Final Environmental Assessment

for

Resumption of Use of Depleted Uranium Rounds at Nellis Air Force Range Target 63-10

September 1998

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TABLE OF CONTENTS

List of Tables

List of Figures

FINDING OF NO SIGNIFICANT IMPACT

1.0 NAME OF THE ACTION

Resumption of use of depleted uranium (DU) rounds at Nellis Air Force Range (NAFR), Range 63 Target 63-10.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The 99th Air Base Wing (ABW), Nellis Air Force Base (AFB), Nevada, proposes to resume the employment of 30 millimeter (mm) DU rounds to fulfill a critical need for instructor training, testing and evaluation of associated tactics, and software development. This activity would be limited to Target 63-10 of the NAFR. This target area lies within a portion of the Desert National Wildlife Range (DNWR). Use of NAFR lands within the DNWR is outlined in a Memorandum of Understanding (MOU) between the United States Air Force (USAF) and the United States Fish and Wildlife Service (USFWS). Target 63-10 is the only remaining air-to-ground gunnery range in the United States, licensed for DU use.

Two alternatives to the Proposed Action were considered: (1) resume use, but at lessor quantities that are approximately 50 percent of the Proposed Action and, (2) No Action.

3.0 SUMMARY OF ENVIRONMENTAL EFFECTS

The activity would result in a total of 9,500 combat mix rounds (of which 7,900 are DU rounds) being expended annually on the target area. This would annually deposit approximately 2.37 metric tons of DU. The potential effects for each resource area are as follows:

Noise: Use of DU rounds on Target 63-10 would not generate noise levels above those already occurring during aircraft operations and firing of conventional munitions on this target area. The general public is prohibited access to the NAFR and would, therefore, be unaffected by noise generated within the restricted areas of the range.

Air Quality: Airborne emissions would consist primarily of fugitive dust and DU particulates. Particulates would settle quickly, resulting in minimal air migration. Resumed DU use would generate approximately 25 additional A/OA-10 aircraft missions annually to the target area, which would not significantly increase air emissions from these operations. The proposed action would not involve construction activities and would result in minor increases in vehicular traffic. The potential emissions from the proposed action would be minimal and not impact the current attainment status of the region. Because the NAFR is located in an unclassified area for all six National Ambient Air Quality Standards, a formal conformity determination is not required.

Water: Water studies conducted in the target area concluded that infiltration through the upper one foot of soil would not occur for approximately 100 to 200 years because of the limited precipitation. Since deep infiltration of water is not occurring, no mechanism for downward transport of uranium to the groundwater exists. Additionally, although the target area is located in a floodplain, the water study indicated that there is little migration

of the existing DU laterally due to surface water transport. Therefore, resumption of DU in the target area would have negligible groundwater and surface water impacts.

Safety and Occupational Health: Air migration of DU particulates are not likely to reach worker or populated areas, nor contain radiation at exposure levels that could affect workers or public health. Exposure to range personnel during target maintenance and clean-up activities would be limited, since personal protective equipment would be used as deemed necessary by Industrial Hygiene personnel.

Hazardous Materials and Waste: The Proposed Action would not change current procedures and practices for transporting, handling, and storing the DU rounds at Nellis AFB. DU fragments are normally concentrated within a 300 to 400 foot radius around the target, with small amounts of the materials extending 1,000 feet from the target. Monitoring and clean up of the target area would occur in accordance with the *DU Management Plan* and supplemental range procedures. The intact DU penetrators and visible large fragments would be removed from the surface area and stored at the holding area until removed for recycling or disposal. Wastes would be recycled or disposed of as low level radioactive waste in accordance with 10 CFR Part 20 requirements.

Biological: The low population and low absorption rate of animals at the target area make the possibility of ingestion minimal. The only federally protected animal species in the area is the threatened desert tortoise. No sightings of this species in the area have been recorded and the general habitat conditions for this species in the area are poor. Therefore, no significant impacts to biological resources are anticipated.

Cultural: There would be no effects on cultural resources, since proposed activities would be similar to ongoing operations and no new surface disturbance would occur.

Geology and Soils: Soil contamination levels in the immediate area of Target 63-10 would increase, but the areal extent of contamination would not change significantly.

Socioeconomics: The Proposed Action would not result in a change in personnel; the size, or location of any range; or the manner in which hazardous materials are handled. Therefore, no significant impacts on socioeconomics or environmental justice considerations would occur.

4.0 CONCLUSION

On the basis of the findings of the Environmental Assessment (EA), no significant impact is anticipated from the Proposed Action on human health or the natural environment. A Finding of No Significant Impact (FONSI) is warranted and an Environmental Impact Statement (EIS) is not required for this action.

Michael R. Patrick 24 Feb 98

MICHAEL R. PATRICK, Colonel, USAF Date
Chairperson, Headquarters Air Combat Command
Environmental Leadership Board

EXECUTIVE SUMMARY

A wide spectrum of training capabilities exist on the Nellis Air Force Range (NAFR) to provide the most realistic combat training environment in the world. Many different types of ordnance, live and inert, are used on the NAFR to provide the training, tactics testing, and evaluation needed to achieve and maintain full combat readiness. One of the important capabilities of the NAFR has been the ability to test and train with depleted uranium (DU) munitions and weapons systems at Target 63-10 on Range 63.

This Environmental Assessment (EA) evaluates the impacts of implementing the Proposed Action or one of the two alternatives. The Proposed Action would be to resume the use of DU munitions for training and test/evaluation purposes. The alternatives evaluated are: Alternative 1, which includes the use of DU munition, but at lesser quantities; and the No Action Alternative, which continues the suspension of DU munition use.

The Proposed Action would allow the United States Air Force (USAF) Weapons School and the 422nd Test and Evaluation Squadron (TES) to resume DU munitions and weapons system training and test/evaluation activities at Target 63-10. These activities would result in a total of 9,500 combat mix rounds (7,900 DU rounds) being expended annually.

Under Alternative 1, the number of rounds that would be expended in support of training and test/evaluation activities would be reduced by approximately 50 percent. This critical reduction in rounds would not accomplish current mission requirements. If the reduced rounds to be expended were distributed, as appropriate, between the Weapons School and 422nd TES, minimal mission requirements would need to be redefined.

The No Action Alternative would continue the suspension of DU munition use for training and test/evaluation purposes. Training of pilots in the use of DU would rely on classroom instruction, which does not satisfy weapons system training requirements.

The existing conditions in the Range 63 target area are described in this EA. Resources addressed include noise, air quality, water, safety and occupational health, hazardous materials and waste, biological, cultural, geology and soils, and socioeconomics. The environmental consequences that may result from the implementation of the Proposed Action and the alternatives are also discussed in terms of these nine resources. The impacts to each resource from the Proposed Action and alternatives are briefly described below.

Noise: Implementation of the Proposed Action or alternatives would not generate noise levels above those already occurring during aircraft operations and firing of conventional munitions on this target area. The general public is prohibited access to the NAFR and would, therefore, be unaffected by noise generated within this target area.

Air Quality: Under the Proposed Action, airborne emissions would consist primarily of fugitive dust and DU particulates. The reduced use of DU under Alternative 1 would proportionately reduce the amount of DU particulates. U.S. Army studies at Yuma Proving Grounds (YPG), Arizona, on use of DU in an arid environment, demonstrate that the high density of DU

particulates does not make them a likely candidate for air migration. Under the No Action Alternative, air quality conditions would not differ from current conditions. The target area would continue to be unclassified, according to the National Ambient Air Quality Standards (NAAQS), in this portion of the Las Vegas Valley Air Quality Control Region (AQCR). A conformity determination is not required for the Proposed Action or alternatives, since they would be undertaken in an area that is unclassified with respect to NAAQS.

Water: There would be no effect on the groundwater as a result of implementing the Proposed Action, Alternative 1, or the No Action Alternative. Migration of additional DU via surface water would not be expected. Results of soil sampling and analysis indicate that existing DU in the target area is concentrated in a 300- to 400-foot circle around the targets, with a few isolated DU materials up to 1,000 feet past the targets. Soil sampling and analysis results show that surface water would not be affected and that DU would not be transported by surface water.

Safety and Occupational Health: Under the Proposed Action and Alternative 1, range maintenance personnel exposure would be limited during target maintenance and clean-up activities because personal protective equipment would be used, as deemed necessary by Industrial Hygiene personnel. Under the No Action Alternative, no adverse health effects are expected.

Hazardous Materials and Waste: Monitoring and clean up would be accomplished in accordance with the *DU Management Plan* under the Proposed Action and Alternative 1. DU would not be used at the NAFR under the No Action Alternative. Site clean-up and closure would be accomplished if the target area is no longer required for mission training requirements.

Biological: The primary potential source of DU impact to biology is through chemical toxicity. The low animal population numbers and low absorption rate of animals at Target 63-10 make the extent of chemical ingestion minimal under the Proposed Action or either of the two alternatives. DU already exists at the target site, so the No Action Alternative would still result in minimal exposure.

Cultural: Activities under the Proposed Action and Alternative 1 would be similar to ongoing operations on this target area, therefore, no new surface disturbance would occur. Thus, this proposal would not result in any effects on cultural resources.

Geology and Soils: Geology would not be impacted by the Proposed Action or Alternative 1. Soil contamination levels in the immediate area of Target 63-10 would increase, but the areal extent/depth of contamination would not change significantly under the Proposed Action and Alternative 1. There would be no change in impact to soils under the No Action Alternative.

Socioeconomics and Environmental Justice: Population, employment, and environmental justice considerations in the area would be unaffected by implementing the Proposed Action or either alternative.

1.0 INTRODUCTION

The 99th Air Base Wing (ABW), Nellis Air Force Base (AFB), Nevada, proposes to resume the employment of 30 millimeter (mm) depleted uranium (DU) armor piercing rounds intermixed with incendiary (API) rounds on the Nellis Air Force Range (NAFR), Target 63-10. Target 63-10 is situated in Three Lakes Valley, approximately 12 miles east-northeast of Indian Springs, Nevada, between the Desert and Pintwater ranges (Figure 1-1). This target area lies within a portion of the Desert National Wildlife Range (DNWR). Air Force use of that portion of the NAFR that lies within the DNWR is outlined in a Memorandum of Understanding (MOU) between the United States Air Force (USAF), Air Combat Command (ACC) and the Department of the Interior (DOI) U.S. Fish and Wildlife Service (USFWS). Target 63-10 is the only remaining air-to-ground gunnery range in the United States (U.S.) licensed for DU use.

This environmental assessment (EA) was prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 (Public Law [PL] 91-190) and the implementing regulations of the President's Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] Parts 1500 through 1508), which require federal agencies to analyze the potential environmental impacts of their proposed actions. Air Force Instruction 32-7061, *The Environmental Impact Analysis Process*, implements NEPA and CEQ regulations for Air Force actions.

1.1 BACKGROUND

A wide spectrum of training capabilities exists on the NAFR to provide the most realistic combat training environment in the world. These capabilities include scorable bombing and gunnery ranges, air-to-air gunnery ranges, and electronic combat threat emitters. Many different types of ordnance, both live and inert, are used on the NAFR to provide the training, tactics testing, and evaluation needed to achieve and maintain full combat readiness. One of the important capabilities of the NAFR has been the ability to test and train with DU munitions at Target 63-10 in Range 63.

Research, tests, and evaluations were conducted during the 1970s to develop improved armor penetrating munitions capable of defeating a heavily armored target. High density materials such as tungsten and DU were considered candidates for this type of munitions, however, DU was ultimately selected due to its very high density, availability, noncompetitive uses, and pyrophoric properties.

DU results from the enriching of natural uranium for use in nuclear reactors and nuclear weapons. Natural uranium is a slightly radioactive metal that is present in most rocks and soils as well as in many rivers and sea water. Natural uranium consists primarily of a mixture of two isotopes (forms) of uranium, Uranium-235 (U^{235}) and Uranium-238 (U^{238}), in the proportion of about 0.7 and 99.3 percent, respectively. Most commercial power reactors require U^{235} to produce energy. Natural uranium normally has to be enriched to obtain the isotope U^{235} by removing a large part of the U^{238}. Uranium-238 becomes DU, which is 0.7 times as radioactive

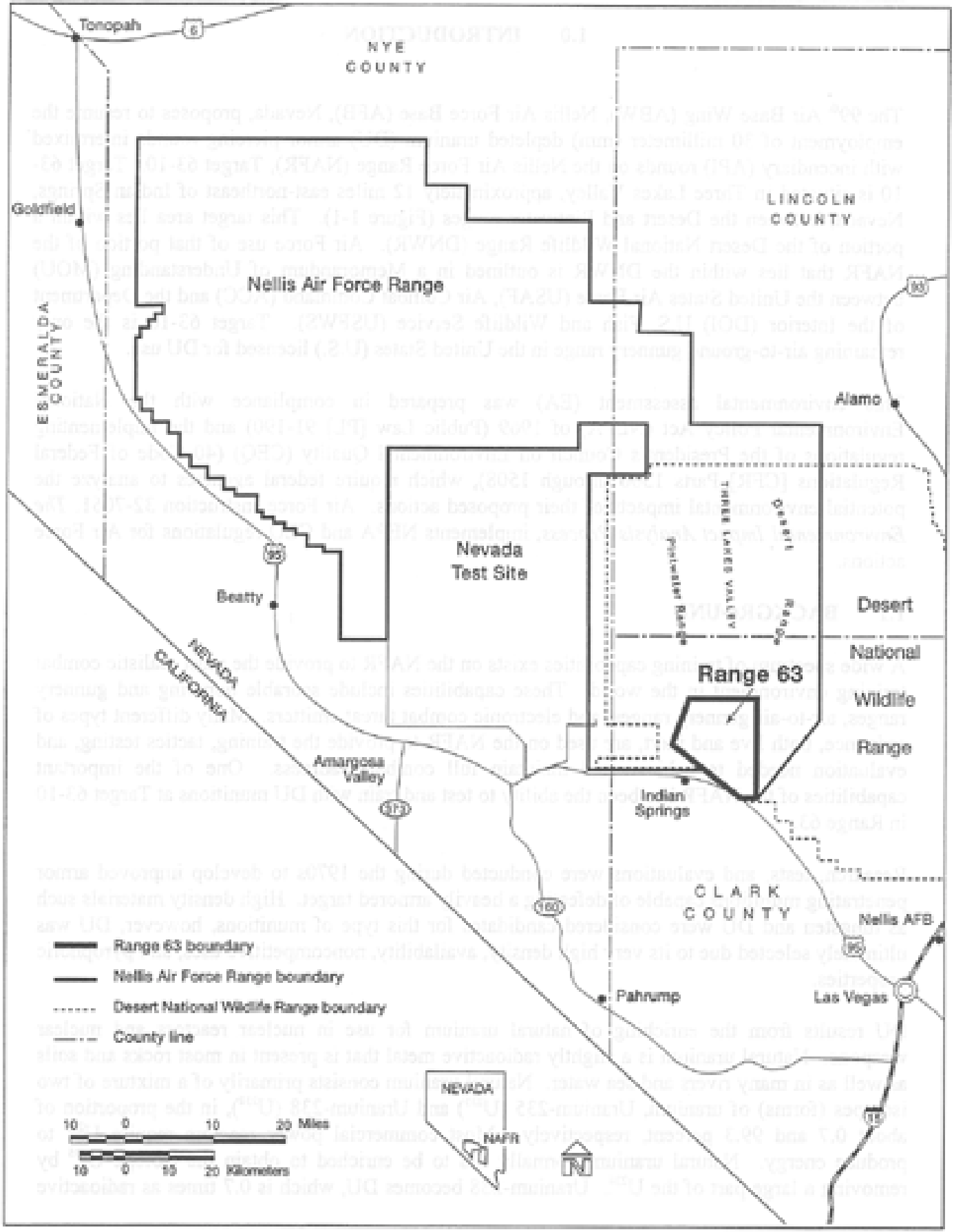

Figure 1-1. Range 63 Within the Nellis Air Force Range.

as natural uranium. When manufactured as 30mm rounds, each DU projectile contains approximately 0.3 kilograms (kg) of extruded DU, alloyed with 0.75 weight-percent titanium. The projectile is encased in a 0.8 mm-thick aluminum shell as the final DU round (Lockheed Martin, 1995).

