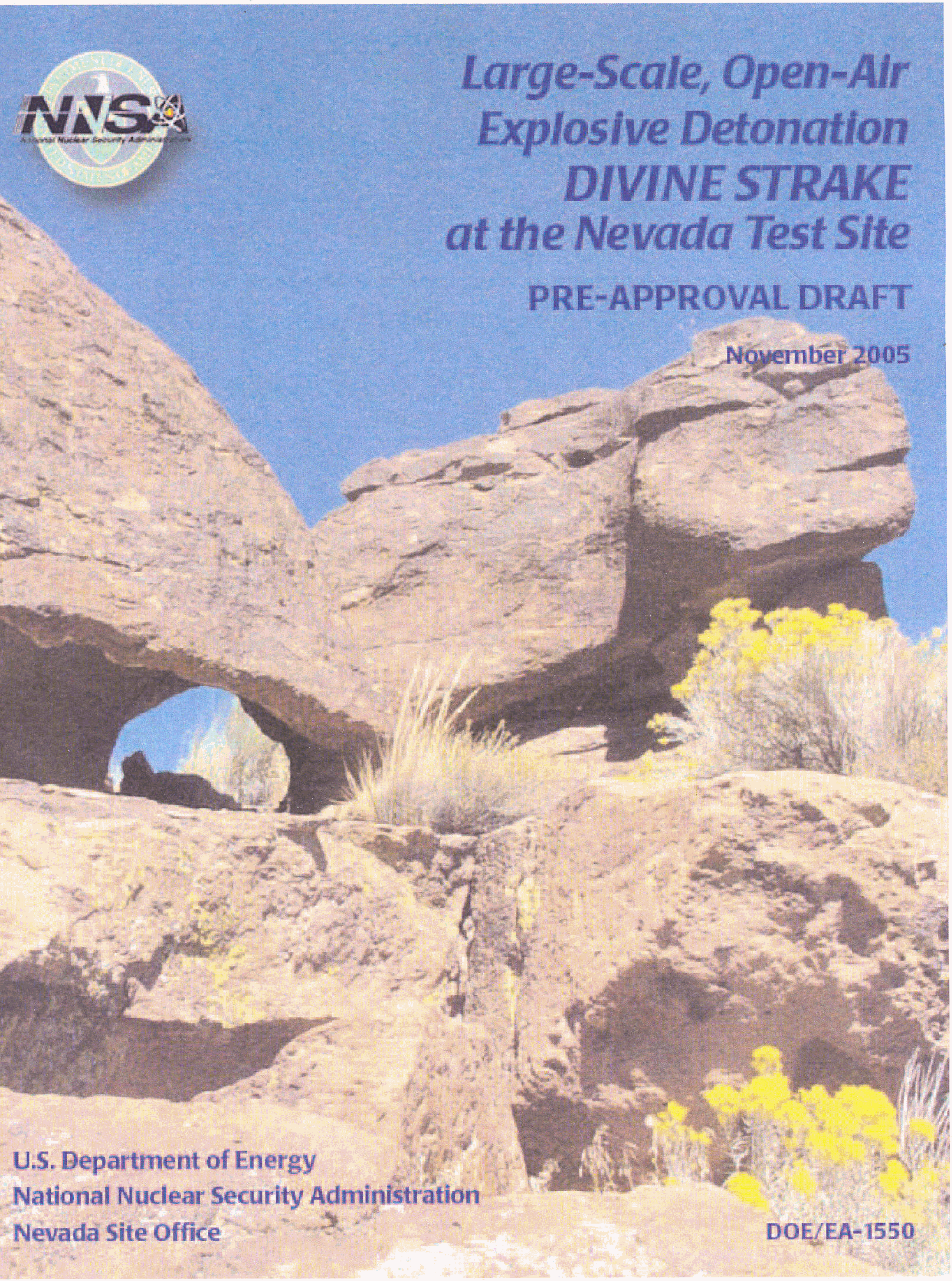

Large-Scale, Open-Air Explosive Detonation DIVINE STRAKE at the Nevada Test Site

PRE-APPROVAL DRAFT

November 2005

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office

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Pre-Approval Draft Environmental Assessment

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Prepared for
Department of Energy
National Nuclear Security Administration
Nevada Site Office

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DEFINITION OF ACRONYMS AND ABBREVIATIONS

Term	Definition
%	percent
°C	Celsius
°F	Fahrenheit
µCi/mL	microcurie per milliliter
$\mu g/m^3$	micrograms per cubic meter
ACGIH	American Conference of Industrial Hygienists
ACHP	Advisory Council on Historic Preservation
ACTD	Advanced Concepts and Technology Demonstration
AMS	aerial measuring system
ANFO	ammonium nitrate fuel oil
ANS	American Nuclear Society
ANSI	American National Standard
APE	area of potential effect
AQOP	Air Quality Operating permit
ARL/SORD	Air Resources Laboratory, Special Operations and Research Division
BAPC	State of Nevada Bureau of Air Pollution Control
BLM	Bureau of Land Management
BN	Bechtel Nevada
CAA	Clean Air Act
$CaCO^3$	calcium carbonate
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CG	cloud-to-ground lightning
CH^4	methane
cm	centimeter
CO	carbon monoxide
CO_2	carbon dioxide
CORRTEX	Continuous Reflectometry for Radius versus Time Experiments
DB	decibel
DBA	A-weighted decibel
dBpk	peak sound level in decibels
DOD	U.S. Department of Defense
DOE	United States Department of Energy
DTRA	Defense Threat Reduction Agency
EBW	exploding bridgewire
EHS	extremely hazardous substance
EIS	Environmental Impact Statement
EMSs	Environmental Management Systems

EODU	explosive ordnance disposal unit
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ER	environmental restoration
ES&H	environment, safety and health
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
Ft	foot/feet
GZM	generalized zonal method
H20	water
HAPs	hazardous air pollutants
HDBT	hardened and deeply buried targets
HMMP	Hazardous Materials Management Plan
HIS	hazardous substance inventory
HTO	tritiated water
HUD	United States Department of Housing
HW	hazardous waste
HWSU	hazardous waste storage unit
Hz	Hertz
in	inch
ISMS	Integrated Safety Management System
km^2	square kilometer
kPa	kilopascal
m	meter
m/s	meters per second
MEDA	Meteorological Data Acquisition
mi	mile
mi^2	square mile
MOU	Memorandum of Understanding
mph	miles per hour
mrem/yr	millirem per year: One commonly used measurement of radiation dose.
MW	moment magnitude
N^2	Nitrogen
NAAQS	National Ambient Air Quality Standards
NAC	Nevada Administrative Code
NAFB	Nellis Air Force Base
NDEP	Nevada Division of Environmental Protection
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emission Standards for Hazardous Air Pollutants
NNSA	National Nuclear Security Administration
NOx	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NPTEC	Nonproliferation Test and Evaluation Complex

NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NTTR	Nevada Test and Training Range
NTS	Nevada Test Site
OCC	Operational Command and Control
ODS	ozone-depleting substances
OEMP	Operational Environmental Management Plan
OSHA	Occupational Safety and Health Act
PELs	Permissible exposure limits
PM-10	particulate matter
PNOC	particulates not otherwise classified
PNOR	particulates not otherwise regulated
ppe	Personal protective equipment
ppm	parts per million
PSD	Prevention of Significant Deterioration
PTS	permanent threshold shift
psi	pounds per square inch
RCRA	Resource Conservation and Recovery Act
RDT&E	research, development, testing, and evaluation
ROD	Record of Decision
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SNVF	Southwest Nevada Volcanic Field
SO2	Sulfur dioxide
SOPs	standard operating procedures
SOX	sulfur oxides
SPL	sound pressure level
TSCA	Toxic Substances Control Act
TTS	temporary threshold shift
TLV	threshold limit value
U.S.C.	United States Code
unwtd-pk	unweighted peak
USGS	U.S. Geological Survey
USSTRATCOM	U.S. Strategic Command
UXO	unexploded ordnance

1.0 PURPOSE AND NEED FOR ACTION

This Environmental Assessment (EA) documents an analysis of the potential effects of a proposal by the Defense Threat Reduction Agency (DTRA), an NNSA customer, to conduct a single large-scale, open-air high explosive detonation on an existing tunnel complex in Area 16 at the Nevada Test Site (NTS). The Nevada Test Site is administered by the U.S. Department of Energy (DOE) National Nuclear Security Administration Nevada Site Office (NNSA/NSO). As such, NNSA/NSO has the responsibility to ensure that any actions on the NTS receive appropriate National Environmental Policy Act (NEPA) review and documentation. The analysis documented in this EA has been conducted in compliance with NEPA and the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA as found in 40 Code of Federal Regulations (CFR) Parts 1500-1508 and DOE's NEPA implementing procedures published in 10 CFR 1021. The purpose of an EA is to provide the NNSA decision-makers with sufficient evidence and analysis to determine whether to prepare an Environmental Impact Statement (EIS) or issue a Finding of No Significant Impact (FONSI). Based on the analysis contained in this EA, NNSA will either issue a FONSI and proceed with the selected action or prepare an EIS.

1.1 Introduction and Background

This chapter provides the objectives of this EA, background information that will aid the reader in understanding the purpose and need for the Proposed Action, the Purpose and Need statement, and the public involvement process.

The objectives of the EA are to:

- Describe the purpose and need for the Proposed Action
- Describe the Proposed Action and reasonable alternatives that satisfy the purpose and need
- Describe baseline environmental conditions at NTS
- Analyze the potential direct, indirect, and cumulative effects to the existing environment from implementation of the Proposed Action or an alternative
- Compare the effects of the Proposed Action with those of the other alternatives, including the No-Action alternative

Additionally, the EA process provides environmental information that can be used to develop mitigation measures, if necessary, to avoid or minimize adverse effects on the quality of human environment and natural ecosystems should the proposed detonation take place at the NTS. Monitoring requirements to verify that impacts to the environment would be minimal are also identified. Ultimately, the goal of NEPA is to provide adequate information to NNSA so that its decisions are based on an understanding of environmental consequences and will, therefore, include actions necessary to protect, restore, or enhance the environment.

The NTS occupies approximately 1,375 square miles (3,560 square kilometers [km^2]) or approximately 880,000 acres (356,000 hectares) in southern Nevada (Figure 1-1), making it one of the largest restricted-access areas in the United States. This remote site is surrounded on three sides by about 6,500 square miles (16,800 km^2) or 2.9 million acres (1.2 million hectares) of additional land withdrawn from the public domain for the Nevada Test and Training Range, (an area for armament and high hazard testing; aerial gunnery, rocketry, electronic warfare, and tactical maneuvering training; and equipment and tactics development and training) and the Desert National Wildlife Refuge (with the airspace co-shared with the Nellis Air Force Range). The NTS is located approximately 65 miles (105 kilometers [km]) northwest of Las Vegas. Numerous offices, laboratories, and support buildings are spread across the NTS. NTS areas and key facilities are shown on Figure 1-2.

The NTS is host to programs from the NNSA, its laboratories, and other Federal agencies such as the Department of Defense (DoD) to develop and apply technical solutions to national security and counterterrorism requirements. Specialties include nuclear materials science, surveillance and technology development, remote sensing science and technology, counterterrorism sciences and technology, data and communications technologies, and diagnostics systems development and operation. Hard/Buried/Critical Target Detection, Defeat, and Defeat Assessment are a type of research, development, test, and evaluation (RDT&E) activity that occurs at the NTS. This activity includes RDT&E of methods, equipment, technologies, and weapons systems, etc. to detect, defeat, and neutralize hard/buried/critical targets.

Figure 1-1.
NTS Site Location
Sources: EA for Activities Using Biological Simulants and Releases of Chemicals at the Nevada Test Site

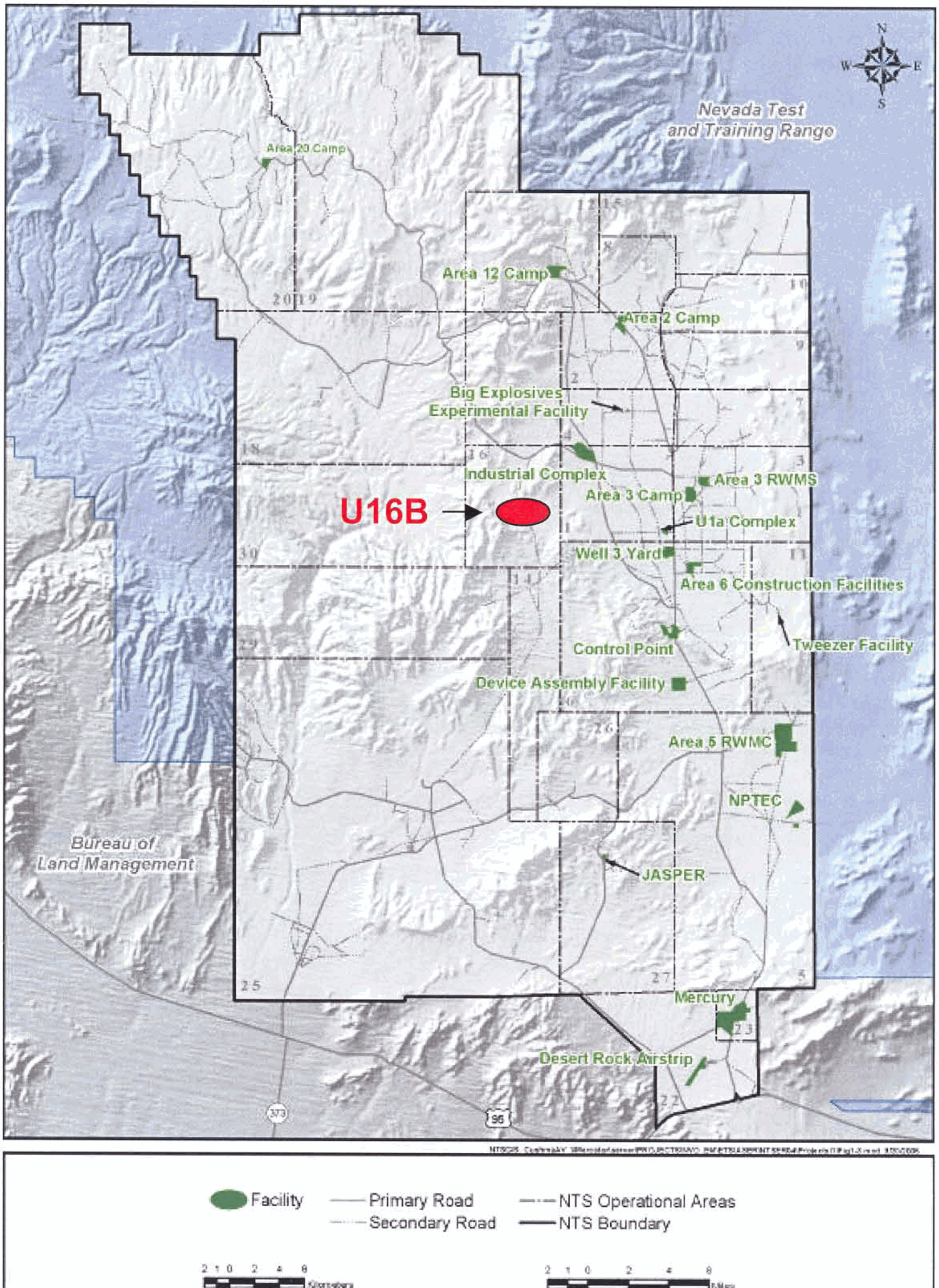


Figure 1-2 NTS Areas and Facilities

1.2 Purpose and Need

Potential adversaries of the United States are increasingly using tunnels and underground bunkers, collectively designated hardened and deeply buried targets (HDBTs), as part of their defensive strategies. These types of facilities are used for command and control, storage of munitions (including weapons of mass destruction, and long-range missiles), modern air defenses, a variety of tactical weapons, wartime refuge for national leaders, and a multitude of other offensive and defensive military uses. In order to deny an adversary the ability to use these capabilities against its forces, the U.S. military must have the ability to defeat HDBTs. To defeat these facilities and the assets they protect, the United States must have the capability to find, detect, characterize the potential targets, and then to plan, attack, and assess the results of such attacks.

The Proposed Action is a key RDT&E component of the DoD Global Strike concept of operations. In September 2001, the DoD's Congressionally-mandated Quadrennial Defense Review report established a shift in defense planning from a "threat-based" to a "capability-based" model, advocating a transformation of DoD planning to achieve critical operational capabilities. The Congressionally-directed Nuclear Posture Review in December 2001 further outlined the foundation for the U.S. nuclear strategic posture for the 21st Century. In addition the January, 2001, DoD Capstone Requirements Document for Hard and Deeply Buried Targets established a new paradigm for addressing strategic targets to include the Global Strike concept.

In response to the requirements outlined in the documents described above, the President of the United States directed the Secretary of Defense in May 2002 to develop the capability to be able to hold all potential adversarial targets at risk, as an integral part of the nation's policy of deterrence. This was to become a DoD extension to the 26 June 2001 U.S. Air Force's Global Strike Force concept to quickly respond to threats anywhere in the world with conventional tactics and munitions. In May 2002 the Secretary of Defense directed the military services to develop Concept of Operations Plans to implement the Global Strike concept with United States Strategic Command (USSTRATCOM) as the overall coordination group.

Per a Presidential Decision Directive issued in Summer 2004, the USSTRATCOM was directed to extend Global Strike to counter all HDBTs to include both tactical and strategic adversarial targets. The Proposed Action is an integral part of the Global Strike concept in support of the national defense.

Through the DoD Advanced Concepts and Technology Demonstration Program (ACTD), DTRA is studying methods and associated technologies to defeat HDBTs. The Proposed Action is an integral part of the Congressionally authorized DoD FY2002 - Initiated Tunnel Target Defeat ACTD.

In order to obtain vital information regarding the methodologies and technologies developed under the Tunnel Defeat ACTD, DTRA proposes to conduct a single large-scale, open-air high explosive detonation above an existing tunnel complex. Such a project would require extensive diagnostic and monitoring capability to ensure recovery of high quality data. The desired results of a project include: (1) Improve the scientific understanding of weapons effectiveness versus collateral effects; (2) reduce geotechnical targeting uncertainties; (3) obtain a relevant full-scale database for code validations; and (4) provide test beds to develop improved weaponeering algorithms.

As the Federal agency charged with operating and managing NTS, U.S. DOE in 1996 published a *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (NTS EIS) (DOE, 1996). Although the NTS EIS addressed a very broad range of potential activities at the NTS, it did not address the conduct of large-scale open-air explosive detonations, except at the Big Explosive Experimental Facility. In order to successfully conduct a project to obtain the desired results, DTRA requires a site or facility that accurately simulates a HDBT. Tunnel U16b at the NTS provides an existing facility that fulfills the needs of DTRA. The U16b tunnel is in a geological setting that simulates the characteristics of important potential, global adversarial targets. This U16b site was carefully chosen after reviewing the geological properties of a number of other locations on U.S. Government range complexes and other controlled land areas. For this reason, DTRA requested approval by NNSA to conduct an open-air high explosive detonation at the U16b Tunnel. Therefore, NNSA prepared this environmental assessment, to determine the potential impacts of the proposed project.

1.3 Related NEPA Documentation and Actions

For the DIVINE STRAKE EA, related NEPA actions include the 1996 NTS EIS, and the 2002 Supplement Analysis for the NTS EIS. Related actions include similar DTRA projects at the White Sands Missile Range in New Mexico and other locations.

Related NEPA Documentation – In 1996, DOE published the *Final EIS for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE, 1996) covering activities occurring at the NTS, or anticipated in the near future. The Record of Decision (ROD) for the NTS EIS stated: "The DOE Nevada Operations Office Work for Others Program will continue to be an important aspect of Nevada Test Site related activities. These ongoing activities primarily involved the Department of Defense, the Defense Special Weapons Agency (now Defense Threat Reduction Agency [DTRA]), and other Federal agencies. The primary focus of these activities is treaty verification, nonproliferation, counterproliferation, demilitarization, and defense-related research and development." Large-scale, open-air explosive detonations were not specifically addressed.

In accordance with DOE NEPA Implementing Procedures (10 CFR 1021), NNSA conducted a 5-year review of the NTS EIS. The review was documented in the *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and off-Site Locations in the State of Nevada* (DOE, 2002). As a result of the analysis, NNSA determined that as of 2002, the NTS EIS continued to adequately address the environmental impacts of activities being conducted and anticipated at the NTS.

Related Actions – At the White Sands Missile Range in New Mexico, DTRA and its predecessors have conducted a series of large-scale Ammonium Nitrate and Fuel Oil (ANFO) detonations. These include:

- Pre-Dice Throw – 120 tons (109 metric tons) in 1977
- Dice Throw – 620 tons (562 metric tons) in 1979
- Distant Runner – 2,250 tons (2,041 metric tons) in 1981
- Mill Race – 620 tons (562 metric tons) in 1982
- Pre-Direct Course – 24 tons (22 metric tons) in 1982
- Direct Course – 609 tons (552 metric tons) in 1983
- Minor Scale – 4,744 tons (4,304 metric tons) in 1985

- Misty Picture – 4,685 tons (4,250 metric tons) in 1987
- Misers Gold – 2,445 tons (2,218 metric tons) in 1989
- Distant Image – 2,440 tons (2,214 metric tons) in 1991

Other detonations have included an underground detonation of 1,410 tons (1,280 metric tons) of ANFO-emulsion (Non-Proliferation Experiment) in the U12n tunnel at the NTS in 1993, and seven 120-ton (109-metric ton) detonations at Misers Bluff at Planet Ranch in Arizona (near Lake Havasu, Arizona) in 1978. Experience obtained from the detonations listed above was used to develop the plans for the proposed large-scale, open-air explosive detonation, DIVINE STRAKE, at the Nevada Test Site.

1.4 Public Involvement

A large-scale, open-air detonation such as DIVINE STRAKE is consistent with the mission of the NTS, and the remote location of the NTS ensures that impacts to the public would be minimal (see Chapter 4). Public Affairs announcements would notify the public prior to the detonation. Based on its decision after reviewing this EA, NNSA will either issue a FONSI or publish a Notice of Intent to prepare an EIS.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action, the No-Action Alternative, and alternatives eliminated from further analysis. Section 2.1 provides an introduction to the alternatives. Section 2.2 describes DTRA and NNSA's Proposed Action of the Large-Scale, Open-Air Explosive Detonation, known as DIVINE STRAKE, at the Nevada Test Site. The No-Action Alternative is described in Section 2.3. Section 2.4 discusses alternatives considered, but eliminated from further analysis.

2.1 Introduction

Two alternatives are analyzed in detail in this EA: the Proposed Action and the No-Action Alternative. The Proposed Action of the Large-Scale, Open-Air Explosive Detonation, DIVINE STRAKE, at the Nevada Test Site is designed to meet the purpose and need for action described in Chapter 1. NTS's large size, remote location, and extensive infrastructure offer a practical technology development site for the Proposed Action. The No-Action Alternative would not meet the purpose and need as described in Chapter 1, but it would maintain NTS operations as they currently exist. Alternatives eliminated from further analysis are also included in this chapter and are briefly summarized.

Information in this chapter, when combined with the affected environment description in Chapter 3 and the environmental impact analysis in Chapter 4, meets the EA goal of informing decision-makers and the public about NTS operations and potential impacts associated with the DIVINE STRAKE experiment.

2.2 Proposed Action – Large-Scale, Open-Air Explosive Detonation, DIVINE STRAKE, at the Nevada Test Site

NNSA proposes to provide a test bed to be used by DTRA to conduct a single large-scale, open-air explosive detonation in Area 16 of the NTS. The proposed detonation, known as DIVINE STRAKE, would occur tentatively in mid-2006 above the existing U16b Tunnel Complex. DIVINE STRAKE would supply a relevant full-scale simulation demonstration with a tunnel complex to create a post-test underground environment sustaining light to severe damage. Figure 2-1 shows an aerial view of U16b tunnel complex and the surrounding terrain of Area 16 at the NTS.

