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14. ABSTRACT The purpose of this summary report is to provide an overview of historical information, synthesize recent data, and draw conclusions from all surveys of depleted uranium survey actions at NTTR 63-10 from 1992 to the present. This summary satisfies the request originated through recent meetings between USAFSAM/OEC, AFMSA/SG3PB, 88 ABW/CEAX, AFIA/SGI, SAF/IEE, AF/A30-BA, NTTR/XP, and 99 AMDS/SGPB to clarify previous sampling strategies/techniques, consolidate the data, and provide a historical basis for future range maintenance and decisions.					
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DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
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15 September 2016

MEMORANDUM FOR AFMSA/SG3PB

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SUBJECT: Consultative Letter AFRL-SA-WP-CL-2016-0009, Summary Report of Depleted Uranium (DU) Survey Actions at Nevada Test and Training Range (NTTR), Airspace Region 63B, Active Target Complex 10 (63-10)

1. INTRODUCTION:

a. *Purpose.* The purpose of this summary report is to provide an overview of historical information, synthesize recent data, and draw conclusions from all surveys of depleted uranium (DU) survey actions at NTTR 63-10 from 1992 to the present. This summary satisfies the request originated through recent meetings between the United States Air Force School of Aerospace Medicine, Consultative Services Division (USAFSAM/OEC); the Air Force Medical Support Agency (AFMSA/SG3PB); 88 ABW/CEAX; AFIA/SGI; SAF/IEE; AF/A30-BA; NTTR/XP; and 99 AMDS/SGPB to clarify previous sampling strategies/techniques, consolidate the data, and provide a historical basis for future range maintenance and decisions.

b. *Background:*

(1) *Nature of Contamination:* The use of DU ammunition is part of ongoing test and training requirements for A-10 aircraft by test/evaluation and weapons squadrons at Nellis AFB. The GAU-8 weapon system was first tested at NTTR between 1976 and 1977. It fires a 30-mm "combat mix" consisting of five armor piercing incendiary DU rounds and one high explosive incendiary round. NTTR 63-10 and the local DU library were used from 1982 to 1993, averaging 7,500 rounds per year, and were reactivated in 2002. Since 2002, A-10 aircraft have expended an average of 7,900 rounds per year. Targets consist of static armored vehicles and are typically used for 5-7 years before replacement. Debris in the NTTR 63-10 vicinity consists of oxidized DU rounds, DU contaminated targets, and target debris munitions residue (TDMR). TDMR is a mixture of inert munitions, metal, wood, and rubber. The DU library consists of more than 180 destroyed targets.

(2) Site Characteristics: NTTR comprises nearly 4,600 mi² in Clark, Nye, and Lincoln counties, NV (Figure 1). The high desert terrain of the NTTR consists of several mountain ranges, valleys, alluvial flows, and dry lake beds. Airspace Region 63B, henceforth “Region 63B,” is a mountainous, desert area of approximately 240 mi² located in the southern half of NTTR (Figure 2). Region 63B encapsulates 2 inactive and 13 active target complexes. The northernmost array of targets, NTTR 63-10, is situated in the northwestern quadrant of Region 63B.