The average background radiation dose normally received by an individual is about 360 millirems (mrem) per year. A mrem is a measurement unit that expresses the amount of absorbed dose from a radiation source that has a biological effect on human tissue. Millirem per hour or year expresses the rate at which a person may receive this dose when directly exposed to the source. Uranium accounts for approximately 4 percent of the average annual background radiation dose received by individuals. Background radiation doses are the result of naturally occurring uranium, radionuclides in air and water such as Radon, cosmic radiation, and other common sources such as medical and dental X-rays and consumer products (Gollnick, 1994). Additionally, less than one mrem per year is the result of fall-out from past atmospheric nuclear weapons testing.

An EA prepared by the USAF in April 1975, *Depleted Uranium Armor Penetrating Munitions for the GAU-8 Automatic Cannon*, addressed the manufacturing, transportation, storage, use, and disposal of DU relative to a proposal to conduct operational tests and evaluations on the South Range of the NAFR (USAF, 1975). This study included information known, at that time, on the chemical properties and biological and environmental effects of DU, and concluded that the use of DU projectiles would not be expected to have significant environmental impacts. With establishment of the Nuclear Regulatory Commission (NRC) in 1982, the Range 63 target area was licensed for firing 30mm DU rounds at tank, aircraft, and vehicle targets.

The U.S. Army has completed several studies on the health and environmental effects of DU use in both peacetime training operations at Yuma Proving Grounds (YPG), Arizona, Aberdeen Proving Grounds, Maryland, and battlefield operations in the Persian Gulf. These studies were reviewed for applicability to the Proposed Action and some similarities could be considered between YPG and Range 63 in regard to climatic and environmental conditions and the transport characteristics of DU in the soil and air. However, differences exist in the mode in which DU firing occurs and the potential exposure of personnel to DU during these operations. Army use of DU includes a variety of caliber applications (20, 25, 30, 105, and 120mm) in the M1 and M60 series tanks, the Bradley Fighting Vehicle, and Armored Gun System in ground firing activities (U.S. Army, 1995). This mode presents a greater potential for ground disturbance and personnel exposure to DU particulates than firing DU from an aircraft on a range where no personnel are present. Relevant results and conclusions from the Army studies were addressed in this EA where applicable to the impact analyses. Although additional studies are needed to more fully define current judgements on DU health and environmental effects, both the Army and Air Force have implemented management actions and protective measures to minimize impacts from DU use.

The possession and use of DU munitions by Nellis AFB is currently authorized by a permit issued by the USAF Radioisotope Committee on April 23, 1996, which is under the auspices of a Master Materials License issued to the USAF by the NRC in 1986. This license is administered by NRC Region IV and its administrative overview and control is managed by the Region's

Division of Radiation Safety and Safeguards. The permit authorizes a maximum quantity of 35,000 kg (77,000 pounds [lbs]; 116,178 rounds) of DU munitions to be stored at Nellis AFB. The permit also authorizes the expenditure of 30mm AN/GAU-8 API and API Tracer (APIT) rounds on the Range 63 target area in quantities "as needed" for pilot training and tactical employment evaluation (USAF, 1996). The storage locations are radiologically surveyed at least annually and the results documented in a report to the Radioisotope Committee. These results have not indicated any radiation levels above acceptable limits.

The Range 63 licensed area encompasses Target 63-10 and a holding area for used and new targets (Figure 1-2). The target area consists of 4 tanks in 2 groups spaced 300 feet apart, located within two 100-meter bladed circles. This area is approximately 2,000 feet east of the row of east-to-west oriented tanks in the holding area (Figure 1-3). This holding area contains nearly 200 tanks and vehicles that have been fired upon with DU munitions in the past.

DU target refurbishment must be accomplished in accordance with the *DU Management Plan* and under the direct supervision of a qualified health physicist, as specified in the Nellis AFB permit. A variety of live and inert ordnance is authorized on the target area and the associated strafing fans encompassing the target. Conventional munitions consisting of 20 and 30mm training projectiles and high-explosive incendiary (HEI) continue to be used on this target area.

Conventional, incendiary, and DU rounds are fired by a AN/GAU-8 30mm seven-barrel gatling gun mounted in the fuselage nose of the A/OA-10 Thunderbolt aircraft, the only USAF aircraft that employs DU rounds. This aircraft is used for close-air support in attacking ground threats such as armored tanks and vehicles, and also serves as a forward air control observer for sighting ground threats and directing air strikes against enemy targets. Current force structure plans project the A/OA-10 to remain in the inventory for a minimum of 15 more years. DU is the primary munition for the A/OA-10 in a combat environment.

In 1993, Nellis AFB suspended the use of DU rounds at the request of the USFWS, who expressed concerns about the environmental impacts of DU to the flora and fauna in the DNWR. Nellis AFB conducted a Limited Site Assessment of Range 63 during 1994 and 1995 and provided information to the USFWS regarding this assessment and other efforts taken for management of the Range 63 target area. In response, the USFWS authorized temporary resumption of DU use in October 1996 (USFWS, 1996).

In October 1994, the NAFR was inspected by the NRC, which recommended that environmental monitoring be performed in the DU permitted area to detect movement of DU contamination. It was also recommended that Nellis AFB recover DU rounds to enhance the control of DU on the range and minimize the spread of contamination.

Based on the USFWS requests, NRC recommendations, and a critical need to resume training with DU rounds, Nellis AFB planned and initiated several actions for managing the Range 63 licensed area. The Limited Site Assessment determined the general locations and probable state of the expended DU munitions on Target 63-10 so that an approach for management and disposal could be developed. The *DU Management Plan* and corresponding supplemental procedures are

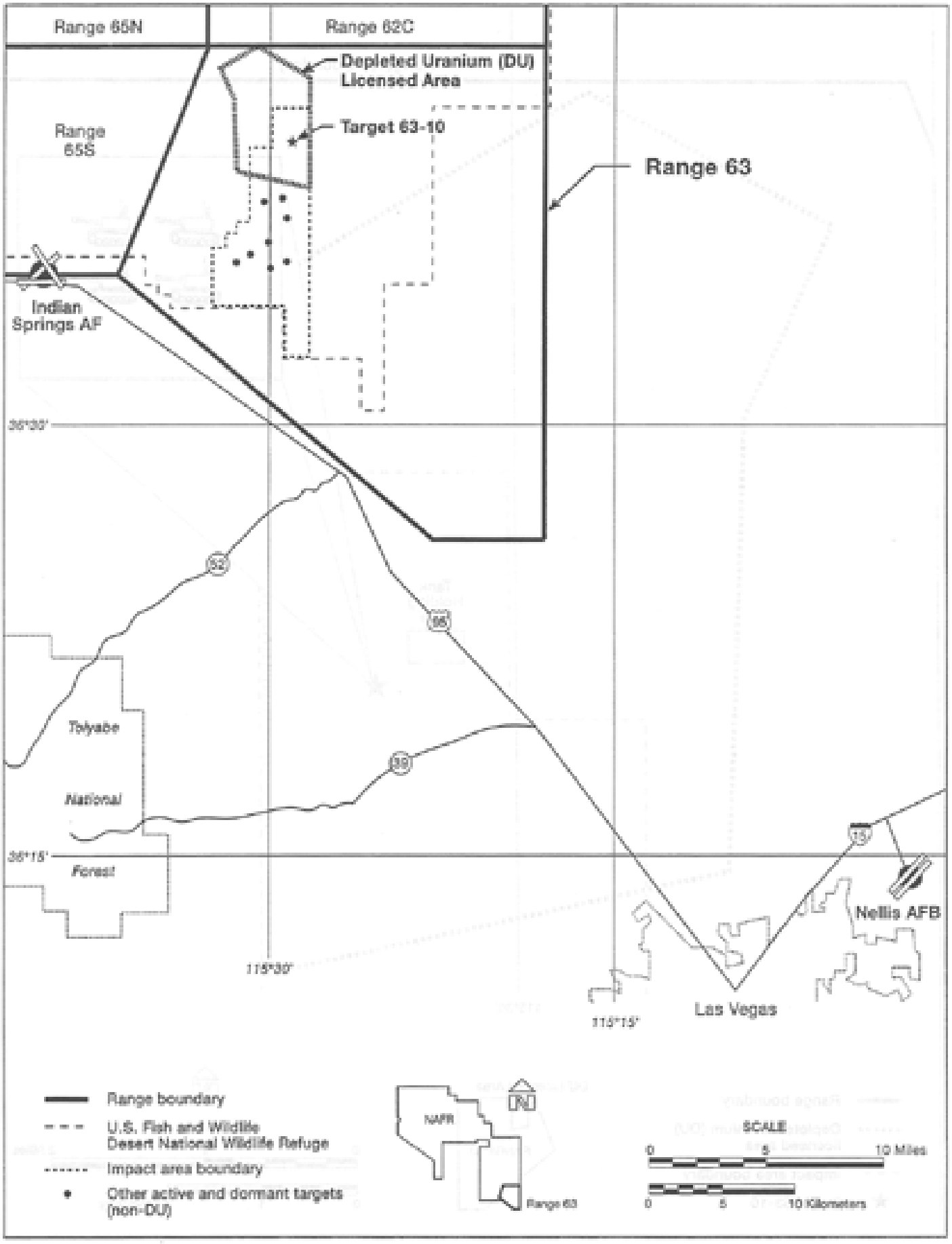

Figure 1-2. Range 63 and Surrounding Area.

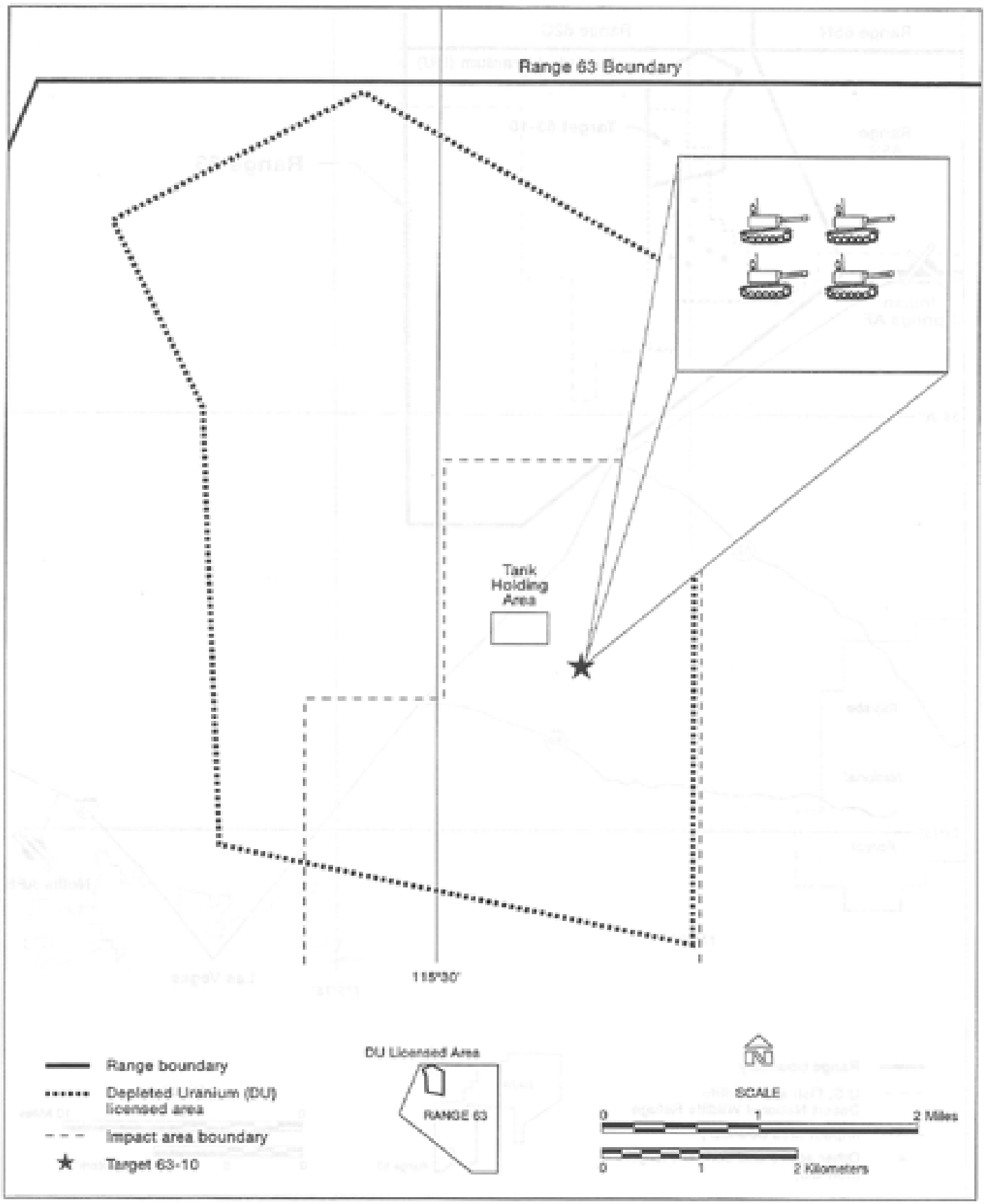

Figure 1-3. Depleted Uranium (DU) Licensed Area and Target 63-10.

being developed to outline procedures for explosive ordnance disposal, clean-up of the target area, and soil sampling for monitoring short- and long-term migration of DU contaminants. This plan will also describe final remediation and closure actions that would be taken when the target is no longer required.

1.2 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

DU munitions is a common type of kinetic penetrator currently used by both friendly and nonfriendly forces around the world. It is, therefore, important that U.S. forces be able to train with DU, both in an air-to-ground (A/OA-10) and ground-to-ground (tank) capability. For that reason, the purpose of the Proposed Action would be to allow the USAF to resume the use of DU on Target 63-10 in order to accomplish training and testing objectives critical to the employment of DU munitions on the A/OA-10 aircraft. The gatling gun weapons system and associated DU munitions comprise the primary mission capability of this aircraft. Weapons system effectiveness is dependent upon the capability to train pilots using DU rounds as they would under actual combat conditions. The 5-year lapse that has occurred in DU training to date has resulted in nonaccomplishment of an important training requirement that is key to the A/OA-10's combat mission capability. Since the NAFR is the only air-to-ground range licensed for DU use, DU familiarization has had to be conducted during this period solely through academics and videos, which have not satisfied weapons system training requirements.

Training and testing in the employment of 30mm DU combat mix (CM) is directed by Headquarters Air Combat Command (HQ ACC) to enable the instructor, students, and test/evaluation pilots to analyze and execute various delivery options using the DU CM munitions. Combat mix is a sequential mixture of DU and HEI rounds in which one HEI round, followed by five DU rounds, are fired by the AN/GAU-8 gatling gun. Training with the CM familiarizes pilots with the different ballistics and effects of the DU and conventional rounds in a manner that cannot be replicated by firing only the conventional training rounds. It is also necessary that DU features and tactics be tested and evaluated for continued effective use of these munitions and the weapons system. The 30mm CM has never been tested since the A/OA-10 first received the Low Altitude Safety and Targeting Enhancement upgrade shortly after Desert Storm. This upgrade provides computerized weapons delivery solutions for all munitions used on the A/OA-10.

