DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT AGENCY
HEADQUARTERS, UNITED STATES ARMY GARRISON-ROCK ISLAND ARSENAL
1 ROCK ISLAND ARSENAL
ROCK ISLAND, ILLINOIS 61299-5000

REPLY TO
ATTENTION OF:

0 4 AUG 2006

Office of the Garrison Manager

Dr. Tom McLaughlin
Materials Decommissioning Branch
Division of Waste Management and Environmental Protection
Office of Nuclear Materials Safety and Safeguards
Two White Flint North
11545 Rockville Pike
Rockville, Maryland 20852-2738

Dear Dr. McLaughlin:

Reference Nuclear Regulatory commission License No. SUB-1435. Provided as enclosure are 6 hard copies and 1 Compact disc of the Deer Tissue Sampling Results report for your information and review.

Should you have any questions, please contact either Mr. Paul Cloud, Jefferson Proving Ground (JPG).License Radiation Safety Officer, US. Army JPG at (410) 436-2381, E-mail address: paul.d.cloud@us.army.mil, or Mr. John J. Welling, Chief Counsel, U.S. Army Garrison-rock Island Arsenal, at (309) 782-8433, E-mail address: wellingj@ria.army.mil.

Sincerely.

Alan G. Wilson
Garrison Manager

Enclosures
CF:
Paul Cloud

U.S. Army Corps of Engineers

DEER TISSUE SAMPLING RESULTS

Depleted Uranium Impact Area Site Characterization
Jefferson Proving Ground, Madison, Indiana

Final

Prepared for:

U.S. Department of Army
Installation Support Management Activity
5183 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5424

and

U.S. Army Corps of Engineers
Louisville District
600 Dr. Martin Luther King, Jr. Place
Louisville, Kentucky 40202-2230

Submitted by:

SAIC
From Science to Solutions™

Science Applications International Corporation
11251 Roger Bacon Drive
Reston, Virginia 20190

Contract No. W912QR-04-D-0019
Delivery Order No. DO17

August 2006

DEER TISSUE SAMPLING RESULTS

Depleted Uranium Impact Area Site Characterization
Jefferson Proving Ground, Madison, Indiana

Final

Prepared for:

U.S. Department of Army
Installation Support Management Activity
5183 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5424

and

U.S. Army Corps of Engineers
Louisville District
600 Dr. Martin Luther King, Jr. Place
Louisville, Kentucky 40202-2230

Submitted by:

Science Applications International Corporation
11251 Roger Bacon Drive
Reston, Virginia 20190

Contract No. W912QR-04-D-0019
Delivery Order No. DO17

August 2006

THIS PAGE WAS INTENTIONALLY LEFT BLANK

CERTIFICATION 4

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has prepared this Deer Tissue Sampling Results Report as part of the site characterization at Jefferson Proving Ground's Depleted Uranium Impact Area, located in Madison, Indiana. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan (QCP). During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

Joseph N. Skibinski — 3 Aug 2006

Joseph Skibinski
Project Manager
Science Applications International Corporation — Date

Joseph E. Peters — 3 Aug 2006

Joseph E. Peters
Quality Assurance Officer
Science Applications International Corporation — Date

Corinne Shia — 3 Aug 2006

Corinne Shia
Independent Technical Review Team Leader
Alion Science and Technology Corporation — Date

Significant concerns and explanation of the resolutions are documented within the project file.

As noted above, all concerns resulting from independent technical review of the project have been considered.

8/3/06

Lisa D. Jones-Bateman
Vice President
Science Applications International Corporation — Date

THIS PAGE WAS INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

APG	Aberdeen Proving Ground
BHZ	Background Hunting Zones
BRAC	Base Realignment and Closure
CSM	Conceptual Site Model
DI	Deionized
DU	Depleted Uranium
GPS	Global Positioning System
HPT	Health Physics Technician
I.D.	Identification
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
JPG	Jefferson Proving Ground
LEU	Low Enriched Uranium
MOA	Memorandum of Agreement
NHZ	Nearby Hunting Zones
NRC	Nuclear Regulatory Commission
NWR	National Wildlife Refuge
SAIC	Science Applications International Corporation
U-234	Uranium-234
U-235	Uranium-235
U-238	Uranium-238
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance
USAF	U.S. Air Force

THIS PAGE WAS INTENTIONALLY LEFT BLANK

1. INTRODUCTION

This section provides a brief overview of the site history, characteristics of uranium and depleted uranium (DU), exposure pathways, and objectives of the report.

1.1 SITE HISTORY

Jefferson Proving Ground (JPG) was established in 1941 as a proving ground for the test firing of a wide variety of munitions. The facility is approximately 55,264 acres (224 square kilometers) and is located in Jefferson, Jennings, and Ripley Counties in southeastern Indiana (Figure 1-1). A firing line with 268 gun positions used for testing munitions separates JPG into two areas: a 4,000-acre (16.1-square kilometer) southern portion and a 51,000-acre (206-square kilometer) northern portion (SAIC 1997). The area north of the firing line consists of undeveloped and heavily wooded land and contains a Nuclear Regulatory Commission (NRC)-licensed area (SAIC 1997).

The U.S. Army used JPG as a proving ground from 1941 to 1994. The U.S. Army test fired DU projectiles as part of its munitions testing program. DU is uranium from which some fraction of the U-235 isotope has been removed and is used as a munition that penetrates armor plating. The possession and test firing of DU penetrators were conducted under a license issued by NRC (License SUB-1435). The test firing of DU projectiles occurred between 1983 and 1994 in the DU Impact Area, which is located in the south-central area of the northern portion of JPG, as shown in Figure 1-2. These tests were nondestructive (i.e., no aerosolization occurred), although the rounds may have fragmented upon impact.

Approximately 220,462 pounds (100,000 kilograms) of DU projectiles were fired at soft targets (i.e., non-armored targets that are made of materials such as cloth or wood) in the 2,080-acre (8.4-square kilometer) DU Impact Area. Approximately 66,139 pounds (30,000 kilograms) of DU projectiles and projectile fragments were recovered at or near the ground surface periodically to ensure that the total 100,000-kilogram license limit was not exceeded. Approximately 154,323 pounds (70,000 kilograms) of DU remain in the DU Impact Area (SEG 1995 and 1996).

JPG was closed in September 1995 under the Defense Authorization Amendments and Base Realignment and Closure (BRAC) Act of 1988. The NRC license for the area north of the firing line was amended for possession-only of DU in May 1996. In May 2005, the U.S. Army requested a license amendment proposing an alternate schedule for submission of a decommissioning plan. This request was approved by NRC on April 26, 2006. Site access to the area north of the firing line and to the DU Impact Area at JPG is controlled by the U.S. Army via the U.S. Army/U.S. Air Force (USAF)/U.S. Fish and Wildlife Service (USFWS) Memorandum of Agreement (MOA) of 2000 (U.S. Army 2000). The property north of the firing line, including the DU Impact Area, became Big Oaks National Wildlife Refuge (NWR) in 2000. Public use of the Big Oaks NWR is limited to hunting, fishing, wildlife observation, photography, and guided tours to selected areas north of the firing line not including the DU Impact Area. Public access to the refuge is controlled strictly at one gate and is limited to two areas: limited day use recreation and special controlled hunting zones. Further details concerning site history are presented in SAIC (2005a).

