria, describing these facilities, describing the nature and extent of activities conducted, and providing statistical data with respect to any hazardous materials utilized at these facilities. The criteria in NUREG-0800, Section 3.1 are:

- All identified facilities and activities within eight kilometers (five miles) of the plant should be reviewed. Facilities and activities at greater distances should be considered if they otherwise have the potential for affecting plant safety-related features.

- Any facilities which meet the above criteria have to be evaluated in accordance with other sections of NUREG-0800 listed below, as appropriate.

  - Section 2.2.3, Evaluation of Potential Accidents

  - Section 3.5.1.5, Site Proximity Missiles (Except Aircraft)

  - Section 3.5.1.6, Aircraft Hazards

It should be noted that hazards from an aircraft crash are covered in a separate analysis (CRWMS M&O 1999a) while hazards from objects/ordnance falling from aircraft will be covered in this analysis.

Initiating events may be screened from further consideration if they have a frequency that is less than 1.0E-06/yr (see Section 4.2) (i.e., they are beyond design basis events (BDBE)) or they have no impact on the MGR due to the combination of the event magnitude (e.g., minimal overpressure, temperature, etc.) and distance from the MGR.

Types of events that are screened include:

- explosions
- fires
- chemical releases
- objects/ordnance falling from aircraft

Specific evaluations of the overpressure from an explosion and the frequency of a radiological release from the Waste Handling Building (WHB) due to dropped objects or ordnance are performed to demonstrate that these events can be screened from further DBE consideration based on either their inability to cause a radiological release or their low frequency of occurrence. In the case of explosion overpressure, it will be demonstrated that a detonation of very large quantities (on the order of that stored at an Army Munitions depot) will not damage the WHB. For aircraft-dropped objects or ordnance, it will be shown that the frequency of a postulated radiological release is less than 1.0E-06/yr.

4. DESIGN INPUTS

4.1 DESIGN PARAMETERS

4.1.1 The number of objects dropped by aircraft flying in the Nellis Range complex, excluding ordnance, is 1.5 drops per 1000 sorties.
Basis: SAIC and DRI (1991), page 2-48.
Data Status: Existing [TBV-1034].
This parameter is used in Section 7.4.

4.1.2 The number of ordnance drops by aircraft flying in the Nellis Range complex is 0.005 per 1000 sorties.
Basis: SAIC and DRI (1991), page 2-48.
Data Status: Existing [TBV-1034].
This parameter is used in Section 7.5.

4.1.3 The number of sorties that overfly the NTS is 18,910 per year. This is the 95% confidence value in CRWMS M&O 1999a.
Basis: CRWMS M&O (1999a), Section 7.2.3.
Data Status: Existing [TBV-1243].
This parameter is used in Sections 7.4 and 7.5.

4.1.4 The footprint of the WHB is 320260 square feet (0.01 square miles). This is the footprint area as calculated in CRWMS M&O (1999a).
Basis: CRWMS M&O (1999a), page II-3.
Data Status: Qualified.
This parameter is used in Sections 7.4 and 7.5.

4.1.5 The WHB is located at approximately 36° 51' N and 116° 25' W. This parameter is sufficiently accurate for locating the WHB on the *Nellis AFB Range Chart* (DMA 1995) and for measuring the distance between Nellis AFB and the WHB.
Basis: CRWMS M&O (1999b).
Data Status: Existing [TBV-1372].
This parameter is used in Sections 7.4 and 7.5.

4.1.6 CEASR TRANSITION is located at 37° 1' N and 116° 28' W.
Basis: Tullman (1997), page 2.
Data Status: Accepted; the location of the CEASR TRANSITION is an established fact.
This parameter is used in Sections 7.4 and 7.5.

4.2 CRITERIA

Probability/Frequency Criteria: Those industrial and military activities which meet the proximity criteria and must be evaluated for potential accidents can be considered beyond design basis events if their total event frequency is less than 1.0E-06/yr. This is based on the definition of Category 2 events (Dyer 1999, Section 2a). (i.e., an accident with at least one chance in

10,000 (1.0E-04) of occuring before permanent closure of the repository a radionuclide release from the repository) and a 100-year period of operation [see Assumption 4.3.9].

Design Criteria: This analysis does not perform a design function; however, this analysis is an input to DBE analysis which, in turn, affects design. Therefore, any *Repository Design Requirements Document* (DOE 1994) requirements for DBEs are indirect requirements for this analysis. Although this document is only applicable to Viability Assessment design, the following requirement from this document is considered applicable:

> **3.2.4.6 D External Blasts and Missiles** – The potential effects of a major explosion at a nearby facility or transportation route shall be considered among the spectrum of external blast effects and missiles that confinement structures must be designed to withstand or against which they must be protected.

4.3 ASSUMPTIONS

4.3.1 The nearby facilities and operations described in this document are assumed to be representative of those present at the time of repository operation.
Basis: Best-available data at the time.
This assumption is used throughout Sections 7.2 and 7.6.

4.3.2 A conservative flight path for aircraft in-route from Nellis Air Force Base (AFB) to the Nellis Air Force Range consists of a direct path from Nellis AFB to the MGR [approximately 88 miles as measured from *Nellis AFB Range Chart* (DMA 1995)], and then from the MGR to the CEASR TRANSISION [approximately 13 miles as measured from DMA (1995)].
Basis: This assumed flight path does not account for any portion of a flight over the Nellis Air Force Range.
This assumption is used in Sections 7.4 and 7.5.

4.3.3 The frequency of dropping objects or ordnance from an aircraft is uniform with respect to the aircraft's flight path.
Basis: No causal mechanisms have been identified that would lead to objects or ordnance being preferentially dropped while a sortie is near the MGR.
This assumption is used in Sections 7.4 and 7.5.

4.3.4 A 2000 lb bomb (i.e., dropped ordnance) that explodes will affect an area of 3.9 mi^2. This is a sufficiently conservative estimate of the area of effect of ordnance that explodes.
Basis: SAIC and DRI (1991), page 2-49. This assumption will be verified by the resolution of TBD-419.
This assumption is used in Section 7.5.

4.3.5 Only 10% of any unarmed ordnance dropped from an aircraft will explode upon striking the ground.

Basis: Engineering judgement based on fact that ordnance is designed to explode only if armed. This assumption will be verified by the resolution of TBD-419.
This assumption is used in Section 7.5.

4.3.6 Only 10% of the sorties flown over the NTS in the vicinity of the WHB carry live ordnance. This parameter is based on the following statement in Tullman (1997):

> "A majority of the aircraft that fly through the western area of the test site [i.e., near the MGR] are armed only with simulated ordnance."

Basis: Tullman (1997), page 4; and engineering judgement. This assumption will be verified as per TBD-420.
This assumption is used in Section 7.5.

4.3.7 An inadvertent drop of armed live ordnance over the NTS airspace has a conditional probability of 0.01 (1.0E-02). This is based on the following statement in Irving (1997) and engineering judgement:

> "No overflight of R-4808N airspace with training or inert ordnance unless the master armament switch is on safe. Aircraft with internally carried weapons may overfly R-4808N if bomb bay doors are closed. No overflight of R-4808N with live ordnance once armament switched (sic) have been activated, even if they are subsequently on safe, unless ordnance is carried internally and bomb bay doors are confirmed closed. Blackjack will confirm weapon status prior to entering R-4808N."

Basis: Irving (1997), page 2. This assumption will be verified as part of TBV-420.
This assumption is used in Section 7.5.

4.3.8 It is assumed that no more than 2% of the total NTS overflights pass within a six mile by six mile "box" centered on the WHB.
Basis: Data are currently being gathered to support this assumption. This assumption will be verified by an evaluation of the data to be performed at a latter date as per TBV-1034.
This assumption is used in Sections 7.4 and 7.5.

4.3.9 The preclosure period (from beginning of repository operations to permanent closure) is assumed to be 100 years (TBV-690).
Basis: This assumption is based on the performance requirement for retrievability in the *Monitored Geologic Repository Requirements Document* (YMP 1999, Requirement 3.2H). A preclosure operational period of 100 years is considered conservative since the MGR waste handling and emplacement activities are expected to span less than 40 years.
This assumption is used in Section 4.2, 7.4, and 7.5.

4.3.10 It is conservatively assumed that any ordnance that is live (i.e., not simulated) and armed will explode upon impact.
Basis: This a bounding assumption.
This assumption is used in Section 7.5.

4.4 CODES AND STANDARDS

Section not used.

5. REFERENCES

5.1 DOCUMENTS CITED

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Walck, M.C. 1995. *Summary of Ground Motion Prediction Results for Nevada Test Site Underground Nuclear Explosions Related to the Yucca Mountain Project.* SAND95-1938. Albuquerque, New Mexico: Sandia National Laboratories. TIC: 226503.

YMP 1999. *Monitored Geologic Repository Requriements Document.* YMP/CM-0025 Revision 3, DCN 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL19990429.0228.

5.2 CODES, STANDARDS, REGULATIONS, AND PROCEDURES

NLP-3-15, Revision 5, ICN 0. *To Be Verified (TBV) and To Be Determined (TBD) Monitoring System.* ACC: MOL.19981117.0148.

NLP-3-18, Revision 4 , ICN 0. *Documentation of QA Controls on Drawings, Specifications, Design Analyses, and Technical Documents.* ACC: MOL.19960611.0170.

Regulatory Guide 1.91, Rev. 1. *Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants.* Washington, D.C.: Nuclear Regulatory Commission. TIC: 2774.

QAP-2-0, Revision 5, ICN 0. *Conduct of Activities.* ACC: MOL.19980826.0209.

QAP-3-9, Revision 8, ICN 0. *Design Analysis.* ACC: MOL.19990702.0261.

5.3 SOURCE DATA, LISTED BY DATA TRACKING NUMBER

CRWMS M&O 1999b. *Waste Treatment and Handling Building.* YMP-99-024.0. Las Vegas, Nevada: CRWMS M&O. DTN: MO9906YMP99024.000.

6. USE OF COMPUTER SOFTWARE

No computer software was used in this analysis.

7. DESIGN ANALYSIS

The following sections of the analysis will cover nearby facilities, nearby transportation routes, and dropped objects/ordnance from aircraft flying in the vicinity of the repository surface facilities.

7.1 APPLICATION OF NUREG-0800 PROXIMITY CRITERIA

NUREG-0800 (NRC 1987, Section 2.2.1.III.1) specifies that all identified facilities and activities within eight kilometers (five miles) of the plant shall be reviewed. When applying this criteria, both surface and subsurface facilities have been considered. Figure 1 (CRWMS M&O 1997) shows the relationship of the surface facilities and the current extent of the subsurface facility with a five-mile perimeter drawn around the both the surface and subsurface areas.