The ability to train and test with DU rounds on the NAFR was largely responsible for the highly successful use of these munitions in the Gulf War. The armor-piercing capability of the DU projectiles fired from A/OA-10s proved exceptionally effective in countering threats from the Iraqi tanks so that a successful ground offensive could then be achieved. Therefore, the purpose and need to resume employment of DU on Target 63-10 is threefold: to train A/OA-10 pilots, to test and evaluate target enhancement software, and to develop and evaluate target tactics.

1.3 DECISION TO BE MADE

The decision to be made by HQ ACC is whether to (1) implement the Proposed Action; (2) implement an alternative that reduces the amount of DU munitions that would be expended under

either the training and/or test and evaluation requirement, and concurrently reduce the requirement for DU training; or (3) take no action.

1.4 RELEVANT ENVIRONMENTAL ISSUES AND SCOPE OF ANALYSIS

Resource areas that were assessed relative to the Proposed Action and alternatives include noise, air quality, water, safety and occupational health, hazardous materials and waste, biological, cultural, geology and soils, and socioeconomics. Transportation, handling, and storage are also discussed, as appropriate, for both pre-employment and post-employment of the DU rounds. This EA examines the potential impacts of: implementing the Proposed Action, which is to resume the use of DU munitions; implementing an alternative that includes the use of DU munitions, but at lesser quantities; and taking no action, which continues suspension of the use of DU munitions.

1.5 PERMITTING, LICENSING, AND CONSULTATION REQUIREMENTS

Permit 27-30048-1AFP, Amendment 3, issued by the USAF Radioisotope Committee, authorizes the storage, pilot training, tactical employment evaluation, and expenditure of 30mm API and APIT munitions on the NAFR Range 63 target area. The permit was issued on April 23, 1996, and the current expiration date is January 31, 1999. Issuance of this permit was under the auspices of the NRC Master Materials License 42-23539-01AF.

Range 63 was included in a Biological Opinion rendered by the USFWS, Nevada State Office, in February 1997, on the Reiteration of Formal Consultation for Continuing Current Weapons Testing and Training on U.S. Department of the Air Force's Weapons and Tactics Center Range Complex.

1.6 ORGANIZATION OF THIS ENVIRONMENTAL ASSESSMENT

This EA follows the organization recommended by the CEQ *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR, Parts 1500-1508). It presents an interdisciplinary analysis of the potential impacts associated with the proposal. The potential environmental issues identified in Section 1.4 are the focus of the analysis.

Chapter 2 describes the Proposed Action and alternatives, and compares the potential environmental consequences of these alternatives. Chapter 3 describes the existing environment that may be affected by the Proposed Action or the alternatives. Chapter 4 describes the potential consequences that may result from implementation of the Proposed Action and each alternative. Chapters 5 through 8 include persons and agencies contacted, references cited, list of preparers, and a glossary. Appendix A contains procedures for monitoring DU on Range 63; Appendix B includes a distribution/mailing list. Appendix C contains a list of acronyms used throughout this document. The Table of Contents provides further detail on the topics included in each of the sections in this EA.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This chapter contains the description of the Proposed Action and alternatives that are being evaluated for the Range 63 target area on the NAFR. The Proposed Action would be to resume the use of DU munitions for training and test/evaluation purposes. The alternatives evaluated are: an alternative that includes the use of DU munitions, but at lesser quantities (Alternative 1); and the No Action Alternative, which continues the suspension of DU munitions use.

2.1 PROPOSED ACTION

The Nellis AFB 99th ABW proposes to resume the employment of 30mm DU rounds on the NAFR Target 63-10 to fulfill a critical need for instructor training, testing and evaluation of associated tactics, and software development. Two Nellis AFB organizations, the USAF Weapons School and the 422nd Test and Evaluation Squadron (TES), are responsible for conducting the training and test/evaluation of the DU on the NAFR. Since no operational A/OA-10 units employ 30mm CM, these two Nellis AFB units constitute the only USAF opportunity to exercise the active employment chain, to include maintenance, weapons loading, ammunition avionics, gun, pilot, and tactics in an unbroken loop.

Training in the use of DU is conducted by the USAF Weapons School as part of its instructor training program. Instructor pilots having past experience and considered experts in firing all types of munitions are sent to Nellis AFB to complete advanced training in tactics and techniques. The Weapons School's main purpose is to provide a cadre of weapons officers to the Combat Air Forces who have received the broadest exposure to all primary conventional weapons and tactics available for their aircraft. During the DU phase of this training program, students are required to calculate delivery parameters, determine target acquisition and munitions employment strategies, and conduct a mission during which the CM is fired from low and high angles at long range with two target deliveries. Only two courses are conducted annually with five students in each class. The DU training consists of one flight mission by each student during which approximately 500 rounds of 30mm CM are fired. This phase is completed in one day, therefore, the recurring DU training would equate to only two days of actual DU employment per year with a total of about 5,000 rounds of CM (containing about 4,150 DU rounds) being expended annually by the 10 students. A total of 10 training missions would be conducted annually with DU. Upon completion of the USAF Weapons School training, the students return to their home bases with the experience to provide classroom instruction to other pilots on tactics and weapons system performance. The classroom instruction uses both briefings and video presentations. There is no simulator capability or other means available for training with these munitions.

Operational Flight Program testing on the DU munitions would be conducted by the 422nd TES and is directed by HQ ACC as an open-ended plan to test and evaluate follow-on versions of the A/OA-10 Low Altitude Safety and Targeting Enhancement software and the constantly compute impact point (CCIP) gun sight that is part of the gatling gun weapons system. This testing would require live firing on a target to realistically evaluate the DU CM ammunition, the GAU-8/AS gatling gun performance, and the CCIP gun sight for ongoing software enhancement and tactics

development. This test and evaluation capability is essential in maintaining the reliability of the software and tactical applications used in DU employment.

Operational test and evaluation of the 30mm CM would require a variety of flight profiles within the target area, that include deliveries from low and high angles at both short and long ranges, with single and multiple strafing on Target 63-10. Aircraft firing DU on Target 63-10 would be limited to flying a northerly heading between 350 and 020 degrees while firing at the targets. Based on historical requirements, about 15 missions would be flown annually to support the DU testing with approximately 300 CM rounds fired per mission for a total of 4,500 CM rounds (containing about 3,750 DU rounds) per year.

These mission requirements and the USAF Weapons School's 10 missions would total 25 annual missions. During 25 missions, approximately 9,500 CM rounds (about 7,900 DU rounds) would be expended on Target 63-10. This would result in approximately 2,370 kg (2.3 metric tons) of DU being deposited on the target area each year. This is generally the same amount that was being used annually prior to the suspension of DU testing and training operations in 1993 (Ostein, 1997). The Proposed Action would not require any modifications to the Target 63-10 configuration, nor to flight profiles and procedures previously established for conducting DU flight operations within this target area.

DU rounds would be transported commercially to Nellis AFB Area II as CM, where they would be stored in an approved and designated earth-covered magazine. Up to 25,000 CM rounds have been stored at the Nellis AFB for testing and training purposes, depending on required annual allotments. Due to the low level of radioactivity in these munitions, they would be handled and safeguarded the same as other munitions during transport and preparation for mission use (Hedlind, 1997).

Aircraft departing Nellis AFB with CM would use standard departure routes and transit to Range 63 via the "Lee" corridor, which parallels Highway 95 to the west along the southern boundary of the NAFR (Figure 2-1). Aircraft carrying any munitions use transit routes that avoid overflight of populated areas to the maximum extent possible. Aircrews must not select armament switches that may cause an inadvertent release of any ordnance prior to range entry (USAF, 1995).

The MOU between the USAF and DOI regarding Air Force Operations on the DNWR in Nevada specifies impact areas within which air-to-ground gunnery may occur, and specific altitude restrictions for aircraft flights conducted within these areas. Target 63-10 is within one of the MOU-defined impact areas. The terms of this MOU require that all military aircraft flying over the DNWR remain above 2,000 feet above the ground level unless mission accomplishment requires lower altitudes (USAF, 1997a). Mission accomplishment includes test and training activities within the impact areas.

The DU licensed area is in the northern portion of Range 63 and is accessed by one unpaved, graded road. This area is normally off-limits to range maintenance personnel unless specifically authorized by range management. For that reason, range maintenance personnel normally access

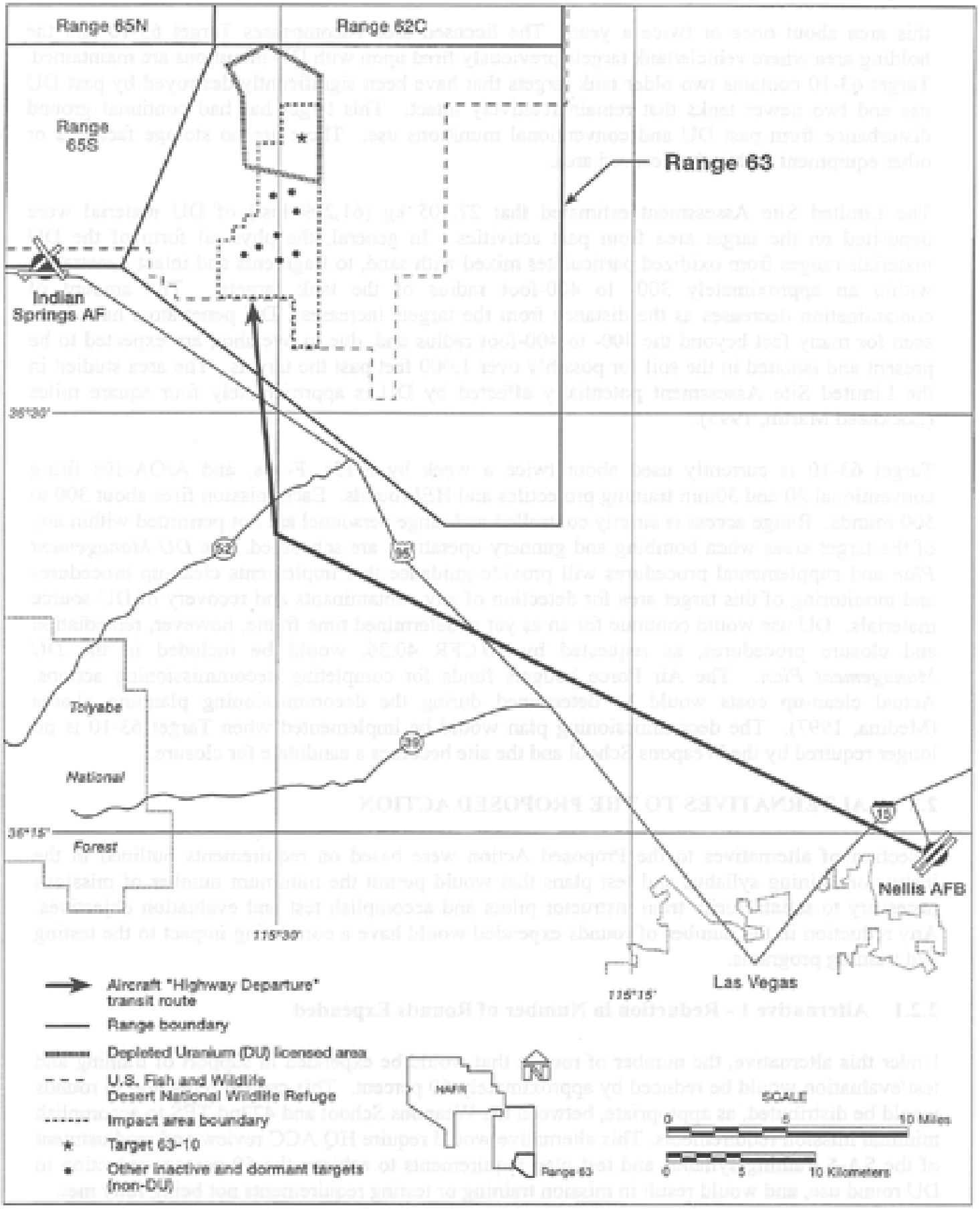

Figure 2-1. Aircraft Transit Route.

this area about once or twice a year. The licensed area encompasses Target 63-10 and the holding area where vehicle/tank targets previously fired upon with DU munitions are maintained. Target 63-10 contains two older tank targets that have been significantly destroyed by past DU use and two newer tanks that remain relatively intact. This target has had continual ground disturbance from past DU and conventional munitions use. There are no storage facilities or other equipment within the licensed area.

The Limited Site Assessment estimated that 27,805 kg (61,299 lbs.) of DU material were deposited on the target area from past activities. In general, the physical form of the DU materials ranges from oxidized particulates mixed with sand, to fragments and intact penetrators within an approximately 300- to 400-foot radius of the tank targets. The amount of contamination decreases as the distance from the targets increases. DU penetrators have been seen for many feet beyond the 300- to 400-foot radius and, due to overshot, are expected to be present and isolated in the soil for possibly over 1,000 feet past the targets. The area studied in the Limited Site Assessment potentially affected by DU is approximately four square miles (Lockheed Martin, 1995).

Target 63-10 is currently used about twice a week by F-15s, F-16s, and A/OA-10s firing conventional 20 and 30mm training projectiles and HEI rounds. Each mission fires about 300 to 500 rounds. Range access is strictly controlled and range personnel are not permitted within any of the target areas when bombing and gunnery operations are scheduled. The *DU Management Plan* and supplemental procedures will provide guidance that implements clean-up procedures and monitoring of this target area for detection of any contaminants and recovery of DU source materials. DU use would continue for an as yet undetermined time frame, however, remediation and closure procedures, as requested by 10 CFR 40.36, would be included in the *DU Management Plan*. The Air Force budgets funds for completing decommissioning actions. Actual clean-up costs would be determined during the decommissioning planning phases (Medina, 1997). The decommissioning plan would be implemented when Target 63-10 is no longer required by the Weapons School and the site becomes a candidate for closure.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

Selection of alternatives to the Proposed Action were based on requirements outlined in the instructor training syllabus and test plans that would permit the minimum number of missions necessary to satisfactorily train instructor pilots and accomplish test and evaluation objectives. Any reduction in the number of rounds expended would have a correlating impact to the testing and training programs.

2.2.1 Alternative 1 - Reduction in Number of Rounds Expended

Under this alternative, the number of rounds that would be expended in support of training and test/evaluation would be reduced by approximately 50 percent. This critical reduction in rounds would be distributed, as appropriate, between the Weapons School and 422nd TES to accomplish minimal mission requirements. This alternative would require HQ ACC review and readjustment of the SA-5 training syllabus and test plan requirements to achieve the 50 percent reduction in DU round use, and would result in mission training or testing requirements not being fully met.

2.2.2 No Action Alternative

The No Action Alternative would continue suspension of the use of DU munitions for training and test/evaluation purposes and would rely on classroom instruction for the training of pilots in the use of DU. Mission training and testing requirements would not be met.

2.3 ALTERNATIVES CONSIDERED AND ELIMINATED FROM FURTHER ANALYSIS

Additional alternatives were considered but eliminated from further analysis. This section identifies the alternatives eliminated from further consideration and provides a brief explanation of the reason for elimination.

2.3.1 Use of Alternate NAFR Location

Use of another target area in the NAFR was considered as an alternative to resuming DU use on Target 63-10. This alternative was eliminated from further analysis due to the potential additional adverse effects of transferring DU use to a new site not previously exposed to DU contamination. Target 63-10 has long been confined, licensed, and used for this purpose; it has already received contamination from this historic use, although the environment immediately surrounding the target area has not been impacted; and measures have been established to reduce and control this contamination through monitoring and clean-up efforts.

2.3.2 Use of an Alternate USAF Range Location

Use of another USAF range was considered as an alternative to resuming DU use at NAFR Target 63-10. This alternative was eliminated from further analysis for several reasons. Use of DU munitions has been strictly limited to completing minimum USAF test and training capabilities currently only available on the NAFR. Establishing an alternate DU target area at another USAF range would not be practical in the time, cost, and logistics of relocating these test and training functions and establishing a new DU target capability. This would also require licensing of a new area that has not previously been exposed to DU contamination.