1.2 CHARACTERISTICS OF URANIUM AND DEPLETED URANIUM

1.2.1 Uranium

Uranium is a naturally occurring metal that can be found throughout the environment in rocks, soil, water, plants, and animals. Natural uranium has three primary isotopes (forms): uranium-238 (U-238), uranium-235 (U-235), and uranium-234 (U-234). U-235 and U-238 are the two most abundant. U-234 is formed during the natural radioactive decay of U-238. Naturally occurring uranium consists of approximately 99.27 percent U-238, approximately 0.72 percent U-235, and approximately 0.0055

percent U-234 (Royal Society 2001). Humans and wildlife are exposed to natural uranium on a daily basis primarily in their food and water (Royal Society 2002). As a result, humans ingest approximately 2 micrograms of natural uranium each day in food and fluids. A similar quantity is excreted each day in the feces and urine (DOE 2000). This presents a uranium balance in which uranium is always present in the tissues.

The range of intake and losses has been observed to vary over several orders of magnitude, depending upon the uranium concentration in foods and in the water supply (DOE 2000). This condition also may occur in wildlife. As a result of this potential exposure, it is possible that uranium may be detected in tissue samples from humans or wildlife.

1.2.2 Depleted Uranium

A modified form of uranium metal can be used as fuel in nuclear power plants. For use as a nuclear fuel, it is necessary to have uranium with a higher content of U-235; therefore, uranium undergoes an enrichment process to convert natural uranium into low enriched uranium (LEU). The U-235 content of LEU is approximately 3 percent by mass. DU is created as a byproduct of the uranium enrichment process. However, because of its high density, DU can have other uses, such as radiation shielding. DU also is used by the military for tank armor, armor-piercing projectiles, and counterweights in missiles and aircraft.

DU contains approximately 0.2 percent of U-235 by mass, with the remainder being U-238 and a very small type amount of U-234 by mass. The difference in U-235 content (by mass) can be used to distinguish natural uranium from DU (DOE 2000). The percent by mass of U-235 for each type of uranium is provided in Table 1-1.

Table 1-1. Percent U-235 by Mass in Different Types of Uranium
Jefferson Proving Ground, Madison, Indiana

Type of Uranium	Percent U-235 by Mass
Natural Uranium	0.72
Low Enriched Uranium (LEU)	3
Depleted Uranium (DU)	Approximately 0.2

Source: DOE 2000

The decay of each atom of uranium gives off radiation that, to some degree and efficiency, can be detected by laboratory instruments. Each isotope of uranium (U-238, U-235, and U-234) decays at its own characteristic rate. Since the rate of decay of U-234 is much faster than U-238 or U-235, the amount of radiation that is available to be detected from U-234 is nearly equal to that available from U-238, even though the mass of U-234 present is much smaller. The contributions for each isotope of uranium in a natural uranium mixture is provided in Table 1-2.

Table 1-2. Amount of Isotope Present by Activity for Natural Uranium
Jefferson Proving Ground, Madison, Indiana

Isotope	Percent
U-238	47.3
U-235	2.3
U-234	50.4
U-238/U-234 Ratio	1.0

Source: U.S. Army 1995

Since the radiation from the radioactive decay of uranium isotopes is relative easy to detect, the levels of activity in a sample are used to determine the relative amounts of the individual isotopes in the sample. In other words, the activity values of the uranium isotopes are used to determine the amounts of the uranium isotopes present, and hence the levels of enrichment.

When uranium is enriched, the level of U-235 is increased in the product. Because the mass of the U-234 atom is very close to the mass of the U-235 atom, the levels of U-234 also are increased in LEU. That also means that the levels of U-234 are decreased in DU. The result is that DU exhibits roughly 60 percent of the alpha radiation as naturally occurring uranium (U.S. Army 1995). The activity ratio for DU is provided in Table 1-3.

Table 1-3. Amount of Isotope Present by Activity for DU Jefferson Proving Ground, Madison, Indiana

Isotope	Percent
U-238	84.7
U-235	1.1
U-234	14.2
U-238/U-234 Ratio	6.0

Source: WISE 2006

In comparing the activity fractions for U-235 in Tables 1-2 and 1-3, the relative contribution of U-235 to the total activity in a sample is nearly the same (2.3 versus 1.1 percent). This makes the identification of an individual sample as natural uranium or DU through measurement of the U-235 activity very difficult. The ratio of U-238 to that of U-234 is significantly different between Tables 1-2 and 1-3. It is for this reason that the U-238/U-234 ratio is used as a key factor in the classification of samples. A U-238/U-234 ratio of 2 or less is representative of natural uranium, whereas higher ratios are potentially indicative of DU (U.S. Army 2002). For the purposes of this report, samples with U-238/U-234 ratios in excess of 2 will be investigated further to validate if the sample is representative of DU or of natural uranium.

Because natural uranium and DU are identical except for their isotopic composition (percentage of U-238, U-235, and U-234), their chemical characteristics are the same. Thus, their biochemical action is also the same (Royal Society 2001 and 2002).

1.2.3 Radioactivity

DU exhibits approximately 60 percent of the alpha radiation as natural uranium because some of the U-235 and much of the U-234 has been removed. The radioactive decay of DU gives off predominantly alpha-particles along with beta-particles and gamma-rays. Alpha-particles are high energy and massive and, therefore, are more biologically harmful than beta-particles or gamma-rays if they are introduced internally (ingested or inhaled). Their large size, however, prevents alpha-particles from penetrating dead skin. Beta-particles are highly energetic and can penetrate tissues up to approximately 1 centimeter compared to alpha-particles. Gamma-rays are extremely penetrating and can penetrate through several feet of concrete or a few inches of lead (USEPA 1998). The biological damage from either beta-particles or gamma-rays passing through cells is much less than alpha-rays (Royal Society 2001).