7.1.1 Surface Facilities

It can be seen on Figure 1 that the five-mile perimeter surrounding the surface facilities at the North Portal is encompassed by the proposed repository withdrawal area. Currently there are no non-repository facilities within this five-mile perimeter. It can be concluded that since the DOE will control use of properties within the withdrawal area, non-repository facilities or operations will not be allowed within the five-mile perimeter during operations of the repository facilities.

7.1.2 Subsurface Facilities

There are no preclosure radiological safety issues associated with Industrial/Military activities involving the subsurface area.

7.2 APPLICATION OF NUREG-0800 PLANT-AFFECTING CRITERIA

NUREG-0800 (NRC 1987, Section 2.2.1.III.1) specifies that facilities and activities at distances greater than five miles should be considered if they otherwise have the potential for affecting plant safety-related features. The area surrounding the 5-mile perimeter includes the balance of the land withdrawal area, the balance of the Nevada Test Site, Air Force land, and Bureau Of Land Management (BLM) land (see Figure 1). The land withdrawal area extends another 2 miles to the west and eight miles to the south. The Nevada Test Site (NTS) extends over 30 miles to the north and over 20 miles to the east of the land withdrawal area (see Figure 1). The Air Force land is part of the Nellis Air Force Range which extends over 50 miles to the north of the withdrawal area (see Figure 1). BLM land extends beyond the withdrawal area to the west and south and includes US Highway 95 providing the major route between Las Vegas and Reno, Nevada. The potential for transportation accidents and Air Force dropped objects affecting the safety-related features will be covered in separate sections. A description of the NTS facilitates/activities and their potential to impact the repository is provided in Section 7.2.1. Facilities, activities on BLM land will be addressed in Section 7.2.2, and facilities/activities on the Nellis Air Force Range (NAFR) discussed in Section 7.2.3.

7.2.1 Nevada Test Site Facilities and Activities

The NTS Final Environmental Impact Statement (FEIS) (DOE 1996a, DOE 1996b) was used to identify current and future planned facilities and activities on the NTS (see Figures 2 and 3). Projects and activities covered in the NTS Final Environmental Impact Statement include (DOE 1996a, p. 3-1):

- defense program
- waste management program
- environmental restoration program
- nondefense research and development program
- work for others program
- site support activities

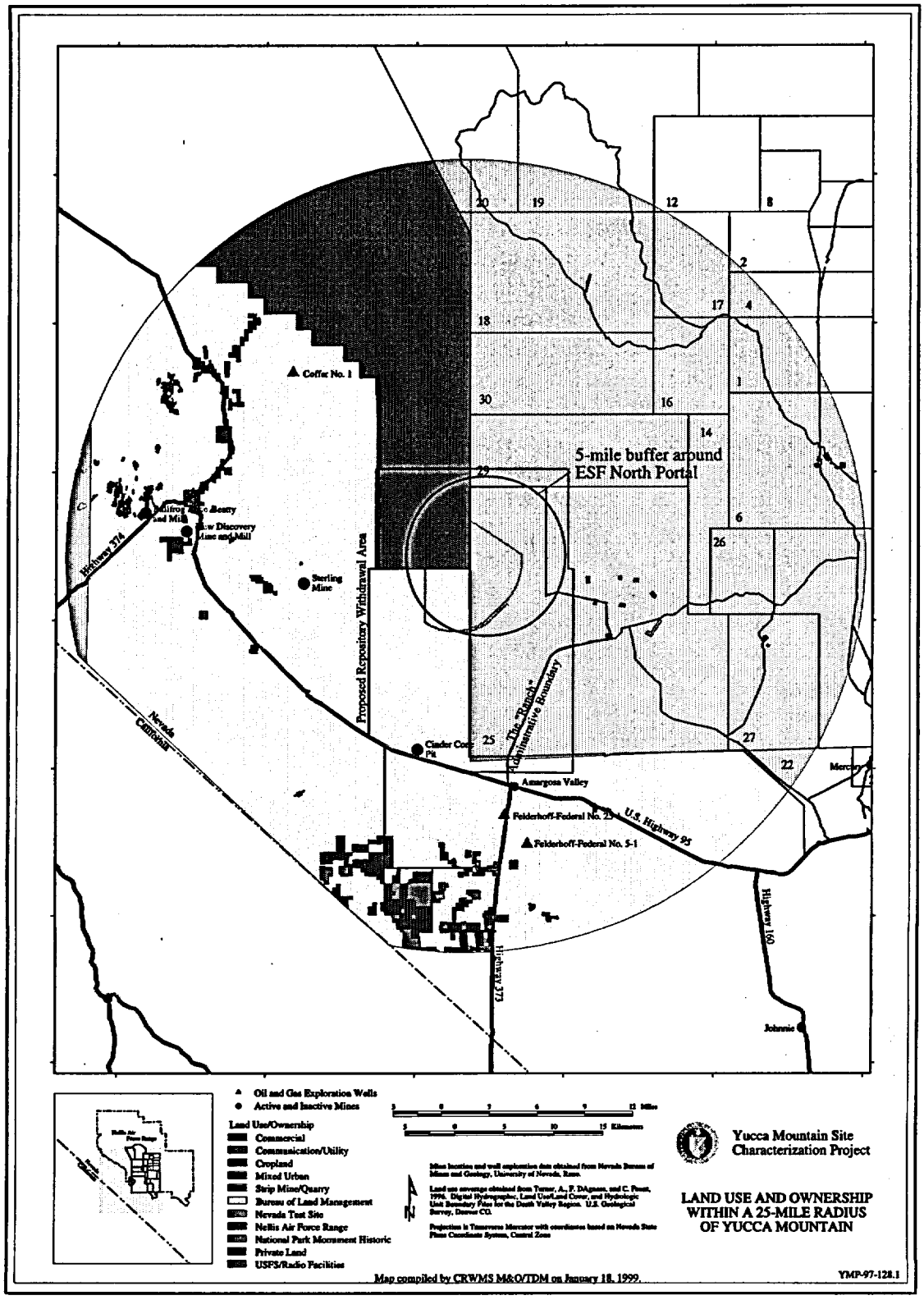

Figure 1. Land Use and Ownership Within a 25-Mile Radius of Yucca Mountain (CRWMS M&O 1997).

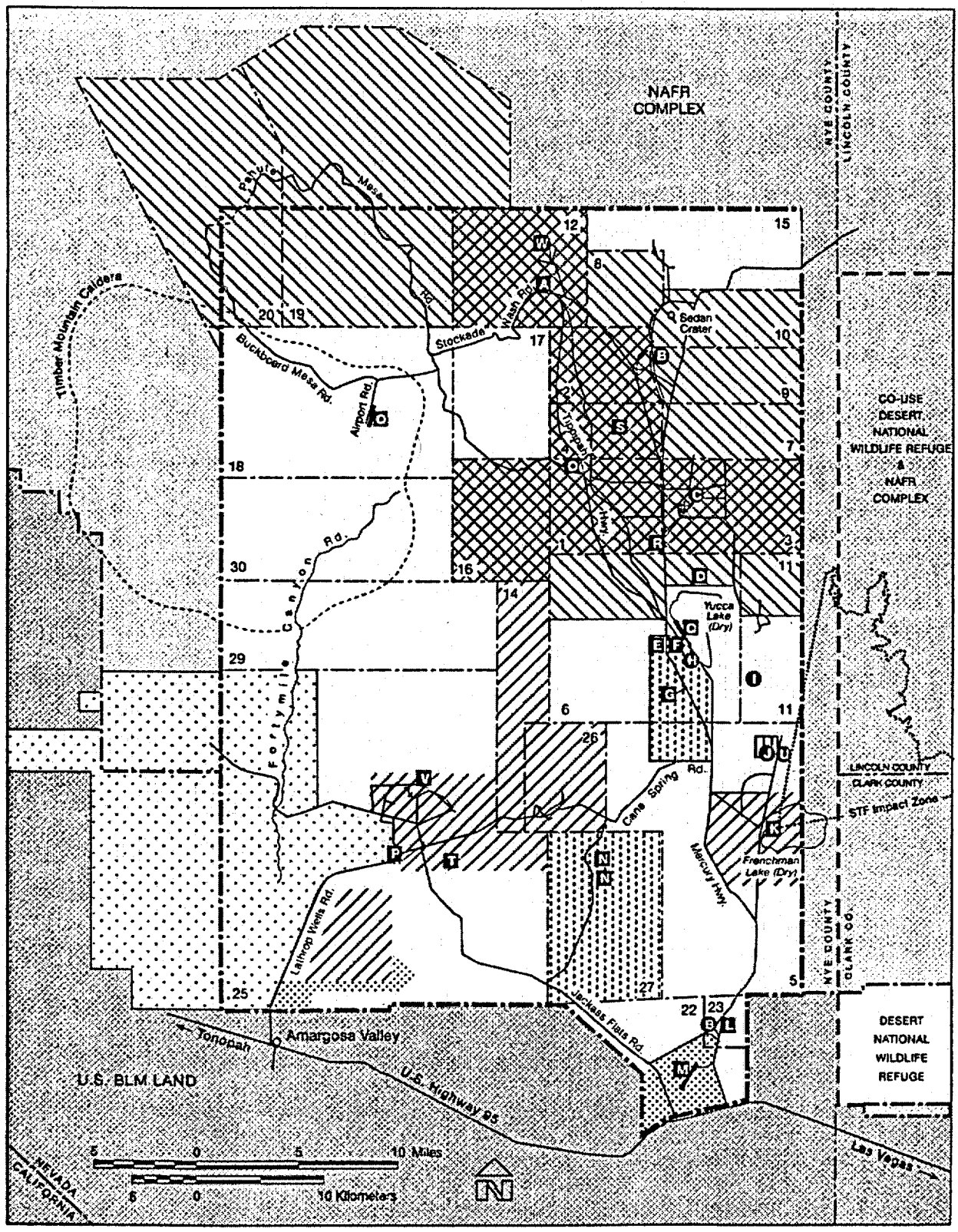

Figure 2. NTS Alternative 3 Land Use Map (DOE 1996a, p. 3-14)