2.3.3 Use of the Nevada Test Site

Use of areas within the Nevada Test Site (NTS) where DU testing has occurred in the past was suggested as an alternative during the comment period. Use of such areas for air-to-ground gunnery test and training would be incompatible with current NTS mission activities and the restricted airspace that has been established over the NTS to support these activities. DU use on the NTS is limited to research and development associated with health and safety objectives, and conducted under controlled conditions that prevent site contamination.

2.3.4 Use of a Substitute Munition

Use of a substitute munition was considered as an alternative to using DU rounds for test and training purposes. This was also a concern raised during the comment period. This alternative

was eliminated from further analysis due to the current nonavailability of any munitions type that replicates the ballistic characteristics of a DU round. Current research and development efforts have not yet successfully developed tungsten munitions that perform at the level equivalent to DU. Furthermore, tungsten is a toxic heavy metal which would present risks from chemical toxicity similar to those associated with DU. Use of tungsten in a weapons system would be far more expensive than DU use, while still having the same characteristics. Until such time that a substitute munition is developed, which would meet acceptable test and training criteria for actual DU use, this alternative is not considered viable.

2.4 COMPARISON OF THE PROPOSED ACTION AND ALTERNATIVES

Table 2-1 summarizes the potential effects for each resource area that may result from implementation of the Proposed Action and alternatives.

Table 2-1. Comparison of Environmental Impacts of the Alternatives

Resource	*Proposed Action*	*Alternative 1*	*No Action*
Noise	Target 63-10 is currently used by A/AO-10 aircraft. Use of DU CM does not change current potential impacts.	Impacts would be the same as those listed for the Proposed Action.	Potential impacts would not be reduced due to current activities.
Air Quality	Airborne emissions would consist primarily of fugitive dust and particulates generated from impact of the DU rounds on the target area. The remoteness of the target area and its restricted access limits the likelihood of these particulates affecting public health and safety.	Reduced use of DU rounds would proportionately reduce the amount of DU particulates and oxides generated. The remoteness of the target area and its restricted access limits the likelihood of these particulates affecting public health and safety.	Air quality conditions would not differ from the current conditions.
Water	There would be no effect on the groundwater because deep infiltration of water is not occurring. Soil sampling and analysis results indicate that there is no migration of DU via surface water.	The impacts would be the same as discussed for the Proposed Action.	The impacts would be the same as discussed for the Proposed Action.
Safety and Occupational Health	DU particulates are gravimetrically heavy, resulting in quick settling. Therefore, public exposure to dust clouds will not occur. Personnel exposure would be limited because they would use the appropriate personal protective equipment, when activities result in dust. DU air concentrations would be less than the NRC Derived Air Concentration (DAC). No adverse health effects are expected.	The impacts would be the same as those discussed for the Proposed Action	No adverse health effects are expected.
Hazardous Materials and Waste	There would be no effect on current procedures and practices for transporting, handling, or storing current 30mm munitions. Monitoring and clean up would be accomplished in accordance with the *DU Management Plan*.	The impacts would be the same as those presented for the Proposed Action.	Additional use of depleted uranium rounds on NAFR Target 63-10 would not be permitted.

Table 2-1. Comparison of Environmental Impacts of the Alternatives (Continued)

Resource	*Proposed Action*	*Alternative 1*	*No Action*
Biological	The effects of the forceful impacts of DU rounds on biological resources would not be greater than the effects of conventional rounds. Minimal impacts may occur due to toxicity. However, the low population and low absorption rate of animals at the site makes the possibility of ingestion minimal.	Impacts would be the same as those presented for the Proposed Action.	No additional DU impacts would occur. This target area is disturbed from previous and continuing conventional sound use.
Cultural	The target area is previously disturbed. Therefore, additional impacts to cultural resources would not occur.	The impacts would be the same as those presented for the Proposed Action.	The impacts would be the same as those presented for the Proposed Action.
Geology and Soils	No additional impacts to geology would result from the Proposed Action. Soil contamination levels in the immediate area of the targets would increase. The areal extent/depth of the contamination would not change significantly.	The impacts would be the same as those presented for the Proposed Action.	There would be no additional impact to geology or soils.
Socioeconomics and Environmental Justice	There would be no impact.	There would be no impact.	There would be no impact.

3.0 EXISTING ENVIRONMENT

This chapter describes existing environmental conditions in the Range 63 target area. Resources addressed, include noise, air quality, water, safety and occupational health, hazardous materials and waste, biological, cultural, geology and soils, and socioeconomics. A basis is given in the appropriate sections for those attributes not anticipated to be affected by the Proposed Action or any alternative. The baseline conditions described in this chapter reflect the most current information available.

The climate in the area of the NAFR is affected by two main sources of air movement. From fall through spring, the area is influenced by Pacific air movements that come across the Sierra Nevada Mountains. In summer to early fall, winds from Mexico are predominate in the area.

Annual precipitation depends mainly on elevation and varies, on the average, from 4 inches on the desert floor, in areas such as the Range 63 target area, to about 16 inches in the higher mesa areas. Winter precipitation often falls as snow (at higher elevations), whereas summer rains are often associated with thunderstorms, which are intense enough at times to produce local flash flooding.

3.1 NOISE

The primary source of noise on Range 63 target areas is from low altitude aircraft operations and air-to-ground bombing and gunnery activities. Aircraft operations on ranges are often sporadic with periods of heavy activity interspersed with slow times. Noise modeling techniques for this type of activity use an adjusted monthly day-night sound level measurement (L_{dnmr}) that includes a penalty of 10 decibels (dB) to compensate for activities after 10 pm and up to an 11 dB penalty to allow for rapid on-set of noise.

About 4,000 aircraft sortie missions are conducted annually in Range 63 by the F-15s, F-16s, and A/OA-10s, which are the aircraft that predominantly use this range (USAF, 1997b). This produces noise levels up to 55 dB, which, due to distance and the sporadic flights do not adversely affect populated areas in the Indian Springs vicinity.

Range 63 contains a target area that is nearest to the NAFR boundary (approximately 6.3 miles). This area was evaluated to determine the noise level associated with the denotation of a 2,000-lb. general-purpose bomb, which contains 1,162 lbs. of trinitrotoluene (TNT)-equivalent high explosive. Modeling of this explosive weight using the U.S. Army's Noise Assessment and Prediction System indicates that a 140 sound pressure level or greater is present out to approximately 3,700 feet from the point of detonation. Safety requirements would preclude any human presence in this zone; therefore, there are no health or safety risks associated with this acoustic level. Using the output from this model, the sound pressure level at 6.3 miles was determined after converting this level in a day-night average noise level (L_{Cdn}). These calculations indicate that a single event results in L_{Cdn} 38.7 at the NAFR boundary. Approximately 214 day-equivalent detonations could occur at that point per day and the noise level of L_{Cdn} 62 would not extend past the range boundary. Based on these calculations,

excessive impulsive noise levels associated with high explosives would not be expected to impact lands off the NAFR (USAF, 1998).

3.2 AIR QUALITY

The U. S. Environmental Protection Agency (EPA) has established nationwide standards, under the authority of the Clean Air Act (CAA), and National Ambient Air Quality Standards (NAAQS), to protect public health and welfare. Under the CAA, state and local agencies may establish air quality standards and regulations of their own, provided these are at least as stringent as the federal NAAQS (General Conformity Rule). In adopting these standards, the State of Nevada has designated Clark County as the responsible agency for enforcing CAA standards within the county, which includes Range 63 and other portions of the NAFR south ranges.

The entire NAFR area, including Range 63, is located in the northwest corner of the Las Vegas Valley Air Quality Control Region (AQCR). The AQCR is unclassified for the state and national standards. However, nearby portions of Clark County are designated as "serious" carbon monoxide and particulate matter less than 10 microns in diameter (PM_{10}) nonattainment areas (40 CFR Part 81.329). The carbon monoxide nonattainment problem occurs within the Las Vegas metropolitan area and is due to vehicular emissions within congested roadways. Elevated levels of PM_{10} mainly occur from fugitive dust within the Las Vegas metropolitan area. Because the General Conformity Rule only applies to nonattainment areas, Range 63 is not subject to conformity requirements.

Air emissions on the NAFR result primarily from aircraft operations, weapons/ordnance delivery impact and detonation, and vehicle and generator operations. Air pollutants generated by these sources include aircraft engine emissions, fugitive dust and gaseous emissions from weapons/ordnance delivery, and fugitive dust and engine emissions from range vehicle travel over unpaved roads. Ground-based and aircraft emissions on the NAFR (in tons per year) result in 1,249 CO, 9,228 nitrogen dioxide, 6,314 particulates, 227 sulfur dioxide, and 130 volatile organic compounds. These emissions were calculated from operational and emissions data. The 15 daily average aircraft sorties conducted on Target 63-10 and infrequent vehicle trips made to this area, result in a relatively small amount of pollutants emitted over this area.

There is little target refurbishment and maintenance activity conducted within the Target 63-10 area that would disturb the soil and result in any appreciable transmission of particulates by forced suspension. Personal air sampling was conducted by USAF Health Physics and Bioenvironmental Engineering during movement of scattered targets on Range 63 in 1992. The sampling was conducted to determine the possible transport of DU and its oxides through normal wind dispersion, and transport of DU during target refurbishment and heavy equipment disturbance of surrounding soils. Sample analysis showed no significant respirable DU concentration above the minimum detectable activity (MDA) of 0.2 femoCuries per liter. This MDA is well below the 18.9 femoCuries per liter derived air concentration limit specified in the International Council of Radiation Protection and Measurements Report Number 30, and 10 CFR 20, which assumes 40 hours exposure per week for 50 weeks. These results suggested that the contamination does not appear to be an inhalation hazard in the undisturbed state. Range

personnel performing target refurbishment and maintenance activities may wear the High Efficiency Particulate Air (HEPA) filtered respirators and other personal protective equipment as evaluated and deemed necessary by Industrial Hygiene personnel (Lockheed Martin, 1995). Additional discussions on air quality effects, relative to safety risks, are contained in Section 3.4, Safety and Occupational Health.

3.3 WATER

The following section discusses the water resources at the NAFR. The discussion is divided into groundwater and surface water.

3.3.1 Groundwater

The primary groundwater flow system on the NAFR is a regional flow system. The general direction of regional flow within the boundaries of the NAFR is from the northeast toward the southwest. According to regional groundwater measurements, the depth to groundwater in the vicinity of Range 63 is estimated to be approximately 200 to 300 feet below ground surface (Thomas, 1986; Science and Technology, 1992).

Three types of aquifers underlie portions of southern Nevada and the NAFR: valley-fill or alluvial aquifers, volcanic aquifers, and carbonate aquifers (Dettinger, 1992). Studies have suggested that the carbonate rock underlying major portions of eastern and southern Nevada forms the principal groundwater aquifer in the NAFR.

The primary source of groundwater recharge on the NAFR is precipitation in the form of rain or snow falling in the mountains and infiltrating into alluvial and bedrock aquifers. Mountain precipitation can infiltrate directly into aquifer outcroppings providing recharge to the bedrock aquifers. The primary types of groundwater discharge from the NAFR are direct evaporation of precipitation from bare soils and subsurface outflow.

Use of groundwater on the NAFR is in support of range personnel and operations. Records from the Nevada State Water Engineer's Office indicate that groundwater from 20 wells is used within the boundaries of the NAFR (TRC, 1996).

3.3.2 Surface Water

Due to the arid conditions of the desert, the NAFR is dry except during and shortly after a storm. The availability of moisture in excess of evaporation and transpiration is so limited in the arid area of the NAFR that few perennial surface water features are present. Surface water is only temporarily present and is associated with ponding in the low permeability playas and channel flow from infrequent precipitation events and snow melt runoff as shown on Figure 3-1. No natural lakes or other open bodies of water occur within or near the Range 63 target area. Playas are not major recharge zones, due to low infiltration potential, and most surface water that reaches the playas is lost through evaporation.

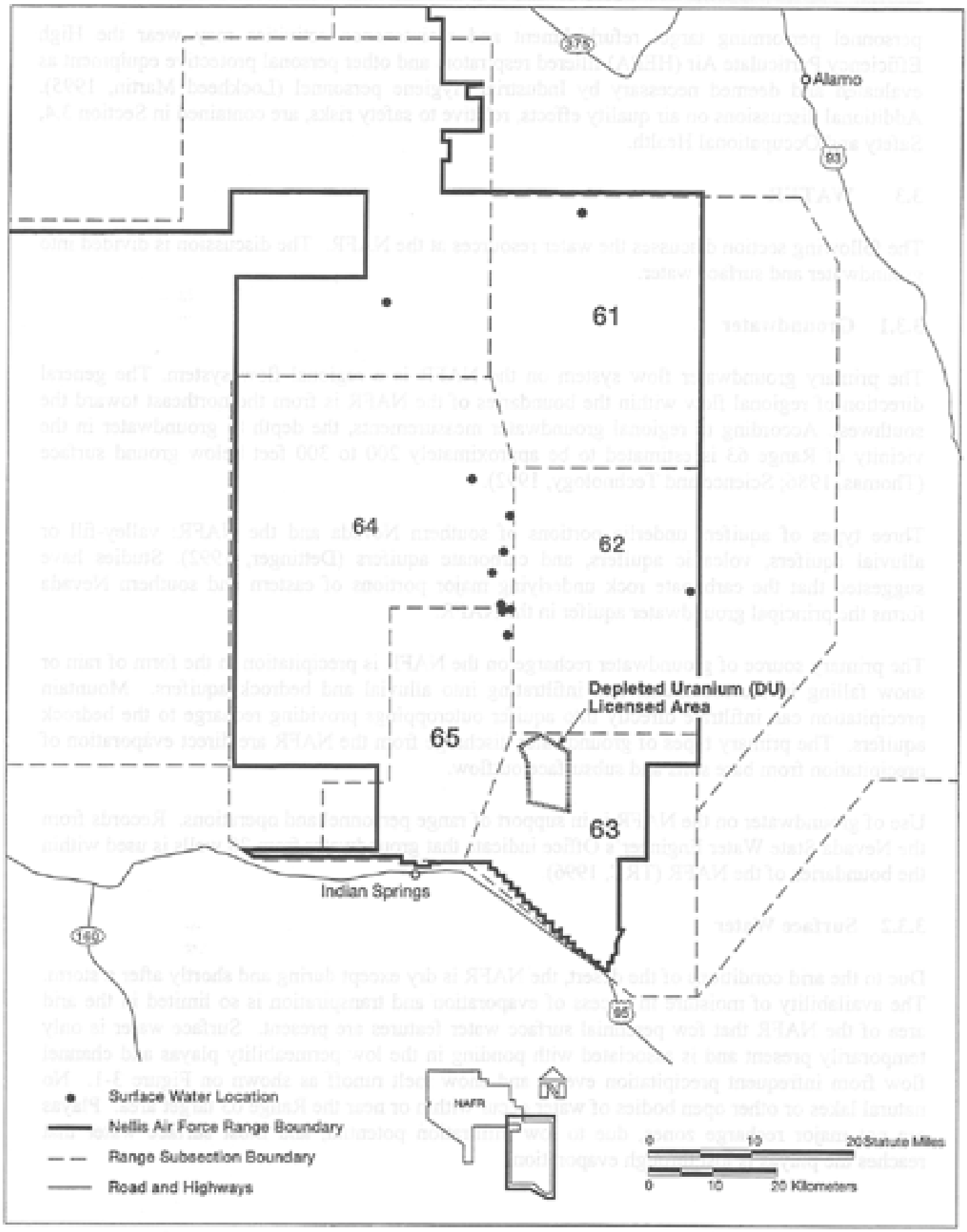

Figure 3-1. Surface Water Resources on the South Range.