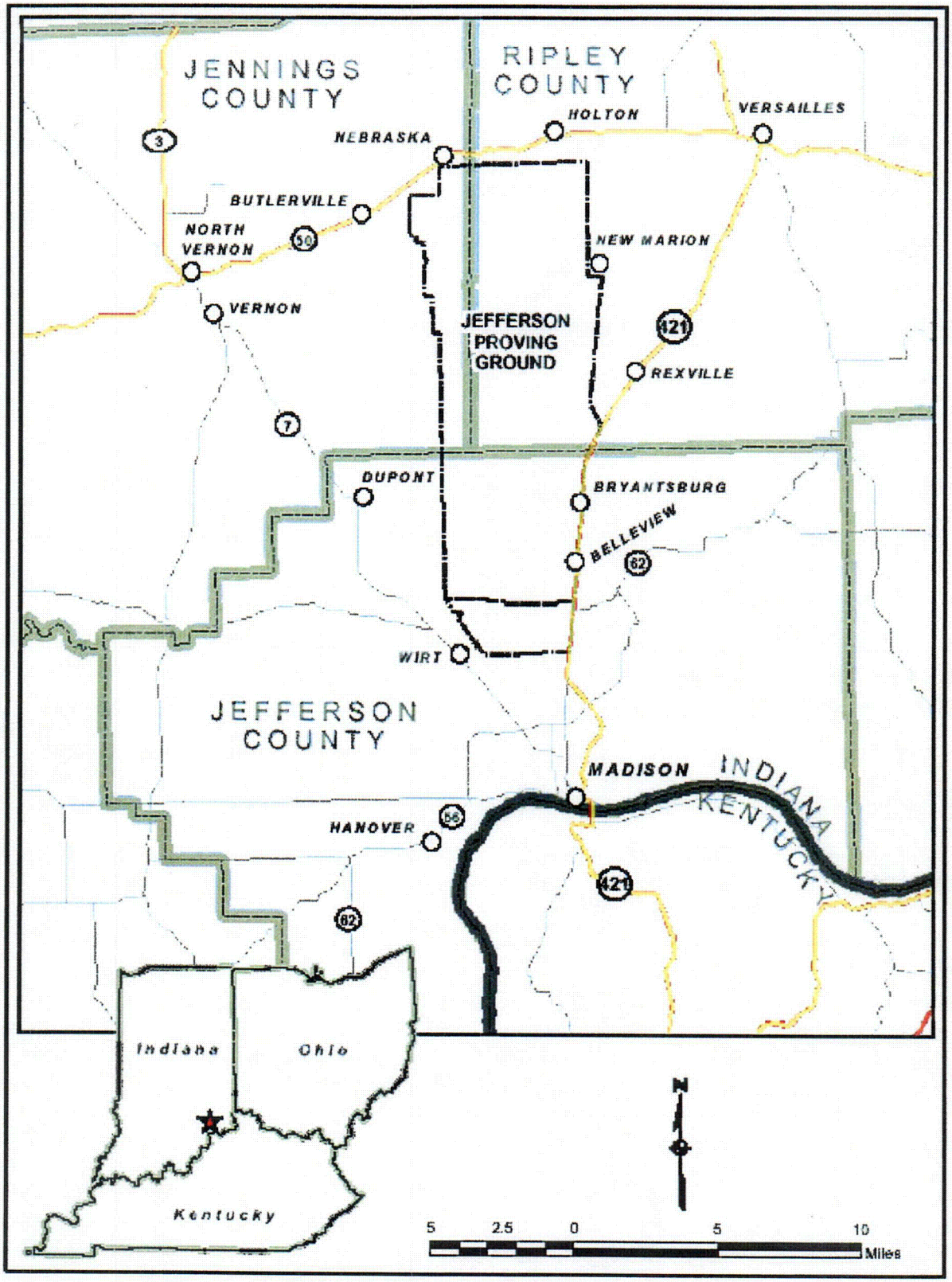


Figure 1-1. Regional Location of Jefferson Proving Ground

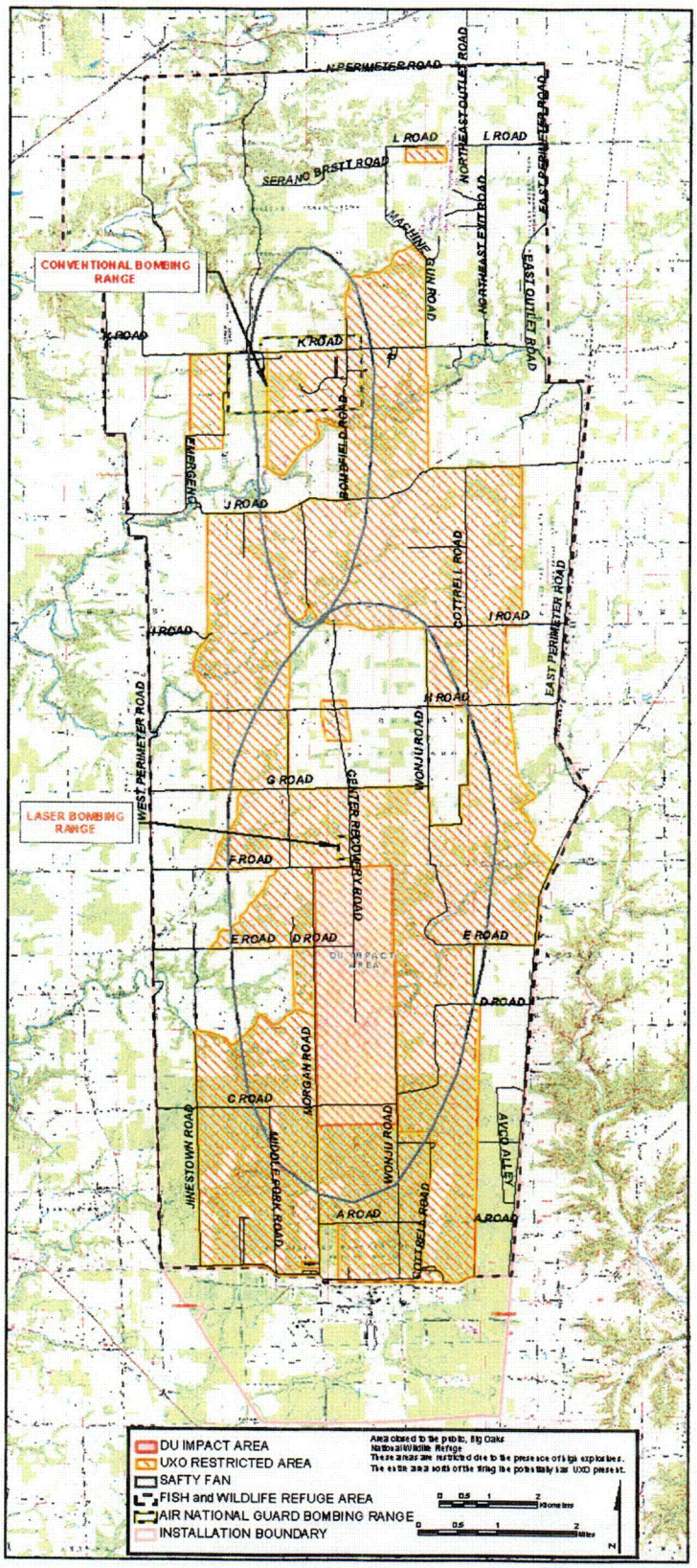


Figure 1-2. Jefferson Proving Ground, Madison, Indiana

1.3 EXPOSURE PATHWAYS

Figure 1-3 is a working graphical representation of the conceptual site model (CSM), including DU sources, release mechanisms, exposure mediums, potential exposure pathways, and potential receptors at JPG. This working draft of the CSM will be revised as data are collected throughout the site characterization program. The transport mechanisms and potential exposure pathways are described in further detail below.

The type of release affects the type and amount of DU released into the environment and the potential for exposure of humans and wildlife. In general, during the testing of DU penetrators, DU either can be released as particles in aerosols and residual metallic fragments created upon impacts with targets or nearly intact penetrators that missed their targets. While DU testing had occurred at JPG (between 1983 and 1994), humans and wildlife could have been exposed to DU from inhaling and inadvertently ingesting particles in aerosols released from the DU munitions. However, as testing operations have not been conducted at JPG since 1994, and any aerosols created by the impact of the DU penetrators with the ground surface were limited because the tests were nondestructive testing on soft cloth (non-armored) targets for trajectory purposes, this pathway is less of a concern than the subsequent inhalation of any resuspended particles from contaminated soil or dust.