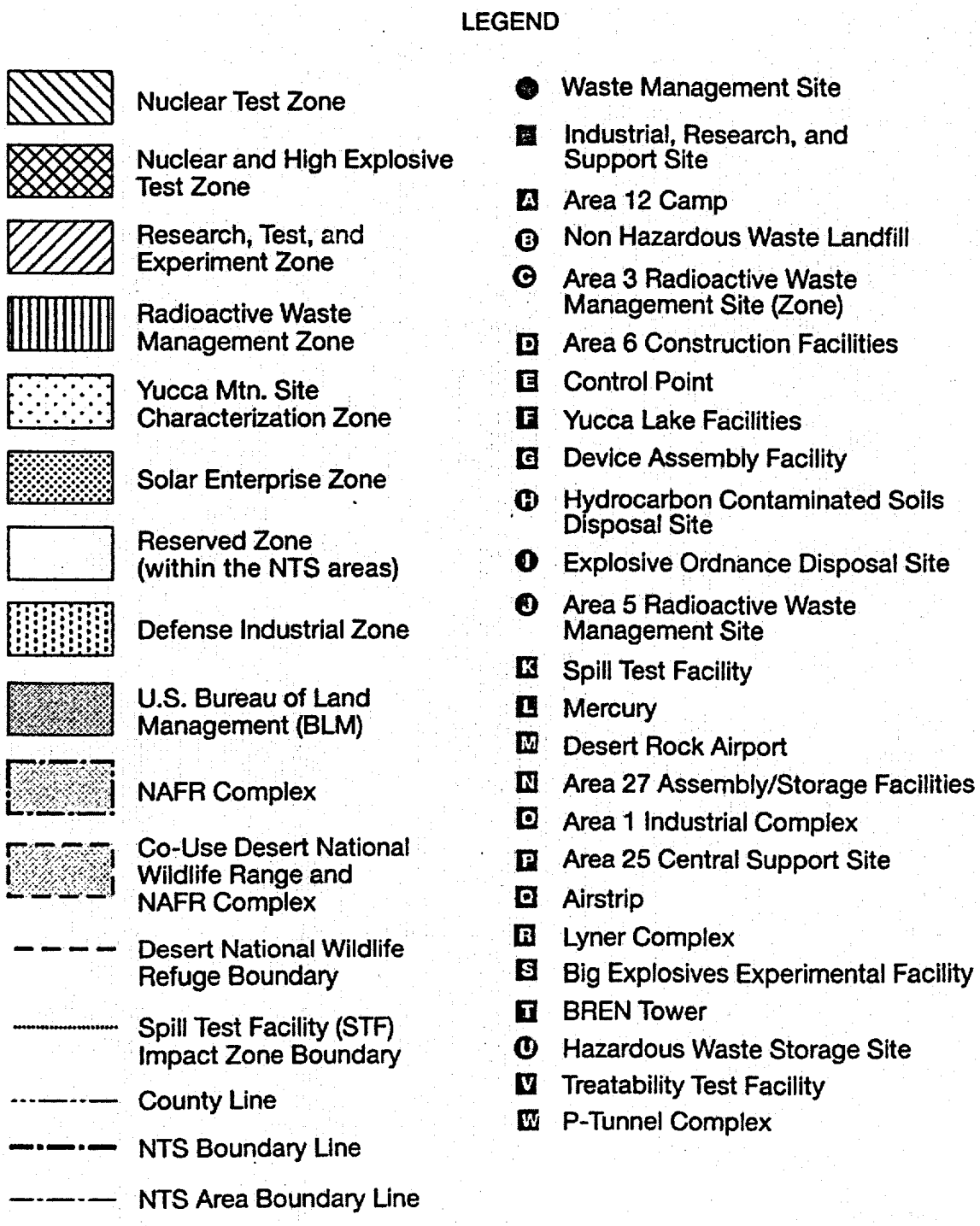

Figure 3. Legend for NTS Alternative 3 Land Use Map (DOE 1996a, p. 3-15)

Four "use alternatives" are evaluated in the NTS FEIS (DOE 1996a, p. 3-1):

- Alternative 1: Continued Current Operations
- Alternative 2: Discontinue Operations
- Alternative 3: Expanded Use
- Alternative 4: Alternate Use of Withdrawn Lands.

All alternatives were evaluated to cover the complete set of potential activities. The activities associated with these alternatives and programs are discussed in the following sections.

7.2.1.1 Defense Program

Stockpile Stewardship

Stockpile stewardship includes nuclear weapons testing and science-based weapons experimentation. The locations for these tests would be within either the Nuclear Test Zones or the Nuclear and High Explosive Test Zones. The closest point that these zones come to the repository is approximately 15 miles. All weapons testing will be either in vertical drill holes or in underground tunnels located in the general area of past weapons tests.

The potential impact of underground nuclear weapons testing is from the ground motions imparted to the region during such a test. Data evaluated for over 14 years of testing concluded that the data and associated analyses demonstrate that the ground motions at Yucca Mountain from nuclear tests have been at levels lower than would be expected from moderate to large earthquakes in the region; thus these nuclear tests would not control seismic criteria for the potential repository (Walck 1995). Therefore this event is bounded by the earthquake event.

In addition to ground motion effects of underground nuclear explosions, there is also a potential hazard from secondary seismic effects. Secondary effects are associated with co-seismic strain release attributed to the release of tectonic strain, aftershocks due to tectonic strain release, and events due to the collapse of cavities created by the explosion. These effects have not be seen at distances greater than 6 miles (DOE 1996a, p. 5-24).

The Device Assembly Facility (DAF) is a multistructure facility in which nuclear devices and high explosives can be assembled, disassembled or modified, staged, and component tested. It is constructed primarily of heavy steel-reinforced concrete. The facility is earth-covered with a minimum of 2 m (5 ft) of compacted earth overlay, leaving only one exterior wall. Assembly cells are designed to absorb the energy of an explosive blast to prevent propagation of the explosion into other structures within the facility. Each assembly cell is designed and tested to undergo an explosion from a maximum high explosive device without injury to personnel outside of the cell (DOE 1996b, pp. A-6 to A-7). This design reduces the potential impacts that could occur during an accident. Hence, no impact is expected at the MGR from an accident at DAF.

The Area 27 complex will house kilogram quantities of special nuclear materials and up to several thousand-pound quantities of various types of high explosives (DOE 1996b, p. A-8). Although the primary assembly buildings are of conventional construction, the adequacy of safety of the Area 27 complex has been demonstrated over the years by a number of safety analyses, safety evaluations, and hazards analysis (DOE 1996b, p. A-7). An accident in Area 27 has been found non-credible (DOE 1996a, p. 5-46):

> *The maximum reasonably foreseeable radiological Defense Program accident at the NTS would be a non-nuclear explosion involving high explosives in an Area 27 nuclear weapons storage bunker, which has the probability of occurrence of 1E-7.*

The Lyner Complex, located west of the Mercury Highway in Yucca Flat, consists of a mined shaft, 961 feet deep, a drill hole and a connecting mined tunnel. Dynamic experiments performed in this facility may include the use of special nuclear materials but the experiments remain subcritical (DOE 1996b, p. A-9). The impact of any events involving this facility upon the MGR would be bounded by underground nuclear testing, and hence have no impact.

The Big Explosives Experimental Facility (BEEF), also located in Yucca Flat, consists of two bunkers used for personnel during nearby surface explosive experiments. Current typical experiments involve at a maximum 3600 kg (8000 lb) of conventional high explosives in a variety of configurations (DOE 1996b, p. A-11). Proposed activities at the BEEF would increase that amount to 32,000 kg (70,000 lb) of conventional high explosives (DOE 1996b, p. A-14). The activities associated with conventional high-explosives testing, surface dynamic experiments, and hydrodynamic tests are not anticipated to impact facilities surrounding these tests and therefore, should not have any impact on repository facilities 20 miles away (see Section 7.3, Parametric Evaluation of Potential Explosions).

Proposed activities such as the Next Generation Radiographic Facility and the Next Generation Magnetic Flux Compression Generation Facility would involve the use of conventional high explosives and subcritical masses. The quantities of conventional high explosives given in the description of these conceptual facilities are bounded by the 32,000 kg (70,000 lb) quantity for the BEEF (DOE 1996b, pp. A-15 to A-16). Experiments with subcritical masses would be designed to remain subcritical (i.e., no self-sustaining nuclear reaction would occur) (DOE 1996b, p A-15).

Stockpile Management

Pantex stockpile management operation could be transferred to the NTS (DOE 1996b, p. A-17). New facilities would be centered around the DAF. These facilities would be necessary to disassemble nuclear weapons; modify, maintain, and monitor nuclear weapons, perform quality assurance testing of weapons components, assembly of nuclear weapons, and storage of special nuclear materials. No activities or potential accidents associated with disposal have been identified that would impact the repository (DOE 1996a, p. 5-111).

Nuclear Emergency Response (DOE 1996b, pp. A-11 to A-12)

The Nuclear Emergency Response activities include:

- Nuclear Emergency Search Team
- Federal Radiological Monitoring and Assessment Center
- Aerial Measuring System
- Accident Response Group
- Radiological Assistance Program
- Internal Emergency Management Program

None of these activities will adversely impact the repository.

Storage and Disposition of Weapons-Usable Fissile Material (DOE 1996b, p. A-18)

Two proposed options for the storage of fissile material have been investigated. One option involves the construction of either a new plutonium storage facility, or a new plutonium storage facility and a highly enriched uranium storage facility. These facilities would be located near the Device Assembly Facility. The other option is to utilize one of the horizontal event tunnels as the monitored storage site. It is anticipated that storage activities would not impact the repository.

Disposition of plutonium activities are proposed for the NTS. Due to a lack of data regarding these potential operations, no evaluation can be made at this time. When specific data become available, an evaluation of a potential accidents will need to be performed.

Large, Heavy-Industrial Facility

No specific information regarding this proposed activity are provided in the NTS Final EIS. When specific data become available, an evaluation of potential accidents will need to be performed.

Tonopah Test Range Activities

See section 7.2.3.

7.2.1.2 Waste Management Program

Area 3 Radioactive Waste Management Site (DOE 1996b, p. A-23)

Area 3 Waste Management Operations consists of subsidence craters created from underground nuclear weapons tests. Bulk low-level waste is disposed of in these subsidence craters. No activities or potential accidents associated with disposal have been identified that would impact the repository.

Area 5 Radioactive Waste Management Site (DOE 1996b, p. A-24)

Low-level and mixed waste are stored on pads and disposed of via shallow land burial in pits and trenches. No activities or potential accidents associated with storage or disposal have been identified that would impact the repository.

Area 6 Waste Management Operations (DOE 1996b, p. A-25)

Polychlorinated biphenyl waste are stored in accordance with the Toxic Substance Control Act and State of Nevada regulations (DOE 1996b, p. A-25). Low-level and mixed waste effluent generated by the Nevada Environmental Management and Defense Program activities at the Liquid Waste Treatment System facilities. The hydrocarbon landfill is a state of Nevada-permitted Class II disposal site. No activities or potential accidents associated with these facilities have been identified that would impact the repository.