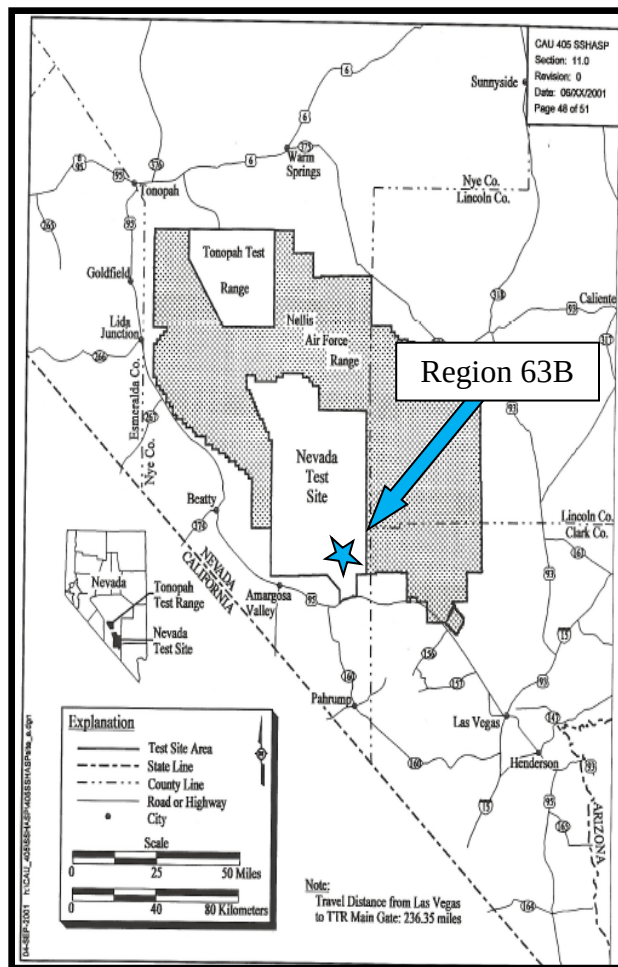


Figure 1: Nellis Range & Airspace Region 63B (AFIERA GIS Laboratory)

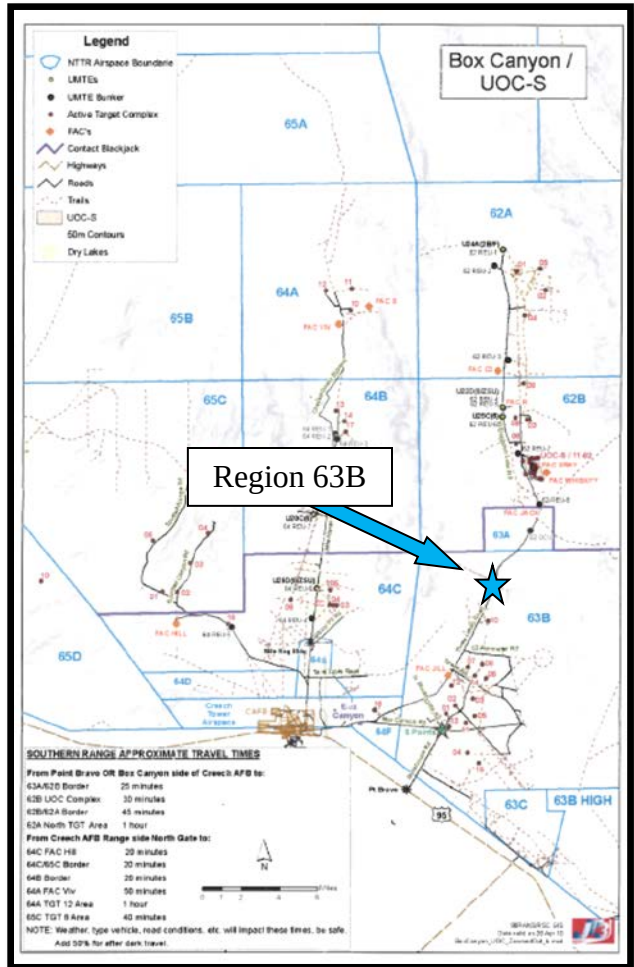


Figure 2: NTTR South Ranges & NTTR 63-10 (98 RANS/RSC GIS)

A local DU library is located 0.25 mi northwest of NTTR 63-10 (Figure 3). From 2005 to 2011, the DU-permitted area surrounding NTTR 63-10 was approximately 4 mi². In 2011, this was expanded to 14 mi² to better encapsulate the pattern of contamination. In 2012, the permitted area was again increased to 29 mi². Several national wildlife management areas are enclosed within the NTTR, and much of the eastern section of the NTTR overlaps with the Desert National Wildlife Refuge.