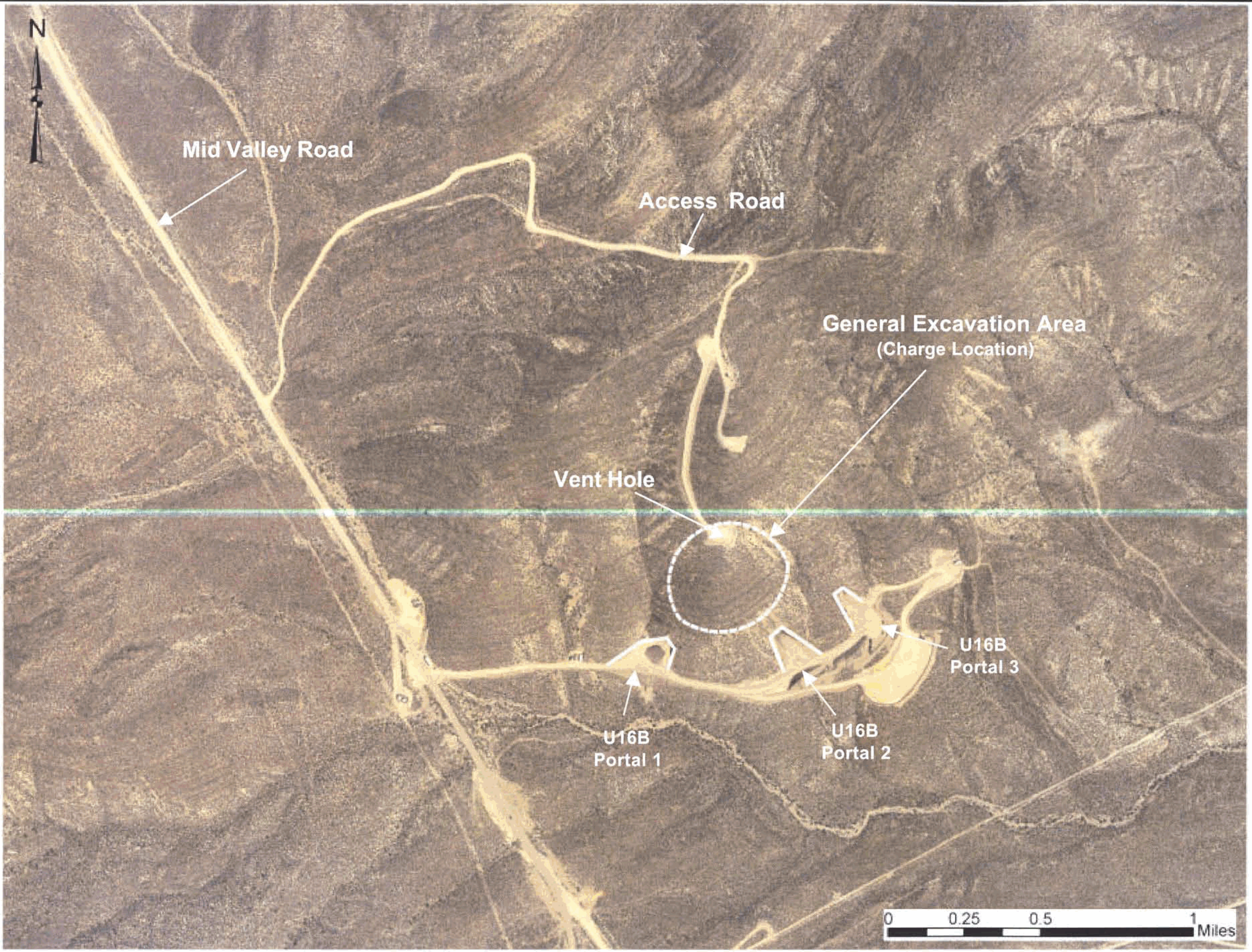


Figure 2-1.
Aerial view of U16b tunnel complex and surrounding terrain at Area 16
Sources: EA for Activities Using Biological Simulants and Releases of Chemicals at the Nevada Test Site

DIVINE STRAKE would detonate up to 700-tons (635-metric tons) of heavy ammonium nitrate fuel oil-emulsion (also known as heavy ANFO), a blasting agent, emplaced in a charge hole about 32 feet (9.8 meters [m]) in diameter and 36 feet (11 m) deep, located at the surface above U16b tunnel (Figure 2-2). In addition to the ANFO, up to 300 pounds (136 kilograms) of C-4 explosive would be used to initiate detonation. The bottom of the charge hole would be about 99 feet (30 m) above the back of the tunnel (Figure 2-3).

Site preparation would include: 1) improvement of an existing dirt road leading to the hilltop above the tunnel, 2) excavation of the emplacement (or charge) hole above the tunnel complex and a three-point turnaround area for bulk delivery trucks, and 3) drilling holes in the back, floor and ribs of the tunnel for installation of instruments and gages for recording the effect of the detonation. Instrumentation bunkers would be constructed and located in previously disturbed areas near the portal of the tunnel. Several accelerometers would be placed in and around the test bed to record ground motion. High-speed cameras would be installed to record portal and underground damage.

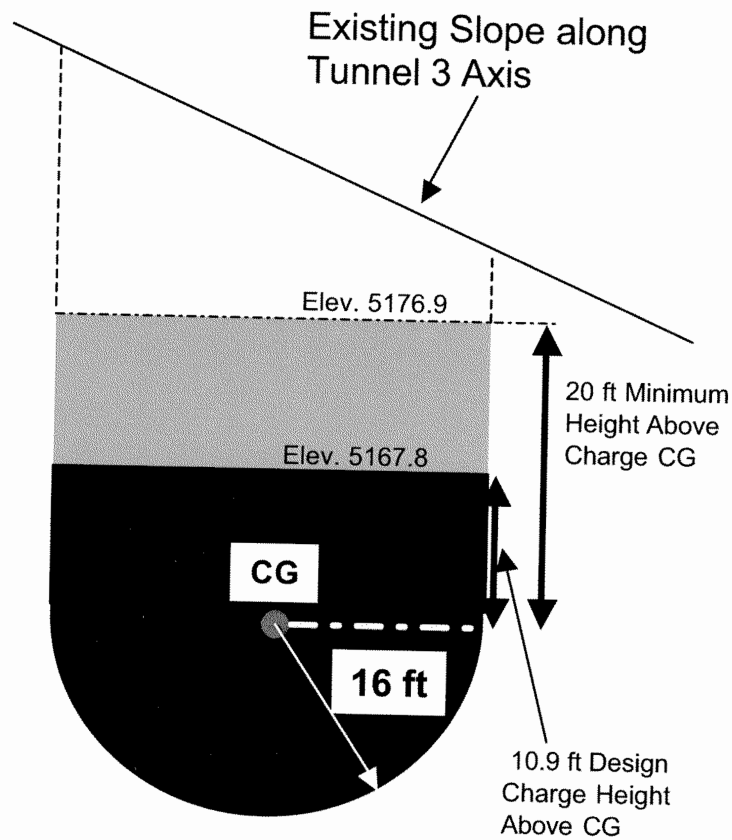
DTRA would provide site characterization data defining *in-situ* properties and 3-D variations within the test bed, and would provide test data defining charge source performance, free-field ground motions and asymmetries, tunnel near-field environment and response data. The geotechnical site characterization would fill an important targeting gap, not only for DIVINE STRAKE, but also for other HDBT testing programs. This test would support the evaluation and validation of attack planning tools and capabilities, including fast-running ground shock and tunnel damage models along with first-principles target response and damage calculations.

Additional experiments may be included to supplement data obtained from the detonation. The following are examples of potential experiments:

- A reinforced concrete structure simulating a stairwell – This structure would be built on the lower pad at the U16b tunnel. It would have an 18.5 feet (5.6 m) by 18.5 feet (5.6 m) concrete foundation, and would be 26.5 feet (8.1 m) tall, with a 16 feet by 16 feet (4.9 m by 4.9 m) stairwell with a hatch installed at the base. The pressure and acceleration instrumentation would be included on and near the structure, and cameras would record structural response. Depending upon the amount of damage, the structure could be left

DIVINE STRAKE Charge Configuration

- **Basic Excavation Design:**
  - 32-ft diameter circular excavation, with hemispherical bottom
  - Hemisphere radius is 16 ft
  - Minimum hole height above CG is 20 ft
  - Surface excavation above Elev. 5176.9 ft above sea level (asl)
- **Design Charge Weight is 700 tons (English) ANFO Emulsion (593 tons TNT eq)**



Charge CG elevation = 5156.9 ft
CG = center of gravity

Figure 2-2.
Divine Strake Charge Hole
Sources: Detonation Phenomena Predictions

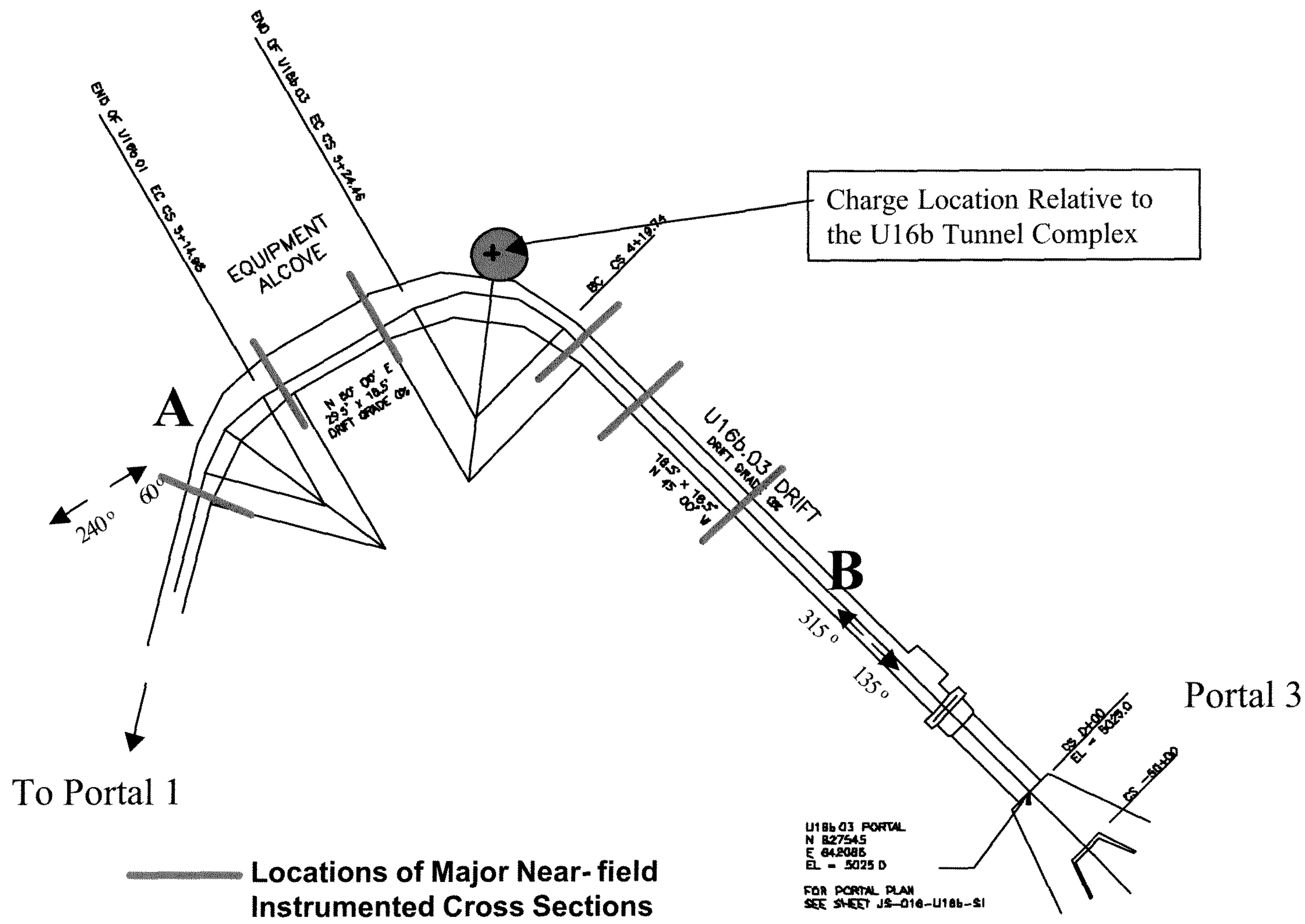


Figure 2-3.
Divine Strake Tunnel layout
Sources: Detonation Phenomena Predictions

in place after DIVINE STRAKE for later experiments. However, the current plan is to dismantle and dispose of the structure in an appropriate NTS landfill after the detonation.

- Sensor collections with a generator in Portal 1 and small fans in the back room area. The intent is to be able to see pre-detonation, detonation, and post detonation images.
- Computer fragility studies – Computers would be placed in Portal 3 along with additional surface mounted accelerometers and cameras to observe the fragility of the computers. Protective shelters may be provided for one or more of the computers for comparison purposes.
- Ejecta studies – Ejecta studies would be conducted to characterize how the ejecta is "shot out" by the detonation and how far it travels. The studies would evaluate both large debris (softball size) and fines. Collection panels (possibly of tarp) would be placed at various distances from the charge hole to collect debris. The large debris would be evaluated for distance traveled, size, condition, and other parameters. For the fines, powdered dyes (tracers) would be placed on the ground around the crater site, most likely on one quadrant on the northern side. The powder would be lofted with the dust cloud during detonation. The fines would be evaluated for travel distance, size distribution, and dispersion.

2.2.1 Construction and Site Plan

DIVINE STRAKE-related construction at the U16b tunnel site would include an extension of an existing road by about 200 feet (61 m) to reach the location of the ANFO emplacement (or charge) hole, excavation of the ANFO charge hole (including a loading pad and truck turnaround area), instrument bunkers, large diameter (6-inch [15 centimeters (cm)]) core drilling, instrumentation borehole drilling and instrument placement, and grout emplacement for instrumentation holes. Existing laydown yards at the U16b tunnel complex would be used as construction and material staging areas. No major roadway improvements on the NTS are necessary to accommodate truck traffic.

Normal delivery of materials would occur in accordance with existing U16b operations using existing access roads (Pahute Mesa Road and Mid-Valley Road). Material delivery during construction would include:

- Light fleet traffic of approximately 15 vehicles per day

- Water provided daily by truck for personnel consumption, dust suppression, and construction, as needed
- Sanitary wastes collected in portable toilets, serviced twice weekly
- Fuel for construction equipment delivered bi-weekly
- Delivery of approximately 200 feet (61 m) of concrete pre-cast culvert section weighing 12 tons (11 metric tons) each (the concrete culvert would be delivered in 5-foot (1.5-m) sections, with an inside diameter of 12 feet by 12 feet (3.7 m by 3.7 m)
- Excavation equipment delivered by flatbed
- Normal construction consumables delivered as needed

The two unmanned instrumentation vans would be positioned just outside the Portal 2 entrance and placed inside an instrumentation bunker. The bunker would be made of the pre-cast concrete culvert sections described above. The vans would be placed inside their own respective bunker, side by side against the Northeast wing wall. Each bunker would be approximately 75 feet (23 m) in length. Additional overburden (muck) would be placed on top of the bunkers and end caps would be placed just prior to detonation to protect the vans.

To support the modeling and calculation efforts for the proposed detonation , a suite of instrumentation would be placed on and around the test bed. The primary measurements would be made using both free-field and near-field accelerometers placed in the various instrumentation holes. A small number of sunburst velocity gages would be co-located with several free-field accelerometers. Relative displacement gages would be installed in the tunnel ribs. Pressure measurements in and around the portals would be made to record the near-field environment. Inside the tunnel a number of high speed cameras and radars (vehicle type radar guns) would be installed to assist in determining surface spalling of the tunnel walls resulting from the high explosive detonation. The charge would be measured using the LANL CORRTEX (Continuous Reflectometry for Radius versus Time Experiments) system and a number of Time-of-Arrival (TOA) crystals located in the blasting agent itself. To support experiments that may be added to supplement data, additional high speed and video cameras would be positioned to observe test results along with additional pressure measurements in and around the reinforced concrete structure.

The ANFO vendor would have trucks delivering each ingredient to the staging area at an existing laydown yard near Tunnel 16b. Three specially designed bulk delivery trucks (each with a capacity of approximately 24,000 pounds (10,900 kilograms) of raw materials) would be loaded with the raw materials at the staging area and then would transport the materials to the pad adjacent to the charge hole. A fourth bulk delivery truck would be onsite for backup and retrieval of any spilled material. For the estimated 4 to 5 days of ANFO emplacement, there would be daily lines of trucks to bring the materials to batch the ANFO (see Section 2.2.2). The staging area would accommodate the four bulk delivery trucks, one fuel truck, four semi-tankers of raw materials, a tool trailer, and a small parts trailer. Because of the potential overlap of deliveries, and deliveries during non-loading hours, additional parking for semi-trucks and trailers would be provided in a staging area just outside the Mercury gate.

2.2.2 Proposed Operating Plan

The proposed operating plan includes acceptable blast conditions, the procedures for filling the charge hole with ANFO (batch and emplacement plan), detonation, and monitoring.

Acceptable Blast Conditions – Prior to the detonation, the extended meteorological forecast for 7 to 14 days would be evaluated. If meteorological conditions were not satisfactory, the emplacement of the ANFO emulsion and the detonation would be postponed. Required meteorological conditions would be no temperature inversions, no more than 40 percent stratus or cumulus cloud cover, and winds less than 25 miles per hour blowing from the southwest (240 degrees) through southeast (120 degrees). Winds blowing to the northeast to northwest would help direct the blast pressure forward onto the northern half of the NTS, away from most NTS facilities and the offsite communities south of the NTS. The analysis in this EA assumes the following acceptable blast conditions:

Surface Winds:	Southerly (from 120° through 240°) up to 25 miles per hour
Winds Aloft:	Southerly (from 120° through 240°) up to 50 miles per hour
Lapse Rate:	3° Celsius per kilometer (moist adiabatic to unstable)
Temperature Inversions:	No temperature inversions from surface to tropopause
Cloud Cover:	No significant low to mid-level cloud cover (less than 40 percent)
Thunderstorms:	No thunderstorms or lightning within a 20-mile (32-kilometer) radius of the 16b test bed

Meteorological conditions would be carefully monitored and evaluated by competent personnel assigned to the NTS prior to NNSA approval for the detonation. If appropriate meteorological conditions do not exist, the detonation would be delayed until the required conditions are met.

Other acceptable blast criteria would include technical criteria such as equipment/sensor failures and power failure to the instrument van.

Batch and Emplacement Plan – To batch (or mix) the ANFO, materials for batching would be brought in as needed, transferred to one of the four bulk delivery trucks, and transported to the pad adjacent to the charge hole. The trucks would mix the raw ingredients into a blasting agent (ANFO) and discharge directly into the hole via an auger. The 700 tons (635 metric tons) of ANFO would be batched into a semi-liquid emulsion (Dyno Gold Extra, formerly know as Dyno Gold C (a registered trademark of Alpha Explosives)) consisting of 78.65 percent ammonium nitrate, 5.52 percent calcium nitrate, 9.45 percent water and 6.38 percent fuel oil. The batching process would take approximately 4 to 5 days to provide the 700 tons (635 metric tons) of ANFO. A small pipe or tube would be placed in the center of the hole prior to filling with the blasting agent. This pipe would allow the booster and detonators to be installed just before DIVINE STRAKE is detonated. Spill tarps would be placed under the fuel truck, the raw material tankers, and the parked bulk delivery trucks. Clean-up and housekeeping activities would be constant. Upon completion of loading the charge hole, the trucks, storage trailers, and any remaining materials would be removed from the site.

Detonation – DIVINE STRAKE would be detonated using a remote firing system. A signal would be generated at the remote data acquisition facility and transmitted through a microwave link to U16b where it would be fed into the arming and firing unit in the small pipe installed in the charge hole prior to loading the ANFO emulsion into the hole. Exploding bridgewire (EBW) detonators would be used to detonate the explosives. There will be a dual system of EBWs (one primary and one backup). A high voltage pulse would be sent to the EBWs, which would be embedded within 100 to 300 pounds (45 to 136 kilograms) of C-4 (booster) located in the center of the ANFO charge. The EBWs and the C-4 would not be added until after the ANFO has been emplaced in the charge hole, acceptable blast criteria have been satisfied, and a final dry run has been completed. Additionally, there would be a second backup firing system using a detcord line running down the length of the small pipe and into the booster. The detcord would also be initiated with another EBW.

To detonate DIVINE STRAKE, EBWs would fire, detonating the C-4 and in turn detonating the ANFO mixture. If the first two EBWs were nonfunctional, the detcord would be fired and the "burn" would propagate down to the booster and then initiate the blasting agent. Detonation products would include water, nitrogen, carbon dioxide, methane, and calcium carbonate.

Monitoring – Both microbaragraphs and three-axis seismometers will be deployed at up to 36 stations both on and off the NTS to measure the airblast overpressure time records and seismic ground shock resulting from the proposed detonations. These types of measurements have been routinely performed on other large explosive detonations to ensure public safety, but also to improve the predictive capability for the long-range effects. In addition, visual and photographic surveys will be conducted pre- and post-detonation to evaluate the effects of the ejecta, airblast, and dust on both biota and facilities.

2.2.3 Associated Operational Planning

This section describes associated operational planning, including safety planning, emergency planning, NTS facility notifications, and the removal and protection of vulnerable equipment and structures prior to detonation.

Safety Plan – A safety plan is currently under development to ensure the detonation would be performed in a safe manner, protective of human health and safety, the environment, and nearby NTS facilities. Key elements of the plan include:

- Regulatory requirements, codes, standards and guidance
- Normal and emergency operational procedures
- Hazard evaluation
- Operational hazards
- Project information
- Training plan
- Emergency Management Plan and implementation

In addition to the safety plan and training provided by DTRA and Bechtel Nevada (the NTS operations contractor), the ANFO vendor will make a formal presentation to explain all safety considerations and answer any questions prior to ANFO emplacement. Additional information about the safety plan and the potential safety impacts to workers and the public are included in Chapters 3 and 4.

NNSA Emergency Planning – NNSA has a comprehensive and integrated emergency management system to ensure an effective and efficient response to emergencies at NTS. The Consolidated Emergency Management Plan (DOE 2005a) specifies the implementing procedures for all elements of the emergency response organization. The NNSA Office of the Assistant Manager for National Security would be notified of the presence and storage locations of the ANFO emulsion and associated chemicals. Accident analysis for the on-site transportation, storage, emplacement and detonation would be modeled using the appropriate and approved models to perform analysis of accident/emergency consequences. The accidental and instantaneous release of the entire ANFO emulsion would be modeled as the worst-case scenario. NTS maintains meteorological measurement and modeling capabilities to determine atmospheric transport and dispersion of materials released into the atmosphere during an accident. Accidental release modeling is conducted by NNSA contractors for chemical materials that are onsite. DOE has identified over 90 atmospheric models that are available. All modeling analyses are conducted in accordance with guidance and procedures specified in the DOE Emergency Management Guide (DOE 1997a). Modeling results are used to define emergency action levels, emergency planning zones, and identify other critical information such as environmental receptors. Additionally, the modeling results are used to develop timely, initial consequence assessments of emergency situations to ensure the consequence assessment provides representative results for making decisions to protect workers and the general public.

NTS Facility Tenant Notifications – All facility tenants at the NTS have been notified of the proposed detonation. NTS facilities are being evaluated for potential impacts to equipment and structures, and additional notifications would be made as the project develops.

Removal/Protection of Equipment – As part of the project planning and evaluation, equipment or structures that may be vulnerable to damage from DIVINE STAKE are being identified, and mitigation measures implemented. These include such items as power poles (replacement poles would be staged) and a nearby air sampling station (would be temporarily relocated). Other facilities/structures such as wells and the U1h and U1a hoist houses and head frames are also being evaluated for potential impacts.

2.2.4 Post Operation and Contingency Planning

DIVINE STRAKE would be designed such that all explosive material would be detonated, leaving no residual explosive material. However, in the highly unlikely event of a partial detonation, any residual material would be managed in conjunction with a Nevada Department of Environmental Protection approved plan. This plan would be coordinated and approved prior to execution of DIVINE STRAKE.

2.3 No-Action Alternative

Pursuant to NEPA and CEQ regulations, the No-Action Alternative must be considered. With this alternative, NTS's baseline operations and management in support of its national security mission would not change. The proposed large-scale, open-air detonation, DIVINE STRAKE, at the NTS would not be conducted and the purpose and need described in Chapter 1 would not be met.

2.4 Alternatives Eliminated from Further Analysis

Other alternatives considered but eliminated from further analysis are briefly described below and include:

- Alternative locations for the Proposed Action
- Variation in scale of Proposed Action (lower or higher amounts of explosives)
- Technological variations

Alternative Locations for the Proposed Action – Sites for the Proposed Action, other than the U16b tunnel complex at NTS, were considered by DTRA including the White Sands Missile Range in New Mexico, Dugway Proving Ground in Utah, and China Lake in Southern California. These sites were eliminated because of the need to conduct the detonation in a limestone bed with specific geological properties. As a number potential adversarial military targets are based in similar limestones, the Proposed Action needed to be sited in a similar geologic setting to actual military targets. The U16b tunnel complex at NTS was chosen based on these criteria for other Hard Target Defeat tests. No other sites exist on U.S. Government controlled areas that meet the geologic criteria and allow for the safe conduct of testing. In the interest of public safety, the proposed detonation site must be located on controlled government land.

Variations in Proposed Action – While the Proposed Action is not directly linked to the test and evaluation of any specific weapon system, one objective is to evaluate damage to a tunnel facility from a large-yield surface detonation. A second objective is to provide field test ground motion and tunnel damage data for the improvement and/or validation of ground motion and underground facility damage computer codes. As part of the HDBT program, smaller scale testing (from grams of chemical explosives up to a few pounds) has been conducted in laboratory experiments and field tests to help develop and validate modeling computer codes.

An intermediate scale test bed was constructed in a limestone quarry near Bedford, Indiana, and two 3,000-pound (1,360-kilogram) chemical explosive tests were conducted to help evaluate and validate the modeling codes. This test bed was located in a limestone with similar material properties as the NTS U16b site; however, the structural geologic setting at the Indiana site was simple, consisting of horizontal bedding planes and vertical joints. This simple geologic setting allowed for the validation of new computer codes prior to attempting to model the proposed U16b site with its complex structural geologic setting involving dipping bedding planes and several joints sets at various orientations.

The logical next step, in this portion of the HDBT program is the Proposed Action: a full-scale test bed for final validation of the modeling effort. The explosive yield (700 tons (635 metric tons) of ANFO-emulsion) was selected based on modeling predictions of the amount of ANFO that would be needed to cause the appropriate extent of damage to the underground facility, and on information gained from the small and intermediate scale tests. A larger amount of ANFO-emulsion is not needed for the Proposed Action, and a smaller amount would not be adequate to significantly damage the full-scale tunnel facility.

Technological Variations – No other tests or technological variations providing the information needed to satisfy the purpose and need (as defined in Chapter 1) were identified.

3.0 AFFECTED ENVIRONMENT

3.1 Land Use

NTS is located on approximately 1,375 square miles (3,560 km^2) or approximately 880,000 acres (356,000 hectares) in southern Nye County, Nevada, in a transition area between the Mojave Desert and the Great Basin. The topography of the site consists of a series of north-south-oriented mountain ranges separated by broad, low-lying valleys and flats. The area surrounding NTS is unpopulated to sparsely populated desert and rural land. Federal lands surround NTS, with the U.S. Air Force Nevada Test and Training Range (NTTR) located on the north, east, and west, and U.S. Bureau of Land Management lands on the south and southwest. Beyond the Federal lands surrounding NTS, principal land uses in Nye County in the vicinity of the site include mining, grazing, agriculture, and recreation. Rural communities located within the vicinity of NTS include Alamo, 69 km (43 miles) to the northeast; Pahrump, 26 miles (42 km) to the south; Beatty, 16 miles (26 km) to the west, Indian Springs, 17 miles (27 km) to the southeast, and Amargosa Valley, 3 miles (5 km) to the south. Las Vegas, located in Clark County is about 65 miles (105 km) to the southeast (DOE, 2004a). Figure 3.1-1 illustrates the NTS and surrounding land use.