Area 11 Explosive Ordnance Disposal Unit

The Area 11 Explosive Ordnance Disposal Unit is a thermal treatment unit rather than a disposal unit. Explosive ordnance wastes, regulated as characteristic reactive hazardous wastes under the Resource Conservation and Recovery Act (DOE 1996b, p. A-25), are detonated at the Explosive Ordnance Disposal Unit. The Explosive Ordnance Disposal Unit was first used in 1965 and continues to operate as a permitted Resource Conservation and Recovery Act treatment unit. The Explosive Ordnance Disposal Unit consists of a detonation pit surrounded by an earthen pad (approximately 8 m [25 ft] x 31 m [100 ft]) and ancillary equipment, including a bunker and an electric shock box. The Explosive Ordnance Disposal Unit has a maximum operating capacity to treat 45 kg (100 lb) per hour or an annual capacity of 1,873 kg (4,100 lb) (DOE 1996b, p. A-25). Due to the distance from the MGR (see Figure 2, *Area 11*) and the amounts of explosive material, this facility is not expected to impact the MGR.

7.2.1.3 Environmental Restoration Program

Environmental restoration projects are currently on-going at the NTS (DOE 1996b, pp. A-31 to A-36). No impact to the MGR is postulated from the characterization, monitoring, decontamination and decommissioning, and other cleanup activities associated with these projects.

7.2.1.4 Nondefense Research and Development Program

Alternative Energy

A Solar Energy Enterprise Zone facility concept is being advanced by a consortium of federal, state, and local entities along with the solar power industry. Proposed technologies for the facility include photovoltaic systems, parabolic-trough solar thermal systems, power tower systems, and parabolic dish systems (DOE 1996b, pp. A-40 to A-41). No impact to the MGR is postulated from these facilities.

Spill Test Facility

The DOE Spill Test Facility is located approximately 25 miles from the repository on the eastern edge of the NTS (see Figures 2 and 3). It is designed to test both large and small scale hazardous and toxic materials in a controlled environment. The facility is available to private companies to conduct experiments. The impact zone for this facility has been determined to be to the east (see Figure 2) putting it even further from the repository site. Based on the distance between the Spill Test Facility and the MGR, it is expected to have no impact on to the repository.

Alternative Fuels Demonstration Projects

DOE has converted 16 of its vehicles at the NTS to run on compressed natural gas (DOE 1996b, p. A-38). A vehicle explosion is bounded by operations at the BEEF and other NTS high explosive test facilities, hence this project will have no impact on the MGR. Also, it has been proposed to construct a compressed natural gas fueling facility (DOE 1996b, p. A-42). No specific information regarding this proposed activity are provided in the NTS Final EIS. When specific data become available, an evaluation of potential accidents will need to be performed.

Alternative fuels and associated technologies may be evaluated, tested, and demonstrated (DOE 1996b, p. A-42). No specific information regarding this proposed activity are provided in the NTS Final EIS. When specific data become available, an evaluation of potential accidents will need to be performed.

Environmental Management and Technology Development Project

Five major remediation and waste management areas are the focus of this project (DOE 1996b, p. A-39):

- Contamination Plume Control and Remediation
- Mixed Waste Characterization, Treatment, and Disposal
- High-Level Tank Remediation
- Landfill Stabilization
- Facility Transitioning, Decommissioning, and Final Disposition

No impact to the MGR is postulated from the control, remediation, characterization, treatment, disposal, stabilization, decommissioning, and dispositioning activities associated with this project.

Kistler Aerospace Corporation is developing a fully re-usable space launch system to put communications satellites into orbit (DOE 1996b, p. A-42). However, due to a lack of data regarding the Kistler operations, no evaluation can be made at this time. When specific data become available, an evaluation of a potential accident involving a reentry vehicle crash into the MGR surface facilities will need to be performed.

Environmental Research Park

The NTS Environmental Research Park was established in 1992. Areas of research involving the environmental research park include, but are not limited to, habitat reclamation, hydrogeologic systems, radionuclide transport, ecological change, waste management, monitoring processes, remediation, and characterization (DOE 1996b, p. A-40). No impact to the MGR is postulated from the activities associated with the research park.

7.2.1.5 Work for Others Program

Treaty Verification

Treaty verification projects include (DOE 1996b, p. A-43):

- Threshold Test Ban Treaty
- Peaceful Nuclear Explosion Treaty
- Chemical Weapons Convention
- The Treaty on Open Skies

No impact to the MGR is postulated from the inspection activities associated with treaty verification projects.

Nonproliferation

In the past, seismic signatures and ground disturbances produced from underground nuclear weapons tests at the NTS have been analyzed to develop techniques and methods for detecting and evaluating underground nuclear tests worldwide. Additional nonproliferation-related experiments are currently using the unique capabilities of the Spill Test Facility for the development, characterization, and testing of remote sensors of chemical effluent (DOE 1996b, p. A-44).

No impact to the MGR is postulated from nonproliferation activities (see Section 7.2.1.4, Spill Test Facility).

Counterproliferation Research and Development

Experiments for Counterproliferation Research and Development can involve the surface and below ground detonation of conventional explosives in the vicinity of the NTS bunkers and tunnels (DOE 1996b, p. A-44). Many of these activities will be performed at the BEEF. The activities associated with conventional high-explosives testing, surface dynamic experiments, and hydrodynamic tests are not anticipated to impact facilities surrounding these tests and therefore, should not have any impact on repository facilities 20 miles away (see Section 7.3, "Parametric Evaluation of Explosion").

Conventional Weapons Demilitarization

Located approximately 10 miles from the repository along the Lathrop Wells Road is the site originally developed for the MX Missile Program (see Figure 2). A tunnel excavated for this program is proposed for various tests, including the detonation of conventional munitions and rocket motor burn experiments (DOE 1996b, p. A-45). Due to its distance from the MGR, no impact is expected from this facility.

Defense-Related Research and Development

In the past, defense-related research and development activities have included tests and training exercises employing a wide variety of weaponry (small arms, artillery, guns, etc.) (DOE 1996b, p. A-45). Explosions associated with these activities should be bounded by operations at the BEEF, and hence have no impact on the MGR.

7.2.1.6 Site Support Activities

No site support activities (e.g., utilities, communications, transportation systems, etc.) identified in the NTS Final EIS (DOE 1996b, Sections A.6, A.6.1, A.6.2, A.6.3, A.6.4) are expected to impact the MGR.

7.2.2 Nearby Facilities Outside the Nevada Test Site

There is one active mine, Sterling Mine, located approximately 11 miles from the proposed repository surface facilities and one active open pit at Cinder Cone located approximately 13 miles from the repository facilities (CRWMS M&O 1997). Nearby mines and pits may use explosive and fuel materials. These facilities are sufficiently distant from Yucca Mountain to preclude adverse effects from accidents at these facilities (see Section 7.3).

There are two gas/oil wells located approximately 16 miles from the proposed repository surface facilities (CRWMS M&O 1997). These facilities are sufficiently distant from the MGR to preclude adverse effects from accidents at these facilities (see Section 7.3).

There is a low-level nuclear waste site approximately 16 miles from the proposed repository surface facilities. There are no activities at this facility which, if an accident occurred, would impact the MGR.

7.2.3 Nellis Air Force Range Facilities and Activities

The Nellis Air Force Range is divided into two functional areas, the North Range and South Range. The South Range is separated from the MGR land-withdrawal area by the NTS; the North Range is adjacent to the MGR land-withdrawal area (USAF 1999, Figure 1-1, p. 1-15).

The North Range contains four unmanned weapons delivery subranges (USAF 1999, p. 1-16) and three Electronic Combat Ranges (USAF 1999, p. 1-21). The nearest threat site or target associated with these ranges is approximately 25 miles from the MGR (USAF 1999, Figure 1-6,

p. 1-22). These sites are sufficiently distant from the MRG that ordnance explosions will not adversely effect the MGR.

The Tonopah Test Range (TTR) is approximately 37 miles from the MGR (USAF 1999, Figure 1-5, p. 1-20). Activities on the TTR include projectile firings, ground-launched rockets (both high-altitude and low altitude), air-launched rockets, explosion effects tests, earth penetration tests, cruise missile flights, and many miscellaneous activities requiring a remote location for non-nuclear DOE Research and Development projects or for other safety or security reasons (USAF 1999, p. 1-21). The remote location of the TTR to the MGR in conjunction with range safety practices will preclude any of these activities from having an adverse impact on the MGR.

7.3. PARAMETRIC EVALUATION OF POTENTIAL EXPLOSIONS

Some of the NTS and NAFR facilities handle high-explosive materials (see Sections 7.2.1.1, 7.2.1.2, 7.2.1.5, and 7.2.3); in addition, events such as transportation and industrial accidents may result in explosions. The overpressure generated by an explosion (i.e., detonation) is a function of the amount of explosive material involved and the distance between the site of the explosion and the repository.

A methodology is given in Regulatory Guide 1.91, *Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants* for evaluating the safe distance from a postulated explosion.

$$R_{safe} \geq KW^{\frac{1}{3}} \qquad \text{(Eq. 1)}$$

where:

- R_{safe} - safe distance from explosion [ft]; based on maximum "no damage" overpressure of 1.0 psig
- K - constant; equal to 45 when R_{safe} is in feet and W is in lbm TNT
- W - mass of TNT [lbm TNT]

Setting R_{safe} equal to the five-mile criterion (26,400 ft) [as per NUREG-0800, Section 3.1 (NRC 1987) and rearranging equation (1) to solve for W yields a "no damage" TNT mass limit of $\leq$ 2.02E+08 lbm TNT ($\leq$ 9.18E+07 kg TNT). This value exceeds any of the TNT inventories currently associated with NTS facilities and any transportation or industrial explosive sources, and is highly likely to exceed any future TNT inventories.

Data from the "Lake Denmark Explosion" that occurred at the Picatinny Arsenal in 1926 (Kinney and Graham 1985, page 13) also provides a measure of safe distance from a large-scale explosion. In that accident, three explosions occurred with TNT-equivalencies of 6.7E+05, 1.6E+06, and 1.8E+05 pounds (3.04E+05, 7.27E+05, and 8.18E+04 kg TNT). Buildings characterized as being of "substantial" construction that were greater than 4000 ft from the explosions suffered practically no damage except for broken windows. Damage to windows and

doors was observed up to three to four miles from the explosion. These data are bounded by the calculated five-mile "no damage" TNT mass limit of 2.02E+08 lbm TNT (9.18E+07 kg TNT).

7.4 OBJECTS DROPPED FROM AIRCRAFT

Objects inadvertently dropped from aircraft can be screened from further DBE consideration by demonstrating that the frequency of a release of radiological material is less than 1.0E-06/yr. An event tree is used to evaluate the frequency of a dropped object causing a radiological release (see Figure 4).