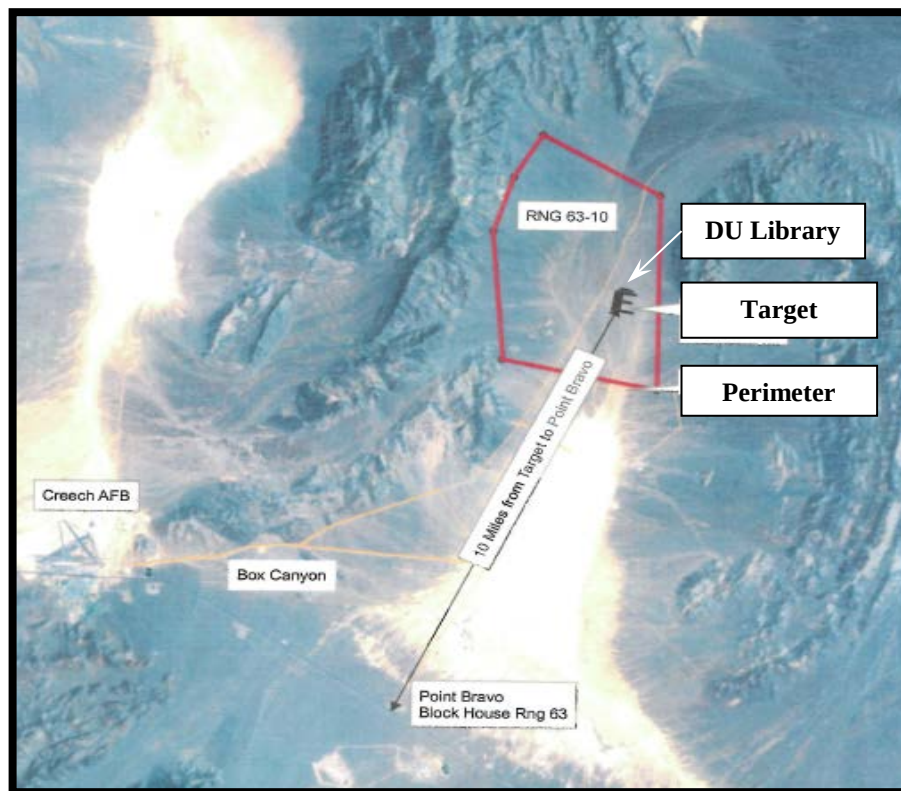


Figure 3: Satellite Imagery, NTTR 63-10 (AFRAT)

(3) Decommissioning Funding Plan (DFP): A DFP for Nellis AFB DU permit (storage area and NTTR 63-10) was prepared by the Air Force Institute for Operational Health, Radiation Surveillance Division (AFIOH/SDRH, now USAFSAM/OEC) in September 2004. The DFP is a site-specific cost estimate for goods and services and will be adjusted every 3 years over the life of the facilities. The DFP was incorporated in the Financial Assurance Package for the Air Force Master Material License that was submitted to the NRC in December 2004. The DFP was updated in December 2011 to account for inflation and revised cost estimates, as well as costs to dispose of contaminated targets. The most recent cost estimate is approximately \$88 million.

(4) Nuclear Testing: No nuclear weapons tests were conducted at Region 63B.

2. METHODOLOGY: At the request of AFMSA, USAF Radioisotope Committee Secretariat, USAFSAM/OEC reviewed historical reports and data:

- a. In October 1992, the former Armstrong Laboratory Health Physics Function, now USAFSAM/OEC, took air and radiation samples during efforts to move two tank targets from NTTR 63-10 to the DU library.
- b. In December 2001, the former AFIERA/SDRH, now USAFSAM/OEC, published “Radiological Scoping Survey of Range 63-10, Nellis AFB, NV.” SDRH conducted a radiological soil survey of approximately 0.4 mi² to determine the extent of DU contamination and migration in the soil.
- c. In October 2006, the former AFIOH/SDRH, now USAFSAM/OEC, published “Radiological Assessment of Permitted Depleted Uranium Area at Range 63, NTTR.” This report further assessed the extent and migration of DU contamination at NTTR 63-10, and the surveillance data were incorporated into the scoping survey results of Figure 4 below.
- d. From 2006 to 2010, the former USAFSAM/OEHHH, now USAFSAM/OEC, conducted several on-site scoping surveys of NTTR 63-10 consisting of vehicle-based and walkover surveillance. Approximately 100% representation of the DU-permitted, vehicle-accessible area was surveyed. No additional reference areas were surveyed; background levels were assumed to be the statistical mean, plus or minus one standard deviation. The area was scanned using several GPS-enabled gamma detection instruments, including the GR-460 “4x4-inch” NaI detector, the RS-700 “dual 4x4-inch” NaI detector, and Model 2221 with a “2x2-inch” NaI detector. Two data sets per instrument were obtained and evaluated.
- e. In March 2005, Headquarters Air Combat Command (HQ ACC) produced a report entitled “NTTR DU Target Disposal Environmental Assessment.” The proposed action of the report was to implement several DU target disposal options, in accordance with guidance for range planning and operations. A prescriptive decision matrix was used to assess a target for reuse or disposal.
- f. In September 2006, HQ ACC produced a report entitled “Environmental Assessment for Increased DU Use on Target 63-10, NTTR.” The proposed action of the report was to increase the annual number of DU rounds authorized from 7,900 to 19,000, in accordance with aircraft test and evaluation requirements.
- g. From December 2006 to September 2009, the Bioenvironmental Flight at Nellis AFB (90 AMDS/SGPB) conducted routine air sampling of NTTR 63-10 in response to a request from AFMSA. Low-volume sampling was conducted both during times of live-firing and non-firing of DU munitions. A background sampling location and three downwind sampling locations were chosen. Distances from the target complex varied from 1 – 2 mi.

3. RESULTS: USAFSAM/OEC compiled the results of historical reports and data:

- a. The October 1992 air monitoring results indicated DU contamination remained localized to the immediate target area and no significant airborne DU contamination occurred during target movement activities.

b. The December 2001 soil survey of approximately 0.4 mi² determined the extent of DU contamination and migration in the soil. DU contamination 0.4 mi from the center of NTTR 63-10 was limited to DU rounds and TDMR. The analysis found little or no diffuse DU particles in the soil in areas outside the target complex, confirming prior conclusions.

c. The October 2006 Radiological Assessment of Permitted Depleted Uranium Area at Range 63, NTTR found minimal diffuse contamination in primary drainage areas, evidenced by the lack of DU activity above background in soil samples. However, survey measurements revealed elevated DU levels over 2 mi south of the NTTR 63-10 target complex. Survey personnel provided visual confirmation of DU in the area extending from the target complex to the road that separated the former permitted and unpermitted areas. The key recommendations were biennial, vehicle-based surveillance and soil sampling in the primary drainage regions south of the active targets. It was also recommended that access to another area (NTTR 63-08) suspect of DU munitions contamination be granted to conduct a health risk assessment.

d. Based upon 2006 to 2010 scoping surveys of NTTR 63-10:

(1) GR-460 instrument data consisted of vehicle-based surveys performed in 2006 and 2008. The mean gamma count rates were 2920 ± 929 cpm and 2271 ± 527 cpm, respectively, where the uncertainty is one standard deviation. The mean count rates and their uncertainties were determined from the valid data points collected. These means and their uncertainties approximate the background level within the data set and were deduced from a statistical analysis of the total data distribution.

(2) RS-700 instrument data consisted of vehicle-based surveys performed in 2009 and 2010. The mean gamma count rates were 46 ± 11 cpm and 52 ± 29 cpm, respectively, where the uncertainty is one standard deviation. The mean count rates and their uncertainties were determined from the valid data points collected. These means and their uncertainties approximate the background level within the data set and were deduced from a statistical analysis of the total data distribution.