Much of the warm weather precipitation in the area is lost to the atmosphere through evaporation and transpiration within a very short period. Regional storms, which generally occur in the winter months, are typically of low intensity with low flooding potential. However, locally intense summer thunderstorms within the mountainous portions of the NAFR can produce flooding in the low-lying valleys. Localized thunderstorms produce high-intensity, short-duration rainfall events that can result in occasional flash flooding (USAF, 1998). When a major storm moves into the area, water collects as surface runoff in a short period. Consequently, the resultant floods are flash floods, having sharp peaks and short durations.

A floodplain inventory study (TRC, 1996) was conducted in support of the proposed NAFR land withdrawal renewal to assess the suitability of present and potential future uses of NAFR with respect to flood hazards. The study identified floodplain boundary delineations for an approximate 100-year frequency storm event for each of the major categories of landforms that influence surface water hydrology and flooding on the NAFR. These categories include major playas (dry lake beds, Zone I), contributing drainage areas (valley collectors, Zone II), and alluvial fans (Zone III). The 63-10 target area is located in Zone II, valley collectors. Valley collectors were defined to be those collectors which generally have relatively large drainage areas or have several smaller tributaries that discharge to the main collector from upstream contributory drainage areas. Runoff in Zone II areas are expected to overflow their banks or inundate larger adjacent areas during flooding events.

3.4 SAFETY AND OCCUPATIONAL HEALTH

The physical form of DU contamination that currently exists on the Range 63 target area ranges from oxidized DU particulates mixed with sand, to fragments and intact DU penetrators. Much of the observable oxidized DU present is the result of weathering of the fragments and penetrators. Since DU is a relatively stable isotope with a 4.5 billion year half-life, and decays principally through alpha emission, there would not appear to be a hazard from direct radiation exposure in this area. Alpha radiation does not penetrate human skin to any depth (Lockheed Martin, 1995).

The aluminum jacket of the DU projectile provides shielding of the alpha particles, which are the predominant radioactive emission of this munition. Both the daughter beta and gamma emissions are negligible. The overall surface exposure rate from a DU projectile is about 0.2 milliRoentgen per hour, which is negligible considering the minimal amount of time personnel are exposed to these projectiles during transportation and storage. A milliRoentgen is a measurement of exposure applicable only to gamma and X-rays.

Internalized DU may have both radiological and chemical health effects; although, the primary hazard from DU is chemical toxicity, not radioactivity (Ebinger et al., 1996). The radioactive properties of DU have the greatest potential for health impacts when DU is internalized through inhalation or ingestion; although, the health risks are relatively small when compared to other common radioactive isotopes. Inhalation could occur to workers at Target 63-10 if DU particles were resuspended in air and ingestion were to primarily occur from hand-to-mouth or from DU-contaminated water or food. Alpha radiation is the primary concern from internalized DU. The radiation dose to critical body organs depends on the amount of time that DU resides in the

organs. When this value is known or estimated, cancer and hereditary risk estimates can be determined.

The toxicity characteristics of DU are similar to other heavy metals such as lead, cadmium, nickel, cobalt, and tungsten. When DU is internalized in the body, the soluble components migrate throughout the body and uranium concentrates in the bone, kidney, and liver. The kidney is the most sensitive organ to DU toxicity and has been broadly accepted as the critical organ for uranium toxicity. When the uranium enters the body, it binds with bicarbonate and proteins. This binding action helps prevent soluble uranium from interacting with most body tissues. However, when the bicarbonate-uranium complex enters the kidney, it leaves the blood and enters the renal tubules which, due to its acidic environment, frees the uranium allowing it to bind with and potentially damage the kidney tissues.

Animal model studies on rats and mice have indicated teratogenic effects when the mother is exposed to high levels of uranium. The effects varied from low birth weight to skeletal abnormalities, and are believed to be chemically induced because radiation exposure was too low to account for the anomalies. Extrapolation of the results to human exposures has proven difficult because of the limited amount of data on the placental transfer of uranium.

Studies of possible short-term and long-term health effects of exposure to DU, including exposure through ingestion, inhalation, or bodily injury, are ongoing.

In 1992, an attempt was made by NAFR maintenance personnel, under the oversight of the USAF Armstrong Laboratory Health Physics Function, to refurbish two DU tank targets within Target 63-10. Background air samples were taken and personnel participating in this activity were fitted with air samplers to determine the extent of any respirable hazard. Readings from the background samplers around the targets showed DU contamination was relatively localized to the immediate target area (within 400 feet).

The personnel air sampler results were considerably less than the allowed DAC, as listed in International Commission on Radiation Protection Publication 30, of 0.09 picoCuries per liter. Use of DAC is a method of determining the hazard associated with air concentrations of radionuclides in the workplace, based on a 2,000-hour work year exposure to the hazard. Since there has been very little range maintenance activities in Target 63-10 over time, personnel exposure to the DU contamination has been negligible (AL/OEBSC, 1993).

None of the individuals monitored during refurbishment had any measurable contamination on their respirators and little, if any, contamination on their protective clothing or equipment. There were a few instances where there was some measurable contamination on boots and gloves but a light brushing adequately decontaminated these items. It was concluded that no significant airborne DU contamination hazard existed; however, adequate health physics controls were implemented to ensure DU contamination was not inadvertently removed from the site via boots, gloves, and equipment. This sampling effort and other personal air sampling in 1992 concluded that the DU contamination does not appear to be an inhalation hazard in an undisturbed state (AL/OEBSC, 1993).

Several occupational safety requirements are followed at the Range 63 target area when range maintenance activities are performed. In order to reduce the risk of inhalation hazard, burning or welding of the contaminated targets is prohibited, unless approved through the Nellis AFB Bioenvironmental Engineering Flight. Proper personal hygiene practices, such as thoroughly washing hands before eating or smoking, are followed to reduce the risk of ingestion hazards. To limit external exposure and contamination from entering the body through open wounds, personnel picking up DU penetrators wear gloves. All vehicles, boots, gloves, respirators, and other equipment used during operations are brushed lightly to rid the surface of clinging dust particles from the site (Lockheed Martin, 1995).

3.5 HAZARDOUS MATERIALS AND WASTE

This discussion of DU use relative to hazardous materials and waste, focuses on how DU rounds are transported, handled, and stored prior to use and after expenditure. Large quantities of munitions are routinely handled and stored at Nellis AFB in support of its operational and training missions. Munitions are normally shipped to Nellis AFB via commercial transportation, and received at the munitions storage site in Area II located northeast of the main base. Packaging and transport of radioactive materials are governed by the NRC and U.S. Department of Transportation regulations designed to protect employees and the public from any exposure. Area II contains 132 earth-covered magazines for munitions storage, maintenance facilities, and holding/build-up pads (SAIC/DRI, 1991). Storage magazines are designed to contain and limit destructive effects of materials inside. The type and amounts of munitions stored at this site will vary, depending on required annual and special allotments of Nellis AFB units and those units deployed to the base for Red Flag and Air Warrior exercises and other training operations.

USAF directives and Technical Orders specify safety standards and procedures for handling and storing munitions. Smaller munitions such as the 30mm rounds are packed in sealed containers with plastic liners between each round. These containers are properly secured during all transport. As different munitions are required for specific training or test missions, they are transported by truck to one of the explosives handling and temporary storage sites on the flight-line, where they are prepared for loading on the aircraft. Unused munitions, including DU rounds, are returned to the storage magazines. Department of Defense ammunition and explosive safety standards that include Quantity-Distance zones ensure that the general public is protected in the event of an explosive mishap.

DU rounds are transported to Nellis AFB, stored in Area II, and generally handled the same as other munitions due to their low radiation level. These rounds are stored in a facility that has been approved and designated for DU munitions in accordance with the Nellis AFB Radioactive Material Permit. The explosive hazards of the munition propellant exceed the DU radiation hazards and thus determine storage requirements. The DU rounds are received as part of a CM in which there is a ratio of five DU rounds per every one conventional round. There is an annual allotment of 25,000 DU CM rounds, however, only about 10,000 rounds have normally been in storage at any given time. DU munitions have an indefinite shelf life. Although DU is presently not in use on the NAFR, the Nellis AFB Radiation Safety Officer is provided with a monthly status report on the receipt and storage of DU rounds (Hedlind, 1997).

Procedures for preventing and reporting incidents involving the loss or release of aircraft parts or ordnance are contained in the Nellis AFB supplement to Air Force Instruction 13-212, *Weapons Ranges*, and the Nellis AFB Instruction 11-250, *Local Operating Procedures*. Standard precautions taken for aircraft carrying ordnance include arming and de-arming aircraft in protective locations on the airfield, departing Nellis AFB on routes that avoid populated areas, and keeping the master arm switches in the "safe" position until within range target areas. In all cases, aircraft carrying inert/training or explosive ordnance are required to avoid overflight of populated areas to the maximum extent possible (USAF, 1996c). Aircraft departing the Nellis AFB and transiting to Range 63 will normally use the "Lee" corridor that parallels Highway 95 along the southern boundary of the NAFR, as shown in Figure 2-1. In the event of an aircraft mishap, a USAF team such as the Air Force Radiation Assessment Team, trained to handle any contingency that may be associated with the mishap, would immediately respond. As appropriate, radiological protection personnel would also respond to safeguard, decontaminate, and clean up any DU round materials that may be present. Nellis AFB has mutual aid agreements with the Clark County Fire Department and Bureau of Land Management (BLM) for initial emergency response to fires, aircraft accidents, and other emergency conditions. There have been no aircraft mishaps at Nellis AFB or on the NAFR involving DU munitions (Carr, 1998).

Intact DU rounds, shell fragments, and contaminated tank targets within Target 63-10, and the approximately 200 potentially contaminated tanks and other vehicles in the holding area remain confined to the Range 63 permitted area. Based on recommendations of the NRC inspection in October 1994, Nellis AFB is developing the *DU Management Plan* and supplemental procedures for monitoring the target area and removing visible DU rounds and shell fragments, to enhance control of the DU and minimize the spread of any contamination. The DU Limited Site Assessment, completed in May 1995, established the baseline for developing the DU management program.

The *DU Management Plan* (Lockheed Martin, 1998) will outline basic policy for management and decommissioning of the DU target area and incorporate all the pertinent provisions of NEPA, the Low-level Radioactive Waste Policy Act, and the NRC regulations that control DU disposal. This plan is based on air monitoring conducted during target refurbishment (1992), direct reading instrument data taken during an NRC visit to the target area, soil sampling and animal trapping conducted under the Limited Site Assessment (1995), and environmental radiological efforts currently underway. Based on the findings of the Limited Site Assessment and other survey results, an annual environmental radiological monitoring program is underway to verify the current locations of DU, determine if any DU has migrated on the surface or vertically downward, and locate any detectable transmission of DU due to resuspension and wind dispersal outside of the original footprint. Specific elements of the monitoring plan are contained in *Procedures for Monitoring Depleted Uranium, Range 63, Nellis Range Complex* (Appendix A).

The *DU Management Plan* will specify that periodic explosive ordnance disposal (EOD) and clean-up be conducted on the target area. After the target area has been rendered safe by EOD, trained technicians will manually remove visible DU rounds and fragments from the target area. This will be performed annually during the NAFR Coronet Clean process when different

portions of the range are closed for target refurbishment. Every five years, surface and subsurface DU rounds and fragments will be removed using a "Barber Rake" (a munitions residual collector), or a "tiller", used in the farming industry. Tilled soil and upturned materials will be inspected by EOD personnel and fed into a hopper for sorting. Recovered DU materials during these clean-up operations will be containerized and taken to the Bio Environmental Office at Nellis AFB. These operations will remove the DU source material on the surface, as well as those expected to be in the upper subsurface.

The penetrators and fragments are to be packaged according to 49 CFR Part 173, Subpart I, *Radioactive Materials*, and coordinated through the Nellis AFB Radiation Safety Officer for proper disposition. If recycling is not viable, source material will be disposed of as low-level radioactive waste through the Air Force Radioactive and Mixed Waste Office, in accordance with 10 CFR Parts 20 and 61, and USAF Technical Order 00-110N-2, *Radioactive Waste Disposal*. If more extensive target refurbishment or closure of the target area is required than what is detailed in the *DU Management Plan*, a more detailed plan will be submitted to the USAF Radioisotope Committee.

Periodic monitoring of DU contaminants will be conducted through surface scanning and subsurface soil sampling of the target area in accordance with *Procedures for Monitoring Depleted Uranium, Range 63, Nellis Range Complex* (Appendix A). This procedure describes equipment and methods used for surface scanning and subsurface sampling, data collection and reporting requirements, and action levels requiring further investigation. This procedure also includes all relevant safety, health, and radiation protection measures for personnel conducting the monitoring operations.

Long-term continuous air sampling is not deemed necessary due to the quick settling nature of dense DU materials after an incendiary event, and findings of past air sampling efforts that revealed contamination was localized to within approximately 300 to 400 feet of the target area. However, air sampling may be conducted if other monitoring efforts indicate a need to examine air quality conditions around the target area.

All DU-contaminated tank targets presently in the storage area are given a unique identifier that is maintained in a database and tracked by range maintenance. These targets are properly labeled with clearly visible warning signs indicating "Caution Radioactive Material". Most of the vehicle targets and tanks in the storage area are being retained for use as future targets once they have been decontaminated from all DU. With many of the tanks, DU contamination exists as surface contamination at various spots on the tank metal, or the penetrator is still in the entry hole and did not pass through the tank metal. Because the DU has been fused into the tank metal, the material is not considered a candidate for migration and is sealed. These small areas of contamination can be removed by metal torches and the contaminated metal plugs disposed of as low-level radioactive waste through the USAF Radiation Protection Division at Brooks AFB, Texas. The rest of the tank will be utilized on other parts of the range as a hard target for conventional weapons (non-DU munitions). The few tank targets that cannot be decontaminated and other debris will ultimately be disposed of either as low-level waste in accordance with 10 CFR Part 20, at a site approved by the USAF Radioisotope Committee, or shipped to a licensed facility for treatment, smelting, and recycling. These tanks and debris would be loaded into

sealed shipping containers on site and transported to the landfill or recycling facility by truck or rail, as appropriate, by a properly licensed contractor.

Target 63-10 would become a candidate for clean-up, decommissioning, and closure if it is no longer required for mission use. Decommissioning of the target area would entail use of the most current technologies such as excavation and earth moving, physical separation methods, chemical separation, and/or in-place stabilization to achieve the standards for soil remediation of DU. Any soils or residue that remain as by-products from one or more of the processes would be shipped for off-site, low-level waste disposal at a licensed facility. The Air Force budgets funds to cover the costs of implementing site clean-up if the target area is decommissioned, as required by 10 CFR 40.36. Estimated costs would be determined during site closure planning and based upon the best available technologies available at that time.

Range 63 contains 17 Installation Restoration Program sites that have been closed with the Nevada Division of Environmental Protection and given the No Further Action status. These sites resulted primarily from past disposal of general refuse, vehicle parts, and target debris. They do not pose a health and safety hazard to the public. None of those sites are within the DU licensed area, nor are they known to be associated with DU (Pedrick, 1997).

3.6 BIOLOGICAL

Target 63-10 is located near the southern end of Three Lakes Valley, north of the southernmost dry lake, at an elevation of approximately 3,200 feet. The target is located in an area where much of the vegetation has already been disturbed by previous military activity, including the firing of DU rounds.

The plant community near the target area is dominated by white burrobush (*Ambrosia dumosa*). Shadscale saltbush (*Atriplex confertifolia*), creosote bush (*Larrea tridentata*), Nevada jointfir (*Ephedra nevadensis*), and littleleaf ratany (*Krameria erecta*) are also represented (Lockheed Martin, 1995).