(a)	(b)	(c)	(d)	(e)	(f)	(g)	
freq. of drop per sortie	# of sorties/yr	fraction of sorties that fly within 6 mi x 6 mi box centered on the WHB	fraction of total flight within 6 mi x 6 mi box centered on the WHB	prob of drop hitting WHB	prob of hitting nuclear material	frequency of adverse consequence	event outcome
1.50E-03	18910	2.00E-02	8.400E-02	2.780E-04	(f)	(g)	object strikes radiological inventory

Figure 4. Dropped Object Event Tree

PARAMETER (a): Frequency of ordnance drop (per sortie)

Dropped objects are defined in SAIC & DRI 1991 (p. 2-48) as items such as screws, bolts, and coverplates. The frequency at which objects are dropped from military aircraft is given as 1.5 drops per 1000 sorties (SAIC and DRI 1991, page 2-48) [TBV-1034].

PARAMETER (b): Number of sorties that overfly the NTS

The number of sorties that overfly the NTS is 18,910 per year. This is the 95% confidence value as calculated in CRWMS M&O (1999a) (p. V-2) [TBV-1243].

PARAMETER (c): Fraction of sorties that fly in the vicinity of the WHB

It is estimated that no more than 2% (2.0E-02) of the total sorties that overfly the NTS fly within a six mile by six mile "box" centered on the WHB [Assumption 4.3.8].

PARAMETER (d): Probability of an object being dropped in the vicinity of the WHB

If it is assumed that drop frequency is uniform with respect to an aircraft's flight path [Assumption 4.3.3], then the conditional probability that a dropped object falls while an aircraft is within the six mile by six mile "box" is the ratio of the flight path length within the "box" to the total flight path length.

A conservative estimate of the potential flight path between Nellis AFB and the Nellis Air Force Range is used to calculate the total flight path length [Assumption 4.3.2]. First, it is conservatively assumed that a flight takes a direct path between its take-off point (the Nellis AFB air field) and the WHB. This is a distance of 88 miles as measured on DMA (1995). From the WHB it is assumed that a flight continues on toward the nearest range transition point (CEASR TRANSITION). When a flight reaches the CEASR TRANSITION – a distance of 13 miles from the WHB – it then turns around and flies back to the Nellis AFB air field along the same route. This yields a flight path of 101 miles. Out of that total flight path, at a maximum 8.5 miles (the diagonal of the six mile by six mile "box") are flown within the six mile by six mile "box" centered on the WHB (see Figure 5).

$$(d) = \frac{\sqrt{(6\,\text{miles})^2 + (6\,\text{miles})^2}}{88\,\text{miles} + 13\,\text{miles}} = 8.40 \times 10^{-2} \qquad \text{(Eq. 2)}$$

PARAMETER (e): Probability of an object dropped in the vicinity of the WHB striking the WHB

The conditional probability of an object dropped within the six mile by six mile "box" centered on the WHB actually striking the building is equal to the ratio of the WHB footprint (0.01 mi^2, see Section 4.1.4) to the footprint of the six mile by six mile "box" (see Figure 5).

$$(e) = \frac{0.01\,\text{mi}^2}{(6\,\text{miles}) \times (6\,\text{miles})} = 2.78 \times 10^{-4} \qquad \text{(Eq. 3)}$$

PARAMETER (f): Probability of an object that hits WHB striking nuclear material

To cause a radiological release, a dropped object that hits the WHB must strike nuclear material; of which the conditional probability is equal to the ratio the available strike area of nuclear material to the area of the WHB footprint. Rather than quantify the conditional probability of a dropped object that hits the WHB striking radiological material (f), it will instead be parametrically varied or solved for as a function of PARAMETERS (a)–(e) and OUTCOME (g).

OUTCOME (g): Frequency of a dropped object striking nuclear material in the WHB

For this outcome to be a beyond design basis event (BDBE), its frequency must be less than 1.0E-06/yr [see Section 4.2 and Assumption 4.3.9].

OUTCOME (g) is expressed as the product of PARAMETERS (a)–(e)

$$(a) \times (b) \times (c) \times (d) \times (e) \times (f) = (g) \qquad \text{(Eq. 4)}$$

Setting OUTCOME (g) < 1.0E-06/yr and using the values for PARAMETERS (a)–(e) as described above, PARAMETER (f) can be back-calculated from equation (4). The result of this back-calculation is PARAMETER (f) < 7.55E-02. This value of PARAMETER (f) sets a limit on the ratio the available strike area of nuclear material to area of the WHB footprint. This limit will have to be verified against the final design of the WHB to demonstrate that an object drop from an aircraft event is BDBE.

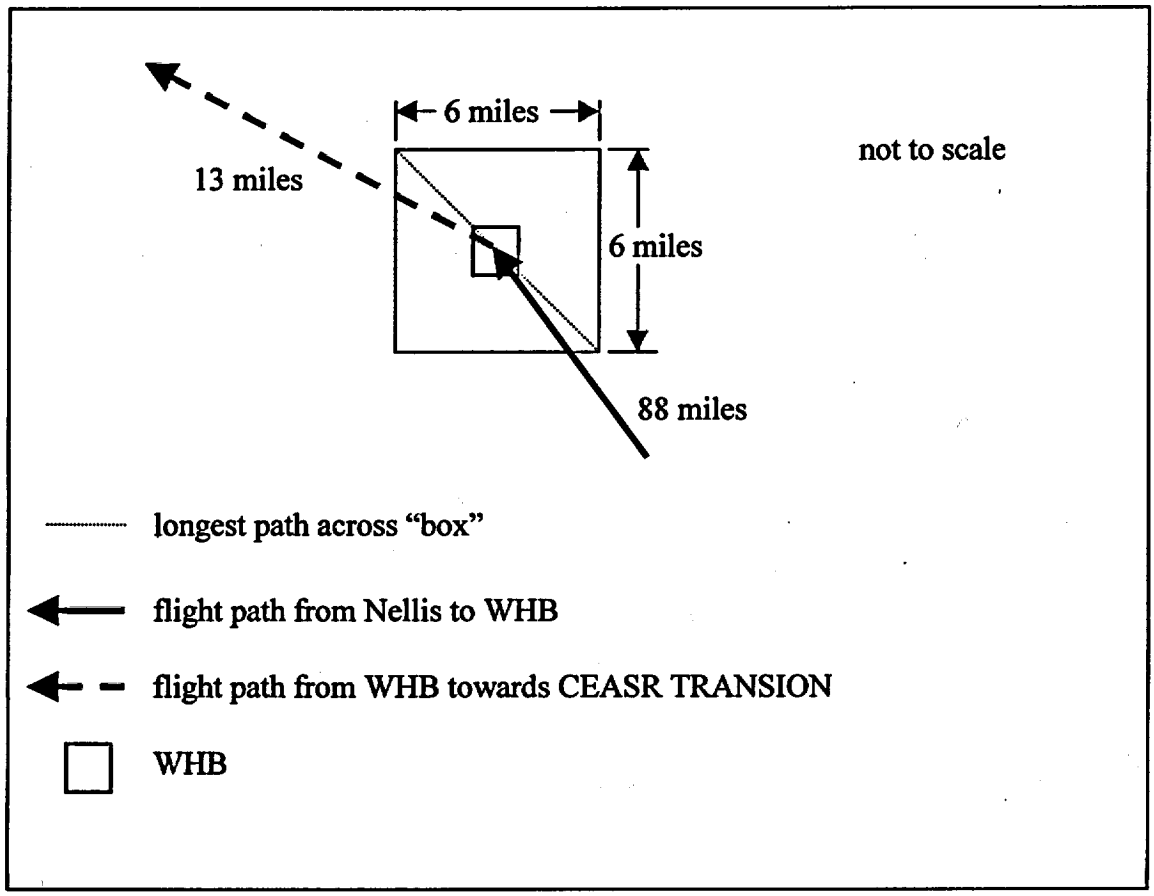

Figure 5. Flight Path Diagram (not to scale)

7.5 ORDNANCE DROPPED FROM AIRCRAFT

Ordnance inadvertently dropped from aircraft can be screened from further DBE consideration by demonstrating that the frequency of a release of radiological material is less than 1.0E-06/yr. An event tree is used to evaluate the frequency of a dropped ordnance causing a radiological release (see Figure 6).

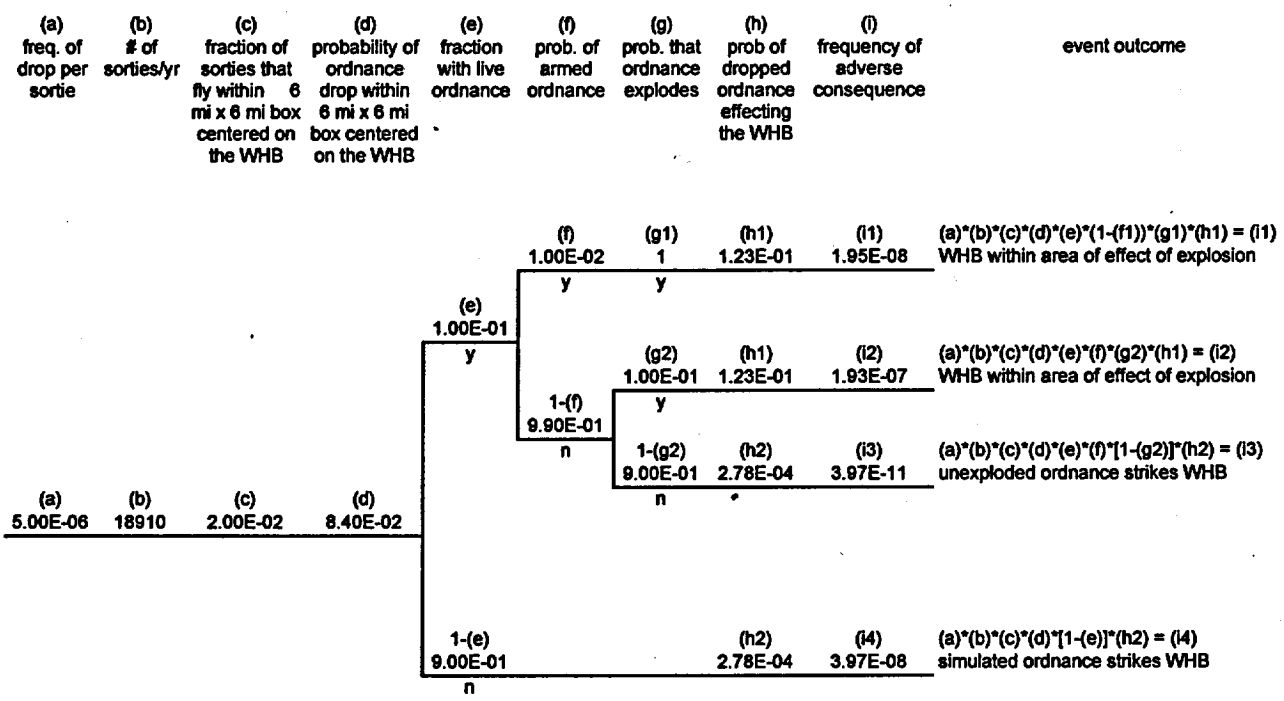

Figure 6. Dropped Ordnance Event Tree

PARAMETER (a): Frequency of ordnance drop (per sortie)

The frequency at which armaments are dropped from military aircraft is given as 0.005 (5.0E-03) drops per 1000 sorties (SAIC and DRI 1991, page 2-48) [TBV-1034].