(3) Model 2221 instrument data consisted of walkover surveys performed in 2009 and 2010. The mean gamma count rates were 4858 ± 1507 cpm and 1924 ± 559 cpm, respectively, where the uncertainty is one standard deviation. The mean count rates and their uncertainties were determined from the valid data points collected. These means and their uncertainties approximate the background level within the data set and were deduced from a statistical analysis of the total data distribution.

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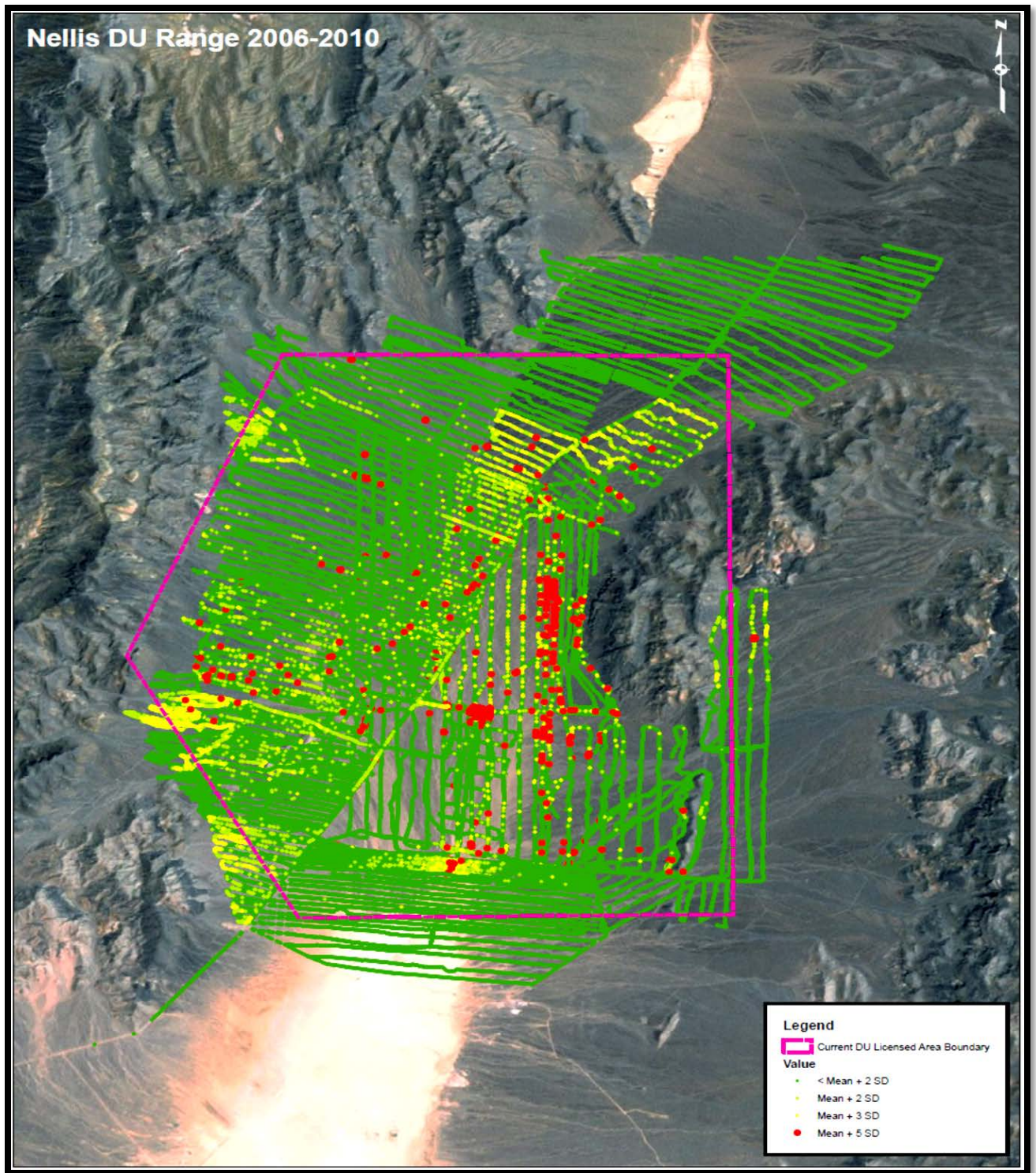