Existing Land Use at NTS

Existing land use on the NTS is divided into seven zones as summarized in Table 3.1-1. Sites within these zones are categorized as industrial, research, support, and waste management. An industrial site is used for the manufacturing, processing, and/or fabrication of articles, substances, or commodities. A research site is used for projects to verify theories or concepts under controlled conditions. Support sites are used for office space, training, equipment storage, maintenance, security, feeding and housing, fire protection services, and health services. A waste management site is a site used for the disposal, storage, and/or treatment of wastes.

To simplify the distribution, use, and control of resources, the NTS is also divided into 26 numbered areas (numbered from 1 to 30; there are no areas numbered 13, 21, 24, and 28). The proposed site for the DIVINE STRAKE detonation is located in Area 16.

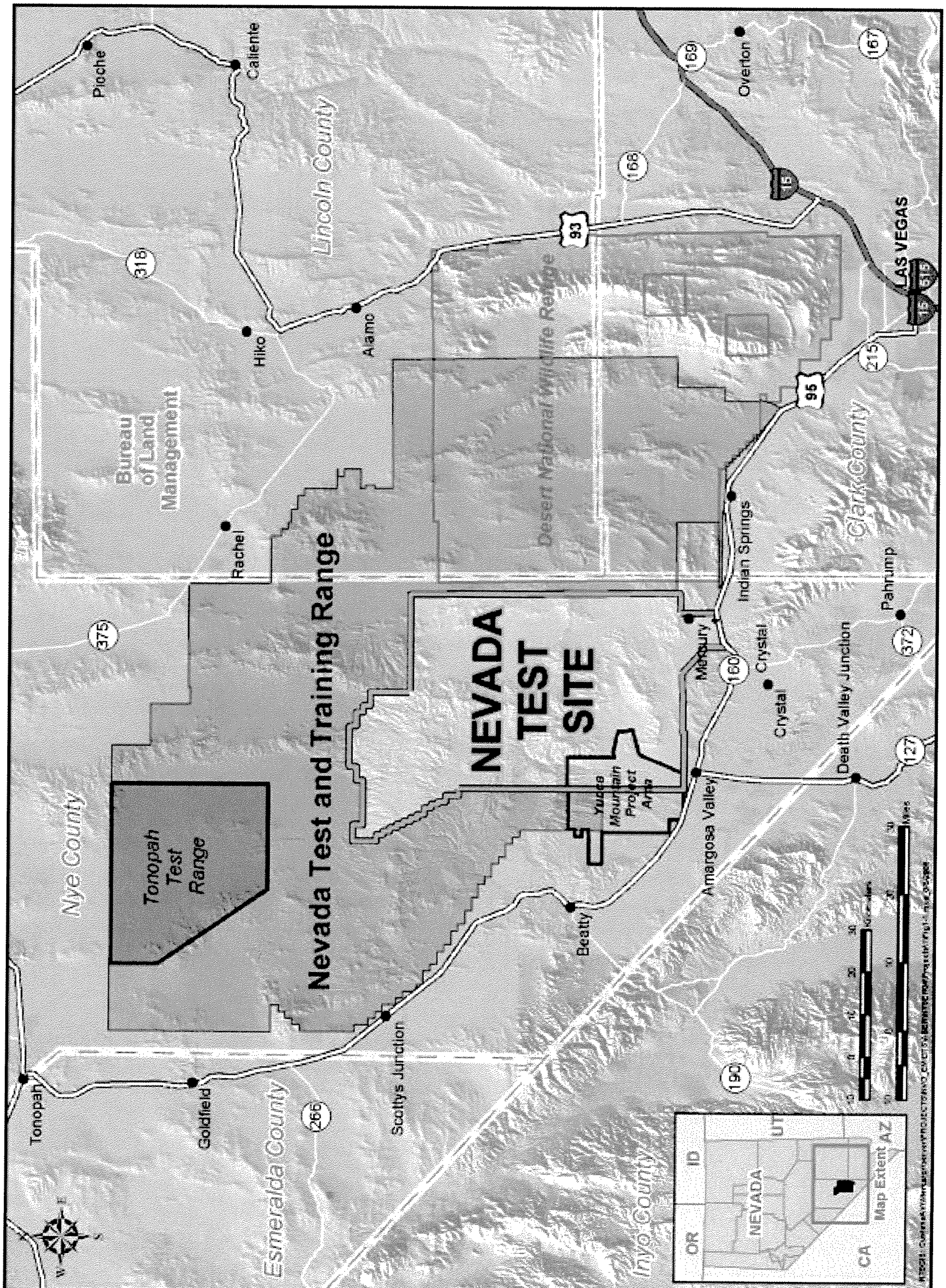


Figure 3.1-1 NTS and Surrounding Land Use

Source: DOE 2005 NTSER

Table 3.1-1

NTS Land Use Zones

Zone	Purpose
Nuclear Test Zone	Underground hydrodynamic tests, dynamic experiments, and underground nuclear weapons and weapons effects tests.
Nuclear and High Explosive Test Zone	Land within the Nuclear Test Zone for additional underground and aboveground high-explosive tests or experiments.
Research, Test, and Experiment Zone	Small-scale research, development projects, pilot projects, and outdoor tests and experiments for the development, quality assurance, or reliability of materials and equipment under controlled conditions.
Radioactive Waste Management Zone	Shallow land burial of low-level and mixed wastes.
Critical Assembly Zone	Conducting nuclear explosive operations. Operations generally include assembly, disassembly or modification, staging, repair, retrofit, and surveillance. The potential for weapons storage also exists in this zone.
Nonproliferation Test and Evaluation Complex (NPTEC)	A downwind geographic area that would confine the impacts of the largest planned tests of materials released at the NPTEC Facility.
Reserved Zone	Controlled-access land area that provides a buffer between non-defense research, development, and testing activities. Includes areas and facilities that provide widespread flexible support for diverse short-term non-defense research, testing, and experimentation. Also used for short-duration exercises and training, such as Nuclear Emergency Search Team and Federal Radiological Monitoring and Assessment Center training, and U.S. DoD land navigation exercises and training.

Area 16, within the Nuclear and High Explosive Test Zone, occupies 28 square miles (73 km^2) in the west-central portion of the NTS. No atmospheric tests have ever been conducted at this location. Area 16 was established in 1961 to support complicated nuclear effects experiments that required a tunnel location in an isolated area away from other active weapons test areas. From mid-1962 through mid-1971, six underground nuclear weapons effects tests were conducted in the U16a tunnel complex located within Area 16. The U16a tunnel complex is located approximately 1.5 miles (2.4 km) southwest of the proposed U16b test bed. Currently, under the NNSA Work for Others program, the DoD uses this area, including both U16a and U16b tunnels for RDT&E in support of HDBT programs involving the delivery and detonation of conventional or prototype chemical explosives and munitions. Figure 2-1 in Chapter 2 shows the configuration of the site. The U16b test bed was constructed in 1998, and it has not been used for any type of nuclear testing activity.

Surrounding Land Use

Other Federal lands surround the NTS, including the NTTR Complex on the north, east, and west and U.S. Bureau of Land Management lands on the south and southwest (see Figure 3.1-1 previous). Beyond the Federal lands that surround the NTS, principal land uses in Nye County in the vicinity of the NTS include mining, grazing, agriculture, and recreation.

Portions of the Desert National Wildlife Range overlap the NTTR Complex and come within 2 miles (3 km) of the boundary of the NTS.

Airspace

Restricted areas R-4808N/S and R-4807B are airspace delegated to the US Department of Energy from the Federal Aviation Administration (FAA). Flight safety and physical security of R-4808N/S (Nevada Test Site) and R-4807B is ensured through restrictions or limitations of over flight. For scheduling purposes, R-4808N is divided into Alpha, Bravo, Charlie, Delta, and Echo. In accordance with FAAO 7400.8, the NNSA has been designated as the using agency of R-4808N/S and R-4807B. As the using agency, the NNSA is responsible for the overall management of all ground and airborne operations in accordance with Title 14 CFR Part 73. The 98th Range Wing's Operations Support Squadron (98th OSS/OSO) at Nellis Air Force Base (NAFB) has the scheduling responsibility for all operations within restricted areas after coordination. The NNSA retains the right to limit all flight activity over R-4808N/S and R-4807B for programmatic reasons and will coordinate restrictions with the 98th OSS/OSO as far in advance as possible. Any areas concerning flight or safety of ground personnel will be coordinated regardless of altitude.

Prior to the execution of DIVINE STRAKE, NTS Operations Command & Control (OCC) would close all airspace within a safe distance of the test bed. This is coordinated through the DIVINE STRAKE Operations Controller and the NTS/OCC. Air space will remain closed until it is deemed safe to reopen.

3.2 Noise

A potentially significant effect of DIVINE STRAKE is the exposure of both inanimate (e.g., structures and land-forms) and animate (e.g., animal and human species) receptors to the adverse effects of airblast and noise.

The Noise Control Act directs all Federal agencies to be cognizant of the potential adverse effects of noise generated by their projects and to take steps to prevent or reduce such effects. The U.S. Environmental Protection Agency (EPA) and Department of Housing and Urban Development (HUD) are concerned with the overall health of the population and with maintaining appropriate levels of long-term noise in communities. The Occupational Safety and Health Act (OSHA) regulations require hearing conservation and protection for all employees potentially exposed to criteria noise levels as will be generated by the project.

The following jurisdictions at the state and local level were investigated for regulations concerning environmental noise:

- State of Nevada
- Nye County
- Clark County
- Nearby municipal jurisdictions

Environmental noise is not regulated by any local jurisdictions. Occupational noise exposure is regulated to the extent required by law. No general noise regulations are relevant to the NTS operations or the DIVINE STRAKE project.

<u>Sound/Noise Measurement</u>

Whenever energy, typically in the form of positive (a "push") or negative (a "pull") pressure, is applied to a compressible elastic medium (many solids, liquids and gasses, including air), the molecules of the medium squeeze together or pull apart. When the energy source changes direction or ceases to transfer its energy to the medium the medium's molecules spring back to their original resting position. The energy related to this molecular motion propagates (moves) as a wave motion in the medium. In air, for example, the compressions and rarefactions move away from the source at a very well defined speed that is related to the ambient air temperature and the relatively constant atmospheric pressure of the air. In air, at standard sea level atmospheric pressure and a temperature of about 68 degrees Fahrenheit (20° C), the acoustic sound wave (not the blast or shock wave) travels at about 1128 feet per second (344 m/sec). If the wave is not constrained or focused, its energy will propagate outward in the shape of a sphere, or a hemisphere (half sphere) if it is traveling over a reflecting plane, such as relatively flat hard ground.

Because the acoustic energy in the wave is spread out over a larger and larger surface area of the growing full or hemisphere as the sound wave travels away from the initial energy source, the sound pressure level (i.e., the magnitude of "push" and "pull" from the wave) diminishes with increasing distance from the source.

This primary factor in the reduction of sound energy is called divergence or geometric spreading loss. Other factors also contribute to changes in sound level between the source (an explosive detonation in the case of DIVINE STRAKE) and any designated receptor location. These include additional decreases in the sound pressure level due to the interaction of the sound wave with oxygen and water molecules in the air, the effect of landforms and structures (barriers), and the sound absorptive or reflective nature of intervening ground. Humans perceive sound when the acoustical wave is processed by the ear-brain complex. Additionally, humans define unwanted sound as "noise". The terms sound and noise are used interchangeably in this assessment.

Because the medium of acoustic transmission is air, acoustic wave propagation is highly influenced by meteorology. This includes absolute ground surface and air temperatures, temperature gradients, relative humidity, turbulence, plus macro and micro wind patterns, both at the surface and up through extreme elevations. Thus, consideration of the climatic characteristics of the NTS and surrounding area as described in Section 3.10 is an important component of the environmental assessment of noise. An important point, especially for loud sounds that may be heard at great distances is that the instantaneous meteorological conditions during production of a sound (i.e., the DIVINE STRAKE detonation) can substantially affect the propagation of the sound wave and its amplitude at distant receptors. These factors are discussed further in Section 4.2.

The unit of sound pressure level measurement is the decibel (dB), which is a unit describing the amplitude of sound pressure compared to a reference pressure. The sound pressure level

(SPL) is mathematically equal to 20 times the logarithm (to the base 10) of the ratio of the pressure of the sound measured to the reference pressure of 20 micropascals and is almost always taken as a root-mean-square value. By using this method we are able to describe a very wide range of sound pressures with a relatively small numeric range.

The most common descriptor of sound and noise associated with occupational and community noise is the A-weighted sound pressure level, which is abbreviated as dBA. It is defined as the sound pressure level in decibels as measured on a sound meter using the A-weighting filter network. The A-weighting frequency filter de-emphasizes the very low and very high frequency components of sound in a manner similar to the frequency response of human hearing to sounds of moderate level, and correlates well with people's group reactions to sound and environmental noise. While audible sound levels in the general environment may range from slightly above the threshold of hearing and very quiet (around 20 dBA) to very loud sounds of 130 dBA or higher, a range of 35 dBA to 85 dBA is much more common.

Exceptions to the use of A-weighted decibels are reserved primarily for the measurement, description, and analysis of very intense or predominately low frequency sound as might be expected from proximate small explosive reactions (e.g., automobile air bag deployment, small arms fire) to large distant acoustic sources (e.g., thunder, sonic boom, HE surface blasts). For occupational noise exposure to very intense short-term sound, the decibel values are typically stated in terms of peak (not rms) pressure and are "linear" (not "weighted") and, thus, include all frequencies in the acoustic wave on an equal basis. The "C" weighting filter is similar to "A" but because of the assumed higher decibel sound level, "C" accounts for more audibility of the low frequency sound energy. This allows for a more meaningful comparison of sound levels from higher SPL events to more typical moderate sound levels.

Environmental Sound Levels

NTS Ambient Sound Levels

Sound levels that typically occur on the NTS are reflective of the type, extent, and intensity of natural and manmade activity ongoing at any particular time. During periods of no human activity and calm weather conditions the ambient acoustic environment on NTS could be quiet or lower (approximately 25 dBA). Conversely, during periods of human activity such as construction, and certainly during surface testing of explosives, sound levels on the NTS could vary from loud to painful to deafening depending upon the distance between the noise source and receptor. Table 3.2-1 presents a range of common (acoustic wave) sound levels for reference and comparative purposes.

Off-Site Ambient Sound Levels

Sound levels in the off-site environs of the NTS result from and are typical of the type of land use in a given area. This land use ranges from uninhabited desert to rural and suburban activity in the desert, the few small areas or towns of Amargosa Valley, Beatty, Indian Springs, Scotty's Junction, and Pahrump, to the urban environment of Las Vegas. The range of ambient environmental noise levels for these land uses is approximately from 35 dBA to 75 dBA. A very few manmade sounds could briefly exceed 90 dBA (e.g., car and train horns, truck backfiring, motorcycle with no muffler), but most sound would be in the background music (40 dBA) to speech range (60-65 dBA) with natural sounds at lower sound levels. Ambient sound levels found in typical environments for a range of land use/development intensities are summarized in Figure 3.2-1.

In summary, the range of existing ambient sounds typically occurring on and near the NTS results in both quiet periods and noisy periods. Thus, some of the louder sounds generated on the NTS may be (and based on anecdotal observations, are) audible in nearby areas outside the NTS boundaries during locally quiet periods.

NTS Area Climate

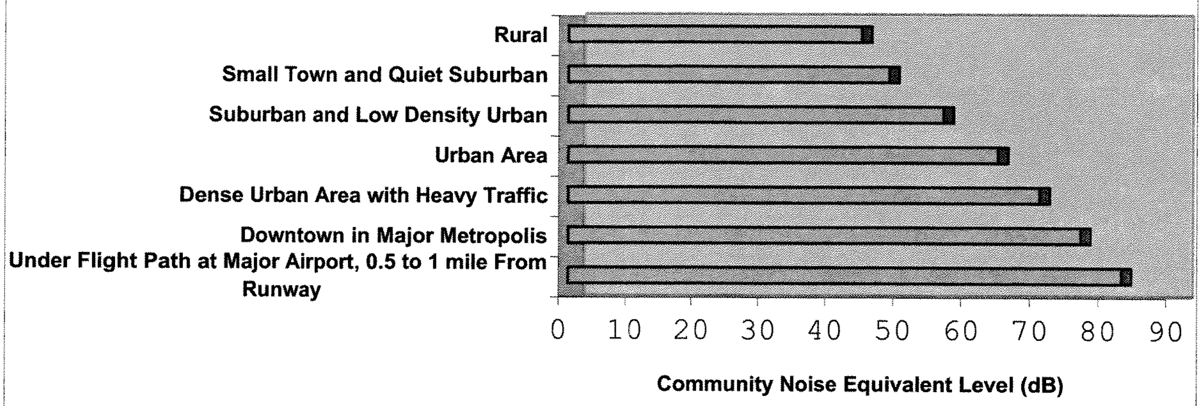
Because the medium of acoustic transmission is air, acoustic wave propagation is highly influenced by meteorology. This includes absolute ground surface and air temperatures, temperature gradients, especially inversion conditions, relative humidity, turbulence, plus macro and micro wind patterns, both at the surface and up through extreme elevations. Thus, consideration of the climatic characteristics of the NTS and surrounding area are an important component of the environmental assessment of the project's potential noise effects. Please refer to the detailed meteorological discussion in Sections 3.10 and 4.10 for more information.

Table 3.2-1
Sound Levels of Typical Noise Sources and Noise Environments

Noise Source (at a Given Distance)	Scale of A-Weighted Sound Level in Decibels	Noise Environment	Human Judgment of Noise Loudness
Large caliber handgun (3 ft)	160	Shooting Range	Deafening, with potential TTS or PTS hearing effects
Military Jet Take-off with After-burner (50 ft) Civil Defense Siren (100 ft)	140 130	Aircraft Carrier Flight Deck	Painful Extremely Loud
Commercial Jet Take-off (200 ft)	120	Airport	Threshold of Pain *32 times as loud
Pile Driver (50 ft)	110	Rock Music Concert	*16 times as loud
Ambulance Siren (100 ft) Newspaper Press (5 ft) Power Lawn Mower (3 ft)	100	Printing Press Plant	Very Loud *8 times as loud
Motorcycle (25 ft) Propeller Plane Flyover (1,000 ft) Diesel Truck, 40 mph (50 ft)	90	Boiler Room	*4 times as loud
Garbage Disposal (3 ft)	80	High Urban Ambient Sound	*2 times as loud
Passenger Car, 65 mph (25 ft) Vacuum Cleaner (10 ft)	70		Loud *70 decibels (Reference Loudness)
Normal Conversation (5 ft) Air Conditioning Unit (100 ft)	60	Data Processing Center Department Store	*1/2 as loud
Light Traffic (100 ft)	50	Private Business Office	*1/4 as loud
Bird Calls (distant)	40	Lower Limit of Urban Ambient Sound	Quiet *1/8 as loud
Soft Whisper (5 ft)	30	Quiet Bedroom	
	20	Recording Studio	Very Quiet
	0		Threshold of Hearing

TTS = Temporary Threshold Shift
PTS = Permanent Threshold Shift
* Relative to a Reference Loudness of 70 Decibels

Figure 3.2-1
Typical Range of Outdoor Community Noise Exposure Level



3.3 Human Health and Safety

The policy of NNSA is to operate NTS in a manner that protects the health and safety of employees and the public, preserves the quality of the environment, and prevents property damage. Environment, safety and health (ES&H) are priorities in the planning and execution of all work activities at NTS.

Regulatory Requirements

NTS policy requires compliance with applicable ES&H laws, regulations, and requirements; and with directives promulgated by DOE regarding occupational safety and health. NNSA requires work at the NTS to be performed according to the safety and health requirements of OSHA as codified in 29 CFR 41 Parts 1910 and 1926. DOE Orders also provide direction for worker safety and health programs.

To integrate the activities of a number of contractors and NTS users, and to avoid discontinuities in the health and safety program, NTS operates under standard operating procedures (SOPs) for NNSA facilities. The relevant procedures include the following:

- 5401 Environment, Safety, and Health Coordination Responsibilities

- 5409 Management of Hazardous Materials and Hazardous Wastes
- 5410 Industrial Hygiene
- 5412 Explosive Safety
- 5415 Safety and Fire Responsibilities

NNSA has implemented an Integrated Safety Management System (ISMS) in accordance with DOE Procedure 450.4 to "...systematically integrate safety into management and work practices at all levels so that missions are accomplished while protecting the public, the worker, and the environment." The ISMS is a systematic approach to defining the scope of work; identifying, planning, and performing work that provides for early identification of hazards; and identifying associated control measures for hazardous mitigation or elimination. The ISMS process also forms the basis for work authorization and provides for both internal and external assessment through a continuous feedback and improvement loop that identifies both failures and successes and incorporates lessons learned into subsequent activities. The health and safety of NTS workers is protected by adherence to the requirements of Federal and state law, DOE orders, and the plans and procedures of each organization performing work on the NTS. A program of self-assessment for compliance with these requirements is conducted by contractors and by NNSA. In addition, workers are protected from the specific hazards associated with their jobs by training, monitoring the workplace environment, using appropriate personal protective equipment (PPE), and using administrative controls to limit their exposures to radioactive or chemical pollutants. Worker access to areas of the NTS with working conditions requiring special hazard control is restricted through the use of signs, barriers, and fences, as appropriate.

Health and Emergency Services

The DOE has a comprehensive Operational Emergency Base Program that provides the basic guidance for NTS safeguards and security procedures for DOE activities/projects. Prior to implementation of any activity, a comprehensive Site/Facility/Activity Operational Emergency Management Plan (OEMP) is prepared. At a minimum, each OEMP must comply with the following requirements:

- Establish an Operational Emergency Base Program that implements the requirements of applicable Federal, state, and local laws/regulations/ordinances for fundamental worker safety programs

- Prepare documentation to establish Emergency Planning Zones; Emergency Plans that document comprehensive emergency management programs; and Emergency Readiness Assurance Plans
- Designate an individual to be responsible for and administer emergency management functions for the organization
- Participate in the preparation of mutual assistance agreements with local, state, and Tribal authorities
- Ensure immediate mitigative and corrective emergency response actions and appropriate protective actions and protective action recommendations to minimize the consequences of the emergency, protect worker and public health and safety, provide security, and ensure the continuance of such actions until the emergency is terminated
- Integrate emergency public information planning with the development and maintenance of the Emergency Plan

Table 3.3-1 details the State of Nevada Emergency Management Directors/Coordinators that the DOE would coordinate with regarding the OEMP.

Table 3.3-1

Emergency Management Offices

Office	Telephone / Facsimile Number
Clark County - Office of Emergency Management Jim O'Brien, Manager 500 S. Grand Central Pkwy. Las Vegas, Nevada 89155-1713 E-Mail ipo@co.clark.nv.us	(702) 455-5710 Office (702) 455-5718 Fax
Las Vegas - Las Vegas Emergency Management Timothy McAndrew, Emergency Manager 500 N. Casino Center Blvd. Las Vegas, Nevada 89101-2986 E-Mail tmcandrew@ci.las-vegas.nv.us	(702) 383-2888 Office (702) 229-0444 Fax
Nye County - Nye County Emergency Services Bill Hall, Director 260 N. Hwy 160 Suite 7 Pahrump, Nevada 89060 E-Mail whall@nyecounty.net	(775) 751-4278 Office (775) 751-4280 Fax

Source: NV 2005

Radiation

Some areas of the NTS were used for nuclear weapons testing that created radioactive fallout and contamination of soils in the vicinity of the tests. NNSA has determined that radioactively contaminated soils are not present within the vicinity of the proposed DIVINE STRAKE detonation. There are no radiologically controlled areas in the southwestern part of Area 16, signifying that there are no known radiological hazards in this area.

The U16b test bed was constructed in 1998, but it was never used for any type of nuclear testing activity. Based upon this process knowledge, the aerial radiation surveys performed in the past by AMS, the current radiological control status of the area under the BN radiation protection program, and the knowledge of the area from the NTS Environmental Restoration (ER) program, NNSA/NSO is confident that no radioactive contamination exists at U16b.

3.4 Waste Management

This section describes the management and disposal of hazardous materials and RCRA waste at NTS. The section addresses the waste management activities and capabilities related to the proposed DIVINE STRAKE project and the associated detonation. NTS manages the following types of waste: transuranic, low-level radioactive, mixed (both radioactive and hazardous), hazardous, sanitary solid, and medical. The remainder of the section discusses the management and disposal of hazardous or potentially hazardous waste, non-hazardous solid waste, sanitary waste, hydrocarbon waste, wastewater, and the management of hazardous materials.

Hazardous Waste Management

NTS stores hazardous waste onsite prior to shipping it to a permitted commercial facility for treatment or disposal. NTS received its RCRA permit for storage in 1995 and renewed it in 2000. NTS is also permitted to treat certain explosive hazardous wastes as discussed further below.

The RCRA Part B permit (NEV HW009) issued by the Nevada Department of Environmental Protection (NDEP) to the NNSA allows NNSA to conduct waste management activities at the NTS. All non-radioactive hazardous wastes (HW) are presently transported off-site to approved RCRA HW treatment, storage, and disposal facilities.

The RCRA Part B Permit includes the operation of the Hazardous Waste Storage Unit (HWSU) in Area 5. The permit allows NNSA to store non-radioactive HW in containers on a pad designed for the safe storage of wastes that have been generated at the NTS. The HWSU consists of a prefabricated, rigid steel framed, roofed shelter that is permitted to store a maximum of 16,280 gallons (61,600 liters) of approved waste at a time.

The Part B permit also covers operations at the Explosive Ordnance Disposal Unit (EODU) in Area 11. The permit allows NNSA to treat explosive ordnance wastes, which are hazardous wastes as defined under 40 CFR (Sections 261.21, 261.23, 261.24, and 261.33), by open detonation in a specially constructed and managed area designed for the safe and effective treatment of explosive HW. The permit allows a maximum of 45.4 kg (100 lbs) of approved waste to be detonated at a time, not to exceed one detonation event per hour.