PARAMETER (b): Number of sorties that overfly the NTS

The number of sorties that overfly the NTS is 18,910 per year. This is the 95% confidence value as calculated in CRWMS M&O (1999a) (p. V-2) [TBV-1243].

PARAMETER (c): Fraction of sorties that fly in the vicinity of the WHB

It is estimated that no more than 2% (2.0E-02) of the total sorties that overfly the NTS fly within a six mile by six mile "box" centered on the WHB [Assumption 4.3.8].

PARAMETER (d): Probability of ordnance being dropped in the vicinity of the WHB

For dropped ordnance to affect the WHB (and potentially cause a release of nuclear material) it must fall off of the aircraft as its flight path passes near the WHB. If it is assumed that drop frequency is uniform with respect to an aircraft's flight path, then the conditional probability that dropped ordnance falls while an aircraft is within the six mile

by six mile "box" is the ratio of the flight path length within the "box" to the total flight path length.

A conservative estimate of the potential flight path between Nellis AFB and the Nellis Air Force Range is used to calculate the total flight path length [Assumption 4.3.2]. First, it is conservatively assumed that a flight takes a direct path between its take-off point (the Nellis AFB air field) and the WHB. This is a distance of 88 miles as measured on DMA 1995. From the WHB it is assumed that a flight continues on toward the nearest range transition point (CEASR TRANSITION). When a flight reaches the CEASR TRANSITION) – a distance of 13 miles from the WHB – it then turns around and flies back to the Nellis AFB air field along the same route. This yields a flight path of 101 miles. Out of that total flight path, at a maximum 8.5 miles (the diagonal of the six mile by six mile "box") are flown within the six mile by six mile "box" centered on the WHB (see Figure 5).

$$(d) = \frac{\sqrt{(6\,\text{miles})^2 + (6\,\text{miles})^2}}{88\,\text{miles} + 13\,\text{miles}} = 8.40 \times 10^{-2} \qquad \text{(Eq. 5)}$$

PARAMETER (e): Fraction of sorties that fly in the vicinity of the WHB with live ordnance

Only 10% (1.0E-01) of the sorties flown in the vicinity of the WHB carry live ordnance [Assumption 4.3.6]. This is based on the statement in Tullman 1997, "A majority of the aircraft that fly through the western area of the test site [i.e., near the MGR] are armed only with simulated ordnance."

PARAMETER (f): Fraction of sorties that fly in the vicinity of the WHB with armed ordnance that could be dropped

Restrictions imposed by the Air Force on NTS overflights forbid overflight of the NTS with armed live ordnance, unless the ordnance is carried internally and bomb bay doors are confirmed closed (i.e., in a configuration where a drop cannot occur) (Irving 1997). Based on these restrictions and engineering judgement [Assumption 4.3.7] the conditional probability of an inadvertent drop of armed live ordnance is 0.01 (1.0E-02).

Note that since simulated ordnance cannot be "armed" to explode there is no branch-point for this parameter on the bottom branch of the event.

PARAMETER (g): Fraction of dropped live ordnance that explodes upon impact

It is conservatively assumed that any ordnance that is live (i.e. not simulated) and armed will explode upon impact [(g1)=1.0] [Assumption 4.3.10].

Only 10% (1.0E-01) of any unarmed ordnance dropped from an aircraft will explode upon striking the ground [Assumption 4.3.5]. This is based on the fact that ordnance is designed to explode only if armed [(g2)=0.1].

Note that since simulated ordnance cannot explode there is no branch-point for this parameter on the bottom branch of the event.

PARAMETER (h): Probability that dropped ordnance effects the WHB

The conditional probability of dropped ordnance affecting nuclear material inside the WHB is dependent upon whether or not the ordnance explodes on impact -- the probability of which is dependent on whether the ordnance is live (as opposed to simulated), and whether the ordnance, if live, is armed.

If the dropped ordnance does explode, the WHB is impacted if it is within the area effected by the explosion. Figure 7 shows that the effected area is equal to that of a circle with a radius that is half the diagonal of the WHB (assuming that the WHB is a square) area plus the radius of the exploded ordnance. The radii are calculated from the exploded ordnance area of effect (3.9 mi^2, see Assumption 4.3.4) and the WHB area (0.01 mi^2, see Section 4.1.4), respectively.

$$\pi\left[\sqrt{\frac{3.9\,\text{mi}^2}{\pi}}+\frac{1}{2}\sqrt{2\times\left(0.01\,\text{mi}^2\right)}\right]^2=4.41\,\text{mi}^2 \qquad \text{(Eq. 6)}$$

The conditional probability that the exploded ordnance lands close enough to impact the WHB is equal to the ratio of the area effected by the explosion and the six mile by six mile "box" in to which the ordnance is dropped [(h1)=1.23E-01].

$$(\text{h1})=\frac{4.41\,\text{mi}^2}{(6\,\text{miles})\times(6\,\text{miles})}=0.123 \qquad \text{(Eq. 7)}$$

For ordnance that does not explode upon impact, the conditional probability that ordnance dropped within the six mile by six mile "box" striking the WHB is equal to the ratio of the WHB footprint (0.01 mi^2, See Section 4.1.4) to the footprint of the six mile by six mile "box" (see Figure 7) [(h2)=2.78E-04].

$$(\text{h2})=\frac{\left(0.01\,\text{mi}^2\right)}{(6\,\text{miles})\times(6\,\text{miles})}=2.78\times10^{-4} \qquad \text{(Eq. 8)}$$

As shown by the event tree in Figure 6, the bounding frequency of dropped ordnance having an adverse effect on the WHB (1.95E-07/yr) is below the cut-off frequency of 1.0E-06/yr [see Section 4.2 and Assumption 4.3.9] (i.e., this event is BDBE).

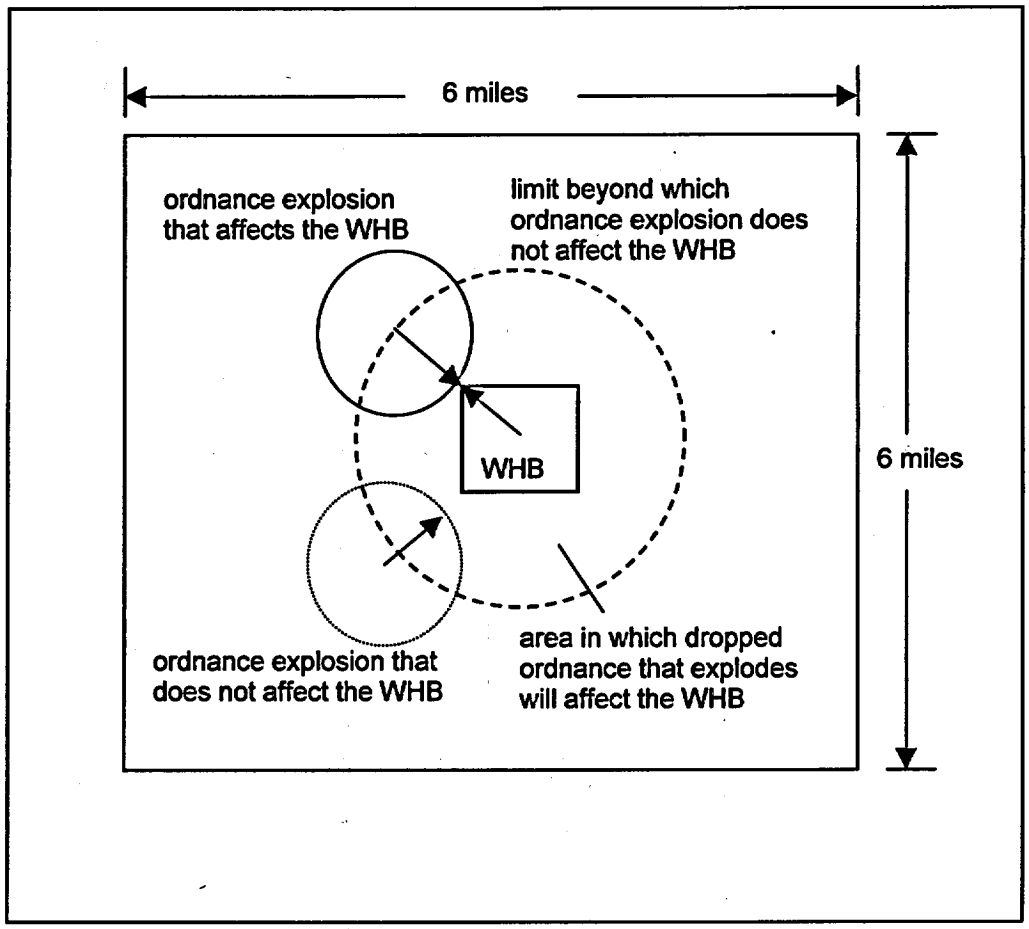

Figure 7. Diagram of Explosion Impact on WHB (not to scale)

7.6 TRANSPORTATION

Both US Highway 95 and roads on the NTS are used to haul significant quantities of explosives, munitions, propellants, and hazardous and radioactive materials. At its closest point, US Highway 95 is approximately 13 miles from the repository surface facilities (DMA 1995).

Most transportation of hazardous materials on the NTS occurs on roads located at least 15 miles from the repository surface facilities (DMA 1995). The Lathrop Wells Road which traverses the southeastern area of the proposed repository withdrawal area is used to support testing described in Section 7.2.1.4 in the X and Y tunnels. Assuming that all materials are transported onto the NTS via the Lathrop Wells Road for this testing, the transport vehicles will be approximately 10 miles from the repository surface facilities (see Figure 2 of this analysis and DMA (1995)).

There are no transportation railroad lines within 20 miles of the repository surface facilities (DMA 1995).

These transportation routes are all sufficiently distant from the MGR to preclude adverse effects of transportation accidents resulting from explosions, as demonstrated in Section 7.3. These distances are also sufficiently distant from the MGR to preclude adverse effects of fires associated with transportation accidents. In the case of toxic releases, the NRC's regulatory position for evaluating the habitability of a nuclear power plant control room is, as per NRC Regulatory Guide 1.78 (AEC 1974):

> *"Chemicals stored or situated at distances greater than five miles from the facility need not be considered because, if a release occurs at such a distance, atmospheric dispersion will dilute and disperse the incoming plume to such a degree that there should be sufficient time for the control room operators to take appropriate action. In addition, the probability of a plume remaining within a given section for a long period of time is quite small."*

7.7 EVALUATION OF APPLICATION OF NUREG-0800 PLANT-AFFECTING CRITERIA TO INDEPENDENT SPENT FUEL STORAGE INSTALLATIONS AND NUCLEAR POWER PLANTS

The Safety Analysis Report (SAR) Chapter 2.2 (Nearby Industrial, Transportation, and Military Facilities) of the following facilities were reviewed to see if there were any cases where detailed analyses were performed to assess facilities outside the NUREG-0800 five-mile evaluation limit.