The only resident threatened, endangered, proposed, or candidate species known to occur near the target area is the threatened desert tortoise (*Gopherus agassizii*). Tortoise transect surveys conducted to the east, south, and northeast of the target area (nearest transect was approximately five miles east) during 1981 indicated the relative abundance of tortoises to be low (Schneider et al. 1982), and no sign of tortoises was found on 43.3 percent of the transects. Although no desert tortoise surveys were specifically conducted in the target area, similar habitats on valley bottoms and along the edges of playas on the adjacent NTS had very low abundance of tortoises (EG & G/EM, 1991).

The American peregrine falcon (*Falco peregrinus*, endangered) and the bald eagle (*Haliaeetus leucocephalus*, threatened) could potentially occur on the NAFR. However, Alcorn (1988) considers both species transients in southern Nevada, and the target area is not suitable habitat for either species.

Several surveys have been conducted in the general area surrounding Target 63-10 and no former candidate species (now called species of concern by the USFWS) are known to occur near the target area (Ackerman, 1981; USAF, 1996b). During 1995, a large population of Parish's scorpion weed (*Phacelia parishii*), consisting of about one million plants, was discovered in Three Lakes Valley growing in the playa southwest of the target area (USAF, 1996b).

Live trapping of small mammals at the target site in 1994 resulted in seven animals captured per 100 trap nights, with the most frequently caught being Merriam's kangaroo rat (*Dipodomys merriami*). Other mammals known to inhabit the area include antelope ground squirrels (*Amospermophilus leucurus*), blacktail hares (*Lepus californicus*), and desert kit foxes (*Vulpes macrotis*) (Lockheed Martin, 1995). Desert bighorn sheep (*Ovis canadensis nelsoni*) are known to inhabit the ranges on either side of Three Lakes Valley.

3.7 CULTURAL

Approximately 68,000 acres, or 2.5 percent of the NAFR, were inventoried for cultural resources before 1993. Most of these surveys covered small, isolated areas and results provide minimal information on cross-sections of sensitivity on the NAFR. New projects to determine the locations of sensitive cultural areas and to re-evaluate previously recorded sites are described in the draft *Nellis AFB Cultural Resource Management Plan* (Myhrer and Hatzenbuehler, 1997). The following information on the prehistory and history of the region is also derived from this document.

Previous studies on the NAFR resulted in relatively limited information on the previous users of this military reservation. Other archaeological research in the region, including 1930s ethnohistoric and 1960s to present prehistoric and historic work, provides a realistic basis for projecting the kinds of resources on the NAFR. While there are archaeological sites in this area where people conducted activities up to 10,000 years ago, most use is concentrated within the past 5,000 years. Present-day Native Americans of the Southern Paiute, Western Shoshone, and Lower Colorado Tribes trace their ancestral hunter-gatherer uses to the NAFR. Their activities consisted of the trapping and hunting of primarily small animals and procuring plant foods on a seasonal round. Knowledge of the locations of water sources in this desert was crucial. Camping sites were concentrated along the margins of dry lakes, which sometimes held water for periods of time, in the high altitudes of the mountains where pinyon collection was held in the fall, and along the bases of hills and mountains where food sources such as the yucca and agave plants were available.

Historic uses involved exploration in the early 19th century, trailblazing, ranching in the wetter valleys, and mining at the turn of the 20th century. The prominent cultural and traditional resources in the South Range are dry lake margin camps, shelters, and an historic railroad and stagecoach trail.

3.8 GEOLOGY AND SOILS

This section describes the geology and soils of the NAFR, and more specifically, the geology and soils of Range 63. Three topics will be discussed in this section: physiography, geology, and soils.

3.8.1 Physiography

The NAFR is in the southern part of the Great Basin, the northern-most subprovince of the Basin and Range physiographic province. The Basin and Range province is generally characterized by a series of north-south trending mountain ranges separated by alluvial basins that were formed by faulting. The Great Basin subprovince is an internally draining basin; i.e., precipitation that falls over the basin has no outlet to the Pacific Ocean.

Range 63 is located in the southern part of Three Lakes Valley, which is located within the South Range of the NAFR. The Range 63 target area is characterized as flat basin-filled alluvium. The Pintwater Range is the source of the alluvium from the west and the Desert Range is the source of the alluvium from the east. Both ranges are approximately 6,000 feet high. The alluvial fans are dissected by numerous channels. There are three dry lakes in the valley, connected by a dry wash. The southernmost lake is at the lowest point in the valley and does not have drainage.

3.8.2 Geology

The bedrock geology of the NAFR can be divided into a southeastern area of largely Paleozoic sedimentary rocks, and a northwestern area of mainly volcanic rocks of late Cenozoic age (TRC, 1996). The Paleozoic sedimentary rocks of the South Range consist primarily of thick sequences of carbonate strata, such as limestone and dolomite. Notable sequences of quartzite and shale are also present at some locations. The South Range is underlain by the Las Vegas Formation of Quaternary age (Longwell, 1965). These deposits consist of silt and clay.

3.8.3 Soils

Generally, the silty loam soils of the NAFR include aridisols and entisols (U.S. Department of Energy [DOE], 1996). The degree of soils development reflects their age, and the soils types and textures reflect their origin. Entisols generally form on steep mountain slopes where erosion is active. The aridisols are older and form on more stable fans and terraces.

3.9 SOCIOECONOMICS

The nearest population center to the Range 63 target area is Indian Springs, Nevada, located about 12 miles southwest of Target 63-10. The population of Indian Springs is approximately 1,100 people. Additionally, the Southern Desert Correctional Center, approximately 7 miles southeast of Indian Springs, includes approximately 1,570 inmates and 246 employees (Arzlone, 1998). The Las Vegas Paiute Colony occupies a 4,000-acre parcel of land approximately 22 miles southeast of Indian Springs, with 12 residential dwellings and various business enterprises.

Environmental justice considers the distribution of minority and low-income populations in the region of influence. The 1990 Census of Population and Housing tract data indicate that the Indian Springs area is part of a census tract that is 20.8 percent minority and 6.0 percent low-income, which is not considered to be disproportionately high for a region that includes Clark, Nye, and Lincoln counties.

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4.0 ENVIRONMENTAL CONSEQUENCES

This chapter presents the environmental consequences that may result from the implementation of the Proposed Action or an alternative. The nine resources addressed include noise, air quality, water, safety and occupational health, hazardous materials and waste, biological, cultural, geology and soils, and socioeconomics.

4.1 PROPOSED ACTION

The Proposed Action would be for the Nellis AFB 99th ABW to resume the use of 30mm DU rounds for training of instructor pilots, testing and evaluation of tactics, and software development. The training and test/evaluation activities would occur at Target 63-10 on the NAFR. The environmental impacts of the Proposed Action on the nine resources are presented in the following sections.

4.1.1 Noise

An addition of 25 A/OA-10 aircraft missions to Target 63-10 would not produce a measurable change from Range 63's 4,000 mission baseline noise levels. Use of DU CM rounds on Target 63-10 would not generate noise levels above those already occurring during aircraft operations and firing of conventional munitions on this target area. The general public is prohibited access to the NAFR and is unaffected by noise generated within the restricted areas of the range. No noise consequences are anticipated.

4.1.2 Air Quality

Past use of DU munitions on Target 63-10 has resulted in DU particulates and oxides remaining in the soil in areas closest to the tank targets. These particulates and oxides can be resuspended into the air during wind storms and by forced resuspension during vehicular and pedestrian traffic.

Extensive soil sampling and air monitoring were conducted at the YPG as part of an evaluation to determine potential environmental impacts from firing DU munitions. The general results of this evaluation should be similar to NAFR Range 63 conditions, considering the comparable arid climate and range environment. Air samples were used during this evaluation to determine the significance and magnitude of the soil to air to human exposure pathway. Many factors such as wind speed, soil particle size, erosion characteristics of the soil, and density of the contaminant were taken into consideration. Soil samples found that 13 percent of the soil particles were under 125 microns in size, and further study found it reasonable to assume that particles greater than 100 microns in diameter will not be resuspended by wind or forced resuspensions in the YPG. These studies also reached an assumption that particles greater than 20 microns in diameter would not remain airborne long enough to reach air samplers around the DU impact area. Because of the high density of DU, resuspension of uranium would be less than those particles of soil containing small amounts of uranium as observed in naturally occurring uranium soils. The results of this study and earlier studies conducted during the period 1979 to 1982 (Gutierrez-

Palmenberg, Inc., 1996) concluded that DU operations have no measurable impacts on air quality.

Airborne emissions resulting from the Proposed Action would consist primarily of fugitive dust and particulates generated from impact of the DU rounds on the target area. As demonstrated by the YPG studies, the high density of the DU particulates and the high probability that they settle relatively quickly to the ground would not make them a likely candidate for air migration. Resumed DU use from 25 additional annual A/OA-10 aircraft missions to this target area would not significantly increase air emissions from these operations. The Proposed Action does not include construction activities, nor would it be expected to significantly increase vehicle traffic beyond the few trips currently made annually to this target area.

Overall, the potential for any increase in regional or localized concentration of air pollutants resulting from DU use is considered negligible. The target area would continue to be in the unclassified portion of the Las Vegas Valley AQCR. A conformity determination would not be required for this Proposed Action, since it would be undertaken in an area that is unclassified with respect to NAAQS. The potential effects of air emissions on public health are discussed in Section 4.1.4, Safety and Occupational Health.

4.1.3 Water

The environmental pathways for potential water impacts are groundwater and surface water at or under Range 63.

An Infiltration Characteristics Chloride Analysis was performed on Range 63, in conjunction with the Limited Site Assessment, to evaluate potential groundwater consequences. The purpose of the study was to determine the potential for DU to be transported from the surface to the groundwater. Target 63-10 is situated in an arid region where deep percolation is not believed to occur on a widespread basis. The study concluded that infiltration through the upper 1 foot of soil would not occur for approximately 100 to 200 years because of the limited precipitation. Since deep infiltration of water is not occurring, no mechanism for downward transport of uranium to the groundwater exists. Therefore, the use of DU in the target area would have no effect on the groundwater.

Water quality from nine wells within the NAFR is monitored for compliance with drinking water standards on a regular basis. Of the nine, two at Indian Springs and one at Point Bravo are nearest to Range 63. Another well is located at Silver Flag Alpha outside of the NAFR boundaries. Maximum Contaminant Levels for all regulated parameters have not been exceeded for any of the wells where data are available (TRC, 1996).

Analysis of potential surface water consequences focused on the Zone II floodplain where target 63-10 is located. Runoff in Zone II areas are expected to overflow their banks or inundate larger adjacent areas during flooding events. The direction of flow for storm water runoff is shown in Figure 4-1. As stated in Section 3.3.2, localized thunderstorms produce high-intensity, short-

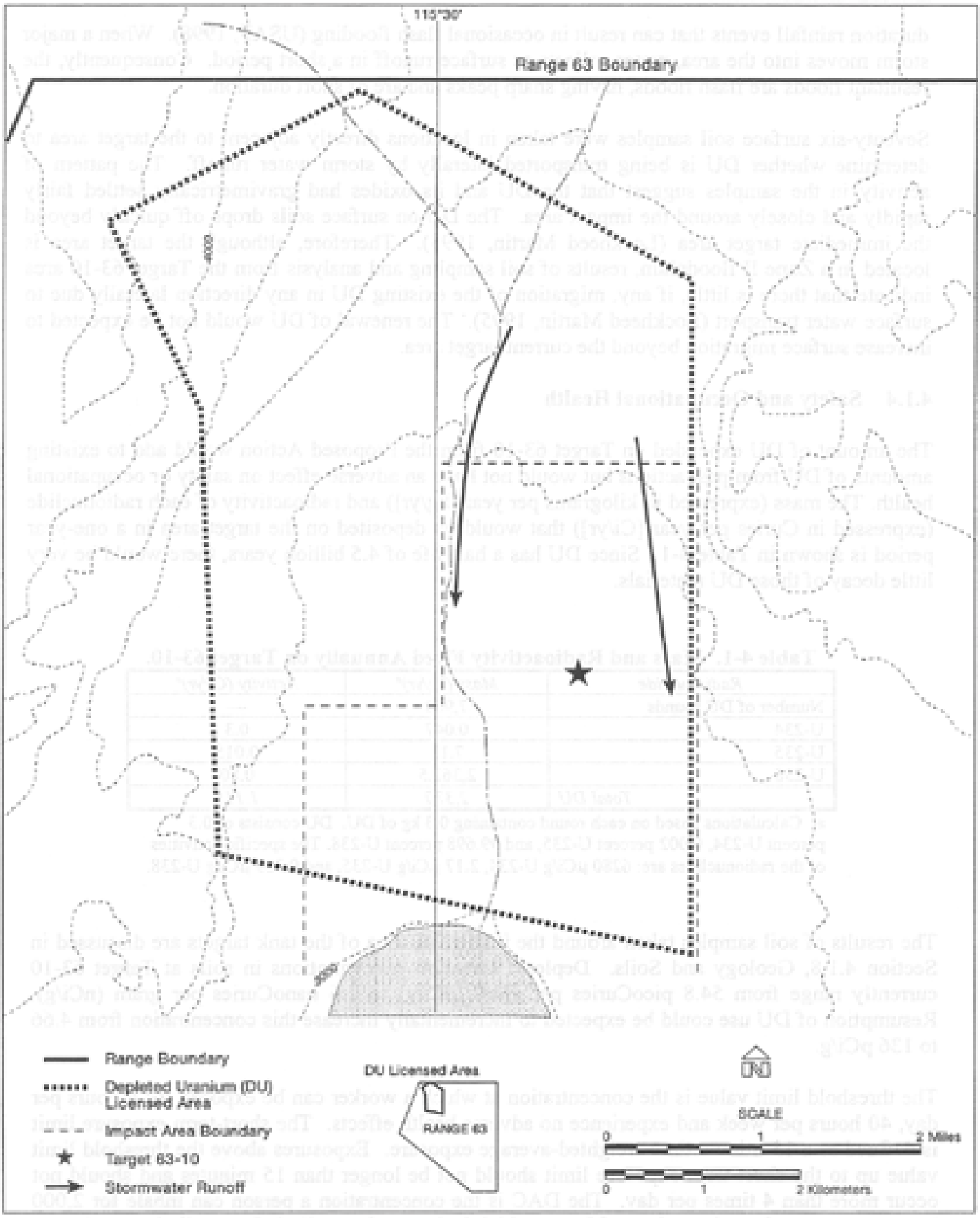

Figure 4-1. Stormwater Runoff.

duration rainfall events that can result in occasional flash flooding (USAF, 1998). When a major storm moves into the area, water collects as surface runoff in a short period. Consequently, the resultant floods are flash floods, having sharp peaks and are of short duration.

Seventy-six surface soil samples were taken in locations directly adjacent to the target area to determine whether DU is being transported laterally by storm water runoff. The pattern of activity in the samples suggest that the DU and its oxides had gravimetrically settled fairly rapidly and closely around the impact area. The DU on surface soils drops off quickly beyond the immediate target area (Lockheed Martin, 1995). Therefore, although the target area is located in a Zone II floodplain, results of soil sampling and analysis from the Target 63-10 area indicate that there is little, if any, migration of the existing DU in any direction laterally due to surface water transport (Lockheed Martin, 1995). The renewal of DU would not be expected to increase surface migration beyond the current target area.

4.1.4 Safety and Occupational Health

The amount of DU expended on Target 63-10 from the Proposed Action would add to existing amounts of DU from past actions but would not have an adverse effect on safety or occupational health. The mass (expressed in kilograms per year [kg/yr]) and radioactivity of each radionuclide (expressed in Curies per year [Ci/yr]) that would be deposited on the target area in a one-year period is shown in Table 4-1. Since DU has a half-life of 4.5 billion years, there would be very little decay of those DU materials.

Table 4-1. Mass and Radioactivity Fired Annually on Target 63-10.