Wastes, including unexploded ordnance (UXO) and hazardous wastes, are addressed in detail in the Part B permit and may be transported, stored, or disposed of in accordance with the permit conditions. In addition, UXO materials and related wastes may be handled in place or transported to the EODU for treatment as detailed in the permit.

The current policy for handling hazardous wastes generated from activities conducted on NTS is in accordance with the Part B permit. Hazardous wastes are analyzed for waste class determination as required. As stated previously, all non-UXO hazardous waste generated is either shipped off site for disposal in accordance with all applicable state and Federal requirements or sent to the HWSU in Area 5 for temporary storage prior to shipment off site for disposal.

<u>Non-Hazardous Solid and Sanitary Solid Wastes</u>

NTS has three landfills permitted for the disposal of solid and sanitary waste (non-hazardous). The Hydrocarbon Disposal Site in Area 6 and the U10c Disposal Site in Area 9 are permitted as Class III (industrial solid waste) landfills. Hydrocarbon-contaminated materials are disposed in the Area 6 landfill, and inert debris (such as construction and demolition debris) is disposed in the Area 9 landfill. The third landfill is a Class II (municipal solid waste) landfill in Area 23 that receives sanitary solid and regulated asbestos waste. As stated in the "*Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*" (DOE, 2002), NNSA concluded that the projected waste volumes through

2011 would consume roughly 12, 14 and 16 percent of the available waste disposal capacity of the Area 6, 9 and 23 landfills, respectively.

Hydrocarbon Wastes

If generated, hydrocarbon wastes may be disposed of in Area 6 in accordance with the Area 6 Hydrocarbon Disposal Site permit requirements (SW 13 097 02).

Wastewater

Wastewater at the NTS is disposed of either in one of 16 septic systems located throughout the site or in one of two lagoon systems located in Areas 23 and 6. The septic systems, which receive sanitary sewage only, have capacities of 750 to 5000 gallons per day (2,839 liters to 18,927 liters). The average daily flow at the lagoons, which receive sanitary sewage and industrial wastewater, is less than 40,000 gallons per day (15,146 liters). Sludge removed from the systems is disposed in the Area 23 sanitary landfill or the Area 6 Hydrocarbon Disposal Site, depending on hydrocarbon content. Portable sanitary units are provided for use in areas not serviced by a permanent wastewater system, including the proposed DIVINE STRAKE site.

Hazardous Material Control and Management

Hazardous materials used or stored at NTS are inventoried through the use of a Hazardous Substance Inventory (HSI) database. All NNSA subcontractors who use or store hazardous materials use this database and are required to comply with the operational and reporting requirements of the Toxic Substances Control Act (TSCA); Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); the Emergency Planning and Community Right-to-Know Act (EPCRA); and the Nevada Chemical Catastrophe Act. In response to the EPCRA requirements, all chemicals that are purchased are entered into the HSI database and assigned hazard classifications (e.g., corrosive liquid, flammable, oxidizer, water reactive). Ammonium Nitrate is not a reportable substance for the Toxic Release Inventory Report. It does, however, have to be reported on the Nevada Combined Agency Report. It would be combined with the weight of ammonium nitrate contained in other substances on the NTS, and total weight would be reported under the following hazard classifications listed above.

The NTS uses the HAZTRAK tracking system to monitor hazardous materials while in transit. When a truck transporting hazardous material enters the NTS, all information concerning the load is entered into the tracking system. Once the delivery is complete, the information provided at the time of entry is removed from the tracking system. If extremely hazardous substances (EHSs) are stored in quantities that exceed threshold quantities established by the NDEP, then NNSA will submit a report notifying the state.

Hazardous materials are stored at the NTS facility in accordance with the permit issued by the State of Nevada Fire Marshall. These materials include high explosives (HE), chemical materials, construction products and petroleum, oil, and lubricant (POL) products. Table 3.4-1 illustrates Waste Management Facility Capacities for NTS.

Table 3.4-1

Waste Management Facility Capacities for NTS

	2002 EIS Supplemental Analysis [a]		
Waste type	Capacity	Projection (through 2011)	Percent usage
Low-level	1,000,000	520,000	14
Mixed	20,000	20,000	31
Transuranic (storage)	Not available	990	(b)
Hazardous (temporary storage on-site or Area 5 prior to disposal)	61.6	650	(c)
Explosive hazardous (EODU treatment)	45.4 kg/hr	1,500	34 hours
Hydrocarbon (Area 6 landfill)	92,000	11,000	12
Non-hazardous/ construction debris (Area 9 U10c landfill)	660,000	93,000	14
Sanitary solid (Area 23 landfill)	210,000	35,000	16

Source: 2002 NTS Supplemental EIS (DOE, 2002).
(a) Quantities given in cubic meters, unless otherwise noted.
(b) Storage capacity dependent on the size of containers and storage configurations.
(c) The RCRA permit limits storage to 61.6 cubic meters at any one time. Hazardous waste is shipped to an off-site permitted facility for treatment/disposal, as needed.

3.5 Infrastructure

Infrastructure at NTS consists of transportation (roads, railroads, and airports) and utilities (DOE 2004b). This section discusses the existing infrastructure of Area 16B of the NTS. There are roads in Area 16B, but there is no rail access. Figure 3.5-1 provides an overview of the major infrastructure of the Proposed Action area.

Water Supply and Distribution

Groundwater is the only local source of potable water on NTS. Drinking water at NTS is provided by 9 potable water wells. For remote areas not connected to an NTS drinking water system, water is transported to the area by permitted water haul trucks (DOE, 2003b) or supplied as bottled water (DOE, 2003a).

Area 16 (Shoshone Mountain) does not contain an active potable water supply. Potential contamination to the one water well located in Area 16, identified as UE-16D ELENA, is currently being monitored (DOE, 2005b).

Wastewater Treatment and Disposal

There are no National Pollutant Discharge Elimination System (NPDES) permits for the NTS, as there are no wastewater discharges to naturally occurring onsite or offsite surface waters. Domestic sewage and industrial wastewater is discharged to permitted sewage lagoons. The lagoons are lined to prevent infiltration to the groundwater. Discharges of wastewater are regulated by Nevada under the Nevada Water Pollution Control Law.

The former Area 16 Camp, which was dismantled sometime between 1960 and 1972, consisted of a trailer park with a septic system (DOE, 2005b). This septic system consisted of underground sewers, a distribution box, three septic tanks, a drainage channel, and a sump excavation (DOE, 2005a).

Energy Supply and Distribution

Electric power is supplied to the NTS under contracts with the Nevada Power Company and Western Area Power Administrative (Valley Electric Cooperative). Fuels used at the NTS consist of unleaded gasoline, JP-8 aviation fuel, propane, and diesel fuels (DOE, 2004a).

Telecommunications

The proposed site currently has surface laid telephone cable lines that would be connected in support of DIVINE STRAKE.

Roadways and Traffic

The NTS currently contains approximately 700 miles of paved roads and 400 miles of unpaved roads (DOE, 2002). The main roads in Area 16, the proposed location for DIVINE STRAKE, include Buckboard Mesa Road, Mine Mountain Road, Mid Valley Road, and Pahute Mesa Road (see Figure 1-2 in Chapter 1). The Pahute Mesa Road, which passes from Area 17 to Area 1 in the northern portion of Area 16, is the only paved road in the vicinity of the Proposed Action site.

3.6 Topography and Physiographic Setting

The NTS is located within the Basin and Range Physiographic Province on approximately 1,375 square miles (879,990 acres) in southern Nye County, Nevada, in a transition area between the Mojave Desert and the Great Basin. The topography of the site consists of a series of north-south oriented mountain ranges separated by broad, low-lying valleys and flats (DOE, 2004a). Shoshone Mountain (Area 16) is located in the middle of the NTS, at the west end of Syncline Ridge (DOE, 2004b).

The relief of the NTS ranges from less than 3,280 feet (1,000 m) above sea level in Frenchman Flat and Jackass Flats to about 7,675 feet (2,339 m) on Rainier Mesa and about 7,216 feet (2,199 m) on Pahute Mesa. Area 16 is located on the Topopah Spring USGS 7.5 minute topographic map. Ground-level elevations range from 5,600 to 6,600 feet, but are generally above 6,000 feet (DOE 2004b). Tippipah Point, above the old Area 16 tunnels, has an elevation of 6,612 feet (DOE, 2004b). The Proposed Action site is located at approximately 5,200 feet.

Practically all the precipitation that falls in the area is returned to the atmosphere by evaporation, either directly from the soil or from the lakes and playas that occupy the lowest points within the basins and that are discharge areas for the alluvial aquifers. It is a closed drainage basin. No surface waters are located within the area of the Proposed Action (USGS, 2005).

3.7 Geology and Soils

Geology

The geology of the NTS region is characterized by a thick section (more than 34,768 feet [10,597 meters) of Paleozoic and older sedimentary rocks, local Cretaceous granitic intrusive blocks, Miocene-age volcanic rock assemblages, and locally thick deposits of post-volcanic alluvial deposits filling present-day valleys (DOE, 1996). The region, part of the Great Basin portion of the Basin and Range Province, has experienced a complex tectonic history involving a combination of compressional and extensional (stretching) crustal deformation resulting in a series of regional thrust faults, folds, normal faults, and strike-slip faults and interfault alluvium-filled basins (Stewart, 1980; DOE, 1996). A detailed discussion of regional geology and soils is located in the NTS EIS (1996) and the Supplemental Analysis (2002). For the purposes of this EA, this section will focus on site-specific geology and soils.

Geologic units exposed at the ground surface across the NTS consist of approximately 40 percent alluvium-filled basins and valleys, 20 percent Paleozoic and uppermost Precambrian sedimentary rocks, and the remainder comprised of Tertiary-age volcanic rocks and a few Mesozoic-age intrusive masses (DOE, 2004b). A generalized geologic map of the NTS and surrounding area, showing the approximate location of the proposed DIVINE STRAKE detonation ("Study Area"), is provided in Figure 3.7-1.

Rock units underlying NTS Area 16 include Tertiary-age volcanic rocks exposed in the northeastern flank of Shoshone Mountain, and Paleozoic carbonate and clastic rocks exposed along Syncline ridge in the central and northeastern portions of NTS Area 16 northeast of Shoshone Mountain (Laczniak et al. 1996; Thomas et al. 1996; Wilson 2001; DOE 2004b).

Paleozoic rock units crop out in the Syncline Ridge Area, which is a syncline extending northeastward from Shoshone Mountain in NTS Area 16 into western Yucca Flat. These rocks include the Permian-Pennsylvanian-age Tippipah Limestone (Sawyer et al., 1995; Laczniak et al., 1996; NNSA, 2004, Table A-2; Slate et al., 1999) that is the host rock unit for the U16b Tunnel Complex and the proposed testing cavity.

Structural Controls

Various structural features occur within the NTS region that exert control on the geometric configuration of the area and affect geologic, as well as hydrogeologic, conditions within the region. Major structural features in the region include:

- Faults (normal; thrust, transverse, and detachment faults)
- Calderas/caldera complexes

A detailed discussion of these structural controls is located in the NTS EIS (DOE, 1996) and the Supplemental Analysis (DOE, 2002).

Seismicity

Regional seismicity is discussed in detail in the NTS EIS (DOE, 1996) and Supplemental Analysis (DOE, 2002). The following subsection discusses seismicity of the NTS.

The NTS is located within Seismic Zone 2B, as defined in the Uniform Building Code. Zone 2B is defined as an area having moderate damage potential resulting from seismic events (DOE 1996, Section 4.1.4.2).

Northern Nevada Test Site

The Timber Mountain caldera, Pahute Mesa, Rainier Mesa, and Yucca Flat areas of the northern region of the Nevada Test Site have been the focus of considerable earthquake activity, which is considered by some investigators to be either a direct or indirect result of prior nuclear testing in this area (EBF, 1999). However, Vortman (1991, pp. 11, 37-39, 42-43) determined that the relative number of artificial and induced earthquakes in these testing areas suggests that the natural seismicity of the region reflects the background activity generally found in the southern Basin and Range province. In 1979 and 1983, swarms of microearthquakes occurred in the region, which appear to be unrelated to underground nuclear explosions.

Southern Nevada Test Site

The southern portion of the NTS is relatively seismically active compared to some other areas in the southern Great Basin (EBF, 1999). Most of the seismicity that has been exhibited across the southern portion of the NTS is concentrated within and adjacent to the Rock Valley, Mine Mountain, and Cane Springs fault zones. Small earthquakes occurred at or near the Cane Spring Fault and Rock Valley Fault Zones, although no surface displacement was associated with either of these earthquakes (DOE, 1996, Section 4.1.4.2). An earthquake occurred in 1992 near Little Skull Mountain in the southwest part of the NTS that was associated with another fault present near Little Skull Mountain (DOE, 1996, Section 4.1.4.2). This seismicity did not occur in areas of underground nuclear testing, and is not considered to be nuclear testing-induced (EBF 1999). A magnitude 4.4 earthquake occurred on June 14, 2002, approximately

7.8 mi (12.5 km) southwest of the peak of Little Skull Mountain, slightly west of the location of the 1992 Little Skull Mountain earthquake (Nevada Seismological Laboratory, 2002).

The 1992 Little Skull Mountain earthquake was the first to cause significant damage to structural facilities on the NTS, including damage to a two-story concrete-block structure located in NTS Area 25. However, this facility was constructed prior to the promulgation of more stringent building codes presently adhered to on the NTS (DOE, 1996, Section 4.1.4.2). The 2002 Little Skull Mountain earthquake was reported as being felt by residents in Amargosa Valley and in the Beatty and Las Vegas areas, however, no significant damage to structures was noted (Las Vegas Review Journal, 2002).

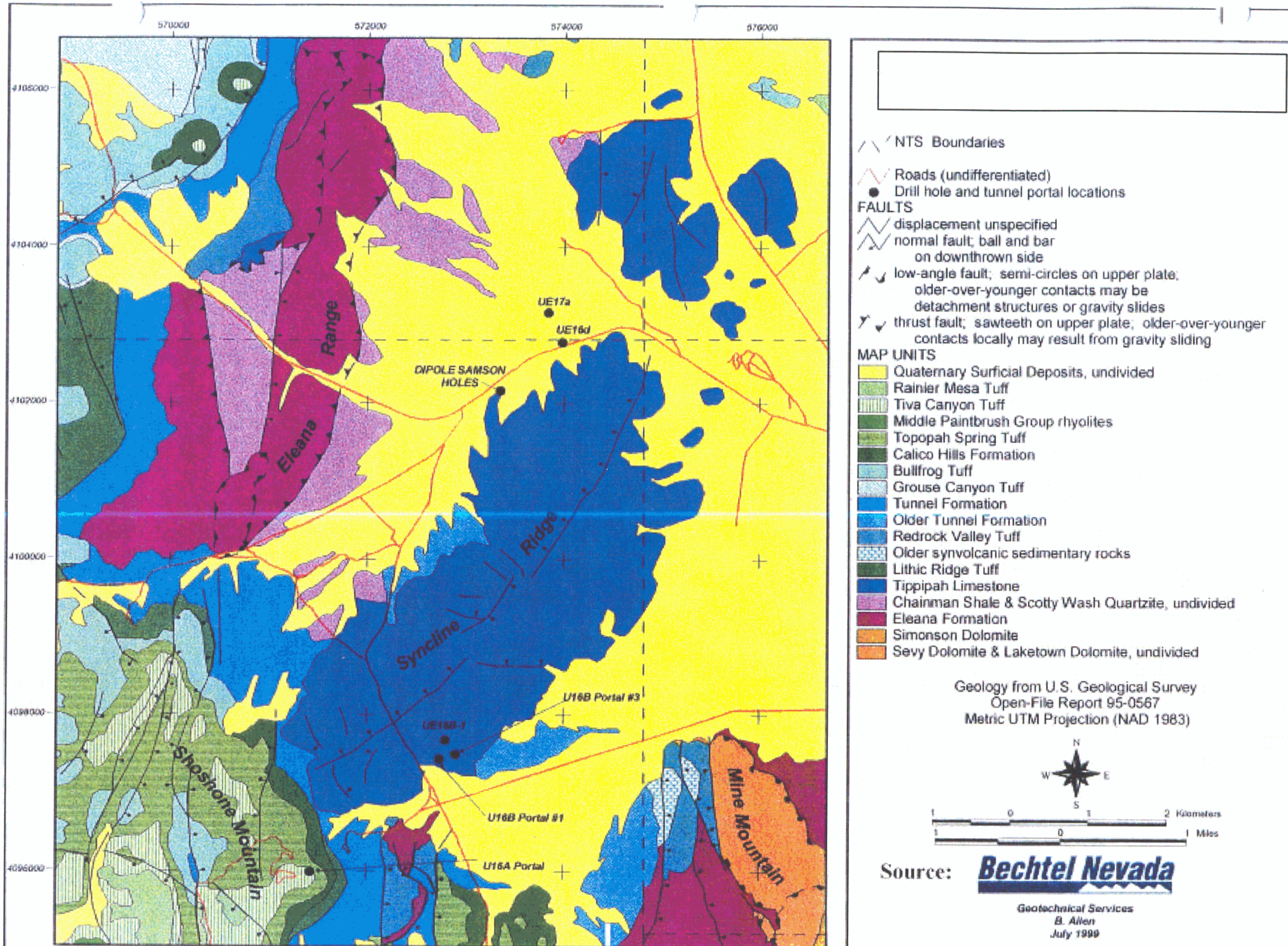


Figure 3-7.1
Generalized Geologic Map of NTS and Surrounding Areas

3.8 Surface Water and Groundwater

NTS is located within the Great Basin, which is a closed hydrographic basin that covers much of Nevada (DOE, 2004a, DOE, 2004b). There are no perennial streams or naturally occurring surface water bodies at NTS. Precipitation at NTS is low as described in Section 3.10. Much of the runoff from snowmelt and precipitation quickly infiltrates rock fractures or surface soils, or is lost by evapotranspiration. Some runoff is carried down alluvial fans in arroyos, or drains into playas where it may stay for weeks as an ephemeral lake (DOE, 2004a). In the southern part of the NTS, which includes Area 16, runoff is carried off towards the Amargosa Desert (DOE, 2004a). There are a number of springs on NTS, but flow from the springs travels only a short distance before evaporating or infiltrating into the ground (DOE, 1996).

Groundwater beneath NTS exists in three groundwater subbasins of the Death Valley Basin flow system. The depth to groundwater varies from about 260 feet (79 m) below the land surface in the extreme northwest part of the site, and about 525 feet (160 m) below land surface in Frenchman and Yucca Flats, to more than 2,000 feet (610 m) under upland portions of Pahute Mesa (DOE, 2004a). The depth to groundwater at nearby water well UE-16d is 755 feet (230 m).

Groundwater flows generally south and southwest with flow rates that are quite variable, ranging from 7 to 660 feet per year (2.1 to 201 m) (DOE, 2003a). Groundwater is the only local source of potable water on NTS. Drinking water at NTS is provided by potable water wells. For remote areas not connected to an NTS drinking water system, water is transported to the area by permitted water haul trucks (DOE, 2003b) or supplied as bottled water (DOE, 2003b). There are no National Pollutant Discharge Elimination System (NPDES) permits for the NTS, as there are no wastewater discharges to onsite or offsite surface waters. Discharges of wastewater are regulated by Nevada under the Nevada Water Pollution Control Law.

3.9 Atmospheric Resources

Air quality in a given location is described as the concentration of various pollutants in the atmosphere. Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. This section describes existing air quality conditions, climatology, and meteorology at the NTS and Area 16.

Applicable Air Quality Regulations

National Ambient Air Quality Standards

The U.S. EPA has established National Ambient Air Quality Standards (NAAQS) for six principal air pollutants (also called the criteria pollutants): carbon monoxide, lead, nitrogen oxides (NO_X), particulate matter (PM-10), ozone and sulfur oxides (SO_X). The U.S. EPA sets primary and secondary standards designed to protect the public health and welfare. The Nevada Ambient Air Quality Standards (AAQS) may further regulate concentrations of the criteria pollutants and are similar to the Federal standards with the addition of hydrogen sulfide. The applicable NAAQS and Nevada AAQS are presented in Table 3.9-1.

Areas that experience ambient air levels of one or more of these criteria pollutants above the NAAQS are deemed to be in "nonattainment" and Regional Air Quality Conformity rules must be evaluated for new projects within the area. EPA designates an area as being in attainment for a pollutant if ambient concentrations of that pollutant are below the NAAQS. In areas where insufficient data are available to determine attainment status, designations are listed as unclassified. Unclassified areas are treated as attainment areas for regulatory purposes.

National Emission Standards for Hazardous Air Pollutants

Under Title III of the CAA, the National Emission Standards for Hazardous Air Pollutants (NESHAP) were established to control those pollutants that might reasonably be anticipated to result in either an increase in mortality or an increase in serious irreversible or incapacitating but reversible illness. The EPA regulates a list of 189 hazardous air pollutants (HAPs) under the CAA. Industry-wide national emissions standards are developed for 22 of the 189 designated HAPs. The State of Nevada also regulates HAPs (NAC 445B.221) and has adopted the Federal list of HAPS found in 42 U.S.C. § 7412(b). NESHAP compliance activities at the NTS are limited to radionuclide monitoring and reporting (BN, 2004). HAPs emissions for which there are no Federal standards (i.e., the remaining 167 HAPs) are also regulated at the NTS through the NTS Air Quality Operating Permit (AQOP).

Table 3.9-1

Ambient Air Quality Standards

Pollutant	Averaging Time	Nevada Standards Concentration	National Primary Standards	National Secondary Standards
Ozone	1 hour	0.12 ppm (235 µg/m3)	0.12 ppm (235 µg/m3)	Same as primary
Ozone – Lake Tahoe Basin, #90	1 hour	0.10 ppm (195 µg/m3)	--	--
Carbon monoxide less than 5,000 ft above mean sea level	8 hours	9 ppm (10,500 µg/m3)	9 ppm (10 mg/m3)	None
Carbon monoxide at or greater than 5,000 ft above mean sea level		6 ppm (7,000 µg/m3)		
Carbon monoxide at any elevation	1 hour	35 ppm (40,500 µg/m3)	35 ppm (40 mg/m3)	
Nitrogen dioxide	Annual arithmetic mean	0.053 ppm (100 µg/m3)	0.053 ppm (100 µg/m3)	Same as primary
Sulfur dioxide	Annual arithmetic mean	0.030 ppm (80 µg/m3)	0.030 ppm	None
	24 hours	0.14 ppm (365 µg/m3)	0.14 ppm	
	3 hours	0.5 ppm (1,300 µg/m3)	None	0.5 ppm
Particulate matter as PM-10	Annual arithmetic mean	50 µg/m3	50 µg/m3	Same as primary
	24 hours	150 µg/m3	150 µg/m3	
Lead (Pb)	Quarterly arithmetic mean	1.5 µg/m3	1.5 µg/m3	Same as primary
Hydrogen sulfide	1 hour	0.08 ppm (112 µg/m3)[D]	--	--

Source: Nevada Administrative Code (NAC), 2005 ([Environmental Commission, Air Quality Reg. §§ R198-03, 4/26/2004)
Note: Additional details can be found in the State of Nevada Administrative Code (NAC) 2005.
µg/m3 – micrograms per cubic meter
ppm – parts per million
mg/m3 – milligrams per cubic meter

Existing Air Quality Conditions

NAAQS

The NTS is located in the Nevada Intrastate Air Quality Control Region 147. The region has been designated as attainment with respect to the NAAQS for all six criteria air pollutant (40 CFR Part 81.329). Title V of the CAA authorizes the states to implement permit programs in order to regulate emissions of the criteria pollutants and HAPs. For Nevada, the Bureau of Air Pollution Control (BAPC) has primacy over Nye County and oversees releases of all regulated pollutants currently covered under the NTS AQOP. At the NTS there is one main AQOP (AP9711-0549.01) that regulates operations and emissions from dust and large-scale high explosives activities, aggregate-producing facilities, fuel-burning equipment, and fuel storage. This permit expires on June 25, 2009. The DIVINE STRAKE test is not included in the NTS AQOP as a permitted facility or activity. However, estimated emissions from DIVINE STRAKE were required to be reported to the NDEP along with a demonstration that the emissions, when combined with those of the NTS site-wide emissions inventory, would not exceed regulatory limits.

Ambient air quality monitoring is currently conducted at the NTS for particulate matter, a non-radiological HAP, during Big Explosives Experimental Facility and Non-proliferation Test and Evaluation Center tests (DOE, 2004b). Elevated levels of criteria pollutants at the NTS may occasionally occur because of construction, aggregate production, surface disturbances, and fugitive dust from vehicles traveling on unpaved roads; various pollutants from fuel-burning equipment, incineration, and open burning; and volatile organics from fuel storage facilities (DOE, 1996). However, these activities do not take place in Area 16. Emissions of HAPs and criteria pollutants from current NTS sources are below regulatory requirements (BN, 2004).

NESHAP

Ambient air quality monitoring is currently conducted at the NTS for radiological HAPs. Sources of radioactive emissions on the NTS include: evaporation of tritiated water (HTO) from containment ponds; diffusion of HTO vapor from the soil (at Area 5 Radioactive Waste Management Complex, Sedan crater, and Schooner crater); tritium gas released during experiment test calibrations at Building CP-50 in Area 6; and re-suspension of plutonium and americium from contaminated soil at nuclear device safety test and atmospheric test locations. No atmospheric tests have ever occurred in Area 16. Based on 2003 data, the NTS is in compliance with NESHAP for radiological air emissions (BN, 2004).

3.10 Meteorology

The NTS is located in the extreme southwestern corner of the Great Basin. The climate is arid with limited precipitation, low humidity, large daily temperature ranges, and intense solar radiation during the summer months.