- Idaho National Engineering Laboratory TMI-2 Independent Spent Fuel Storage Installation (INEL 1999)
- Rancho Seco Independent Spent Fuel Storage Installation (SMUD and PNC 1993)

No cases were found in any of the reviewed SARs in which specific facilities/events were evaluated with respect to the NUREG-0800 Plant-Affecting Criteria.

8. CONCLUSIONS

8.1 DISCUSSION OF RESULTS

The near-by industrial operations, transportation routes, and operations on the NTS and NAFR were found to have no events that would impact the MGR. The remote location of the MGR (5+ miles from NTS facilities, 13+ miles from near-by industrial operations and US 95, and 25+ miles from NAFR facilities) is the major reason none of the postulated events (e.g., explosions, fires, chemical releases) impact the MGR.

The calculation method from Regulatory Guide 1.91 was used to develop the screening criterion for potential explosion events. The calculation found that a TNT-equivalence of 2.02E+08 lbm TNT or less would meet the NRC's 1.0 psig "no damage" overpressure criterion.

Proposed activities at the NTS (e.g. Kistler Aerospace Corporation Launch Operations, Alternative Fuels, Compressed Natural Gas Facility, Heavy-Industrial Facility) were not evaluated due to a lack of information. When these operations are further developed and

information becomes available, an evaluation of potential accidents from these operations will need to be performed.

Objects or ordnance dropped from military sorties flying out of Nellis AFB were screened from consideration as DBEs. However, many of the parameters used to quantify the frequency of these events (e.g. fraction of flights that pass near the WHB, probability of objects/armament dropping from an aircraft, etc.) as BDBE have TBVs and/or TBDs associated with them.

The facility design will have to be evaluated to verify that the available strike area of nuclear material is less than 7.55% of the WHB footprint area (a requirement in the analysis to meet the BDBE criteria). If this condition is not met, then the analysis will have to be refined.

8.2 DISCUSSION OF TBDS/TBVS

The following TBDs/TBVs impact the results and conclusions of this analysis:

- TBV-690 -- Duration of Preclosure Period: The preclosure period (from beginning of repository operations to permanent closure) is assumed to be 100 years. If the preclosure period is longer than 100 years, the BDBE frequency limit will change.

- TBV-1034 -- Military Overflight Data for Nevada Test Site (NTS): Resolution of this TBV will qualify the number of military flights over the NTS per year and the number of those flights that pass within three miles of the MGR. If the qualified values for these parameters are greater than those currently used, the results of this analysis could change.

- TBV-1243 -- Frequency of object/armament drops from military aircraft flying in the Nellis Range Complex: Resolution of this TBV will qualify frequency of object/armament drops from aircraft that flying in the Nellis Range Complex. If the qualified values for these parameters are greater than those currently used, the results of this analysis could change.

- TBV-1372 -- Location of the Waste Handling Building: Resolution of this TBV will qualify the location of the WHB. If the qualified location of the WHB changes, the results of this analysis could change.

- TBD-420 -- Fraction of aircraft that fly near the MGR that are carrying live ordnance: Resolution of this TBV will qualify fraction of aircraft that fly near the MGR that are carrying live (as opposed to simulated) ordnance. If the qualified value for this parameter is greater than that currently used, the results of this analysis could change.

- TBD-419 -- Behavior of unarmed ordnance dropped from an aircraft: Resolution of this TBV will qualify the probability of unarmed ordnance dropped from an aircraft exploding upon impact. It will also qualify the area of effect of ordnance that is postulated to explode. If the qualified values for these parameters are greater than those currently used, the results of this analysis could change.

9. ATTACHMENTS

Section not used.

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
TECHNICAL CHANGE REQUEST

QA:
Page 1 of: 2

Section 1 - Change Description

1. TCR NO.:	1a. INTERIM TCR NO.: *(expedited changes only)*	
TI999-0195	N/A	

2. PRIORITY:	3. Q:	4. DOCUMENT ACTION:
☑ Routine ☐ Expedited	☑ Q ☐ Non-Q	☑ Initial Issue ☐ Revision ☐ Change ☐ Editorial

5. TCR TITLE:
Screening of Industrial/Military Activity-Initiated Accidents

6. ORIGINATOR: *Name*	*Signature*	*Date*	*Phone*	*Bldg./Room*
Donald A. Kalinich		9-02-99	295-4202	SUM 7/726B

7. DOCUMENTS REQUIRED TO IMPLEMENT CHANGE:

Document No. ANL-WHS-SE-000004 Rev./ICN 00/00

Title Industrial/Military Activity-Initiated Accident Screening Analysis

☐ Continuation Page

8. TCR JUSTIFICATION:
The Preliminary Hazard Assessment has identified Industrial/Military Activity-Initiated accidents as potential hazards to the Yucca Mountain site. This TCR is necessary to evaluate whether Industrial/Military Activity-Initiated accidents would have to be considered as MGR design basis events (DBEs).

☐ Continuation Page

9. TCR DESCRIPTION: *(Include sketch(es) as necessary)*
Potential accidents will be screened per NUREG-0800 based on their frequency and/or effect on the facility. Accidents with frequencies below 1.0E-06/yr will be screened-out as MGR DBEs. Accidents whose effects (e.g. heat, overpressure, etc.) can be shown to be unable to cause a radiological release from the MGR will be screened-out as MGR DBEs.

☐ Continuation Page

10. ATTACHMENTS:

☐ Continuation Page

11. RELATED CAUSE DOCUMENT(S): (TCR, CAR, NCR, DR, ETC.)	12. CAUSE CODE(s)
None	1. 25 2. 3. 4.

13. IMPACT IF CHANGE IS NOT MADE:
If Industrial/Military Activity-Initiated accidents are not screened-out they will have to be addressed as DBEs in the LA.

☐ Continuation Page

14. RESPONSIBLE SUPERVISOR: *Name*	*Signature*	*Date/Time*	*Phone*	*Bldg./Room*
Thomas D. Dunn		9/2 8:00	295-5993	SUM 7/712

Section 2 - Disposition of Expedited Changes

15. SME: *Name*	*Signature*	*Date*	*Concur?*
			☐ Yes ☐ No

16. OQA REPRESENTATIVE: *Name*	*Signature*	*Date*	*Concur?*
	N/A		☐ Yes ☐ No

17. RESPONSIBLE MANAGER: *Name*	*Signature*	*Date*	*Interim Approval?*
			☐ Yes ☐ No

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
TECHNICAL CHANGE REQUEST

QA:

18. TCR NO.:	19. INTERIM TCR NO.: *(expedited changes only)*	20. ACCEPTED BY CCB SECRETARY:
TI999-0195	N/A	1. Initials ____ Date/Time ____ 2. Initials ____ Date/Time 12-7-99 1110

Section 3 - Impact Analysis

21. DISPOSITION AUTHORITY: ☐ RM ☐ OM ☑ CCB

22. AUTHORIZATION TO CONTINUE: ☑ Yes ☐ No

Name	Signature	Date
J.R. Wilkins	J.R. Wilkins	12-7-99

23. CCB REQUIRED REVIEW LIST CHANGE: ☐ Yes ☑ No

24. TECHNICAL IMPACT(S): ☐ N/A

	Yes	No		Yes	No		Yes	No
1. Design	☐	☑	5. Interface	☐	☑	9. Scientific Investigation	☐	☑
2. QA	☐	☑	6. Regulatory/Environmental	☐	☑	10. Specialty Engineering	☐	☑
3. Safety/Health	☐	☑	7. Construction	☐	☑	11. Affected Technical Documents	☐	☑
4. OMT	☐	☑	8. Waste Isolation	☐	☑	12. Performance Assessment	☐	☑
						13. Other	☐	☐

☐ Continuation Page ____

25 COST IMPACT(S): ☐ N/A

	Yes	No	Increase	Decrease	Amount
1. TPC	☐	☑	☐	☐	$
2. TSLCC	☐	☑	☐	☐	$
3. Budget Baseline:	☐	☑	☐	☐	$

☐ Continuation Page ____

26. SCHEDULE IMPACT SCOPE:

☐ Level 0 ☐ Level 1 ☐ Level 2 ☐ Level 3 ☑ N/A

☐ Delay ☐ Improve ____ Days

☐ Continuation Page ____

27. OTHER IMPACTS: ☐ N/A

	Yes	No		Yes	No
1. Institutional	☐	☑	3. Programmatic	☐	☑
2. Contractual	☐	☑	4. Work Scope	☐	☑

28. OTHER IMPACTED DOCUMENTS: *(enter document no. & title)*

NA

☐ Continuation Page ____

Section 4 - Disposition

29.

FUNCTION	RECOMMENDED? Yes	No	N/A	PRINT NAME/INITIAL/DATE
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	N/A
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	

FUNCTION	RECOMMENDED? Yes	No	N/A	PRINT NAME/INITIAL/DATE
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	N/A
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	

30. DISPOSITION:

☑ Approve ☐ Approve with Conditions ☐ Disapprove ☐ Endorse ☐ Defer

*** After Making Disposition, Please Return TCR Package to the CCB Secretary ***

31. COMMENTS/IMPLEMENTING ACTIONS/RATIONALE FOR DISPOSITION OTHER THAN APPROVE:

N/A

32. ACTION ITEMS: ☐ Yes ☑ No ☐ N/A

☐ Continuation Page ____

	Name	Signature	Date
33. RESPONSIBLE MANAGER:			
34. RESPONSIBLE OPERATIONS MANAGER:	N/A		
35. CCB CHAIRPERSON:	Jean Younker	Jean Younker	12-7-99

Attachment 1 Preliminary Impact Analysis

The Industrial/Military Activity-Initiated Accident Screening Analysis to be developed will determine if any identified accidents will have to be evaluated as MGR design basis events (DBEs) in the accident analysis for the License Application.

The results of this analysis could impact the design of the MGR if unscreened accidents required design features to preclude them from exceeding the 10 CFR 63 dose limits.

The analysis does not affect the agreements or design solutions documented in any Interface Control Document.

Since this analysis is an initial issue no search of the DIRS database was performed.