DU that had been distributed on or immediately below the ground surface and/or within the surface water (streams) of the DU Impact Area as a result of the testing may be transported throughout the environment by several different processes. DU in the soil or surface water can be subject to physical movement by erosion (during floods and high runoff events) and these processes may cause migration and transport of DU penetrators along the ground surface and along the surface water drainageways. Corrosion of the DU in the surface water or soil could enable soluble forms of DU to be absorbed by plants and incorporated within the plant matter for uptake by wildlife. Although vegetation may be burned as part of a management effort or unintended fires (e.g., from lightning), the levels of DU carried in smoke associated with natural vegetation (such as the controlled burns at JPG) is not likely significant (Williams et al. 1998 and U.S. Army 2001). Leached DU from the penetrators and/or fragments in the surface water potentially could be transported to groundwater and surface water, which in turn could migrate to drinking water sources and be ingested by humans, livestock, and wildlife.

Exposure of wildlife to DU can be highly variable depending on animal behavior and recent diet in addition to the nature of the DU contamination. Wildlife that traverses the DU Impact Area may be exposed to DU from direct contact with the penetrators and/or fragments and incidental ingestion of DU or DU-impacted soils or water. In addition, wildlife may be exposed to the effects of the external radiation from the DU due to the proximity of DU (in the soil and/or water and/or sediment). Ingestion of contaminated soil could be an important exposure pathway for animals as animals typically eat more soil than humans (i.e., incidentally when licking fur or pelts or as part of their diet).

Wildlife may be exposed indirectly to DU by ingestion of plants that have taken up DU or where DU has been deposited on the leaves by wind dispersion. Plants are generally poor accumulators of uranium and concentrations of uranium in plants are several orders of magnitude lower than those in the soil in which they grow (Royal Society 2002). However, despite the generally low transfer of uranium from soil to plants, certain plant species (i.e., microbial species such as fungi, yeasts, algae, and other unicellular bacteria [Hu et al. 1996, reported in Royal Society 2002], black spruce and some forest plants [Thomas 2000, reported in Royal Society 2002], sugar beets and sunflowers [Erikkson and Evans 1983 and Dushenkov et al., reported in Royal Society 2002], and Indian mustard [*Brassica juncea*] [Edenspace 2004]) have been shown to exhibit high uptake of uranium. Nonvascular plants (mosses and lichens) generally accumulate higher concentrations than vascular plants (Cramp et al. 1990, reported in Royal Society 2002). Ingestion of microbial and plant species with accumulation of DU presents a route

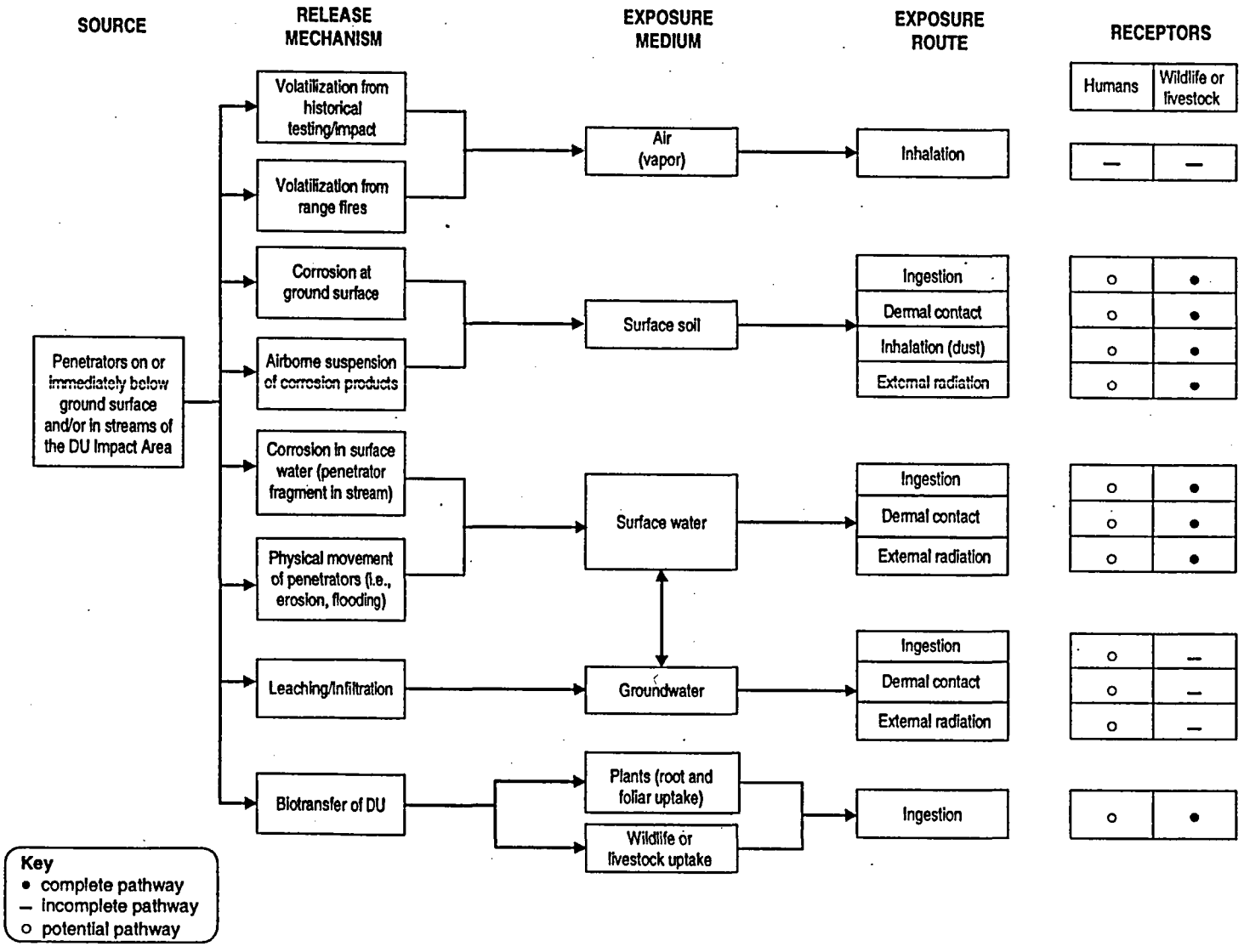


Figure 1-3. Working Conceptual Site Model of DU Transport Through the Environment at and in Close Proximity to the JPG DU Impact Area Jefferson Proving Ground, Madison, Indiana

by which higher trophic levels of wildlife can be exposed. Some accumulation of uranium has been observed in animals. Measurements of uranium in tissues of animals grazing in uranium-contaminated areas have been reported to be higher than those in control areas. Few measurements of uranium in wild animals have been made, but those compiled do not report significant accumulation in tissues (e.g., Clulow et al. 1998), although they are measurable and often elevated in whole animal samples at contaminated sites (Royal Society 2001). Ingestion of animal species with accumulation of DU presents a route by which higher trophic levels of wildlife can be exposed.