Meteorological Monitoring

The Air Resources Laboratory, Special Operations and Research Division (ARL/SORD), collects meteorological and climatological data on the NTS. Data are collected through the Meteorological Data Acquisition (MEDA) system, a network of approximately 30 mobile meteorological towers located primarily on the NTS. Locations of the MEDA stations as of the date of this document are shown in Figure 3.10-1.

Currently, there is a MEDA station in Area 16. Wind direction and speed are measured at the 10-m level according to ANS/ANSI 3.11 (American Nuclear Society, 2000). Ambient temperature, relative humidity, and atmospheric pressure measurements are taken at approximately the 6.5-foot (2-m) level to be within the surface boundary layer. The observations are collected and transmitted every 15 minutes. Wind data are 5-minute averages of speed and direction. The peak wind speed is the fastest instantaneous gust measured within the 15-minute time interval. Temperature, relative humidity, and pressure are instantaneous measurements. Wind data from the MEDA stations are used each year to calculate radiological doses from NTS air emissions to members of the public residing near the NTS. Wind speed and direction data have been collected for all the MEDA stations on the NTS.

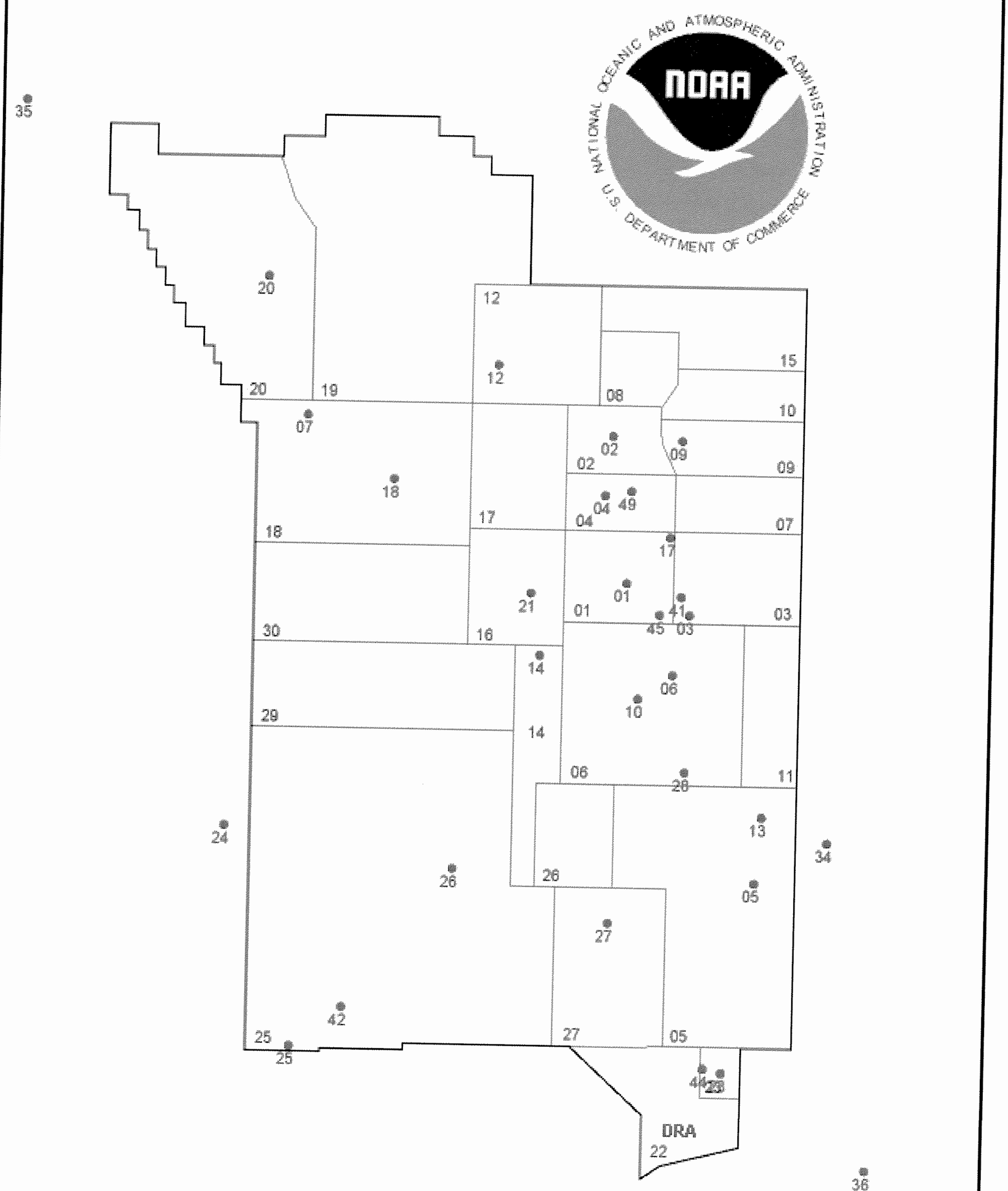


Figure 3.10-1
MEDA stations at NTS
Sources: NOAA

NTS Area Climate

Precipitation

Two fundamental physical processes drive precipitation events on the NTS: those resulting from cool-season, mid-tropospheric cyclones and those resulting from summertime convection. Cool-season precipitation is usually light and can consist of rain or snow. Summer is thunderstorm season. Precipitation from thunderstorms is usually light; however, some storms are associated with very heavy rain, flash floods, intense cloud-to-ground lightning, and strong surface winds. Thunderstorms generally occur in July and August when moist tropical air can flow northward from the southeastern North Pacific Ocean and spread over the desert southwest. This seasonal event is referred to as the southwestern monsoon. Mean annual precipitation totals on the NTS range from nearly 13 inches (.33 m) over the high terrain in the northwestern part of the NTS to less than 5 inches (12.7 cm) in Frenchman Flat. However, inter-annual variations can be great. For example, 9.67 (24.5 cm) inches fell in Frenchman Flat in 1998 and only 1.14 (2.9 cm) inches fell in 1989.

Precipitation also varies with terrain elevation. On average, annually, only 4.8 inches (12.2 cm) of precipitation are measured at Well 5B in Area 5, elevation 3,080 feet (939 m), while an annual average of 12.82 (32.6 cm) inches occurs on Rainier Mesa, elevation 7490 feet (2,283 m). Annual totals of less than 1.0 inch (2.5 cm) have occurred over the lower elevations of the NTS. Daily precipitation totals can also be large and can range from 2.0 to over 3.5 inches (5 to 8.9 cm). A storm-total precipitation amount of 3.5 inches (8.9 cm) is a 100-year, 24-hour, extreme precipitation event. Two- to three-inch (5 to 7.6 cm) daily totals have been measured at several sites on the NTS. Snow can fall on the NTS anytime between October and May. Maximum daily totals of 15 to 20 inches (38 to 50 cm) of snow or more can occur on Pahute and Rainier Mesas. Hail, sleet, freezing rain, and fog are rare on the NTS. Hail and sleet can cover the ground briefly following intense thunderstorms.

Temperature

As is typical of an arid climate; the NTS experiences large daily, as well as annual, ranges in temperature. Moreover, temperatures vary with elevation. Sites 5,000 feet (1,524 m) above mean sea level can be quite cold in the winter and fairly mild during the summer months. At lower elevations, summertime temperatures can frequently exceed 100°F. On the dry lakebeds, daily temperature ranges can vary by 40°F to 60°F (4 to 15°C) with very cold morning temperatures in the winter and very hot temperatures in the summer. In Frenchman Flat, the average daily temperature minimum and maximum for January is 24°F to 56°F (-4 to 13°C), while in July it is 62°F to 102°F (16 to 39°C). By contrast, on Pahute Mesa the minimum and maximum temperature for January is 25°F to 41°F (-3.8 to 5°C) and for July, 61°F to 84°F (16 to 29°C). The highest maximum temperature measured on the NTS is 115°F (46°C) in Frenchman Flat, near Well 5B, in July 1998 and in Jackass Flats near the Lathrop Wells Gate, in July 2002. The coldest minimum temperature measured on the NTS is -14°F in Yucca Flat in December 1967. The temperature extremes at Mercury are 11°F to 113°F (-11 to 45°C).

Wind

Complex topography, such as that on the NTS, can influence wind speeds and directions. Furthermore, there is a seasonal as well as strong daily periodicity to local wind conditions. For example, in Yucca Flat, during the summer months, the wind direction is usually northerly (from the north) from 10 p.m. PDT to 7 a.m. PDT and southerly from 9 a.m. PDT to 8 p.m. PDT. However, in January the winds are generally from the north from 6 p.m. PST to 11 a.m. PST with some southerly winds developing between 1100 a.m. PST and 5 p.m. PST. March through June tend to experience the fastest average wind speeds (8 to 12 mph [12.8 to 19 kmph) with the faster speeds occurring at the higher elevations. Peak wind gusts of 50 to 70 mph (80 to 112 kmph) have occurred throughout the NTS. Peak winds at Mercury have been as high as 84 mph (134 kmph) during a spring windstorm. Frenchman Flat experienced wind gusts to 70 mph (112 kmph) during the same windstorm. The peak wind speeds measured on the NTS are above 90 mph (145 kmph) on the high terrain with maximums of 91 mph (146 kmph) at Yucca Mountain Ridge-top, 92 mph (147 kmph) at the Monastery in Area-6, and 94 mph (151 kmph) in Area-12 on Radio Hill.

Relative Humidity

The air over the NTS tends to be dry. On average, June is the driest month with humidity ranging from 10 percent to 35 percent. Humidity readings of 35 percent to 70 percent are common in the winter. The reason for this variability is that relative humidity is temperature dependent. The relative humidity tends to be higher with cold temperatures and lower with hot temperatures. Consequently there is not only a seasonal variation but also a marked diurnal rhythm with this parameter. Early in the morning the humidity ranges from 25 to 70 percent and in mid-afternoon it is in the 10 to 40 percent range, with the larger readings occurring in winter. Humidity readings of more than 75 percent are rare on the NTS.

Hazardous Weather Phenomena

Wind speeds in excess of 60 mph (96 kmph) occur annually. Additional severe weather in the region includes occasional severe thunderstorms, lightning, hail, and dust storms. Severe thunderstorms may produce high precipitation rates that may create localized flash flooding. Few tornadoes have been observed in the region and are not considered a significant threat. Cloud-to-ground (CG) lightning can occur throughout the year but primarily between June and September. Maximum CG lightning activity on the NTS occurs between 1 p.m. and 8 p.m. PDT, while minimum activity occurs between 8 a.m. and 9 a.m. PDT. For safety analyses, the mean annual flash density on the NTS is 0.4 fl/sq. km/yr.

In the dry, clear desert air, the UV component of sunlight can be very intense. Safety precautions are necessary to protect against sunburn, especially between April and October. Extreme meteorological conditions throughout the NTS are documented on the ARL/SORD webpage (www.sord.nv.doe.gov) under the "Climate" link.

3.11 Biological Resources

This section discusses the biological environment of the proposed project area within Area 16 of the Nevada Test Site. The vegetation and wildlife are discussed at the site-specific scale. Wetlands and other aquatic resources are also briefly described. Regional information on vegetation and wildlife can be found in the NTS EIS (DOE, 1996).

Terrestrial Communities

Vegetation

The project site is located on the northeast slope of a low hill, within the transitional zone between the Mojave and Great Basin deserts. Blackbrush is the dominant plant species and represents the largest portion of ground cover surrounding the site. Associated plant species include Nevada jointfir (*Ephedra nevadensis*), white burrobush (Hymenoclea salsola), Stansbury cliffrose (*Purshia stansburiana*), rabbitbrush (*Chrysothamnus* spp.), four-wing saltbush (*Atriplex canescens*), goldenbush (*Ericameria sp.*), and Joshua tree (*Yucca brevifolia*). The area surrounding the project site is heavily disturbed from previous activities in the area. The non-native, invasive cheat grass (*Bromus tectorum*) and red brome (*Bromus rubens)* are present throughout the project site.

Wildlife

The project site occurs within the transitional zone, resulting in overlap of both Mojave and Great Basin species, and exhibits a wide variety of wildlife. Several species of small mammals occur within or near the project site. In general, these animals are inconspicuous because of their small size and tendency to remain below ground during the day. The most conspicuous terrestrial animal species within the project area include black-tailed jackrabbits (*Lepus californicus*), desert cottontail (Sylvilagus audubonii), coyotes (*Canis latrans*), side-blotched lizard (*Uta stansburiana*), western fence lizard (*Sceloporus occidentalis*), desert horned lizard (*Phrynosoma platyrhinos*), and western shovel-nosed snake (*Chinoactis occiptalis*).

In general, bat species tend to feed over reliable water sources (ponds, lakes, water tanks, etc.) and roost in rock crevices or man-made buildings or structures. However, because they are able to fly, several species of bats have the potential to feed above or migrate through the project area. In general, however, there are few suitable areas for roosting within the project area and bats that may occur would likely be transient. Common bat species in the NTS, and potentially the project area, include the western pipistrelle (*Pipistrellus hesperus*), California myotis (*Myotis californicus*) and the pallid bat (*Antrozous pallidus*).

Common migratory birds potentially occurring within the project site or surrounding areas, as seasonal residents or transient, include black-throated sparrow (*Amphispiza bilineata*), house finch (*Carpodactus mexicanus*), common ravens (Corvus corax), Loggerhead shrike (*Lanius ludovicianus*) *and* horned lark (Eremophila alpestris). Several of these species may breed and nest within the project area. Commonly occurring raptors include red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), turkey vulture (*Cathartes aura*), and American kestrel (*Falco sparverinus*).

Aquatic and Wetland Resources

No wetlands, springs, or seeps that would support wetland vegetation are known to occur within the project area. The closest known spring is Tippipah Spring, approximately 1.9 miles (3 km) to the northwest. The spring has been heavily disturbed by past use and currently is represented by an adit approximately 29 feet (9 m) in length with a pool within the adit. Wetland vegetation consist of a narrow, linear corridor that extends for 558 feet (170 m) for m the adit with flow varying from 33 to 131 feet (10 to 40 m) down gradient depending on season and drought conditions (Hansen et al. 1997)

Endangered, Threatened or other Special Status Species

The Endangered Species Act states that any federally listed threatened or endangered species must be evaluated through consultation with the U.S. Fish and Wildlife Service (FWS) to insure that proposed activities do not jeopardize the continued existence of the species, or significantly alter or destroy critical habitat.

Listed Plants

No plants that have been federally listed as threatened or endangered, or proposed for listing, are known to occur on the NTS. However, 18 plants considered to be Species of Concern (SOC) by the Nevada Natural Heritage Program occur on the NTS. The closest monitored population of SOC plants is the Pahute penstemon (Penstemon pahutensis) over 6 miles (9 kilometers) southwest of the project area (DOE, 2004a).

Listed Animals

Several special status animal species are known to occur within or near the NTS (Table 3.11-1). The threatened desert tortoise is the only federally listed species that occurs within the NTS. The primary habitat for desert tortoise is restricted to the southern portion of the NTS, in the Mojave Desert ecosystem. The northern-most known occurrences of this species are the northern edges of the CP Hills (DOE, 2004b). The DIVINE STRAKE project site is approximately 6.2 miles (10 km) northwest of desert tortoise habitat and its known range.

The Migratory Bird Treaty Act protects all migratory birds from disturbance while nesting. Birds cannot be disturbed until all young have fledged and the nest is no longer in use. As stated above, a number of migratory birds are present on the NTS during the normal breeding season and have the potential to nest within or near the proposed project site. However, due to lack of suitable habitat, no waterfowl or shore birds are likely to occur within, or near, the project area. One of the most notable migratory birds which occurs within the NTS is the western burrowing owl (*Athene cuniculario*). This species is a ground dwelling bird that nests in burrows excavated by other animals. It occurs within open, flat to minimally sloping terrain throughout the southern and eastern portions of the NTS. The majority of the known occurrences of this species on the NTS are within the transitional ecosystem, with the closest observation of the species being 3 miles (5 km) to the north along Pahute Mesa road (DOE, 2003c).

Table 3.11-1

Special Status Species Known to Occur on or Adjacent to the NTS

Scientific Name	Common Names	Status*
Reptile Species		
Gopherus agassizii	Desert Tortoise	LT, NPT
Sauromalus obesus	Chuckwalla	SOC
Bird Species(b)		
Athene cunicularia hypugea	Western burrowing owl	SOC, P
Aquila chrysaetos	Golden eagle	BE, P
Buteo regalis	Ferruginous hawk	SOC, P
Charadrius montanus	Mountain plover	PT, P
Chlidonias niger	Black Tern	SOC
Empidonax wrightii	Gray flycatcher	SOC
Falco peregrinus anatum	American peregrine falcon	<LE, P
Haliaeetus leucocephalus	Bald eagle	LT-PD, BE, P
Ixobrychus exillis hesperis	Western least bittern	SOC, P
Phainopepla nitens	Phainopepla	SOC
Plegadis chihi	White-faced ibis	SOC, P
Mammal Species		
Corynorhinus townsendii pallescens	Townsend's big-eared bat	SOC
Equus asinus	Burro	H&B
Equus caballus	Horse	H&B
Euderma maculatum	Spotted bat	SOC, NPT
Myotis ciliolabrum	Small-footed myotis	SOC
Myotis evotis	Long-eared myotis	SOC
Myotis thysanodes	Fringed myotis	SOC
Myotis volans	Long-legged myotis	SOC
Myotis yumanensis	Yuma myotis	SOC

*Status Codes:
Endangered Species Act, FWS
<LE - Formerly listed as endangered; LT - Listed as threatened; PD - Proposed for delisting; PT - Proposed for listing as threatened; SOC - Species of concern
U.S. Department of Interior
BE - Protected under the Bald Eagle Protection Act
H&B – Protected under Wild Free Roaming Horse and Burro Act
State of Nevada
NPT - Protected as threatened; P - Protected bird
(b) Does not include all bird species that are protected by the Migratory Bird Treaty Act or by the state. Additionally, there are 26 birds which have been observed on the NTS, which are all protected by the state.

3.12 Cultural Resources

This section describes the existing cultural resources in the vicinity of the Proposed Action. Cultural resources located on the NTS include archaeological sites, historic architectural or engineering features, and Native American religious or sacred places.

Definition and Background

Cultural resources are those aspects of the physical environment that relate to human culture and society, and those cultural institutions that hold communities together and link them to their surroundings. They consist of prehistoric and historic sites, structures, artifacts, and other physical evidence of human activities considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Prehistoric and historic archaeological resources are locations where human activity measurably altered the earth or left deposits of physical remains. Archaeological resources are found in all environments on the NTS. Archaeological resources generally must be older than 50 years to be considered for protection under existing Federal cultural resource laws, however the cold war structures associated with nuclear testing on the NTS are the exception to this guidance.

Federal legislation requires agencies to consider the effect of proposed projects on cultural resources that are considered eligible for listing on the National Register of Historic Places (NHRP).

To date, more than 400 cultural resource investigations have been conducted on the NTS (DOE, 2004a). Approximately 4 percent of the NTS has been investigated, mostly by 100 percent coverage pedestrian surveys, with some data recovery excavation and Native American ethnographic consultation (DOE, 2004b). A total of almost 2,200 cultural resources have been recorded; of those nearly half are eligible for inclusion on the NRHP listing of historic properties. Ninety-six percent of the resources are prehistoric, with the remainder either historic, recent significant, unknown, or multi-component (DOE, 2004a).

Archaeological Resources

The area of potential effect (APE) for construction of the U16b test bed was defined and surveyed by qualified NTS archeologists in 1997, prior to ground breaking for the tunnel complex (see Figure 3.12-1). The cultural resource survey identified one site that was deemed ineligible to the NRHP.

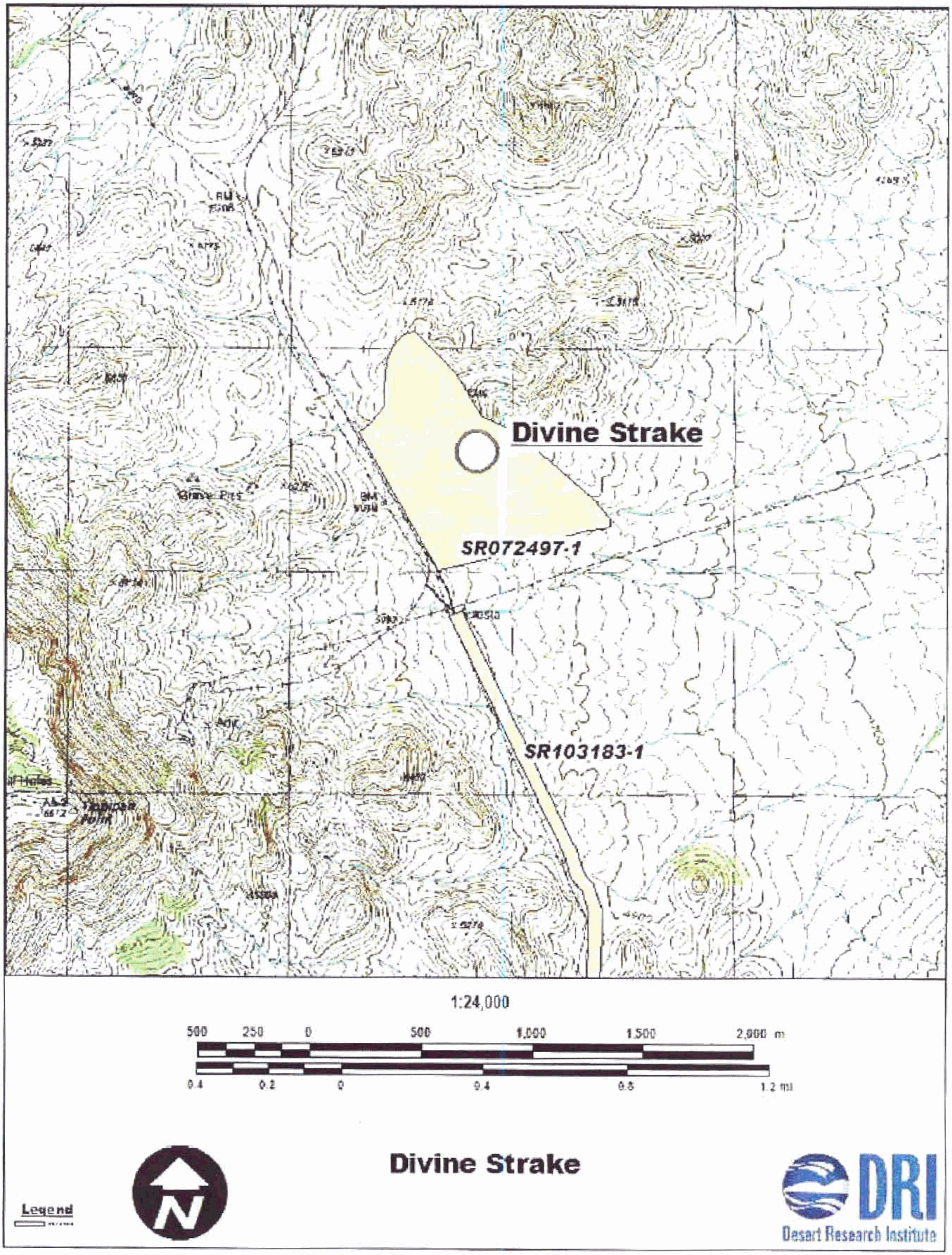


Figure 3.12-1
APE for Proposed Action
Sources: Dessert Research Institute

Archaeological investigations conducted at Tippipah Spring, site 26NY4, in 2004 have produced evidence of a long prehistoric and historic occupation at the site. Prehistoric cultural material includes stone tools, flakes from tool manufacturing and grinding stones and features, such as rock rings and cairns (DOE, 2005c). The historic occupation at Tippipah Spring consists of a stone cabin, corrals and historic debris.

Historic Resources

Investigations for historic cultural material have been performed in the vicinity of the Proposed Action. Historic cultural material includes metal cans, glass, shell casings, and automobile engine parts and features including residential structures, corrals, a water tank, and rock cairns typical of mining claims (DOE, 2005c). Historic research focuses on the relationship between springs and historic mining activities and the relationship between springs and historic transportation. Open-range grazing is known to have occurred on the NTS as early as the late 1800s (Fehner and Gosling, 2000). Suitable forage grounds existed for both cattle and sheep, but access to water was a problem. Flow from the widely scattered springs was often minimal, and ranchers, to augment the supply of water, modified some springs and constructed water storage tanks. The remains of one such tank, made from a boiler, was found at Tippipah Spring (Fehner and Gosling, 2000).

While ranchers and their families tended to live in nearby communities outside the present site boundaries, they built and maintained some structures on the site. One historic structure is located near the proposed detonation site (Figure 3.12-2). This structure is eligible for listing in the National Register; however, the structure is severely deteriorated. DOE is currently in negotiations with SHPO regarding this structure, potential effects as a result of the Proposed Action, and potential Section 106 mitigation.

Native American Resources

No specific Native American sacred or religious sites have been identified within the APE of the construction of the U16b tunnel complex.

Figure 3.12-2

View of the Side and the Back of the Tippipah Spring Historic Site

3.13 Socioeconomics and Environmental Justice Issues

This section describes the existing social and economic conditions in the vicinity of the Proposed Action, including population, housing, and environmental justice issues.

Socioeconomics

Ninety-seven percent of NTS employees reside in Nye (7 percent) or Clark (90 percent) counties. Between 1990 and 2000 the Nevada population grew 66.3 percent; Nye County grew 82.7 percent and Clark County grew 85.6 percent. Population growth in Nevada is expected to exceed average national trends for the foreseeable future. The growth in Clark County is expected to slow, but remain well above national averages. In 2001 per capita income was $24,968 in Nye County and $28,992 in Clark County, compared to a Nevada average of $30,128. Unemployment in Nye and Clark Counties in 2001 was 5.5 percent. There are no permanent residents at the NTS. The off-site area within 50 miles (80 km) of the NTS is predominantly rural. Several small communities are located southwest of the NTS, including: Pahrump Valley located approximately 50 miles (80 km) south of the NTS, the Amargosa farm area located approximately 31 miles (50 km) southwest of the NTS, and the town of Beatty located approximately 40 miles (64 km) west of the test site.