Subject Matter Expert: 
Donald A. Kalinich

DETAILED IMPACT ANALYSIS

Summary

This impact analysis investigates a determination regarding the credibility of Industrial or Military activities initiating accidents in Monitored Geologic Repository (MGR) surface facilities that contain radioactive materials. This analysis is prepared in accordance with AP-3.4Q Rev 1/ICN 0. The *Industrial/Military Activity-Initiated Accident Screening Analysis* (ANL-WHS-SE-000004) listed on form AP-3.4Q.1, Block 7 evaluates activities and determines if their consequences could initiate an accident at the MGR or calculates their frequency of occurrence and compares it to the proposed DBE category criteria in the Revised Interim Guidance (Dyer 1999). The event screening analysis required under Section 102(f) of Dyer (1999) and performed in accordance with QAP-3-9, *Design Analysis*, has concluded that near-by Industrial/Military activities will not result in credible accidents at the MGR surface facilities.

A list of items (AP-3.4Q Rev 0/ICN 0, Attachment 5) to be addressed in this detailed analysis are provided following this summary. An evaluation of these items shows that the preparation of the analysis does not have any impacts on the 12 technical areas evaluated.

There are no schedule or cost impacts as a result of the military/industrial activity screening analysis.

There are no institutional impacts as a result of the military/industrial screening analysis. However, interactions with the Department of Energy (DOE) Nevada Operations Office (NVO) are required prior to FY 2001. The qualified basis for the number and location of military aircraft flights over the Nevada Test Site in the area of Yucca Mountain will involve data provided by NVO.

The evaluation of specific criteria is provided below.

Technical Impact(s)

1. DESIGN

a. Will implementation of the change have impacts on design organizations? If so, will more than one system or design organization be affected?

> No. The military/industrial activity screening analysis does not have an impact on design organizations. Designs developed to date assumed that any potential military/industrial activities will have no impact on the MGR.

b. Is the proposed change outside the bounds of the applicable design analyses?

> N/A. The military/industrial activity screening analysis is an initial issue.

If appropriate, will field changes require incorporation into impacted design documents?

N/A. No field changes are required as a result of the military/industrial activity screening analysis.

For field changes approved other than by revision to the impacted design document, are provisions included to incorporate these into the design document?

N/A. No field changes and hence no provisions are required as a result of the military/industrial activity screening analysis.

Will the change impact design support for licensing?

No. No design support for licensing will be impacted.

Will the change impact design support for Test Facility Operations?

No. The military/industrial activity screening analysis does not address Test Facility Operations.

For items that do not meet original design requirements and are dispositioned "use-as-is" or "repair," have the items been subjected to design control measures commensurate with those applied to the original design?

N/A.

2. QA

a. Will implementation of the change have an impact upon current QA procedures?

No. No impacts upon current QA procedures are identified in the military/industrial activity screening analysis.

b. If a significant change is necessary due to an incorrect design, will the design process, verification methods, and implementing documents require review and modification?

N/A. The military/industrial activity screening analysis was not initiated as a result of incorrect design.

c. For expedited changes, if the change is not approved or is different than originally approved, are there any adverse effects on work performed?

N/A. This activity is not an expedited change.

d. Will a DR and/or CAR be required for any conditions adverse to quality (e.g., significant design deficiencies)?

No. Conditions adverse to quality are not identified by this activity.

e. Will NCRs (per YAP-15.1Q, *Control of Nonconformances*) be required for any (constructed or partially constructed) nonconforming system, structure, or component?

No. No nonconforming SSCs are identified by this activity.

f. Will this proposed change cause the need for new QA procedures, surveillance, or audits? Do we need to audit vendors who manufacture these needed items?

No. No new QA procedures, surveillance, or audits are required. The question on auditing vendor is not applicable because no needed items are identified in the military/industrial screening analysis.

3. SAFETY/HEALTH

a. Will implementation of the change have a bearing on radiological or nonradiological considerations?

No. The military/industrial activity screening analysis has no bearing on current radiological or nonradiological considerations.

b. Are there any specific Occupational Safety and Health Administration regulations that need to be monitored?

No. The military/industrial activity screening analysis does not affect any OSHA regulations or requirements.

c. Are current procedures and plans regarding personnel safety and health, safeguards and security, and facilities affected by this change?

No. Current procedures and plans regarding personnel safety and health, safeguards and security, and facilities are not affected.

4. OPERATIONS, MAINTENANCE, AND TESTING

a. Will implementation of the change affect operations, maintenance, or testing procedures?

No. Operations, maintenance, or testing procedures are not affected.

b. Does OQA monitor activities as a result of implementation?

No. The military/industrial activity screening analysis does not result in additional activities requiring OQA monitoring.

c. Is there a need for more manpower and/or specialists?

No. The military/industrial activity screening analysis does not require additional manpower and/or specialists.

d. Is there a need for new and/or specialized training?

No. There is no need for new and/or specialized training.

5. INTERFACE

Will implementation of the change have an impact upon any interface specifications or Interface Control Documents generated per NLP-3-34?

No. The military/industrial activity screening analysis has no impact on any interface specifications or Interface Control Documents generated per NLP-3-34.

6. REGULATORY/ENVIRONMENTAL

Will implementation of the change have an impact upon licensing and/or environmental requirements?

No. The activity does not have an impact licensing and/or environmental requirements.

Will licensing strategies or commitments have to be altered or developed as a result of this proposed change implementation?

No. Current licensing strategies or commitments will not be altered as a result of the military/industrial activity screening analysis.

7. CONSTRUCTION

Will implementation of the change affect construction procedures or construction in the field?

No. No current construction activities are affected by the military/industrial activity screening analysis.

Will schedules or costs be affected?

No. No current schedules or costs are affected by the military/industrial activity screening analysis.

Will procurement staff need long lead time notifications in order to carry out their tasks?

No. No current procurement activities are affected by the military/industrial activity

screening analysis.

Will QA procedures or quality control procedures change?

No. No current QA procedures or quality control procedures are affected by the military/industrial activity screening analysis.

Are the correct contractual commitments in place or do they need to be renegotiated?

No. No renegotiation is required.

8. WASTE ISOLATION

Will implementation of the change affect the isolation of radioactive waste for both natural barriers or engineered barriers?

No. The isolation of radioactive waste for both natural barriers and engineered barriers is not affected by the military/industrial activity screening analysis.

9. SCIENTIFIC INVESTIGATION

Will implementation of the change have an impact upon any ongoing scientific investigation either onsite or offsite (e.g., national laboratories, U.S. Geological Survey, Universities)

No. The military/industrial activity screening analysis has no effect on ongoing scientific investigations.

Will scientific assumptions be affected?

No. No scientific assumptions are affected.

Do models need to be developed or revised? Will scientific procedures need to be changed or developed?

No. No scientific models or procedures are affected.

10. SPECIALTY ENGINEERING

Will implementation of the change affect the specialty engineering plans and procedures (i.e., relating to human factors, engineering, integrated logistics support, reliability/availability/ maintainability, and system safety)?

No. The military/industrial activity screening analysis will not affect specialty engineering plans and procedures.

11. AFFECTED TECHNICAL DOCUMENTS

Will implementation of the change require a change to other documents?

No. The military/industrial activity screening analysis does not require a change to other documents. All other documents assumed that this event was not credible and this analysis provides the analytical basis for this assumption.

For document changes and revisions, identify documents affected by the change in accordance with AP-3.17Q, (if not already identified during document development and review).

N/A. The military/industrial activity screening analysis is an initial issue.

12. PERFORMANCE ASSESSMENT

Will implementation of the change have impacts for the performance assessment organization?

No. The military/industrial activity screening analysis has no effect on performance assessment.

Is the change within the bounds of applicable performance assessment models and assumptions?

N/A.

Are there any other considerations relating to technical impacts?

No.

COST IMPACT(S)

With the assistance of the Project Control Organization, consider the following for possible cost impacts:

1. Total Project Cost (TPC) - (TPC is only considered if change exceeds Level 3 approval authority). Does implementation of this TCR have an impact upon TPC?

No. No increase cost to the TPC. All FY 2000 through FY 2003 development work associated with this analysis is contained within the planning submittal to DOE.

2. TSLCC - Will implementation of the change have an impact upon TSLCC? Does the proposed change affect the current TSLCC models?

No. No impact to TSLCC. The TSLCC estimate is based on the MGR cost estimate

contained in the Viability Assessment Report. The military/industrial activity screening analysis has no change to the Viability Assessment design basis (technical basis for the MGR cost estimate).

3. Budget Baseline - Will implementation of the change have an impact upon the Annual Work Plan contractor budget baseline at the control account level?

No. No impact to the budget baseline. All FY 2000 through 2003 development work associated with this analysis is contained within the planning submittal to DOE.

SCHEDULE IMPACT(S)

With the assistance of the Project Control Organization, identify schedule impacts.

None. Based on a review of the Integrated Project Schedule (IPS) and the Project Summary Schedule (PSS) there are no impacts to Level 0, 1, 2, 3, or 4 milestones or schedule activities.

OTHER IMPACT(S)

Consider the following areas for other impacts associated with the change:

1. Institutional - Will implementation of the change have an impact upon agreements, laws, codes, and standards that are currently valid for such external bodies as Congress, Indian tribes, state legislative bodies, or other federal/state agencies/departments/commissions?

No. There are no institutional impacts as a result of the military/industrial activity screening analysis. The analysis is based on an existing classified memorandum of understanding (MOU) between the U.S. Air Force and the Department of Energy (DOE) Nevada Operations Office (NVO). The analysis is also based on unqualified data provided by Nellis Air Force Base staff. The analysis identifies two "to be verified" (TBV) assumptions that require interactions with DOE/NVO. These interactions are needed to provide a qualified basis for the number and location of military aircraft flights over the Nevada Test Site near Yucca Mountain. The TBVs state that QA qualified overflight data will be provided by NVO during a 12-month period prior to verification of the fabrication, procurement, and construction design in 2002.

2. Contractual - Will implementation of the change require the M&O contract to be amended?

No. There are no contractural impacts as a result of the military/industrial activity screening analysis.

3. Programmatic - Will implementation of the change require management plans within the Office of Civilian Radioactive Waste Management Program?

No. There are no programmatic impacts as a result of the military/industrial activity screening analysis.

4. Work Scope - Will implementation of the change affect the baseline work scope for the individual projects activities?

No. There are no work scope impacts as a result of the military/industrial activity screening analysis.

References

Dyer 1999. *Revised Interim Guidance Pending Issuance of New U.S. Nuclear Regulatory Commission (NRC) Regulations for Yucca Mountain, Nevada.* Letter from J. Russell Dyer (DOE) to D. R. Wilkins (YMP), September 3, 1999, OL&RC: SB-1714, with enclosure, "Interim Guidance Pending Issuance of New NRC Regulations for Yucca Mountain (Revision 01)" ACC: MOL.19990910.0079.

Subject Matter Expert: Donald A. Kalinich for

11-15-99
Date