Radionuclide	*Mass (kg/yr)*[a]	*Activity (Ci/yr)*[a]
Number of DU rounds	7,900	—
U-234	0.047	0.3
U-235	7.13	0.015
U-238	2,362.5	0.80
Total DU	*2,370*	*1.115*

a. Calculations based on each round containing 0.3 kg of DU. DU consists of 0.3 percent U-234, 0.002 percent U-235, and 99.698 percent U-238. The specific activities of the radionuclides are: 6280 µCi/g U-234, 2.17 µCi/g U-235, and 0.339 µCi/g U-238.

The results of soil samples taken around the immediate area of the tank targets are discussed in Section 4.1.8, Geology and Soils. Depleted Uranium concentrations in soils at Target 63-10 currently range from 54.8 picoCuries per gram (pCi/g) to 1.6 nanoCuries per gram (nCi/g). Resumption of DU use could be expected to incrementally increase this concentration from 4.66 to 136 pCi/g.

The threshold limit value is the concentration at which a worker can be exposed for 8 hours per day, 40 hours per week and experience no adverse health effects. The short-term exposure limit is defined as a 15-minute time-weighted-average exposure. Exposures above the threshold limit value up to the short-term exposure limit should not be longer than 15 minutes and should not occur more than 4 times per day. The DAC is the concentration a person can inhale for 2,000 hours per year and receive a dose of 5 rem, which is the regulatory limit for a radiation worker.

Based on the increased U^{238} soil concentration that would result from the Proposed Action, there is also the potential that the concentration of DU particulates in the air would increase proportionally from wind resuspension and forced soil resuspension. If a worker were to be at a full-time job at Target 63-10 for a year, the worker would receive an estimated 18 to 20 percent of the DAC for U^{238} and 160 to 320 percent times the threshold limit value for insoluble uranium (0.2 mg/m^3). There are no full-time workers at Target 63-10. The Target is only visited a few times per year by range maintenance personnel. The maximum air concentration is calculated to be above the short-term exposure limit for uranium. Exposure to humans might only occur within the target area with soil disturbance during target refurbishment. Range personnel wear respirators and other protective equipment, as evaluated and deemed necessary by Industrial Hygiene, during clean up, target refurbishment, or other ground disturbing activities while working within this target area. Soils testing demonstrates that air migration of DU particulates is not likely to occur at any great distances due to the extreme density of these particulates and the oxides. Any DU particulates that may be resuspended by high winds would settle quickly due to weight. Such particles are not likely to reach worker or populated areas nor contain radiation at exposure levels that could affect worker or public health.

Implementation of the *DU Management Plan* and supplemental procedures for sampling and monitoring existing soil concentrations and any increases that could occur as a result of the Proposed Action, will provide a means for enhancing safety and occupational health protection for personnel working within or near the target area.

4.1.5 Hazardous Materials and Waste

The Proposed Action would have no effect on current procedures and practices for transporting, handling, and storing the DU rounds at Nellis AFB. DU rounds are currently in storage at an approved magazine within Area II, and any future shipments supporting the proposed resumption of testing and training activities would be reported monthly to the Radiation Safety Officer.

Expenditure of the 7,900 DU rounds on the target area would generate wastes in the form of intact penetrators and fragments that would be removed from the surface area during the annual clean-up. Monitoring and clean-up of the DU target area would be accomplished in accordance with the *DU Management Plan* and supplemental range procedures. The intact DU penetrators and visible large fragments would be removed from the surface area and stored at the holding area until removed for recycling or disposal. Wastes would be recycled or disposed of as low-level radioactive waste in accordance with 10 CFR Part 20 requirements.

As tank targets in Target 63-10 become deteriorated from DU use, they would be exchanged with those currently maintained in the holding area. These tanks would also be controlled and labeled as radioactive materials. Contaminated tank components and the DU penetrators and fragments would be disposed of as discussed in Section 3.5, Hazardous Materials and Waste.

The term of DU use would be undefined. However, a decommissioning plan would be implemented upon termination of the license and site closure.

4.1.6 Biological

Overall, the proposed resumption of firing DU rounds into the Target 63-10 area would have minimal impacts on the biological resources in the area. Both conventional and DU ordnance weapons testing and training are similar in action. There are no additional effects expected on the biological resources in the area resulting from forceful impacts of DU rounds.

The primary impact of DU on biological resources is not from radioactivity, but from chemical toxicity (Ebinger et al., 1996). Generally, DU is thought to have a low absorption rate because of its relatively low solubility (Lockheed Martin, 1995). Organisms in the target area could be exposed to DU by direct contact, through root uptakes by plants, and ingestion or inhalation of particles by animals. Root uptake by plants at the YPG DU site did not occur to any significant degree, but carcasses of lizards, insects, and mammals collected at the YPG DU site did contain uranium from DU (Ebinger et al., 1996). Four species of small mammals were collected at the YPG during that study and uranium concentrations in most of the animals collected were below detection limits. However, one of 30 pocket mouse and two of eight kangaroo rat kidneys sampled during that study approached or exceeded the suggested toxicity threshold for uranium, suggesting that nephrotoxic effects may be possible following exposure to DU. Given the limited area of the Target 63-10 site and the low numbers of rodents in the area, the number of individuals potentially impacted would be small.

There is potential for animal-vectored migration of DU from the site, for example, if rodents ingest contaminated soil and move out of the area or are consumed by raptors or other predators. Trapping surveys in 1994 at the target area indicated low numbers of rodents in the area. The area of DU contamination at Target 63-10 is relatively small compared to surrounding habitats where rodents would be expected to be more abundant because of lack of vegetation disturbance. In addition, most YPG mammals collected had tissue concentrations below detection limits (Ebinger et al., 1996). The likelihood of DU migration from the site by rodents in the manner described above is extremely small.

The target area is located in an area where much of the vegetation has already been disturbed by previous military activities. With the exception of the large population of Parish's scorpion weed, located southwest of the target area, none of the plant species or communities located in the area are unique. The only federally-protected animal species in the area is the threatened desert tortoise, yet no sightings of this species in the area have been recorded and the general habitat conditions for this species in the area are poor. Because of the low probability of encountering tortoises in the area, measures to actively exclude tortoises from the target area are unwarranted.

Bighorn sheep probably cross the valley near the target area, but this most likely occurs infrequently since they spend most of their time at higher elevations where they would not be directly affected by DU.

4.1.7 Cultural

Section 106 of the National Historic Preservation Act of 1966 requires that Federal agencies take into account the effects of their undertakings on historic properties. Efforts to identify and evaluate cultural resource properties for this proposal were initiated, in accordance with 36 CFR 800.4, in an existing data review by the Nellis Archaeologist/Cultural Resource Manager in May 1997. No cultural resources surveys have been conducted in or near the Range 63 target area. In those portions of this area where there are no impacts, there is low-to-medium potential for the presence of lithic debris scatters, presumably associated with opportunistic hunting and gathering activities. The sites probably represent short-term use locales, and would not likely be considered to be properties eligible for nomination to the National Register of Historic Places.

Range 63 consists of target areas that were used for DU rounds from 1982 up to 1993, and has long been used, and continues to be used, for conventional munitions. The Proposed Action is considered by the Cultural Resource Program as an activity similar to ongoing operations on this target area, therefore, no new surface disturbance would occur. Thus, this proposal would not result in any effects to cultural resources.

4.1.8 Geology and Soils

Implementation of the Proposed Action would not impact the geology of the region. However, it could result in additional soil contamination in the immediate vicinity of the targets. Soils in the Range 63 target area were sampled and analyzed to determine the level, areal extent, and depth of existing contamination. The specific sampling and analyses that were conducted were chosen based on the physical and chemical properties of DU and the environmental conditions at the site. Guidance documents on sampling protocols included "Data Quality Objectives Process for Superfund," U. S. Environmental Protection Agency Interim Final Guidance (EPA, 1993), and the draft "Branch Technical Position on Site Characterization for Decommissioning Sites," (NRC, 1992). The samples were analyzed to detect Thorium-234 (Th^{234}) concentrations in the soils. The U^{238} value was then determined using the Th^{234} peak with the assumption that the Th^{234} is in equilibrium with the U^{238} (Lockheed Martin, 1995).

Soil samples were taken at the Range 63 control center to determine background levels of U^{238}. Background levels range from 0.14 pCi/g to 1.0 pCi/g. Samples taken from or immediately adjacent to the DU targets gave results ranging from 54.8 pCi/g to 1.6 nCi/g of U^{238} (Lockheed Martin, 1995). As discussed in Section 4.1.4, Safety and Occupational Health, the Proposed Action would result in an additional 4.66 to 136 pCi/g of U^{238} being introduced to the Target 63-10 area.

The results of the sampling and analysis indicate that the soils within a radius of approximately 300 to 400 feet of the 63-10 target area are contaminated with DU and that the activity of surface soils decreases quickly beyond the immediate target area (Lockheed Martin, 1995). These results suggest that the DU and its oxides have gravimetrically settled fairly rapidly and within the immediate area of Target 63-10. These results also imply that there is little, if any, migration of the DU in any direction laterally, due to surface water or air transport.

In addition to soil sampling and analysis, gamma scans were performed on the area around the trenches and on the trench bottoms and sidewalls. The results of the gamma scans indicate that the maximum concentrations of DU persist on and in the surface soil, and that there is no uranium penetration or migration into the soil below 1 foot.

The extent, depth, and type of soil contamination resulting from the Proposed Action would be expected to be similar to the existing conditions. Because DU and its oxides settle fairly rapidly, soils within approximately 300 to 400 feet of Target 63-10 would be contaminated with DU. The activity of the soils would decrease with distance from the target area. Although the majority of the contamination would settle within a 400-foot radius of the target area, some DU penetrators are expected to be present beyond that radius as the result of overshot.

4.1.9 Socioeconomics

Population, employment numbers, and environmental justice considerations in the Indian Springs area or in the region would not be affected by the Proposed Action. Public access to the NAFR is prohibited.

4.2 ALTERNATIVE 1

This alternative would reduce the number of DU CM rounds used for both training and testing missions by about 50 percent, with these rounds being distributed between the two missions, as appropriate, to meet critical minimum requirements. This alternative would require redefinition of these minimum requirements relative to the reduced number of allowable DU CM rounds.

4.2.1 Noise

Any reduction in DU use would not change noise levels currently generated by aircraft operations and air-to-ground bombing and gunnery activities in Range 63.

4.2.2 Air Quality

Reduced use of DU rounds on Target 63-10 would proportionally reduce the amount of DU particulates and oxides emitted in the soils immediately surrounding the tank targets. Air pollutants generated during munitions impact or resuspension by wind or other ground disturbance would be negligible and not likely to reach worker or populated areas nor contain radiation levels that would affect air quality in this region or worker or public health. Range 63 and the target area would continue to be in attainment with the NAAQS and no conformity determination would be required.

4.2.3 Water

Studies at Target 63-10 have indicated that deep infiltration of water is not occurring. Therefore, the use of DU in the target area would have negligible effects on the groundwater.

Soil sampling and analysis results, and the limited precipitation at Target 63-10, imply that surface water would not be affected by this alternative and that DU would not be transported by surface water.

4.2.4 Safety and Occupational Health

Under Alternative 1, DU concentrations would increase 2.33 to 68 pCi/g. The potential increase is calculated to be 9 to 18 percent of the DAC, and 80 to 160 percent of the threshold limit value. The maximum air concentration is calculated to be less than the short-term exposure limit. Reduced DU use would also proportionally reduce any risks that may exist to workers at Target 63-10. Use of personal protective equipment during any target area activities that would disturb the soil would continue to protect worker safety and health.

4.2.5 Hazardous Materials and Waste

Using a reduced amount of DU CM rounds would have no effect on the manner in which these munitions are transported, handled, and stored at the Nellis AFB. Reduced amounts expended on Target 63-10 would also not change procedures outlined in the *DU Management Plan* and supplemental procedures for monitoring the target area and clearing and disposing of intact DU rounds and fragments. The term of reduced DU use would be undefined; however, a decommissioning plan would be implemented if the target area is no longer required for mission accomplishment.

4.2.6 Biological

The biological effects of reduced use would be the same as those discussed in Section 4.1.6.

4.2.7 Cultural

The area of ground disturbance or effects on cultural resources would not change under this alternative.

4.2.8 Geology and Soils

The impacts of this alternative to geology and soils would be the same as for the Proposed Action. See Section 4.1.8 for additional information.

4.2.9 Socioeconomics

Population, employment, and environmental justice considerations in the area would not be affected by this alternative.

4.3 NO ACTION ALTERNATIVE

The No Action Alternative would continue the suspension of DU munitions use for training, and test/evaluation purposes. Continued test and training on targets would occur, but new DU munitions would not be used.

4.3.1 Noise

This alternative would have no effect on the noise levels currently generated during aircraft operations and bombing and gunnery operations on this target area.

4.3.2 Air Quality

The No Action Alternative would result in the same conditions that currently exist with continued use of conventional munitions on this target area and the presence of DU particulates and oxides that exist from past use. As indicated in Section 3.4, fugitive dust resulting from these conditions and other activities at Target 63-10 would have no effect on attainment of air quality standards in this area.

4.3.3 Water

Under the No Action Alternative, there would be no change from baseline water resource conditions.

4.3.4 Safety and Occupational Health

Under the No Action Alternative, the target area would continue to be monitored and managed in accordance with current procedures, as discussed in Section 3.4, for protecting the health and safety of range maintenance personnel requiring access to the licensed area.

4.3.5 Hazardous Materials and Waste

Under the No Action Alternative, DU CM munitions currently stored at Nellis AFB would continue to be maintained until future disposition of these munitions was determined. The decommissioning plan that is in place would be implemented upon termination of the DU license and site closure.

4.3.6 Biological

The No Action Alternative would not be expected to have any change from baseline biological resource conditions at and near Target 63-10.

4.3.7 Cultural

The No Action Alternative would not affect cultural resources due to the ongoing conduct of similar ground-disturbing activities.

4.3.8 Geology and Soils

Under the No Action Alternative there would be no change from geology and soils baseline conditions

4.3.9 Socioeconomics

Population, employment, and environmental justice considerations in the area would not be affected by this alternative.

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8.0 GLOSSARY

Alpha particle. A positively charged particle, consisting of two protons and two neutrons, that is emitted during radioactive decay from the nucleus of certain nuclides. It is the least penetrating of the three types of radiation (alpha, beta, gamma).

Ambient air. That portion of the atmosphere, outside of buildings, to which the general public has access.

Ambient Air Quality Standards. Standards established on a state or federal level that define the limits for airborne concentrations of designated criteria pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, particulate matter with aerodynamic diameters less than 10 microns [PM_{10}], ozone, and lead) to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).

Aquifer. A body of rock that contains enough saturated permeable material to transmit groundwater and to yield significant quantities of groundwater to wells and springs.

Background radiation. Radiation from cosmic sources, from radioactive materials that are naturally occurring in the environment, and from man-made sources. Background radiation due to cosmic rays and natural radioactivity is always present.

Beta particle. An elementary particle emitted from a nucleus during radioactive decay; it is negatively or positively charged, identical in mass to an electron, and in most cases easily stopped, as by a thin sheet of metal.

Candidate species. Species for which the USFWS has on file sufficient information on biological vulnerability and threat(s) to support the issuance of a proposed rule to list but issuance of the proposed rule is precluded.

Curie (Ci). A unit of radiation that describes the number of atoms undergoing nuclear transformations per unit time, i.e., 3.7×10^{10} disintegrations per second.

Day-night average sound level. A-weighted sound-pressure levels averaged over a 24-hour period with 10 dBA added for events occurring between 10 p.m. and 7 a.m.

Decibel. A standard unit of measuring sound-pressure levels based on a reference sound pressure of 0.0002 dynes per square centimeter. This is the smallest sound a human can hear.

Decibel, A-weighted (dBA). Adjusted unit of sound measurement that corresponds to the relative sensitivity of the human ear at specified frequency levels. This represents the loudness as perceived by humans.

Depleted uranium (DU). Uranium in which the abundance of the isotope uranium-235 is decreased well below the normal (naturally occurring) levels.