Environmental Justice

Under Executive Order 12898, DOE is responsible for identifying and addressing disproportionately high and adverse impacts on minority or low-income populations. Minority persons are those who identify themselves as Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; or another non-white race; or persons of Hispanic or Latino ethnicity. Persons whose incomes are below the Federal poverty threshold are designated low-income. At NTS, the 80-km (50-mi) radius includes portions of Clark, Nye, and Lincoln Counties in Nevada and a portion of Inyo County, California. In 2002, minority populations comprised 30.9 percent of the U.S. population, and the same percentage of the Nevada population. The percentage of minority populations in the area surrounding the NTS is greater than that in the United States or Nevada; however, the minority populations in the area are concentrated in the Las Vegas metropolitan area, outside the 80-km (50 mi) impact area (DOE, 2003b). Low-income populations comprised 12.4 percent of the U.S. population, based on 1999 income, and 10.5 percent of the Nevada population. Within the counties surrounding NTS, 10.8 percent of the population lives below the poverty level (DOE, 2003b).

3.14 Aesthetics and Visual Resources

Visual resources include the natural and man-made physical features that give a particular landscape its character and value as an environmental factor. The feature categories that form the overall impression a viewer receives of an area include landform, vegetation, water, color, adjacent scenery, scarcity, and man-made (cultural) modification.

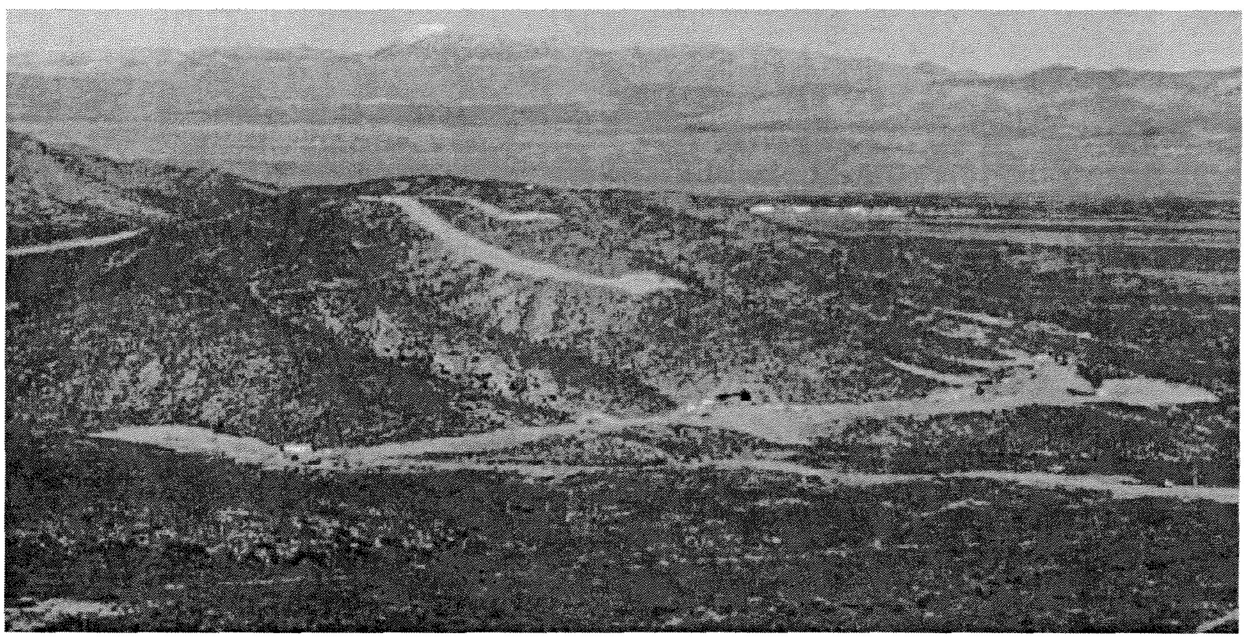
Visual sensitivity for this analysis was based solely on the volume of travel on public highways because these roads are the only key public viewpoints from which the study areas are seen. Study areas that are visible from highways with 3,000 or more average annual daily traffic were average daily traffic were assigned a medium sensitivity level. Study areas that are visible from highways with annual average daily traffic below 1,000 were assigned a low sensitivity level.

The NTS is located in a transition area between the Mojave Desert and the Great Basin. Vegetation ranges from grasses and creosote bush in the lower elevations to juniper, pinyon pine, and sagebrush in elevations above 5,000 feet (1,524 m). The topography of the NTS consists of a series of mountain ranges arranged in a north-south orientation separated by broad valleys. A portion of the site is characterized by the presence of numerous subsidence craters resulting from past nuclear testing. Scenic views related to geologic features are numerous within this region. The southwestern Nevada volcanic field, which includes portions of the NTS, is recognized by researchers to be a classic example of a nested, multicaldera volcanic field. Area 16 is located in the center of NTS.

The area surrounding the NTS consists of unpopulated to sparsely populated desert and rural lands. Because the NTS is surrounded to the east, north, and west by the NTTR Complex and to the south by lands controlled by the U.S. Bureau of Land Management, the main public views of the NTS interior are from U.S. Highway 95. Because the southern boundary of the NTS is surrounded by various mountain ranges, including the Spector Range, Striped Hills, Red Mountain, and the Spotted Range, views from U.S. Highway 95 are limited to Mercury Valley and portions of the southwestern sector of NTS, which can be seen from Amargosa Valley. Traffic on U.S. Highway 95 at the Mercury exit is approximately 3,600 vehicles per day. Therefore, portions of the NTS visible from this area would have a high sensitivity level. The detonation is proposed to occur well inside the boundaries of NTS at U16b. Figure 3.14-1 shows a view of the location facing northeast.

Figure 3.14-1

View from the Proposed Detonation Site Looking Northeast



4.0 Environmental Consequences

This Chapter discusses the environmental consequences of implementation of the Proposed Action and No-Action Alternative. For each resource, significance criteria are identified followed by a discussion of identified impacts and mitigations, if required.

4.1 Land Use

Existing and background information pertaining to land use of the study area is summarized and presented in Section 3.1. This section discusses the potential for significant impacts based on the criteria listed below. Impacts to land use would be present if implementation of the Proposed Action were to cause:

- Incompatibility of the Proposed Action with land uses on nearby properties in region of influence
- Zoning conflict
- Conflict with local/ regional land use plans

No land use impacts were identified. A detailed discussion of the land use analysis is provided below.

Environmental Consequences of the Proposed Action

With the Proposed Action, the Large-Scale, Open-Air Explosive Detonation would occur within Area 16, which is within the designated Nuclear or High Explosive Test Zone at the NTS. Area 16 occupies about 73 km^2 (28 mi^2) in the west-central portion of the NTS. Area 16 was established in 1961 for the DoD's exclusive use in support of complicated nuclear effects experiments that required a tunnel location in an isolated area away from other active weapons test areas. From mid-1962 through mid-1971, six underground nuclear weapons effects tests were conducted in the U16a tunnel complex located within Area 16. The U16a tunnel complex is located approximately 2.5 miles southwest of the proposed U16b test bed. Currently, the DoD uses this area, including both U16a and U16b tunnels for RDT&E in support of HDBT programs involving the delivery and detonation of conventional or prototype explosives and munitions.

The Proposed Action is consistent with the current land use classification for Area 16 and the region of influence, and would not conflict with any zoning or land use plans in these areas. These areas are isolated and designed for National Security and testing events. As a result, no impacts related to Land Use would occur with implementation of the Proposed Action.

With the Proposed Action, NNSA would retain the right to limit/suspend all flight activity over R-4808N/S and R-4807B, the airspace above the proposed DIVINE STRAKE location. Since there would be no aircraft activity above the proposed location during the DIVINE STRAKE detonation, there would be no airspace-related impacts.

Environmental Consequences with the No-Action Alternative

With the No-Action Alternative, the Large-Scale, Open-Air Detonation would not occur. Land use would remain the same as described in Section 3.1. Therefore, there would be no impacts to Land Use with implementation of the No-Action Alternative.

4.2 Noise and Blast

Existing and background information pertaining to the noise environment of the study area is summarized and presented in Section 3.2. The potential for significant impacts related to blast and noise effects have been assessed based on whether the Proposed Action would:

- Damage structures or property
- Expose on-site personnel or off-site persons to severe or hazardous noise levels that cause adverse effects
- Expose threatened or endangered species to severe or hazardous noise levels that cause adverse effects
- Conflict with a jurisdictional noise ordinance or violate any law or relevant standard
- Cause substantial permanent increase in ambient noise levels at sensitive receptors
- Cause substantial temporary increase in ambient noise levels at sensitive receptors during construction and/or operation phases
- Cause startle reaction from persons off NTS in reaction to a sudden noise from detonation

No significant noise or blast impacts were identified, assuming that the test is conducted only during prescribed meteorological conditions. A more detailed discussion of the noise and blast analyses is presented below.

While there are a number of laws and guidelines at the Federal level that direct the consideration of a broad range of noise and vibration issues, most of the areas addressed by Federal regulations are not applicable to the proposed project. Documents containing regulations and guidance relevant to the project are listed below:

- NEPA of 1969 (42 U.S.C. 4321, et. seq.) (PL-91-190) (40 C.F.R. § 1506.5)
- Noise Control Act of 1972 (42 U.S.C. 4910)
- EPA recommendations on "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety", NTIS 550\9-74-004, USEPA, Washington, D.C., March 1974
- HUD Environmental Standards (24 C.F.R. Part 51)
- OSHA Occupational Noise Exposure; Hearing Conservation Amendment (FR 48 (46), 9738--9785 (1983)

Environmental Consequences of the Proposed Action

This Section discusses likely airblast effects and the potential effects of the linearly propagating acoustic wave resulting from the proposed DIVINE STRAKE detonation. Because of the size of the detonation (593 tons TNT equivalent), under certain conditions sound waves with relatively high peak pressure levels (>125 dB $_{unwtd\text{-}pk}$) could travel distances beyond the NTS boundary. However, DIVINE STRAKE has been designed to only occur under acceptable blast criteria as described in Chapter 2.

Detonation Related Impacts (Airblast and Acoustic Wave)

"Airblast" describes the action of the air relatively close to the detonation point. The velocity of the rapidly expanding gas (from a high energy chemical reaction) greatly exceeds the speed of sound in air and produces a shockwave. The magnitude of this peak overpressure wave may be described using various units. In units of pounds per square inch (psi) of pressure, the airblast portion of the wave front extends to where the peak overpressure has decreased below about 0.4 psi (which for this project is a distance of slightly over one mile). Where airblast peak overpressure has reduced to approximately 0.4 psi, the shock wave would have slowed to the point where it approaches the speed of sound in air and becomes an acoustic wave that can be refracted by discontinuities in wind and temperature gradients. Both types of wave are audible but their physical consequences are different as may be seen from inspection of Table 4.2-1 4.2-2, and 4.2-3 below where the potential effects of both airblast and acoustic wave propagation are summarized. "Audibility" of the airblast phase would be the least of environmental concerns considering the range of potential non-auditory effects that might occur in proximity to the detonation site.

Because of the variability in meteorological assumptions contained in acceptable methodologies that were used to calculate the air blast and acoustic wave propagation phenomena, minor differences in decibel levels at great distances from the detonation site are noted. Based on airblast and acoustic wave propagation evaluation conducted by DTRA for the proposed test, the airblast shockwave effects of DIVINE STRAKE are limited to the boundaries of the test site. A summary of the site and immediate area impact evaluation is shown in Table 4.2-1.

Table 4.2-1

Summary of Levels and Extent of DIVINE STRAKE Damage Criteria to Biota*

Criteria	Peak Overpressure, kPa	Peak Overpressure, Psi	Range in Feet	Range in Miles
Birds in flight injured[a]	68.9	10.0	1084	
Tree breakage (10%)[a]	24.1	3.5	2033	
Human eardrum rupture[a]	20.7	3.0	2251	
Incipient small mammal injury[a]	13.8	2.0	2974	
Noise - Tinnitus (ringing), possible PTS or TTS (163dB)[b]	2.4	0.35	7511	1.4
Noise – OSHA impulsive limit, possible TTS (140dB)[b]	0.2	0.029	71,912	13.6
Noise – Thunder sound (130dB)[b]	0.1	0.015	135,040	25.5

Source: Table 3 of Finding of No Significant Impact and Environmental Assessment for High-Explosive Field Test MILL RACE, January 1981
[a] 1% threshold
[b] Limits
PTS – permanent threshold shift
TTS – temporary threshold shift
kPa – kilopascal
Psi – pounds per square inch
dB – decibel
OSHA – Occupational Safety and Health Administration
* For a calm homogeneous atmosphere; for overpressure below 2.8 kPa, if strong amplifying gradient is present these distances could be as much as 7x greater and if strong reduced gradient is present, distances could be 1/3 less.

Table 4.2-2

Summary of Potential Airblast Environmental Damage Criteria to Structures and the Predicted Ranges for DIVINE STRAKE*

	Kpa	psi	feet	mi
Chimney breakage (10% probability)	12.4	1.8	3208	
Major structural damage threshold	6.9	1.0	4932	
Roof damage (10% probability)	2.8	0.4	9895	1.9
Inflight light aircraft damage threshold	1.4	0.2	12,261	2.3
Door Failure (10% probability)	1.0	0.15	16,648	3.2
Broken bric-a-brac threshold	0.69	0.10	23,327	4.4
Broken tile and mirrors threshold	0.62	0.09	25,709	4.9
Wall and plaster cracks threshold	0.41	0.06	37,443	7.1
Cracked Windows Threshold:				
- less than 1 in 1000 pop	0.40	0.058	38,294	7.2
- less than 1 in 10,000 pop	0.20	0.029	71,912	13.6

Source: Table 3 of Finding of No Significant Impact and Environmental Assessment for High-Explosive Field Test MILL RACE, January 1981
kPa – kilopascal
Psi – pounds per square inch
mi – mile
*For a calm homogeneous atmosphere, for overpressure below 2.8 kPa, if strong amplifying gradient is present these distances could be as much as 7x greater and if strong reduced gradient is present, distances could be 1/3 less.

The detonation of 700 tons (635 metric tons) of ANFO (593 equivalent tons TNT) would generate substantial peak overpressure in the airblast shockwave and high peak acoustic sound pressure levels at substantial distances from the blast site's ground zero location, during periods of calm or non-downwind, non-refracting, and non jet stream or monsoon ozonosphere ducting. Assuming neutral day conditions with no enhanced propagation or excess attenuation due to meteorological conditions, and a conservative estimate of variance (99% confidence), additional modeling of the peak, unweighted, sound levels expected at the NTS boundary and beyond indicates that peak sound levels of approximately 140 dB would occur at the nearest NTS boundaries (approximately 14 miles (mi) (22,600m) easterly and 20.5 mi (33,100m) westerly of ground zero Tunnel Complex 16b, respectively). Peak sound levels closer to the blast site (without local shielding or barriers) would be higher. Peak sound levels farther from ground zero would be lower. At the southerly boundary of the NTS near its intersection with Jackass Flats Road (24.1 mi[38,780m]) the expected level is 138.5 dB_{pk} and at Mercury (26.9 mi [43,330m]) it is 137.5 dB_{pk}. Additional results are:

- Amargosa Valley 136.5 dB_{pk} (28.7 mi [46,170m])
- Beatty 135 dB_{pk} (32.8 mi [52,720m])
- Indian Springs 132 dB_{pk} (41.9 mi [67,380m])

- Scotty's Junction 129 dB_{pk} (51.8 mi [83,310m])
- Pahrump 128 dB_{pk} (57.2 mi [92,050])
- North Las Vegas 126 dB_{pk} (67.5 mi [108,670m])

TABLE 4.2-3

Summary of Levels and Extent of Airblast Damage Criteria*

Effect	Corresponding Incident Peak Overpressure Level	Distance From GZM at Which Overpressure Level Occurs
Threshold of lethality		
Small animals in the open	3 – 6 psi	1250 – 2000 ft
5-lb animal in the open	>8 psi	<1100 ft
Small animals (rabbits or smaller) in burrows	10 psi[a]	1000 ft
Larger animals in burrows	18 psi[a]	750 ft
Threshold of lung damage to animals in burrows		
Small animals	3 psi[a]	2000 ft
Large animals	6 psi[a]	1250 ft
Threshold of eardrum rupture to animals in the open	3 – 5 psi	1400 – 2000 ft
Threshold of injury to birds in flight	5 – 10 psi	1000 – 1400 ft
Toppling of broadleaf trees (small leaves or defoliated or light crowned)	>10 psi	<1000 ft
Damage to small vegetation or tree branches	3 psi	2000 ft
Structural damage to buildings	1 – 2 psi	2800 – 5000 ft
Window breakage (one window for each 1000 human population	200 pa (0.029 psi)	14 mi[b]
Impulsive noise level limit for industrial workers by Occupational Safety and Health Administration (OSHA)	140 dB (0.029 psi)	14 mi[b]
Tinnitus or "ringing" of ears	160 dB (0.29 psi)	1.8 mi[b]

Notes:
[a] The peak overpressure levels shown are the levels that occur without reflections. Airblast filling a burrow can produce pressures that are 2 to 3 times these values and are sufficient to result in the effect that is described.
[b] Assuming a calm, nonrefracting atmosphere.
kPa – kilopascal
Psi – pounds per square inch
dB – decibel
ft – feet
m – meter
mi – mile
Source: Table 3 of Finding of No Significant Impact and Environmental Assessment for High-Explosive Field Test MILL RACE, January 1981

Due to the initial blast spectrum (i.e., frequency content) and the attenuation mechanisms affecting long range sound propagation, the audible character of the blast would be similar to thunder or a sonic boom with predominant frequencies around 30 Hz or lower. This "thump" would likely be felt as much as heard. Also, because the "one-shot" sound level is below 140

dB_{pk} and because of the exclusive low frequency energy content of the sound wave, no temporary or permanent effects on human hearing are at all likely for off-site receptors without the need for personal hearing protective devices. DIVINE STRAKE would be detonated remotely without personnel on site. Additionally, a safe stand off distance would be established for personnel on the NTS.

Based on an evaluation of probable effects as provided by DTRA for DIVINE STRAKE, a review of previous tests and blasts of similar size, and further calculation of probable off-NTS sound levels, the following indicates that the DIVINE STRAKE test would not cause significant environmental effects:

- Destruction and damage caused by the airblast would be confined within the NTS boundary and would not cause injury, or structural or surficial damage to off-site persons, structures or property
- The detonation would not expose off-site persons to severe or hazardous noise levels
- Threatened or endangered species would not be exposed to severe or hazardous noise levels (see Section 4.11)
- The off-site noise level would not conflict with a jurisdictional noise regulation
- The detonation would not cause substantial permanent increase in ambient noise levels at any receptors
- The detonation may cause a very brief substantial but not significant increase in ambient noise level at sensitive receptors
- With proper notification to the public, the detonation is not likely to cause widespread startle reaction from persons off the NTS in reaction to a sudden moderately loud noise resulting from detonation
- The detonation during daylight hours would not cause a significant visual effect in sensitive areas

These findings are subject to the Acceptable Blast Conditions Criteria decision framework presented in Chapter 2, and certain meteorological considerations as described below.

Meteorological Considerations and Qualifications

The absolute air temperature, the rate of change of air temperature with distance above the ground, and wind direction, velocity, and gradients which affect the sound velocity profile above the ground can refract (or "bend") the sound wave away from or toward the ground at some distances from the source (focusing). At substantial distances from the detonation point these atmospheric effects could increase or decrease the sound level that would be expected from wave divergence alone. A severe form of atmospheric effect known as channeling could increase the distance from the source at which a certain sound level is expected to occur by a factor of seven to ten. This is with respect to a calm, homogeneous, nonrefracting atmosphere. (Ristvet, 2005).

The predicted distance to a particular environmental effect is predicated on a calm, homogeneous, nonrefracting, non-channeling atmosphere. Adverse meteorological conditions could increase these distances by seven to ten times. This could result in a more widespread, off-site regional impact. Conversely, certain atmospheric conditions could reduce the distance-to-effect by a factor of three. This EA assumes a conservative approach of non-reliance on special atmospheric conditions that might reduce sound levels. Further, this EA assumes avoidance of atmospheric conditions that favor extra long distance blast and sound wave propagation.

Construction Related Impacts

Potential noise from project-related on-site construction activity was evaluated using standard methods (EPA, 1971). All sound from construction activity would be inaudible off the NTS. Following standard OSHA regulations would prevent any excessive noise exposure to on-site workers. Noise from trucks transporting supplies and material to the site would not substantially increase traffic noise at any sensitive receptors.

Mitigation Measures to Avoid Significant Effects

- Establish and follow conservative acceptable blast conditions criteria to ensure favorable meteorological conditions at the time of the detonation. A detailed description of acceptable blast conditions criteria is located in Chapter 2.
- Monitor near ground and upper atmosphere weather conditions using radiosondes released at intervals and Doppler radar for an appropriate period leading up to and just prior to detonation.
- Notify affected NTS personnel that very high on-site sound levels and possible visible light levels would be likely from the DIVINE STRAKE detonation and provide affected

NTS personnel with PPE hearing and eye protection as prescribed by OSHA regulations.

- Provide advance and proximate civil notification that NTS would be conducting "A test that may result in a loud boom, audible over a large area surrounding the NTS" to prevent unnecessary startle and anxiety in off-site areas.
- Provide acoustic monitoring at locations near the NTS such as Amargosa Valley, Beatty, and Indian Springs. A detailed description of the acoustic monitoring that would occur with implementation of DIVINE STRAKE can be found in Chapter 2, Description of the Proposed Action and Alternatives.

Environmental Consequences of the No-Action Alternative

With the No-Action Alternative, the large-scale, open-air detonation, DIVINE STRAKE, would not occur. Therefore, there would be no noise, blast, or light impacts.

4.3 Human Health and Safety

Existing and background information pertaining to human health and safety issues within the study area is summarized and presented in Section 3.3. This section discusses the potential for significant impacts based on whether the Proposed Action would create unsafe conditions or expose employees and the public to situations that exceed health standards or present an undue risk of health-related accidents: The methodology used to determine the potential impacts to human health and safety is based on consideration of the following:

- Hazardous materials used or produced by the Proposed Action and the associated exposure levels compared with regulatory requirements
- Hazardous conditions created by the Proposed Action

No significant impacts were identified when analyzing based on the above criteria. A detailed discussion of the human health and safety analyses is provided below.

Environmental Consequences of the Proposed Action

The potential for DIVINE STRAKE to create health and safety impacts to the general public is minimized by a combination of the remote location of the NTS, the sparse surrounding population, and a comprehensive program of administrative and design controls. Further, there is no public access to the NTS due to strict access controls.

Effects to the public for Health and Safety were evaluated within the NTS boundary. Public areas more distant than the NTS boundary were not taken into consideration because potential human health and safety effects are assumed to diminish with distance from the site of the test. Distances to the site boundary and other locations are listed below.

- East - Boundary of NTS (abuts NTTR) 14.5 miles (23.3 km)
- West - Boundary of NTS (abuts NTTR) 14 miles (22.5 km)
- North – Boundary of NTS (abuts NTTR) 15.5 miles (25 km)
- South - Mercury Gate 29 miles (46.6 km)
- South - Lathrop Wells 29 miles (46.6 km)

The only human health or safety impact that could potentially extend beyond the NTS boundary would be related to potential noise or blast wave impacts as a result in overpressure higher than 140 dBs. As discussed in Section 4.2, Noise and Blast, overpressure higher than 140 dBs would not occur as a result of the Proposed Action. Therefore, unsafe conditions resulting from exposure of the public to situations that exceed health standards would not occur and off-site impacts would be less than significant.

The NTS EIS (DOE, 1996) contains an analysis of NTS workforce injuries and illnesses. With the Proposed Action, no health and safety impacts other than those presented in the 1996 NTS Sitewide EIS are anticipated. General health and safety protocols for NTS personnel are detailed in DOE regulations and site and facility SOPs. During a detonation, the primary means of personnel protection would consist of administrative and access controls to the test area, establishment of a safe stand off distance, and personnel clear zones.

Operations workers would not be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (DOE, 2003d). Workers would be protected from high noise through implementation of existing hearing protection programs to minimize noise impacts on workers.

Contact with explosive test materials or byproducts would occur primarily during test preparation, post-test evaluation, and site cleanup. The materials that would be used in the test and the respective Threshold Limit Value (TLV) are listed in Table 4.3-1. A TLV is the airborne concentration of substances devised by the American Conference of Governmental Industrial Hygienists (ACGIH) that represents conditions under which it is believed that nearly all workers may be exposed day after day with no adverse effect. TLVs are advisory exposure guidelines, not legal standards that are based on evidence from industrial experience, animal studies, or human studies when they exist. None of the compounds that would be used during the proposed detonation are immediately dangerous to life or health.

Table 4.3-1

Worker Safety Limits

Compound	Exposure Type	TLV
ANFO	Ammonium Nitrate Dust (Nuisance Dust)	10 mg/m^3
	Mineral Oil Dust	5 mg/m^3
Booster C-4	RDX, Cyclonite	1.5 mg/m^3
Components:	Hexogen	3.0 mg/m^3
	Vistanex	N/A
	DOA or DOS	N/A
	Process Oil	5 mg/m^3

TLV – threshold limit value

During detonation, administrative and access controls and monitoring would prevent health impacts to workers and the general public. With appropriate administrative and access controls in place, there would be no impact to workers or members of the public.

Table 4.3-2 lists the detonation products that would result from the Proposed Action. Nitrogen, carbon dioxide, and methane are gases that would displace oxygen following the test. Reentry into the test area would be delayed until the gases have dispersed sufficiently for safe entry.

Table 4.3-2

ANFO-Emulsion Detonation Products

Compound	Symbol	Amt/kg of Explosive (g/kg)	Total Produced (Mg)
Water	H_20	504.45	271.62
Nitrogen	N	285.8	153.89
Carbon Dioxide	CO_2	171.64	92.42
Methane	CH_4	7.06	3.80
Calcium Carbonate	$CaCO_3$	31.05	16.72

DoD (U.S. Department of Defense) Explosives Safety Management and the DoD Explosives Safety Board. DOE Directive 6055.9E, August 19, 2005.