Humans at JPG also may be exposed to DU from direct contact or incidental ingestion of penetrators and/or fragments from impacted surface water during recreational activities such as hunting. As fishing is not permitted in JPG streams and the nearest fishing is several miles north of the DU Impact Area, humans are not exposed to DU from direct contact while fishing. Possible exposure pathways for humans include ingestion of food (i.e., meat and/or animal products from animals that have ingested DU impacted soil, water, or biota), water, or soil containing DU; inhalation of dust containing DU; or external radiation from the presence of DU.

Insoluble uranium from DU or natural sources that has been inhaled may deposit in the lungs and associated lymph nodes and may remain in the lungs for years. Soluble uranium, once inhaled, may be transported to the gastrointestinal tract. In addition, uranium may be deposited in the intestinal tract of humans or wildlife from ingestion (Royal Society 2001). Once inside the intestinal tract, accumulation may occur in bones, livers, or kidneys. To a lesser degree, the uranium may accumulate in the muscle. Uptake from the stomach gut to the blood is low (0.2 to 5 percent) and most ingested uranium is excreted, where it could be reingested or recycled via the soil into forage. Uptake factors of uranium from the gut to the blood for ruminants (i.e., deer, cattle, or goats) may vary depending upon environmental conditions, but are approximately five times greater than that of humans (Royal Society 2002).

Deer hunts are held annually on the former JPG reservation at Big Oaks NWR, providing a potential mechanism of human exposure to residual DU from earlier munitions tests. Approximately 400 to 800 deer are harvested per year. Although none of the existing JPG environmental reports provides conclusive evidence of elevated levels of DU migrating outside the DU Impact Area (SAIC 2005a) and hunting is not allowed in the DU Impact Area, there are no structures in place that would limit deer from entering and leaving the DU Impact Area. Local residents from surrounding communities who hunt deer at or near JPG are concerned about potential adverse health effects from exposure to DU (NRC 2004). Although NRC has acknowledged that DU concentrations in the most recently collected deer samples in 1996 were low from a human health perspective, NRC also believes there were modest total uranium increases in kidney (0.05 to 0.151 pCi/g) and bone (0.0003 to 0.416 pCi/g) compared to background samples. As a result, NRC has expressed concern that concentrations may continue to increase to levels that could affect human health (NRC 2004) and the U.S. Army agreed to conduct additional deer sampling and analysis as described in the Field Sampling Plan (SAIC 2005a) and applicable addenda.

1.4 OBJECTIVES

In order to account for any potential degradation of DU projectiles and subsequent migration of DU throughout a portion of the JPG environment over the past 10 years, the U.S. Army has prepared a 5-year site characterization study (SAIC 2005a,b,c,d). As part of this study, work plans to collect deer samples of bone, kidney, liver, and muscle tissues were prepared (SAIC 2005e,f). Muscle tissue had not been collected previously at JPG because uranium (either natural or DU) is more likely to accumulate in bone, kidney, or liver. It was included for this project because muscle most often is consumed by people in larger quantities.

The objectives of this report are to present the results of the most recent deer sampling effort and make recommendations concerning the need for additional deer sampling as well as the need for additional biota sampling at JPG.

1.5 REPORT ORGANIZATION

The Deer Tissue Sampling Results Report is organized to provide a description of the site history, overview of characteristics of uranium (natural or DU), description of potential exposure pathways, sampling methods and results, and conclusions. The information provided in each of the six sections of this report is summarized below:

- ***Section 1. Introduction***—This section provides a brief overview of the site history, characteristics of uranium and DU, exposure pathways, and objectives of the report, as well as summarizes the organization and contents.
- ***Section 2. Sample Design and Procedures***—This section provides an overview of the methods used to collect deer tissue samples.
- ***Section 3. Sample Results and Analyses***—This section summarizes the deer tissue results collected in November/December 2005 and February 2006.
- ***Section 4. Comparison with Previous Results at JPG and Other Military Installations***—This section compares the recently collected deer results with historical data at JPG as well as at other military installations where DU has been tested.
- ***Section 5. Conclusions and Future Sample Recommendations***—This section summarizes the conclusions and provides future sample recommendations concerning deer as well as other biota.
- ***Section 6. References***—This section identifies the documents used to support development of this report.
- ***Appendices***—The following appendices are included in this report:
  - Appendix A. Final Field Sampling Plan Addendum (Main Text and Appendix A)
  - Appendix B. Field Logbook
  - Appendix C. Photographs
  - Appendix D. Data Validation Summary
  - Appendix E. Historical JPG Deer Sampling Results.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

2. SAMPLE DESIGN AND PROCEDURES

This section provides an overview of the sampling design (also see SAIC 2005a) as well as the procedures used to collect the deer tissues.

2.1 SAMPLE DESIGN

Areas to the west, north, and east of the DU Impact Area are hunted for turkey and deer under the control of USFWS. The hunting zones to the west and east of the DU Impact Area are referred to as the nearby hunting zones (NHZ). Portions of the NHZ are less than 0.5 miles (0.8 kilometers) from the western boundary of the DU Impact Area, while portions of the NHZ are approximately 1 mile (1.6 kilometers) from the eastern boundary of the DU Impact Area. Hunting areas to the north of the DU Impact Area (i.e., background hunting zones [BHZ] are more than 5 miles (8.0 kilometers) from the DU Impact Area. These hunting zones are shown in Figure 2-1.

The size of the home range of a deer is approximately 1 square mile (Smith 1991), so there is potential for deer to forage in the DU Impact Area (1 mile [1.6 kilometers] in width by 3.25 miles [5,230 meters] long) and then be harvested by hunters in NHZ. However, due to the size of Big Oaks NWR, the relatively limited home range of deer, and the limited number of hunting zones near the DU Impact Area, the potential is remote for hunters in most of the hunting zones at Big Oaks NWR to harvest deer that have encountered DU in or near the DU Impact Area.