DU Source material. The initial quantity of DU released into the environment.

Endangered species. A plant or animal species that is threatened with extinction or serious depletion in its range and is formally listed as such by the USFWS.

Enriched uranium. Uranium in which the abundance of the isotope uranium-235 is increased well above the normal (naturally occurring) levels.

Ephemeral. Lasting only a brief period of time.

Expended munitions. Munitions that have been fired.

Fugitive dust. Particulate matter composed of soil. Fugitive dust may include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is either removed or redistributed.

Groundwater. Subsurface water within the zone of saturation.

Infiltration. Water that falls on the land surface that does not runoff but percolates into the ground. Some of this water evaporates, some is used by plants, and some percolates downward to the groundwater.

Isotope. Nuclides having the same number of protons in their nuclei, and hence the same atomic number, but differing in the number of neutrons, and therefore in the mass number. Almost identical chemical properties exist between isotopes of a particular element. The term should not be used as a synonym for nuclide.

Low-level radioactive waste. Radioactive waste not classified as high-level waste, transuranic waste, or spent nuclear fuel, or the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic elements is less than 100 nanoCuries per gram.

NanoCurie (nCi). Curie times 10^{-9}.

National Ambient Air Quality Standards (NAAQS). Section 109 of the Clean Air Act requires the Environmental Protection Agency to set nationwide standards for widespread air pollutants. Currently, six pollutants are regulated: sulfur dioxide, carbon monoxide, particulate matter less than 10 micrometers in diameter (PM_{10}), nitrogen dioxide, ozone, and lead.

PicoCurie (pCi). Curie times 10^{-12}.

Playa. A dry, vegetation free, flat area at the lowest point of an undrained basin.

Pyrophoric. Igniting spontaneously.

Radiation. The emissions, either electromagnetic or particulate, resulting from the transformation of an unstable atom or nucleus.

Rem. A unit of dose equivalent or effective dose equivalent equal to the product of the absorbed dose in rad, the applicable quality factor(s), all other necessary modifying factors, and the applicable weighting factors as appropriate.

Roentgen (R). A unit of the amount of exposure to electromagnetic, ionizing radiation. One R is the amount of electromagnetic, ionizing radiation necessary to generate 2.58×10^{-4} coulombs of electric charge in one kilogram of dry air at standard temperature and pressure.

Source material. The initial quantity of any material released into the environment.

Threatened species. A species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

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APPENDIX A

PROCEDURES FOR MONITORING DEPLETED URANIUM, RANGE 63, NELLIS RANGE COMPLEX

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APPENDIX A

PROCEDURES FOR MONITORING DEPLETED URANIUM, RANGE 63, NELLIS RANGE COMPLEX

Surface Scanning: Materials and Methods

A radiological scan of the original area of contamination and surrounding areas will be conducted every year to detect any migration of the depleted uranium. Surface scanning for radiological contamination will be conducted using a portable, battery operated general purpose survey meter. This meter is used with a sodium iodide beta/gamma probe, and will detect the 2.28 MeV beta from ^{234m}Pa (the third radionuclide in the ^{238}U chain). At Yuma Proving Ground, a similar probe has been found to be effective in determining the presence of DU even when buried within an inch of soil.

Before each sampling event, the target area shall be cleared of unexploded ordnance (UXO) by EOD personnel during the annual Coronet Clean process. The range is closed once a year to allow for range clean-up. This sampling protocol will occur immediately after the 63-10 Coronet Clean, but prior to the next training event.

There are six transacts along which surface scanning will be performed. Each of the two target groupings has three lines projecting radially outward from the center between the two tanks. Transects labeled "a" represent the west target grouping. Transects labeled "b" represent the east target grouping. Transects Lla and Llb are on the heading 005 degrees, lining up with the attack restrictions for the pilots. Transects L2 and L3 radiate from LI on 45 degree headings. Transects L2 and L3 fall in the approximate heading of the most common wind during the winter and summer months (NNW and SSW).

Starting from the targets, a 0.75m wide area of ground will be scanned from the target outward along each transect line LI, L2, and L3, (a and b). The probe will be kept as close to the ground surface as practical. It is expected that the DU will be concentrated within 150m of the targets. However, the transect will be scanned beyond this potentially "contaminated" region, to approximately 300m to detect any possible migration of DU.

Data Collection/Reporting: The field data collected during these surveys will include instrument information (i.e.. serial number, calibration data, survey date and time, technician initials, etc.). Calibration checks will be performed on instruments as recommended by the manufacturer. and all instrument readings described below.

At a location selected by the technician (e.g., 1,000 m from the target site) 10 background measurements will be recorded. The location of the 10 measurements will also be recorded.

The field data measurement sheet will include a sketch of the target area and the scanning lines (L1, L2, and L3), [a and b]). The sketch will reflect the location and in what range the readings fall, relative to background radiation (Bkg), e.g.: > 100 X Bkg, between 10 X Bkg and 100 X

Bkg, between 2 X Bkg and 10 X Bkg, and <2 X Bkg,. Distances from the target area will be recorded with each change in readings. Survey readings of the larger pieces of DU will not be used in the soil activity data. but picked up and collected as low level waste to be disposed of with other penetrators.

Larger pieces of fragments and intact DU rounds will be collected and recycled through Wright-Patterson Air Force Base. In the event that this is no longer viable, fragments and rounds will be disposed of as low level radioactive waste through the Air Force Radioactive and Mixed Waste Office.

Action Levels and Reporting: All data will be entered into a report that will provide an annual trend analysis of the boundary between the activity regions (i.e., is the >100 X Bkg region getting larger, smaller, or remaining the same, etc.). Comparison of the annual reports will show the migration trends, if any, of the depleted uranium. The Lockheed Martin Radiation Safety Officer (RSO) will submit all data in annual reports to 99 AMPS/SGPB.

The Lockheed Martin RSO will document and immediately notify the base RSO of any noticeable migration trends in the activity regions will merit further investigation of the site (for instance, readings that suggest that the DU contamination is spreading beyond the 300-350 foot radius identified in the *DU Limited Site Assessment*, or that the highest activity region (> 100 X Bkg) is spreading). Additional surface scans will be undertaken to verify that this is occurring throughout the area and not just along lines L1, L2, and L3, (a and b). If contamination is detected in areas beyond the original footprint, additional sampling will be coordinated with 99 AMDS/SGPB. If the contamination is determined to be spreading, the Radioisotope Committee and Armstrong Laboratory will be consulted for further guidance.

<u>Sub-Surface Soil Sampling</u>

The characterization of DU infiltration as a function of soil depth is essential in determining the potential for groundwater contamination. The groundwater on Range 63 is at approximately 300 ft. The following sampling protocol will be repeated every five years, due to the apparent stability and high degree of localization of the DU. The collection of samples will require about one week while the radiological analysis can take up to two weeks. The bombing range will not be cleared for re-opening until the radioanalytical results have been returned. This would allow for the possibility of additional sampling while maintaining the integrity of the sampling holes

As with the surface scanning protocol, during any digging operations EOD personnel should verify that no UXOs are present Each sample site will be surveyed and marked with a survey marker to remain as a reference for future sampling events

Sub-surface soil samples will be collected at 10m and 150m radially from each side of the targets on transacts L1, L2, and L3 (a and b) (ref Atch 2c). This amounts to a total of 24 soil sample locations.

The soil samples will be obtained by digging a hole approximately 60 cm deep (24 in). A suitable coring tool will be used for this purpose based upon the condition of the soil. Data obtained from the *DU Limited Site Assessment* suggests that the depth of interest for subsurface

soil sampling is between 20-25cm. This portion of the coring sample will be collected, sieved to remove particles >2mm, and then air dried to ensure large fragments are removed so as not to skew sample results. The soil will be placed in a marked ziplock (one quart size bag). To ensure adequate soil is available for laboratory analysis, two quart-sized samples will be collected from each sample location. If necessary, due to the radius of the coring tool, a number of cores will have to be taken next to each other in order to ultimately fill two ziplock bags per sample location.

An alternative approach, which requires one hole and guards against cross contamination of soil profiles, is to dig a single hole approximately 60cm deep. All loose soil will then be removed from the hole. Starting from the top, the sides should be freshly scraped (with a small tool such as a putty knife) to a depth of 30cm The scraping tool will then be cleaned. Any loose soil will be carefully removed without touching the sides of the hole. Soil droppings will be collected when the sides of the hole are scraped again with the putty knife between the depths of 20-25cm Three bags of soil will be collected in quart-sized ziplock bags. When completed the soils should be sieved to remove particles > 2mm For each hole, two field replica samples will be taken. This process will prevent false readings from spike areas and provide quality assurance for field methodologies and laboratory techniques.

Therefore, given 24 soil sample locations and 2 samples per location, 48 soil samples will be collected. Two background locations (2 samples each) will also be taken.

Data Collection and Reporting: The soil samples will be sent to the Armstrong Laboratory, Radioanalytical Branch for analysis, or other suitable civilian laboratory. Tests will be performed to determine the $^{235}U/^{238}U$ ratios in each soil sample. The results will indicate whether the samples contain natural quantities of uranium or that derived from DU infiltration. The uranium soil concentrations will also be reported.

Copies of all reports will be on file at 99 AMDS/SGPB, 99 RANSS/RSXF, and with the Range Radiation Safety Officer (RSO), as part of the Contractor Environmental, Health and Safety program. Trend analyses will be performed annually by the EHS Contractor.

Action Levels and Reporting: 35 pCi/g is the clearance standard suggested by the NRC (NUREG/CR-5849) for the decommissioning of land for unrestricted use. This standard will be used to represent the strictest possible standard. If DU concentrations are found by Armstrong Labs to be greater than this value at a depth of 20 to 25cm, then additional holes will be sampled to determine the vertical extent of this level of contamination. The Radioisotope Committee and the Armstrong Laboratory Health Physics Branch will be notified of such findings by the base RSO.

Radiation Exposure Assessment

Personnel exposure to depleted uranium has been studied in depth by a number of sources. The following information was taken from Health and Environmental Consequences of Depleted Uranium use in the US Army: Technical Report. US Army Environmental Policy Institute, June 95.

Health risks from DU are largely dependent on amount present, chemical and physical form, and duration and mechanism of exposure. DU has chemical and radiological health hazards when it enters the body. In general, the radioactivity of DU is very low.

External Radiation Exposures: Studies show that the external exposure risk to radiation from intact DU penetrators is expected to be below the general public exposure limit. DU is a relatively stable isotope with a 4.5 billion year half-life and it decays principally through alpha emission. Alpha particles do not penetrate the skin.

Internal Radiation Exposures: DU may enter the body through inhalation, ingestion, and open wounds. Inhalation and subsequent ingestion of DU panicles is dependent on its dimensions and mass. When in the body alpha particles are the biggest contributor to radiation exposure. The radiation hazard to target organs are dependent on the amount of time DU stays in the body. The rate at which DU is released from the body can be measured in urine and in feces. This information can help estimate internal DU exposures and potential risks to cancer.

In addition to the U.S. Army report Mays et al., estimates that with a constant intake of 5 pCi/day, for 50 years, the increased risk of bone cancer over a life time is 1.5 bone cancers per million persons. This contrasts sharply with the naturally occurring incidence of bone cancers in the United States of 750 bone cancers per million persons. In summary, exposure to DU by ingestion is unlikely to be a significant health risk.

Reference: Mays, C.W., R.E. Rowland, and A.F. Stehney, 1985. Cancer Risk from the lifetime intake of radium and uranium isotopes. Health Physics. 48:635-647.

Chemical Exposures: Chemical exposure to DU is a more significant health hazard than radiation exposures. DU and naturally occurring uranium are the same in chemical toxicity. Everyone ingests and inhales a quantity of naturally occurring uranium daily that is dependent on their geographical location. The kidney is the target organ for DU toxicity.

Inhalation would be expected to be the greatest health risk from DU in the DU target area. Previous personal air sampling has been conducted when several tanks were dragged to the license area. This activity created the opportunity to re-suspend more DU than the clean up and sampling plans addressed in this document could produce. This air sampling was undertaken by personnel from Armstrong Laboratory, Brooks Air Force Base representing the Health Physics and Bioenvironmental Engineering function. Personnel engaged in the air sampling collection were fitted with Metrosonics P-2500 sampling pumps and cyclone breathing zone air samplers to determine the extent of any respirable hazard. The pumps were operated at 2.5 l/min for approximately 20 hours which reflects the time spent by each person operating in the area. The Brooks Report concluded that breathing zone samples showed results considerably less than the allowed Derived Air Concentration of 2×10^4 Bq/m^3 (0.9 picoCuries per liter) as listed in the International Council of Radiation Protection (ICRP) Publication 30, and 10 CFR 20 which assumes 40 hours exposure per week for 50 weeks. Therefore, it is extremely unlikely personnel performing the described duties in this document could be exposed to DU through inhalation.

There will be no burning or welding of targets that maybe contaminated with DU unless a plan is submitted and approved through Bioenvironmental Engineering Flight.

Personal Protective Equipment (PPE) will be determined by the Contractor RSO. Potential inhalation and ingestive pathways will be controlled through the use of personal protective equipment as specified by the Lockheed Martin Radiation Safety Officer. The existing OSHA Permissible Exposure Level (PEL) for insoluble uranium compounds is 0.2 mg/m3 for soluble compounds. If major refurbishment activities are to be performed. all medically qualified personnel will be fit tested. and required to donn respirators with HEPA cartridges.

Personnel picking up DU penetrators will wear gloves to limit the potential for alpha particles to enter the body through open wounds, or from hand to mouth activities. All vehicles, boots, gloves, and any other equipment used during operations will be brushed lightly to rid the surface of clinging dust particles from the site. All personnel clothing and boots will be monitored for radioactive dusts prior to leaving the site. All contaminated disposable PPE will be containerized in bags, labeled. and stored as low level waste pending turn-in to the base RSO.

The radiation protection program for Lockheed Martin employees is coordinated by Lockheed Martin Environmental Health and Safety Office through the Nellis 99 AMDS/SGPB, and their Radiation Safety Officer.

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APPENDIX B

DISTRIBUTION/MAILING LIST

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APPENDIX C

LIST OF ACRONYMS

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APPENDIX C

LIST OF ACRONYMS

ABW	Air Base Wing
ACC	Air Combat Command
AFB	Air Force Base
API	armor piercing incendiary
APIT	armor piercing incendiary tracer
AQCR	Air Quality Control Region
BLM	Bureau of Land Management
CAA	Clean Air Act
CCIP	constantly compute impact point
CFR	Code of Federal Regulations
CEQ	Council on Environmental Quality
Ci/yr	Curies per year
CM	combat mix
DAC	Derived Air Concentration
dB	decibel(s)
DNWR	Desert National Wildlife Range
DOE	Department of Energy
DOI	Department of the Interior
DU	depleted uranium
EA	Environmental Assessment
EOD	explosive ordnance disposal
EPA	Environmental Protection Agency
HEI	high-explosive incendiary
HEPA	High Efficiency Particulate Air
HQ ACC	Headquarters Air Combat Command
kg	kilograms
kg/yr	kilograms per year
lbs	pounds
L_{Cdn}	day-night average noise level
L_{dnmr}	monthly day-night sound level measurement
MDA	minimum detectable activity
mm	millimeter
MOU	Memorandum of Understanding
mrem	millirems
NAAQS	National Ambient Air Quality Standards
NAFR	Nellis Air Force Range
nCi/g	nano Curies per gram
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
pCi/g	picoCuries per gram
PL	Public Law
PM_{10}	particulate matter less than 10 microns
TES	Test and Evaluation Squadron
Th^{234}	Thorium-234
TNT	trinitrotoluene
U.S.	United States
U^{235}	Uranium-235
U^{238}	Uranium-238
USAF	United States Air Force
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
YPG	Yuma Proving Grounds

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