Workers would also be presented with potential hazards from construction activities associated with the Proposed Action. These activities would include excavation of the charge hole, drilling holes into rock for installation of monitoring equipment, driving to and from the test area, and installing equipment for the test. During these activities, common hazards would be present including falling, tripping, burns, noise exposure, and traffic accidents. Accidents associated with these hazards would be expected to occur at a rate similar to that for other industrial projects as identified in the 1996 NTS Sitewide EIS. The number of injuries related to construction of DIVINE STRAKE would depend on the number of workers and the specific types of tasks they would perform.

The site of the proposed DIVINE STRAKE detonation (the U16b test bed) has never been used for any type of nuclear testing activity. Based upon this process knowledge, the aerial radiation surveys performed in the past, the current radiological control status of the area under the existing radiation protection program, and the knowledge of the area from the NTS Environmental Restoration (ER) program, radioactive contamination does not exist at U16b. Therefore, the Proposed Action would not result in the suspension or dispersion of radioactive materials or human exposure to radioactive materials. To reduce the potential for human health related impacts, the DIVINE STRAKE detonation would be subject to planning and execution plans to ensure that the work would be conducted safely. A safety plan specific to the test would be prepared that would include procedures for training, hazard analysis, hazard communication, personal protective equipment, and emergency response preparation. Other measures that would be employed to further reduce the potential for impact include:

- Evacuation of workers from the area surrounding the test site to a safe stand off area
- Proper storage of explosive materials
- Inventory and accountability of all explosive materials

Because of safety measures that would be implemented as part of the Proposed Action, potential impacts related to Human Health and Safety are expected to be less than significant.

Accident Analysis

This section describes the range of accidents at the NTS that are reasonably foreseeable for the DIVINE STRAKE experiment. In general, work at the NTS has been conducted with a lower rate of accidents than for similar work performed in the private sector. Although accidents are rare, the consequences could be minor to catastrophic depending on the type of accident and the number of involved workers. The postulated accidents analyzed for the EA were considered on the basis of project phase, probability frequency, and the magnitude of consequences. The analysis was done using a qualitative approach due to the lack of historic data that could form a basis for projecting the frequency of an accident. DOE guidance on conducting accident analysis was followed (DOE, 2002) and the DoD Mil Std 882c System Safety Program Requirements document was applied, as appropriate. The guidance directs that a sliding scale should be used when analyzing accidents considered in an EA. This means that projects involving radioactive or highly toxic materials would be given a more detailed review than projects involving less hazardous materials. The following sections describe the methodology, hazardous analysis, accident scenarios, accident consequences, and mitigation measures.

Methodology

A set of accident scenarios was developed for work related to DIVINE STRAKE conducted within the NTS. The accident scenarios for each of the following phases of work were considered:

- Preparation
- Mixing and loading
- Firing
- Reentry

The accident scenarios for the project are listed in Table 4.3-3. The scenarios for each phase were developed based on accidents that have occurred in the past when similar activities have been conducted or were thought to be possible given the type of work, the materials handled and the environment. A scenario for each phase was selected to represent the most serious combination of consequence and frequency for the phase. These are shown in bold print in Table 4.3-3.

Consequences for each scenario were developed based on the number of workers, the type of accident, and the mitigation measures that were assumed to be used by the workers.

Historic Accident Rates

Work at the NTS and other facilities managed by NNSA has been performed with fewer accidents than work in the private sector. This is born out by the Bechtel Nevada Total Reportable Cases (TRC) rate of 3.4 for FY 2004 when 2,485,111 hours were worked (DOE, 2005a). This compares with an average industry TRC rate of 6.4 for the years of 1997 to 2001.

Hazard Analysis

A Hazard Analysis and Risk Assessment (DTRA, 2005) was prepared that describes the nature of hazards that workers would face on the project. Workers would be subject to hazards that are common to many construction worksites and some hazards that are more common to mining operations where explosives are used.

Accident Scenarios

This section describes a set of selected accident scenarios including the number of workers, type of accident, qualitative probability of occurrence and the consequences. Three types of accidents are assumed to pose the highest risk of an injury or fatal accident: traffic, construction, and explosion. Of the three types, traffic accidents are the most common.

A representative traffic accident would involve four workers commuting to the DIVINE STRAKE experiment site in Area 16. The accident could be initiated by a tire failure, impact with a large animal, or driver inattention. This scenario assumes that all passengers would wear seatbelts and minor injuries would result. This scenario was assigned a frequency of occasional. An even less frequent traffic accident would be a rollover or other more serious collision that could result in one or more fatalities.

Construction accidents could occur during site preparation, excavation of the charge hole, fitting the tunnel with instrumentation or other equipment, installing the concrete culvert, or constructing facilities for timing and control or observation. A construction accident could result from a wide variety of causes including: tripping, falling, slope failure of excavations, electric shock, or equipment falling on a worker. The varieties of accident causes are not unique to DIVINE STRAKE and are common risks in construction workplaces. A representative scenario for a construction accident is a worker tripping on equipment or debris and receiving a lost time injury. This scenario was assigned a frequency of occasional. An even less frequent construction accident with higher consequences would be failure of an earthen slope during an excavation. One or more workers could receive fatal injuries.

The third type of accident is related to an unintentional explosion involving materials to be used in the experiment. An accident of this type could occur during transportation, mixing and loading or during the firing phase of the experiment. A representative accident was assumed to consist of the detonation of part of the ANFO truck shipment as it traveled within the NTS to deliver the load to Area 16. The accident was assumed to involve a rollover accident of a truck carrying ANFO, a subsequent fire, and detonation of part of the load. ANFO is a stable product and usually will not explode unless a detonator is used. However, a recent accident involving supposedly stable explosives has shown that the impact of an accident and fire could cause an unintentional explosion (Deseret News, 2005). Two workers are assumed to be involved and would receive injuries. The frequency of this type of accident is assumed to be remote.

Other accident scenarios that were initially considered were later found to be unrepresentative of site conditions, unrealistic or of extremely low frequency such that they were not analyzed further.

Accident Consequence Summary

As noted in the previous section, the potential consequences of an accident range from minor injuries to multiple fatalities. None of the accidents described in this section are expected to occur because of the safety procedures that would be observed and the relatively short duration of activities related to the detonation.

Minor accidents such as a worker tripping and spraining an ankle are the most common type of accident that would likely happen and was assumed to happen occasionally. The most common accident of significance is assumed to be a traffic accident involving commuting workers at the NTS with injuries to vehicle occupants. The "occasional" frequency listed in Table 4.3.3 is roughly equivalent to one chance one in 1,000 that this type of accident would occur. Similarly, a vehicle rollover accident and fire involving one of the trucks transporting explosives is considered to be "remote" having an approximate frequency of one chance in 100,000. The other accident scenarios are considered be similar in frequency or even less frequent.

Mitigation Measures to Avoid Significant Effects

The same mitigation measures listed for Health and Safety would apply to accident avoidance.

Table 4.3-3

Accident Scenarios and Consequences

Project Phase	**Event**	**Root Cause**	**Number of Involved Workers**	**Maximum Impact**	**Expected Impact**	**Probability** (risks listed are qualitative and do not indicate a degree of precision)
Experiment Preparation						
Worker Commute	**Vehicle Accident**	**Various**	**3**	**3 Fatalities**	**3 Injuries**	**Occasional (approximate risk of 1x10-3)**
Excavation	Tunnel roof failure	Unstable rock, earthquake	3	3 Fatalities	1 injury	Improbable (approximate risk of 1x10-6)
Excavation	**Charge hole collapse**	**Unstable soil, lack of shoring**	**4**	**1 Fatality**	**2 injuries**	**Remote (approximate risk of 1x10-5)**
Mixing & Loading						
Transportation of Explosives	**Truck collision, fire and explosion**	**Tire failure, driver falls asleep, etc.**	**2**	**2 Fatalities**	**2 Injuries**	**Remote (approximate risk of 1x10-5)**
Mixing and loading	Premature detonation	Spark from a vehicle, lightning	10	10 Fatalities	2 Injuries	Improbable (approximate risk of 1x10-6)
Firing						
Detonation	Premature detonation	Detonator malfunction	6	6 Fatalities	6 Injuries	Improbable (approximate risk of 1x10-6)
Detonation	**Delayed detonation**	**Detonator malfunction**	**2**	**2 Fatalities**	**2 Injuries**	**Improbable** (approximate risk of 1x10-6)
Smoldering Hole	Incomplete detonation	Detonator malfunction, rainwater infiltration into ANFO	2	0 Fatalities	0 Injuries	Occasional **(approximate risk of 1x10-3)**
Reentry						
Tunnel/Confined space reentry	Suffocation	Improper use of PPE, inadequate ventilation, reentry too early after the experiment	2	2 Fatalities	0 Injuries	Improbable (approximate risk of 1x10-6)
Tunnel/Confined space reentry	Fire	Blowback, explosive gases ignite when supplied with fresh air	2	2 Fatalities	2 Injuries	Remote **(approximate risk of 1x10-5)**

Environmental Consequences of the No-Action Alternative

With the No-Action Alternative, the large-scale, open-air detonation event would not take place. Therefore, there would be no impacts to Human Health and Safety.

4.4 Waste Management

Existing and background information pertaining to hazardous materials and waste management within the study area is summarized and presented in Section 3.4. The primary significance criteria for hazardous materials and waste management involve the service area boundaries, existing and projected future capacities and demands on hazardous material use and storage, and hazardous waste collection and disposal services (hauling contractors and hazardous waste landfills). Specific criteria used to assess the potential for significant impacts include:

- Potential for significant effect on capacity of solid waste collection services and landfills caused or induced directly or indirectly
- Potential for significant effect on capacity of hazardous and radioactive waste collection services and landfills caused or induced directly or indirectly
- Creating reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous waste
- Creating reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous material
- No significant waste management impacts were identified. A detailed discussion of the waste management analysis is described below.

<u>Environmental Consequences of the Proposed Action</u>

The proposed test would generate primarily solid waste. Hazardous waste is not expected as a result of implementation of the DIVINE STRAKE detonation; however, some hazardous waste could be generated if any residual chemical that exhibits one or more hazardous characteristics or is listed as hazardous by EPA remain after the detonation. The manner in which hazardous materials, wastes, and residuals would be handled and the anticipated impacts of each are discussed in detail in the following subsections. However, in summary, the quantities of waste generated and the amounts requiring storage or disposal would not be expected to have a significant impact on the overall hazardous and non-hazardous waste collection, storage, or disposal services or available capacities. There are no reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous waste as long as the requirements of RCRA are followed. No impacts or mitigation requirements would likely result with respect to hazardous waste generation, storage, or disposal.

As stated in Section 4.3, Human Health and Safety, the location of DIVINE STRAKE (the U16b test bed) has never been used for any type of nuclear testing activity. In addition, aerial radiation surveys have been performed in the past. NNSA has no reason to believe that radioactive contamination exists at U16b that might be re-suspended as a result of the DIVINE STRAKE detonation. Therefore, the proposed DIVINE STRAKE detonation would not be expected to generate any radioactive wastes.

Non-Hazardous Solid Waste

Wastes from the proposed detonation would likely be composed of non-hazardous debris, empty containers, measuring devices, equipment, and PPE. In addition, if cleanup of a spill or release area were required, cleanup wastes could include soil and vegetation wastes. These wastes would be characterized and managed according to the NTS RCRA waste management plan and permit. Removal of all solid waste, trash, hardware, construction debris, etc., would be conducted as required during the construction and preparation activities as required for the proposed DIVINE STRAKE detonation.

No incremental environmental impacts over baseline conditions from waste management activities associated with DIVINE STRAKE would be expected. The project would result in a slight increase in waste materials generated with respect to the overall waste quantities managed at the NTS. These quantities could be accommodated by existing landfills with minimal to no impact.

Hazardous Materials and Waste

The proposed test would use approximately 700 tons (635 metric tons) of heavy ammonium nitrate fuel oil (ANFO) slurry comprised of 78.65 percent ammonium nitrate, 5.52 percent calcium nitrate, 9.45 percent water, and 6.38 percent fuel oil. Toxic or hazardous materials would not be stored onsite except for during emplacement. Other hazardous materials potentially requiring storage at the project site includes POL products from vehicles and equipment maintenance.

As stated in Section 3.4, the use of hazardous materials would be tracked and controlled in accordance with the NTS HAZTRACK system and the Hazardous Materials Management Plan (HMMP). No hazardous materials storage would take place on site. There are no reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous material as long as the requirements of the NTS HMMP are followed. No impacts or mitigation requirements would likely result with respect to hazardous materials control or storage.

Wastes generated from the proposed test would be managed in the same manner as the hazardous wastes currently generated at NTS. The DIVINE STRAKE project is currently not expected to generate any hazardous wastes. In the unlikely event that hazardous waste is generated during the test, it would either be accumulated in an identified satellite accumulation area adjacent to proposed test site and shipped directly off site, or transferred to the RCRA-permitted storage facility in Area 5 prior to shipping off site for treatment or disposal. Given this existing accumulation and storage practice and availability of off site permitted treatment and disposal facilities, the impact on the NTS storage facility and offsite treatment and disposal facilities from hazardous waste as a result of implementation of DIVINE STRAKE would be negligible.

Since 1996, the NTS has continued to store hazardous waste on-site prior to shipping it to a permitted commercial facility for treatment or disposal. The available storage capacity is expected to be adequate in the unlikely event that hazardous wastes are generated with the proposed implementation of DIVINE STRAKE. The greatest annual generation of hazardous waste at NTS in the last 5 years was about 65 cubic meters. Considering this historic high volume, the NTS can maintain storage limitations by continuing its practice of shipping stored waste off-site for treatment/disposal when sufficient quantities have been accumulated (about four times per year) and by shipping waste from the generation area, rather than first transferring waste to on-site storage.

Hazardous waste that could be generated by construction or other activities would be recovered and disposed of off site according to the RCRA Part B permit and NNSA requirements. There would be no demand on hazardous waste facilities used by NNSA with respect to waste types or quantities since hazardous waste generation would not be expected with implementation of DIVINE STRAKE.

No hydrocarbon wastes would be expected as a result of implementation of DIVINE STRAKE. In the unlikely event that hydrocarbon wastes are generated, they would be disposed of in Area 6 in accordance with the Area 6 Hydrocarbon Disposal Site permit requirements (SW 13 097 02). Only emergency maintenance of vehicles and equipment would be conducted on site during the construction of the project, thereby minimizing the production of hydrocarbon or potentially hazardous waste (e.g., petroleum, oil and lubricants or POL products).

Two commercially available compounds would be used as tracers during the DIVINE STRAKE detonation: Glo Germ Powder and Fluorescein USP. Glo Germ Powder is synthetic Organic Colorant A-594-5 that is not diluted with any inert materials. Glo Germ Powder has been in use for more than 30 years as a tracer for a variety of applications including direct dermal contact to evaluate the efficacy of hand washing. The material would be stored according to the manufacturer's recommendations away from oxidizers. The tracer material would not be stored onsite. The compound is considered to be hazardous if it is burned, and toxic gases can be formed. The powder would not be mixed in the ANFO blasting agent so it would not be subject to the oxidizing effects of the detonation. The powder would be placed on the tarps surrounding the charge hole so that the powder will be lifted and spread with ejecta from the shock wave. Ultra violet light would be used to evaluate the extent of the tracer dispersion on tarps and mats placed in an array surrounding the test area. Approximately 5,000 pounds of Glo Germ Powder would be used in the experiment.

Fluorescein USP is commonly used tracer produced by several manufacturers. It is used as a tracer in medical procedures and in water systems to identify water leakage. It is not a known carcinogen or acute toxin that would pose a serious hazard to workers. The primary hazard of using both tracers is from inhalation and dermal exposure and subsequent allergic reaction in sensitive individuals. No unusual storage considerations are required for this compound.

Personal protective equipment is recommended by the manufacturers of both tracers to avoid inhalation of dust and unnecessary dermal exposure. Some of the tracer material would be collected on tarps and mats in areas downwind of the detonation. This material would be disposed of in a permitted landfill. The remainder of the tracers would remain in scattered in surface soils and would be subject to bio degradation and photo degradation over time. No long term detrimental impacts of the use of the tracers are foreseen.

Mitigation Measures to Avoid Significant Effects

The same mitigation measures that address the handling of potentially hazardous material on other aspects of the project apply to the use of the two tracers. However, there is little way to know in advance which workers may be sensitive to the tracers and susceptible to allergic reaction. For this reason, all personnel who handle the material would be required to wear PPE for inhalation and dermal protection. There is a small potential that some of the Glo Germ Powder could combust and release toxic gases. The waiting period following the detonation before reentry would allow any toxic gases be dispersed to safe levels and would be confirmed by the reentry team instrumentation.

Residual Materials

The Proposed Action would be designed so that all materials would be detonated, leaving no residual waste. However, in the unlikely event that material remains once the test is completed, it would be handled as an emergency situation, which would require an emergency permit from the State of Nevada, and be consolidated on the test bed and burned or detonated in place, following notification and approval of the NDEP (DOE, 2004b).

Environmental Consequences of the No-Action Alternative

With implementation of the No-Action Alternative, the large-scale, open-air detonation, DIVINE STRAKE, would not occur. Therefore, there would be no impacts to hazardous materials management and RCRA waste management.

4.5 Infrastructure

Existing and background information pertaining to the NTS infrastructure is summarized and presented in Section 3.5. This section discusses the potential for significant impacts on water supply and distribution, wastewater treatment and disposal, energy supply and distribution, telecommunications, and transportation.

Environmental Consequences of the Proposed Action

This section describes the potential impacts on infrastructure services that may occur as a result of the Proposed Action, the construction and operation of the proposed facilities, in comparison to the No-Action Alternative.

Water Supply and Distribution

As detailed in Section 3.5, there is currently no active water supply and distribution system located within the vicinity of the Proposed Action. No water supply infrastructure would be constructed for the Proposed Action. Water would be provided daily by water haul trucks for personnel consumption, dust suppression, and construction, as needed. Sufficient water would be transported to the site via 6,000-gallon (22,712 liters) capacity water haul trucks to supply water for fire suppression. This water would be obtained from one of the water wells located on the NTS. The recharge rates of these wells are sufficient that the withdrawal would not impact the existing groundwater capacity.

Water Treatment and Disposal

No wastewater treatment infrastructure would be constructed for the Proposed Action. Sanitary wastes would be collected in portable toilets and serviced twice weekly and no wastewater discharge to surface waters would occur as a result of implementation of the Proposed Action.

Energy Supply and Distribution

Implementation of the Proposed Action would require site preparation activities to provide for installation of instrumentation bunkers for the placement of various instruments and gages for recording the effect of the detonation. Instrumentation bunkers would be constructed and located in previously disturbed areas near the portal of the tunnel to accommodate accelerometers, high-speed cameras, and various instruments and gages to record portal and underground damage (see Chapter 2 for information on proposed sensor and instrument locations). The energy supply for these cameras, accelerometers, and various instruments and gages would be provided by generator with battery backup; therefore, no construction of additional electrical distribution supply would be required.

Fuel for construction equipment would be delivered bi-weekly to the U16b tunnel complex. The existing fuel supply would be able to accommodate vehicles required in support of the Proposed Action.

Above ground electrical lines that service certain portions of the NTS are present in the study area, and could potentially be affected by blast wave propagation. The electrical grid in the area of the blast site and areas expected to experience blast waves that could substantially damage structures would be temporarily shut down during the test activity. These areas would be limited to NTS. Replacement poles and other network equipment would be staged prior to the test to allow expedient replacement of any damaged electrical components (e.g.; downed electrical poles). Since potential impacts to the electrical grid would be limited to NTS, and temporary in nature, these potential impacts are considered to be less than significant.

Telecommunications

The proposed site currently does contain telephone lines that traverse the site. Telecommunications for the Proposed Action would include the use of existing land lines that would be stretched to the site and connected. Implementation of the DIVINE STRAKE detonation would not require construction of additional telephone and/or Internet/cable utilities. As a result of implementation of the Proposed Action, no disruptions to services are anticipated. As detailed in Section 2, the explosives that would be used for the single large-scale open-air high explosive test detonation would not result in an electrostatic discharge with the potential of telecommunication disruptions.

Roadways and Traffic

The Proposed Action would utilize existing roads of the NTS. The U16b tunnel complex would be accessed from Pahute Mesa Road and Mid-Valley Road. Site preparation activities would include improvements to the existing dirt road leading to the top of the hill above the U16b tunnel. These improvements would consist of extending the dirt road approximately 200 feet to reach the location of the ANFO charge hole (see Chapter 2).

Implementation of the Proposed Action would require additional light fleet traffic of approximately 15 vehicles per day during construction activities. The existing roadways are sufficient to accommodate this additional traffic. The additional traffic would not degrade the existing level of service for the NTS roadways.

No permanent alteration of NTS traffic patterns would result from the Proposed Action. Since NTS is a secured area, no traffic impact to the surrounding communities would occur as a result of implementation of the Proposed Action. Signage and coordination with the Guards at all entrance points would be used to provide notification and no access to the detonation area would be allowed on the day of the DIVINE STRAKE experiment.

Environmental Consequences of the No-Action Alternative

With implementation of the No-Action Alternative, the large-scale, open-air detonation, DIVINE STRAKE, would not occur. Therefore, there would be no infrastructure-related impacts.

4.6 Topography and Physiographic Setting

Existing and background information pertaining to topography and physiography of the study area is summarized and presented in Section 3.6. This section discusses the potential impacts of these areas based on the following criteria:

- Permanent damage or alteration of a unique or recognized topographic and physiographic feature or landmark
- Substantial alteration of the existing function of the landscape

No significant topography and physiographic setting impacts were identified during the analysis. A detailed discussion of the topography and physiographic setting analyses is provided below.

Environmental Consequences of the Proposed Action

Implementation of the Proposed Action would result in localized and notable topographic changes to the U16b tunnel complex and the immediate area of the blast. The area of effect would be limited to the area excavated for charge placement and the U16b tunnel complex. Although large-scale modification to the U16b tunnel complex would likely occur, as portions of the tunnel are expected to collapse, these changes would be expected to be mostly subsurface. Topographic changes would occur as a result of excavation for charge placement as well as from the potential blast crater; however, these changes would be limited to the ridgeline that extends above the U16B portal. Since this ridgeline is neither unique or a recognized landmark, and potential topographic changes would not substantially alter the function of the landscape, topography and physiography related impacts are considered to be less than significant.

Environmental Consequences of the No-Action Alternative

With implementation of the No-Action Alternative, the large-scale, open-air detonation, DIVINE STRAKE, would not occur. Therefore, there would be no topography or physiography related impacts.

4.7 Impacts on Geology and Soils

The impacts to geology and soils anticipated to result from the DIVINE STRAKE detonation are presented in this section. Potential impacts to soils and geology have been assessed based on whether the Proposed Action would result in:

- Geologic hazards that create the potential for damage to structures
- Destruction or rendering inaccessible valuable mineral deposits
- Conversion of active prime or unique farmlands to nonagricultural use
- Loss of acreage of prime or unique farmland soils to commercial development
- Soil erosion that would cause environmental harm and that cannot be mitigated in site plan and design

No significant impacts to geology and soils were identified. A detailed discussion of the analysis and findings is provided below.

Environmental Consequences of the Proposed Action

Geology

The DIVINE STRAKE detonation would result in some disruption of geologic materials in the area immediately surrounding the blast cavity and localized disturbance of the underground test bed inside the U16b Tunnel Complex tunnel beneath the charge cavity. Boreholes drilled into the tunnel back wall, floor and ribs to allow installation of various instrumentation for recording the effect of the detonation would locally disturb the host rock materials in the tunnel. Instrumentation bunkers constructed and located in previously disturbed areas near the tunnel portal would also locally disturb geologic materials.

Due to the distances (Figure 3.7-1 and Slate et al. 1999) between the DIVINE STRAKE testing location and the nearest faults or fault zones (the closest faults are the Mine Mountain and Carpetbag Faults, which pass within approximately 5 miles (8 km), and 6.8 miles (11 km), respectively, of the DIVINE STRAKE site at their closest approach), and given the relatively small output of the DIVINE STRAKE detonation) when compared to previous nuclear tests, the potential for activation or reactivation of faults or fault zones is expected to be minimal. In addition, there are no valuable mineral, oil and gas, and/or aggregate resources present within region of influence that could be affected. Therefore, geologic impacts are considered to be less than significant.

Soils

Soils present in the proposed DIVINE STRAKE site and immediately around the proposed U16b tunnel are limited to locally occurring colluvium derived from limestone and micrite rock units exposed in the hillside that is the site of the U16b Tunnel Complex (Metcalf et al., 1999). Existing prime farmlands are located in Amargosa Desert and limited areas of potentially arable soil types exist at lower elevations in Yucca Flat. Both areas are outside the region of influence. The proposed DIVINE STRAKE detonation area, consisting of the NTS Tunnel U16b Complex and surrounding hilly terrain, has experienced some minor surface disturbance as a result of previous tunnel excavation activities. DIVINE STRAKE would result in some additional disturbance of the ground surface in the vicinity of the DIVINE STRAKE charge pad and access road leading to the charge pad above the U16b Tunnel Complex. The proposed detonation would disturb surficial soils present in the immediate vicinity surrounding the detonation cavity. Peripheral cavity collapse effects would locally alter soil conditions; however, due to the limited thickness and extent of soils at the testing site and vicinity, such effects would be limited and localized in extent.

In addition to the direct effect of the detonation on soils, surface preparation activities performed prior to the proposed detonation would cause some localized disturbance of soils. Existing roads would be used to the maximum extent practicable to minimize soil disturbance. Improvement of the existing earthen access road leading toward the top of the hill above the U16b tunnel, extension of this access road, regrading for construction of the earthen charge pad, and excavation of the charge hole would locally alter topography in the vicinity of the detonation site. DIVINE STRAKE-related activities may involve limited off-road travel by team personnel for performing pre- and post-testing reconnaissance surveys, geologic mapping, and placement of sensor devices, cameras, or similar activities. Surficial disturbance resulting from such travel is expected to be temporary and negligible in magnitude and extent. The impact of these activities on site soils would not be significant.