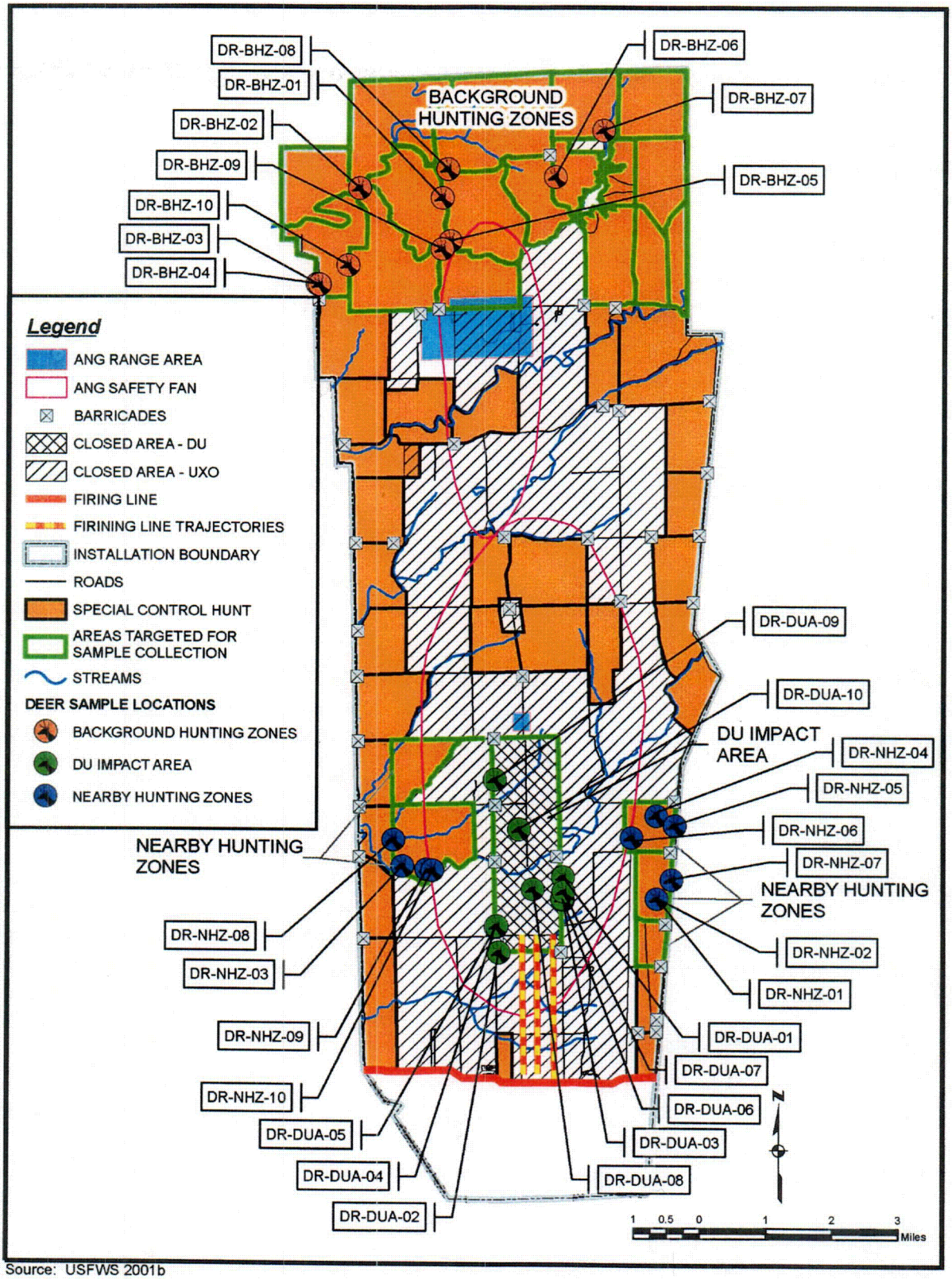
Deer samples also were collected from the DU Impact Area, which is the zone of maximum potential exposure. Based on the size of the DU Impact Area, a number of deer could forage exclusively there. Although hunting is prohibited within the DU Impact Area, the data were used to help determine if verification samples were needed (see Section 5).

In order to account for deer migration in and out of the DU Impact Area, as well as the potential for migration of DU from the DU Impact Area, 10 samples were collected from nearby NHZ (Figure 2-1; west and east of DU Impact Area within 2 miles of the DU Impact Area boundary). These deer could have been exposed to DU in either the DU Impact Area and/or DU that might have migrated beyond the boundaries of the DU Impact Area. Please note that none of the existing JPG environmental reports provides conclusive evidence of elevated levels of DU migrating outside the DU Impact Area (SAIC 2005a).

Given the limited size of the home range of deer, background data were collected from northern hunting zones at Big Oaks NWR (BHZ in Figure 2-1), which are more than 5 miles (8 kilometers) from the DU Impact Area. These deer are not likely to have either visited the DU Impact Area or come in contact with any migrating DU based on available data. Section 3.3 provides additional information on the home range of deer.

2.2 SAMPLE PROCEDURES

The initial phase of deer sampling was conducted between November 28 and December 8, 2005. During that phase, 10 deer were collected from the DU Impact Area and 2 deer were collected from the BHZ. Sampling initially started in the NHZ and BHZ, but was largely unsuccessful as the deer were skittish from the public hunting season that had ended the week before. Sampling was completed in the DU Impact Area, which is off-limits to hunting. Rather than continue sampling in the NHZ and BHZ, the sampling was delayed until February, at which time deer in these zones would be easier to harvest after they had become accustomed to feeding at the bait stations. The second phase of sampling occurred in February 2006. Between February 21 and February 24, 2006, 10 deer were collected from the NHZ and 8 deer were collected from the BHZ. As part of the Field Sampling Plan Addendum (SAIC 2005f), the



Source: USFWS 2001b

Figure 2-1. Biological Tissue Sampling Locations

sample design included harvesting six deer from the NHZ to the west of the DU Impact Area and harvesting four deer from the NHZ to the east of the DU Impact Area. However, at the time of sampling, deer were more prevalent in the eastern NHZ. As a result, four deer were harvested from the NHZ to the west of the DU Impact Area and six deer were harvested from the NHZ to the east of the DU Impact Area. All of the NHZ deer were harvested within 2 miles of the boundary of the DU Impact Area and the change from the Field Sampling Plan Addendum is not significant to the results. All of these deer potentially could have been exposed to DU and all could have been harvested by hunters.

Specific deer tissues were collected from each deer. Kidney, bone (3 to 4 inches from foreleg), liver, and muscle were collected. Each sample was approximately 100 grams, except for the bone, which was approximately 30 grams. Teeth samples also were collected by Science Applications International Corporation (SAIC) to age the deer in the event that it would be beneficial in interpreting the data (e.g., to determine if there was a correlation between the age of the deer and the presence of DU in the tissue).

USFWS started at dusk (approximately 4:30 p.m.) each night to review the bait stations in the three sampling areas. All deer were collected using a high-powered rifle and scope. Once USFWS collected a deer, they placed cyalume glow sticks and/or flags to mark the exact location of the killed deer. USFWS then called SAIC personnel, who would rendezvous at the sample location and park their vehicles along the road. The senior unexploded ordnance (UXO) supervisor and health physics technician (HPT) cleared a path to the deer and collected radiological and global positioning system (GPS) readings. After the monitoring and readings were completed and the path was determined to be safe, the deer was brought back to the parked SAIC vehicle using a deer cart. The deer was weighed by suspending it within a net from a scale from the truck bed. The sex and weight of each deer, as well as the GPS coordinates of each collection site, were noted in the field logbook (Appendix B). In addition, the hunting areas specified by USFWS for access permits (USFWS 2006) were recorded in the logbook. In instances where obtaining an accurate GPS reading was problematic (DR-NHZ-04) or GPS coordinates were transcribed incompletely (DR-BHZ-02, DR-NHZ-03, and DR-NHZ-06) or likely transposed (DR-BHZ-01), the locations indicated in Figure 2-1 were based on the recorded hunting area.