Figure 4: Survey Data, NTTR 63-10, 2006 – 2010 (USAFSAM)

(4) To aggregate all data sets, a composite plot of all 2006 – 2010 USAFSAM survey data was created (Figure 4). The particular data set for each survey and instrument was analyzed based on its mean and standard deviation. The lowest readings of the survey are marked in dark green and correspond to less than two standard deviations above the mean value. The next category falls between two and three standard deviations, marked in light green. The green areas are where DU soil concentrations are expected to be the lowest, with reasonable confidence. The other colors, namely yellow and red, represent areas of statistical significance where higher DU concentrations are expected to be found. The color scheme demonstrates a scale of instrument data based upon standard deviations from background, where no regulatory values are implied. Color schemes from this report and the previous NTTR 63-10 surveys do not correspond to the same range of values, so a direct comparison, based solely on color, is not applicable.

e. The HQ ACC report from March 2005 cited that, during disposal operations, minimal environmental migration of DU particulates occurred through soil erosion and groundwater movement.

f. In the HQ ACC report from September 2006, an assessment of DU aerosolization found that respirable particulates could be generated and suspended for only short durations after munitions expenditure. An evaluation of DU migration via water erosion found a primary affected area within a 1,300-ft radius of the target complex. The report concluded that a doubling of the DU round usage would not significantly increase the amount of soil contamination.

g. Air sampling conducted at NTTR 63-10 from December 2006 to September 2009 found no sampling results surpassed the U-238 air effluent concentration of 1×10^{-12} $\mu\text{Ci/mL}$, as given in 10 CFR 20 Appendix B.

4. DISCUSSION:

a. The original intent of the 2006 – 2010 on-site USAFSAM surveillance was to provide ground data for interpretation by 99 AMDS/SGPB. These data were subsequently provided by USAFSAM. Given that USAFSAM retained this information in formats readable by current software, it was possible to retrieve each data set electronically. Upon extensive examination of the files, it was found that six data sets could be discretely analyzed and included in this compilation report.

b. Due to the nature of the NTTR 63-10 terrain, there were significant geographical variations in the data sets. The large area of the NTTR 63-10 location required multiple surveys over several years, therefore creating additional uncertainty with regard to a fixed background value. Additionally, rugged landscape features may have created uncertainty with respect to detector geometry and overall performance.

c. After preliminary examination of the data, certain elements of the survey techniques and procedures were not recovered. No quality control data were retained, and consequently, it was not immediately clear whether detector performance was measured throughout each survey.

Sections of the data were removed due to obvious instrument malfunction, whereas data that were found to be statistically valid were kept.

5. CONCLUSIONS AND RECOMMENDATIONS:

a. Based upon observed survey data and findings of previous reports, there is a minimal human health and safety impact due to DU contamination or the migration of DU material at NTTR 63-10.

b. Area boundaries such as those shown in Figure 4 may not encompass all of the DU fragments expended at NTTR 63-10.

c. USAFSAM/OEC recommends that AFMSA, SAF/IEE, and/or NTTR plan, program, and budget for further scoping/characterization surveillance, in particular to the west and east of the existing area boundaries. Surveillance using an aerial platform may be the most cost-effective and practicable survey method for this extensive and rugged terrain.

6. Questions regarding this memorandum may be directed to Bret Rogers at DSN 798-3413 or by email at bret.rogers.1@us.af.mil.

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