Soils on the sloped hillside immediately above and below portions of the existing access road and the proposed access road extension have the potential for some accelerated erosion as a result of ground-disturbing activities (e.g., pre-detonation site preparation and/or ground shaking from the blast). The unvegetated fill materials that would comprise the charge pad would also be disrupted by the blast and this disrupted platform could be susceptible to some post-detonation accelerated erosion. Appropriate erosion control measures would be implemented during the DIVINE STRAKE detonation, including installation of angled water bars in soil, soil terracing, or other conventional erosion control measures, to mitigate against any increased sediment losses. The DIVINE STRAKE detonation would not significantly alter natural drainages or erosion rates in surficial materials in areas beyond the immediate vicinity of the charge pad and a portion of the extended access road nearest the charge pad.

In summary, impacts of DIVINE STRAKE on geology and soils are anticipated to be minor and localized to the immediate vicinity of the DIVINE STRAKE charge hole and charge pad. Where soils are locally disrupted, conventional erosion controls would be used to mitigate excessive soil erosion.

Environmental Consequences of the No-Action Alternative

With the No-Action Alternative, the DIVINE STRAKE detonation event would not occur. Therefore, no impacts to geology and soils would occur as a result of implementation of the No-Action Alternative.

4.8 Surface Water and Groundwater

Existing and background information pertaining to surface water and groundwater for the study area is summarized and presented in Section 3.8. The potential for significant impacts to surface water and groundwater resources have been assessed based on whether the Proposed Action would:

- Adversely affect capacity of available surface water resources; conflict with established water rights or regulations protecting water resources for future beneficial uses; contaminate public water supplies and other surface waters exceeding water quality criteria or standards established in accordance with the Clean Water Act, state regulations, or permits; conflict with regional water quality management plans or goals
- Substantially alter storm water discharges and adversely affect drainage patterns, flooding, and/or erosion and sedimentation; or cause filling of wetlands or otherwise alter drainage patterns that would adversely affect jurisdictional wetlands
- Adversely affect a sole source aquifer; substantially deplete groundwater supplies or interfere with groundwater recharge affecting available capacity of a water source; conflict with established water rights or regulations protecting groundwater for future

beneficial uses; contaminate a public water supply aquifer exceeding Federal, state, or local water quality criteria; or conflict with regional or local aquifer management plans or goals of governmental water authorities

No impacts to surface water and groundwater were identified based on the criteria listed above. A detailed discussion on the surface water and groundwater analyses is presented below.

Environmental Consequences of the Proposed Action

Implementation of the Proposed Action would not result in any impact to surface water or groundwater, because no perennial streams or naturally occurring surface water bodies are located on the NTS. In addition, groundwater within the vicinity of the Proposed Action is estimated to be approximately 2,000 feet below the land surface, and the precipitation rate is low on the NTS (DOE, 2004a). Since water would be imported to the site via water haul trucks, no additional depletion to groundwater supply or interference with groundwater recharge affecting available capacity would occur as a result of construction of the Proposed Action.

Site preparation activities would include the construction of spill containment in the construction and material staging areas (see Section 2.3.1). Thus the potential for spill would be minimized and potentially related impacts would be less than significant.

Implementation of the Proposed Action would have no impact or effect on regional aquifer management plans or goals.

Environmental Consequences of the No-Action Alternative

With implementation of the No-Action Alternative, the proposed detonation would not occur. Therefore, there would be no impacts to surface water and groundwater.

4.9 Atmospheric Resources

This section describes the potential impact to air quality resulting from implementing the Proposed Action and No-Action Alternative. Additionally, this section describes favorable meteorological conditions for the Proposed Action. With the Proposed Action and the No-Action Alternative, radiological material would not be used. Therefore, there would be no radiological impacts. The potential for significant impacts to atmospheric resources have been assessed based on whether the Proposed Action would:

- Violate NAAQS primary and secondary standards or contribute substantially to existing or projected violations
- Degrade air quality locally, regionally, nationally
- Increase frequency and severity of existing violations in nonattainment areas
- Exceed maximum allowable pollution concentration increases
- Create long-term visibility problems from particulate matter
- Violate the NTS Air Quality Operating Permit
- Substantially increase greenhouse gas emissions

No significant impacts were identified during the atmospheric resources analysis. A detailed discussion is provided below.

Environmental Consequences of the Proposed Action

Emissions Released from Explosives Detonations

The mixture of ANFO-emulsion that would be used for DIVINE STRAKE is a commonly used blasting agent in commercial blasting operations. The end products of explosive reactions are determined primarily by the oxygen balance of the explosive. The ANFO mixture contains a fuel oil content of 5.5 percent, which creates an oxygen-balance during the detonation of the blasting agent; hence, only the products shown in Table 4.3-2 would be produced by the detonation. As shown in Table 4.3-2, a minor amount of methane gas would be produced as a detonation product. Previous experience with large open air ANFO detonation has shown that most of the methane gas would auto-ignite and burn at the edges of the rising fireball.

Ejecta is a component of DIVINE STRAKE. The goal of the ejecta experiment is to characterize how a material disperses from the charge hole at detonation. A powdered dye is used to define the scope of the detonation. Secondly, an evaluation of the post-detonation materials, including an examination of the range of ejecta, the size distribution of particles, and the dispersion would occur. The dyes would be placed on the ground around the crater site so that once the detonation occurs, the powder would be then lofted into the dust cloud with the other debris. This powered dyes would only be placed on one quadrant, the northern side, and then tracked on the ground afterwards.

The near field measurements would be calculated after detonation. Tarps would be laid out for collection of the ejecta debris. Ejecta would be primarily contained to the north and northeast of the proposed site. Because of the scope of this experiment, and the materials used, there would be no impacts to health and human safety resulting from the ejecta test.

Air Dispersion Modeling

Air dispersion modeling is used to predict the manner in which pollutants will disperse as they are released into the atmosphere and the resulting concentrations of these pollutants at various receptors (e.g. residential areas, parks, etc.). Air dispersion modeling is used to demonstrate compliance with the NAAQS and NV AAQS. Initial air dispersion modeling for Divine Strake was conducted using the POLU4WN. The initial modeling results indicate that detonation of DIVINE STRAKE would be well below acceptable levels; however, because the POLU4WN model does not evaluate for particulate matter, OBOD modeling will also be conducted to evaluate the impact of particulate matter as PM_{10} associated with DIVINE STRAKE. Use of both of these models for DIVINE STRAKE was approved by the State.

NAAQS and Title V Permit Compliance Analysis

Compliance with NAAQS is based on the total estimated emission quantity from the Proposed Action plus the emission quantity from existing conditions.

The highest potential volume of ANFO was 940 tons; therefore modeling for emissions of criteria pollutants using 940 tons of ANFO detonated by C-4 or PETN high explosives provides for a very conservative analysis. Emission factors used to calculate the emissions of those pollutants that would result from the detonation were derived from Chapter 13, Table 13.3-1 of EPA Publication AP-42. As Table 4.9-1 indicates, these emissions, when added to the total NTS potential to emit for each pollutant, would still well below the 100-ton-per-pollutant threshold for Title V permitting. Particulate matter was not included because it is not used in determining whether a source is Title V. The ANFO quantity for the proposed detonation was reduced to 700 tons, so the emissions presented in Table 4.9-1 represent a conservative estimate.

Table 4.9-1

Estimated Emissions of Criteria Pollutants

Criteria Pollutant	NTS[a]	DIVINE STRAKE	Total (tons)
Carbon Monoxide	23.47	31.49	54.96
Nitrogen Oxide	72.33	7.99	80.32
Sulfur Dioxide	6.89	0.94	7.83

Source: [a]NTS Emissions Inventory, May 2005

Diesel generators would be used during the DIVINE STRAKE testing operation to provide power for the instrumentation van. The generators are below the horsepower limits to require permitting, and are considered Insignificant Sources by the State of Nevada. Emissions from the diesel generators would be included in the NTS emissions inventory.

State of Nevada regulations as well as the NTS AQOP requires the control of fugitive dust during surface disturbing activities. Water sprays would be used to minimize dust created during construction-related activities, road building, and excavation of the test hole.

Environmental Consequences of the No-Action Alternative

With the No-Action Alternative, NTS's baseline operations and management in support of its national security mission would not change and would continue in the same manner and degree as they have within the past years. DIVINE STRAKE would not be implemented. Therefore, impacts to air quality resulting from the No-Action Alternative would be substantially similar to existing conditions.

4.10 Meteorological Conditions

Environmental Consequences of the Proposed Action

Existing and background information pertaining to meteorological conditions for the study area is summarized and presented in Section 3.10. The Proposed Action would not alter or affect meteorological conditions; however, these conditions substantially affect the ability to conduct the Proposed Action in a manner that minimizes potential impacts. Thus this section is devoted to describing the conditions that are favorable to executing the Proposed Action.

Predictions for airblast environmental damage to biota and structures are based on meteorological periods when the atmosphere is calm, homogeneous, non-refracting, and non-channeling. Adverse meteorological conditions can increase damages and environmental impact by seven to ten times (Ristvet, 2005). These impacts are discussed in their respective sections of the EA.

DIVINE STRAKE would be detonated in mid-year 2006 when meteorological conditions, as monitored by a meteorological team, are most likely to be acceptable. Criteria that would be used by DTRA to determine if the test would be conducted are detailed in Chapter 2.

Prior to the DIVINE STRAKE detonation, forecasted meteorological conditions for 7 to 14 days would be evaluated. If meteorological conditions were not satisfactory, the emplacement of the blasting agent and the detonation would be postponed. Required meteorological conditions would be no inversions, no more than 40 percent stratus or cumulus cloud cover, and either no surface wind or wind velocities less than about 25 miles per hour blowing to the northeast to northwest (approximately 110 degrees to 250 degrees) from the surface up to 45,000 feet above msl. Winds blowing to the northeast to northwest help direct the blast pressure forward onto the northern half of the NTS, away from most NTS facilities and the offsite communities south of the NTS. The blast wave analysis and predictions in this EA assumes calm, homogenous, atmosphere.

On the day before and the day of the detonation meteorological observations consisting of National Oceanic and Atmospheric Administration (NOAA) regional weather data and predictions and on-site NOAA rawindsonde launches (weather balloons) would be used to measure wind and temperatures aloft so that long-range airblast levels can be calculated and compared to data on civilian population centers to determine the likelihood of structural damages and excessive noise. NOAA meteorologist would be present to assist in the interpretation of the meteorological data and in the airblast predictions. If any damage is predicted, the decision can be made whether to detonate the charge or to wait for better meteorological conditions. Further discussions on the effect of meteorological conditions on airblast and noise are in Section 4.2, Environmental Consequences (Blast and Noise). Acceptable blast conditions criteria are detailed in Chapter 2.

<u>Environmental Consequences of the No-Action Alternative</u>

With the No-Action Alternative, the DIVINE STRAKE detonation would not occur. Therefore, there would be no meteorological impacts.

4.11 Biological Resources

Potential for significant impacts to terrestrial and aquatic resources as well as to special status species are discussed in this section. The potential for impacts was assessed based on whether the Proposed Action would:

- Cause substantial displacement of unique terrestrial communities or loss of habitat
- Diminish the value of a substantial amount of habitat for wildlife or plants to an unusable level
- Cause a native wildlife population to drop below self-sustaining levels
- Substantially interfere with the movement of any native resident or migratory wildlife species for more than one reproductive season
- Conflict with applicable management plans for wildlife and habitat to the extent that the plan's objectives cannot be achieved
- Adversely affect or displace special status species
- Cause encroachment or an adverse effect on a designated critical habitat

With the use of mitigation measures, impacts to biological resources would be less than significant. A detailed discussion of the analysis is provided below.

Environmental Consequences of the Proposed Action

Terrestrial Communities

Potential impacts to terrestrial communities were assessed by identifying the communities present within the region and at the project area by reviewing the various available documents on the topic, and by conducting a site visit. The information obtained from the literature review and from the site visit were evaluated to identify if any unique communities were present within the project area, and to assess the quality of the habitat in the area. The characteristics of the proposed construction and other activities associated with the proposed project were then reviewed to identify the types of potential impacts on the components of the community.

Potential regional impacts on the terrestrial communities are expected to be minimal. One potential regional impact includes the short-term startle-effect on some wildlife species from the noise and vibration of the blast. Regionally, the wildlife would experience noise comparable to thunder or sonic booms experienced during occasional overflights. Ground motion experienced by wildlife would be comparable to mild earthquakes. Responses by wildlife to such noise and ground motion would not substantially alter their behavior or interfere with movement patterns.

The proposed project would alter a small amount of habitat characterized as Mojave-Great Basin desert transition zone. The affected vegetation associations are well represented on the NTS and throughout the region, therefore the loss of a relatively small part of these habitats would have minimal regional impacts on the communities or the plant and wildlife populations found within them. None of these impacts are expected to be significant.

Project area impacts on the terrestrial community would include the destruction of habitat, loss of vegetation, and potential death or injury of some wildlife species. Locally, the impacts would be substantial and in many cases permanent; however, the impacts are not expected to be significant. Construction activities associated with the access road, staging areas, and the excavation of the pit would result in disturbance of approximately 0.15 hectares (0.38 acres) of blackbrush-Nevada jointfir vegetation association. The loss of this habitat would be long-term, and possibly permanent, due to the loss of substantial geologic material and all of the topsoil as a result of the blast. The severe alteration of the topography and lack of topsoil hinders natural succession of the native vegetation community. Areas adjacent to the blast site would be covered with overburden of rock and soil in varying depths. Given these areas would have topsoil and vegetative structure beneath the outfall, natural succession would allow these areas to revegetate over time.

The Proposed Action may result in the death or injury of various wildlife species in the vicinity of the project area from several causes. During construction, ground-dwelling small mammals, lizards, and snakes may be killed as the site is prepared using heavy equipment. Some individual animals also may be killed or injured due to construction and operation traffic on roads, but these incidences would be low due to reduced speed limits on most roads. The blast would result in the greatest impact on wildlife in the project area. Though many individuals would move from the area due to the construction activities, some individuals likely would remain in the adjacent areas. Small mammals, lizards, snakes, and some small songbirds could be present in the area at the time of the blast, and may be killed or injured from the concussion of the blast, from burial due to the collapse of burrows or other shelters, or receive varying degrees of permanent or temporary deafening.

The distance to which wildlife may be injured or killed due to the blast would be highly dependent on atmospheric conditions and topography. There is an approximate 1-percent probability of serious injury to small animals (even less for large animals) at a peak overpressure of 5.7 pounds per square inch (psi) (0.401 kg per square centimeter). Prior calculations were made using 800 tons (725 metric tons) of ANFO during DIVINE STRAKE conceptualization. It was later determined that 700 tons (635 metric tons) would be sufficient material to conduct DIVINE STRAKE. The estimated peak overpressure from DIVINE STRAKE (assuming 800 Tons [725 metric tons] of ANFO) was calculated at 2.9 psi (0.204 kg per square centimeter), which would occur up to 2,250 feet (686 meters) from the center of the blast. Based on this, within a 2,250-foot (686-meter) perimeter of the blast there is a less than 1-percent probability of serious injury to small animals that remain above ground during the blast. Since the Proposed Action would be the detonation of 700 tons of ANFO, the calculations provided above are a very conservative estimate. The blast area would be reduced. Therefore, there would be an even decreased probability of an injury to small animals. Additionally, if an animal is protected by a burrow or depression, the overpressure required for serious injury increases by forty percent. The distance at which burrows would collapse cannot be determined due to the lack of data on stability of wildlife burrow structures. Likewise, the impacts on hearing in wildlife is difficult to assess, but in humans damage to the eardrums may occur at about 2,500 feet (760 m), so similar impacts on wildlife could be inferred if the wildlife are above-ground at the time of the blast.

The proposed project would substantially alter a relatively small amount of habitat common to the region, and may kill or injure wildlife in and around the project site from the construction, the explosive blast, and the noise. However, the project would not affect unique habitats or a substantial amount of common habitat, would not reduce wildlife populations in the region below a self-sustaining level, would not affect movement patterns or reproductive behavior for more than one season, nor would it conflict with management plans on the NTS. For these reasons, the impacts on the terrestrial communities would not be significant.

Required Mitigation to Avoid Significant Effects

In accordance with DOE policy, pre-construction surveys by qualified biologists would be conducted to identify any unique or protected wildlife species that may be found in the area.

Aquatic and Wetland Communities

No aquatic or wetland communities are present near the proposed project area. For that reason, no impacts to Aquatic or Wetland Communities are likely to occur.

Endangered, Threatened or other Special Status Species

Potential impacts to threatened and endangered species were assessed by identifying those species potentially occurring in the region through reviewing available documents and by conducting a site visit. The information obtained from the literature review and the site visit was evaluated to identify if any listed or otherwise sensitive species may be present within the project area. The characteristics of the proposed construction and other activities associated with the proposed project were then reviewed to identify the types of potential impacts that might occur on the species in the region.

The only threatened or endangered species that resides in the general region of the proposed project is the desert tortoise, which is found within the southern portions of the NTS, approximately 6.2 miles (10 kilometers) from the project site. For this reason, there should be no impacts to threatened or endangered species from the proposed project. Other special status species potentially occurring within the area may be impacted by the startle-effect at the time of the blast. However, this impact would be of short duration and is likely to have no significant impacts on these species. Other special status species likely would not be affected based on the limited potential impacts beyond 2,250 feet (686 meters) from the project area.

No threatened or endangered species are known to occur in the vicinity of the proposed project site, therefore no impacts to listed species are likely to occur. Other special status animal species are known to occur on the NTS, but are not likely to be present in this area based on habitat requirements. However, several special status bird and mammal species range widely and could pass through the area. The golden eagle and ferruginous hawk have been observed on the NTS, and could fly over the project area. Additionally, wild horses are present on the NTS and also range widely but have not been reported within 5 kilometers of the project area. For large birds and wild horses, being within 2,250 feet (686) meters of the project site during the blast could result in severe injury or death. No special status plant species are known to occur in the area, and therefore no impacts to these species are expected to occur.

Required Mitigation to Avoid Significant Effects

Pre-construction surveys would be conducted prior to ground-disturbing activities to ensure special status species are not present in the area. Any species found would be relocated prior to the detonation.

Environmental Consequences of the No-Action Alternative

With the No-Action Alternative, the DIVINE STRAKE detonation event would not be conducted. Therefore, there would be no impacts to biological resources.

4.12 Cultural Resources

This section describes the potential effects to archaeological sites, historic architectural or engineering features, and Native American religious or sacred places in the vicinity of the Proposed Action. The potential for significant impacts to these resources have been assessed based on whether the Proposed Action would:

- Cause the potential for loss, isolation, or substantial alteration of an archaeological resource eligible for listing on the Federal Register
- Cause the potential for loss, isolation, or alteration of the character of a historic site or structure eligible for listing on the Federal Register
- Introduce visual, audible, or atmospheric elements that would adversely affect a historic resource eligible for listing on the Federal Register
- Cause the potential for loss, isolation, or substantial alteration of Native American resources, including graves, remains, and funerary objects

No significant effects were identified during the cultural resources analysis. A detailed discussion is presented below.

Environmental Consequences of the Proposed Action

Archaeological Resources

Implementation of the Proposed Action could potentially have an impact on prehistoric and historic cultural materials in areas where land-disturbing activities would take place; however, the U16B tunnel complex and areas where Proposed Activities would occur mostly consists of previously disturbed areas. Based on pedestrian surveys and shovel testing within the project APE (as defined in Section 3.12), no archeological materials have been identified and the potential for archaeological occurrence is considered low. Coordination with the SHPO has been initiated and this data has been provided to the SHPO under the Section 106 process. Since no project construction would be performed prior to receiving clearance from the SHPO and completion of the Section 106 Process, impacts related to archaeological resources are considered to be less than significant.

As with any land-disturbing project there is always the possibility that unknown deposits or resources could be encountered during construction or other project activities. In the unlikely event that evidence of archaeological deposits is encountered during construction, work in the immediate area would cease and archaeological staff would be contacted to initiate accidental discovery procedures under the provisions of the ACHP.

Historic Resources

Implementation of the Proposed Action could potentially have an impact on a structure that is located on a National Register eligible site (Tippipah Spring, site 26NY4). This structure is severely deteriorated and lacks structural integrity. Given the condition of this resource it is possible that blast effects from the Proposed Action could further damage the structure. DOE is currently engaged with SHPO under the 106 process to evaluate the potential for an adverse effect to this property, and to determine the appropriate mitigation (if any) that may be necessary to reduce this impact to a below significant level. Since DIVINE STRAKE would not proceed prior to completion of the 106 process with the SHPO, impacts to historic resources are expected to be less than significant.

Native American Cultural Resources

No specific Native American sacred or religious site has been identified within the APE of the Proposed Action; therefore, implementation of the Proposed Action would have no effect on this issue.

Environmental Consequences of the No-Action Alternative

With implementation of the No-Action Alternative, the DIVINE STRAKE detonation event would not occur. Therefore, there would be no impacts to Cultural Resources.

4.13 Socioeconomic and Environmental Justice Issues

This section describes the potential effects to social and economic resources in the vicinity of the Proposed Action, including population, housing, and environmental justice issues. No significant socioeconomic and environmental justice issues were identified. A discussion is presented below.

Environmental Consequences of the Proposed Action

Implementation of the Proposed Action alternative would have no effect to the population of the off-site communities, nor the population growth rate. Temporary impact from potential temporary-assignment employees would also not have an impact to the population growth rate and business generated by temporary-assignment employees would not be significant. Proposed Action activities would also not impact employment projections and services of the area.

Environmental Consequences of the No-Action Alternative

With implementation of the No-Action Alternative, the DIVINE STRAKE detonation event would not occur and baseline condition the study area would not change. Therefore, there would be no impacts related to socioeconomics or environmental justice.

4.14 Aesthetics and Visual Resources

This section describes the potential effects to aesthetics and visual resources in the vicinity of the Proposed Action. The potential for significant impacts to these resources have been assessed based on whether the Proposed Action would:

- Adversely affect a national, state, or local park or recreation area
- Degrade or diminish a Federal, state, or local scenic resource
- Create adverse visual intrusions or visual contrasts affecting the quality of a landscape

No significant impacts were identified for aesthetic and visual resources. A discussion is presented below.

Environmental Consequences of the Proposed Action

The Proposed Action would occur well inside the boundaries of the NTS and project construction related activities are not expected to be visible from surrounding public lands. These activities would not affect any scenic resources or parks, and would not create and adverse visual contrast that would affect the quality of landscape when compared to baseline conditions.

Explosions associated with the Proposed Action could produce a detonation cloud that would be visible from various vantage points within the NTS; however, this cloud would be temporary and would not adversely affect aesthetic or visual resources. Because the southern boundary of the NTS is surrounded by various mountain ranges, including the Spector Range, Striped Hills, Red Mountain, and the Spotted Range, and views from U.S. Highway 95 are limited to Mercury Valley and some portions of the southwestern sector of NTS, it is not expected that such a cloud would be visible from these areas. In the event that the detonation cloud is visible from adjacent lands, impacts would be minimal since they would be temporary.

Environmental Consequences of the No-Action Alternative

With implementation of the No-Action Alternative, the DIVINE STRAKE detonation event would not take place. Therefore, there would be no impacts that would affect aesthetic and visual resources.

5.0 AGENCIES AND PERSONS CONSULTED

This section will contain all non-NNSA and non-PHE/URS/SAIC personnel consulted during the public review of the DIVINE STRAKE EA, including consultation with SHPO and other interested parties.

6.0 Definition of Technical Terms

Term	Definition
Aerial Measuring System	A system that detects, measures and tracks radioactive material at an emergency to determine contamination levels
ammonium nitrate fuel oil	ANFO under most conditions is considered a high explosive: it decomposes through detonation rather than deflagration and with a high velocity of detonation.
Area of potential effect	The area that would potentially be affected with implementation of the Proposed Action. It may vary depending on the resource analyzed.
Cloud-to-ground lightning	Most flashes originate near the lower-negative charge center and deliver negative charge to Earth. However, an appreciable minority of flashes carry positive charge to Earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months.
Continuous Reflectometry for Radius versus Time Experiments	CORRTEX is a particular technique for measuring a certain property of the shock wave, and merely provides data for hydrodynamic yield estimation methods.
Criteria pollutants	Six principal air pollutants idenified by the EPA: carbon monoxide, lead, nitrogen oxides (NOX), particulate matter (PM-10), ozone and sulfur oxides ()
dBA	A-weighted sound pressure level: A-weighting frequency filter de-emphasizes the very low and very high frequency components of sound in a manner similar to the frequency response of human hearing to sounds of moderate level, and correlates well with people's group reactions to sound and environmental noise.
Exploding bridgewire	a piece of fine wire which contacts the explosive, and a "strong" source of high-voltage electricity—strong, in that it holds up under sudden heavy load.
generalized zonal method	An efficient computational scheme for radiation heat transfer.
millirem per year	One commonly used measurement of radiation dose.

moment magnitude	A scale used to measure the energy released by earthquakes.
PELs	Permissible exposure limits: OSHA time-weighted average concentrations that must not be exceeded during any 8-hour work shift for a 40-hour workweek.
term that describes the symptom of ringing in the ears	
Threshold limit value	the amount of chemical in the air established by the American Conference of Industrial Hygienists that almost all healthy adult workers are predicted to be able to tolerate without adverse effects. There are three types: • TLV-TWA (TLV-Time-Weighted Average), which is averaged over the normal eight-hour day/forty-hour work week. • TLV-STELs are 15-minute exposures that should not be exceeded for even an instant. It is not a stand-alone value but is accompanied by the TLV-TWA. It indicates a higher exposure that can be tolerated for a short time without adverse effect as long as the total time weighted average is not exceeded. • TLV-C or Ceiling limits are the concentration that should not be exceeded during any part of the working exposure.

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