Once weighed, the deer was placed on a clean piece of plastic sheeting on the bed of the SAIC truck. Each plastic sheeting was replaced between sampling of each individual deer. The sampler(s), wearing clean nitrile gloves (over protective gloves), began the deer dissection. The jaw was cut first, with a bone saw, to collect teeth samples. Then, the foreleg (below the knee) was removed using the bone saw. Fur and any tissue were scraped from the bone to provide a relatively clean bone sample.

The sampler then used a clean knife to begin the gross dissection and expose the abdominal cavity and muscle. The kidney, liver, and muscle samples were harvested with a new, clean scalpel. The samples were placed into clean glass jars and labeled. The HPT monitored the sample jars before they were bubble-wrapped and placed in the cooler. A duplicate sample was collected from one deer within each sampling area. Appendix C contains photographs of various deer sampling field tasks.

Once all of the samples were collected, the deer carcass was disposed of just off the roadside according to USFWS instructions. The HPT monitored personnel (feet and hands) and the deer cart. SAIC personnel decontaminated the bone saw and knives used during the dissection by placing them in a clean plastic tub, cleaned with a scrub brush and Alconox®, then rinsed off with deionized (DI) water. The scalpels were disposed of in a sharps container. The personnel protective clothing, gloves, plastic sheeting, and booties were scanned by the HPT and were thrown away, since readings did not indicate radiological contamination.

At the end of each night, the samples were taken from the cooler and placed into a freezer in a secured room until they were shipped to the laboratory. No samples were shipped to the laboratory until they had been in the freezer at least 48 hours. In preparation for shipping, the samples were double bagged in Ziploc® bags and packed into shipping coolers with frozen gel packs.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

3. SAMPLE RESULTS AND ANALYSES

This section provides an overview of the sample results for total uranium as well as the isotopic analyses to determine the source of the uranium. In addition, the suitability of the BHZ as background is discussed.

3.1 SAMPLE RESULTS

Deer tissue samples were collected from 30 deer (10 within the DU Impact Area, 10 from the NHZ to the DU Impact Area, and 10 from BHZ locations). No unusual external anomalies were noted on any of the captured deer by USFWS (Robb 2006). Samples were collected from the kidney, bone, liver, and muscles of each deer and analyzed for isotopic uranium (U-234, U-235, and U-238). One set of duplicate samples for each tissue type was collected from each deer in each sample area. Of the 132 isotopic uranium analyses conducted on the deer tissues, isotopes of uranium (U-234, U-235, or U-238) were detected in 38 of the analyses conducted. Of these 38 detected isotopes, none of the concentrations of uranium was attributed to DU.

Table 3-1 presents the ranges of total uranium concentrations and average total uranium concentrations per tissue type per sample area. In general, average total uranium concentrations were slightly higher in tissues less likely to be consumed by hunters (bone and kidney tissues) compared to tissues more likely to be consumed by hunters (liver and muscle), as expected for uranium. The highest total uranium concentration (0.074 pCi/g) from any tissue type was detected in a kidney sample from the BHZ, whereas the lowest total uranium concentration (0.014 pCi/g) from any tissue type was detected in a kidney sample from the DU Impact Area. The highest average total uranium concentration (0.019 pCi/g) was detected in kidney from the BHZ. Each sampling area had the highest average total uranium concentrations for at least one tissue type. There is overlap between total average uranium concentrations in the different tissues between the different sample groups. These results suggest that tissue concentrations of total uranium are similar throughout JPG, regardless of how close the deer were collected to the DU Impact Area. A comparison of these results to historical tissue data collected at JPG is presented in Section 4.

Table 3-2 identifies the specific deer samples with the maximum total uranium concentrations per tissue type per area. For each tissue type in each sample area, a different deer had the maximum total uranium concentration. These data again support that tissue concentrations of total uranium are similar throughout JPG as no one deer or no few deer consistently had the maximum total uranium concentrations for each tissue type.

In Table 3-3, the number of deer with at least one of the uranium isotopes (U-234, U-235, and U-238) detected is presented. In some deer, there were no detections of any isotopes. Uranium isotopes were detected less frequently in kidney and liver than in bone and muscle samples, but just barely. Based on the total uranium data presented in Tables 3-1 through 3-3, there is no indication that one group of deer had been exposed to greater levels of uranium.

3.2 ANALYSES OF SOURCES OF URANIUM

To determine whether the measured uranium present was due to DU or natural uranium, the U-238/U-234 ratio was calculated in Tables 3-4 through 3-6 (presented at the end of Section 3) for each sampling area. A U-238/U-234 ratio of 2 or less is representative of natural uranium, whereas higher ratios are potentially indicative of DU (U.S. Army 2002). Based on these calculations, there is no indication of the presence of DU in the deer tissues that were collected in any of the three study areas.

Table 3-1. Summary of Total Uranium in Deer Tissue Jefferson Proving Ground, Madison, Indiana

Exposure Unit	Tissue Type	Number of Samples[a]	Range of Total Uranium Concentration[b] (pCi/g)	Average Total Uranium Concentration[b] (pCi/g)
BHZ[c]	Bone	11	0.007 – 0.033	0.016
DU Impact Area	Bone	11	0.008 – 0.069	0.02
NHZ	Bone	11	0.0004 – 0.032	0.013
BHZ[c]	Kidney	11	0.003 - 0.074	0.019
DU Impact Area	Kidney	11	0.004 - 0.014	0.009
NHZ	Kidney	11	0.007 - 0.022	0.012
BHZ[c]	Liver	11	0.007 - 0.020	0.012
DU Impact Area	Liver	11	0.004 - 0.016	0.01
NHZ	Liver	11	0.005 - 0.022	0.012
BHZ[c]	Muscle	11	0.005 - 0.020	0.012
DU Impact Area	Muscle	11	0.001 - 0.019	0.008
NHZ	Muscle	11	0.008 - 0.021	0.013

[a] Eleven samples where collected from 10 deer. One duplicate sample was collected from each tissue type in each exposure unit.
[b] In instances were an isotope of uranium was not detected, the isotope was assumed to be present at the reporting limit.
[c] These hunting zones are more than 5 miles north of the DU Impact Area within the Big Oak NWR.

Table 3-2. Tissue-specific Summary Data from Deer Sampling Jefferson Proving Ground, Madison, Indiana

Tissue	Tissue Sample with Maximum Total Uranium Concentration*	Maximum Total Uranium Concentration (pC/g)
Bone		
DU Impact Area	DR-DUIA-01	0.0689
NHZ	DR-NHZ-02D	0.0323
BHZ	DR-BHZ-10	0.0334
Kidney		
DU Impact Area	DR-DUIA-09	0.0142
NHZ	DR-NHZ-01	0.0222
BHZ	DR-BHZ-07	0.0743
Liver		
DU Impact Area	DR-DUIA-04D	0.0163
NHZ	DR-NHZ-07	0.0221
BHZ	DR-BHZ-06	0.0196
Muscle		
DU Impact Area	DR-DUIA-07	0.0187
NHZ	DR-NHZ-01	0.0205
BHZ	DR-BHZ-09	0.0202

* In instances where an isotope of uranium was not detected, the isotope was assumed to be present at the reporting limit and included in the total uranium concentration.

Table 3-3. Summary of Deer Tissue with Uranium Isotopes Detected Jefferson Proving Ground, Madison, Indiana

Exposure Area	Tissue Type	Number of Deer with U-234, U-235, or U-238 Detected	Any Indication of DU?*
BHZ	Bone	7 of 10	No
DU Impact Area	Bone	7 of 10	No
NHZ	Bone	7 of 10	No
BHZ	Kidney	6 of 10	No
DU Impact Area	Kidney	4 of 10	No
NHZ	Kidney	4 of 10	No
BHZ	Liver	6 of 10	No
DU Impact Area	Liver	5 of 10	No
NHZ	Liver	5 of 10	No
BHZ	Muscle	9 of 10	No
DU Impact Area	Muscle	4 of 10	No
NHZ	Muscle	8 of 10	No

* Samples exhibiting U-238/U-234 ratios less than 2 are likely of natural origin (see Tables 3-4 through 3-6 for ratios).

As discussed in Section 2, teeth samples also were collected to estimate the age of the deer in order to investigate trends (e.g., to determine whether a correlation exists between the age of the deer and the presence of DU in the tissue). These data are not presented, since DU was not detected in any tissue samples.

3.3 ADEQUACY OF BACKGROUND SAMPLES

The size of the home range of a deer is approximately 1 square mile (Smith 1991). Given the limited size of the home range of deer, background data were collected from the BHZ at Big Oaks NWR, which is more than 5 miles (8.0 kilometers) from the DU Impact Area. There are two assumptions inherent to the selection of the BHZ as a suitable background area. First, given the distance from the DU Impact Area, there is no reason to believe that the BHZ is contaminated with DU. Second, deer collected in the BHZ would not have traveled at some point to the DU Impact Area, been exposed to DU, and then returned to the BHZ. There are a number of factors that could affect deer home range size, including food, cover, and hunting pressure. Without a tagging study, it is not possible to state with 100 percent certainty that the deer collected in the BHZ did not visit the DU Impact Area at some point previously. However, given the size of Big Oaks NWR and the limited home range of deer, it seems unlikely that many, if any, would have visited the DU Impact Area.

Finally, the safeguard against incorporating improper background data from JPG is the use of isotopic ratios that indicate the presence/absence of DU. The analysis of these ratios allows the opportunity to collect background samples onsite. Had the ratio(s) from the BHZ been greater than 2 and indicated DU, those samples would have been considered for removal from the dataset. Based on the absence of DU in any of the BHZ samples, the BHZ samples are considered to be suitable background samples.

3.4 STATISTICS

No formal statistical comparisons were conducted to determine whether deer from the NHZ, DU Impact Area, and BHZ were from the same population because no DU was detected in any samples. Based on qualitative comparisons of the data presented in Tables 3-1 through 3-3, all three groups would

appear to be from the same statistical population. No single group had either the highest or lowest total uranium concentrations for each tissue type. Regardless, the absence of DU in any of the tissue types is the most important result. Without DU in the tissues, there is no exposure pathway from deer to hunters.

3.5 SUMMARY

Each sampling area (NHZ, DU Impact Area, and BHZ) had the highest average total uranium concentrations for at least one tissue type. There is overlap between total average uranium concentrations in the different tissues between the different sample groups. The total uranium concentration data showed similar levels in tissue throughout JPG regardless of how close the deer were collected to the DU Impact Area. Thus, despite the potential for greater exposure to DU in the NHZ and DU Impact Area deer than the BHZ deer, tissue concentrations were essentially the same.

The U-238/U-234 ratios indicated the presence of natural uranium. Thus, from the perspective of DU contamination, the deer appear to be healthy. Based on these results, hunters would not be exposed to DU via ingestion of deer tissues at JPG. The absence of DU in the BHZ deer tissues supports their selection as suitable background samples. In a manner similar to the total uranium concentration data, proximity to the DU Impact Area did not necessarily result in the highest U-238/U-234 ratios. In fact, the highest individual ratios were observed for two (bone and muscle) of the four tissue types from deer collected in the BHZ. The NHZ had the highest kidney and liver U-238/U-234 ratios.

Table 3-4. Isotopic Uranium in Background Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
Bone Tissue			
DR-BHZ-01	SAICB	U-234	0.0047 U
DR-BHZ-01	SAICB	U-235	-0.0004 U**
DR-BHZ-01	SAICB	U-238	0.0027 U
		Total Uranium	**0.007**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-02	SAICB	U-234	0.0104 J
DR-BHZ-02	SAICB	U-235	0.0015 U
DR-BHZ-02	SAICB	U-238	0.0086 J
		Total Uranium	**0.0205**
		U-238/U-234 Ratio*	**0.83**
DR-BHZ-02	SAICBD	U-234	0.0108 J
DR-BHZ-02	SAICBD	U-235	0.0036 U
DR-BHZ-02	SAICBD	U-238	0.0016 U
		Total Uranium	**0.016**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-03	SAICB	U-234	0.0015 U
DR-BHZ-03	SAICB	U-235	0.001 U
DR-BHZ-03	SAICB	U-238	0.0057 J
		Total Uranium	**0.0082**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-04	SAICB	U-234	0.0049 U
DR-BHZ-04	SAICB	U-235	0.0008 U
DR-BHZ-04	SAICB	U-238	0.0031 J
		Total Uranium	**0.0088**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-05	SAICB	U-234	0.0079 J
DR-BHZ-05	SAICB	U-235	-0.0004 U
DR-BHZ-05	SAICB	U-238	0.0119 J
		Total Uranium	**0.0194**
		U-238/U-234 Ratio*	**1.5**
DR-BHZ-06	SAICB	U-234	0.0056 U
DR-BHZ-06	SAICB	U-235	0.0071 J
DR-BHZ-06	SAICB	U-238	0.0016 U
		Total Uranium	**0.0143**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-07	SAICB	U-234	0.006 U
DR-BHZ-07	SAICB	U-235	0.0012 U
DR-BHZ-07	SAICB	U-238	0.0023 U
		Total Uranium	**0.0095**
		U-238/U-234 Ratio*	**ND**

Table 3-4. Isotopic Uranium in Background Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-BHZ-08	SAICB	U-234	0.0116 J
DR-BHZ-08	SAICB	U-235	0.004 U
DR-BHZ-08	SAICB	U-238	0.002 U
		Total Uranium	**0.0176**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-09	SAICB	U-234	0.0025 U
DR-BHZ-09	SAICB	U-235	0.0015 U
DR-BHZ-09	SAICB	U-238	0.0025 U
		Total Uranium	**0.0065**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-10	SAICB	U-234	0.019 J
DR-BHZ-10	SAICB	U-235	0.005 U
DR-BHZ-10	SAICB	U-238	0.0094 J
		Total Uranium	**0.0334**
		U-238/U-234 Ratio*	**0.49**
Kidney Tissue			
DR-BHZ-01	SAICK	U-234	0.0054 U
DR-BHZ-01	SAICK	U-235	0.0012 U
DR-BHZ-01	SAICK	U-238	0.001 U
		Total Uranium	**0.0076**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-02	SAICK	U-234	0.0052 U
DR-BHZ-02	SAICK	U-235	0.0023 U
DR-BHZ-02	SAICK	U-238	0.0016 U
		Total Uranium	**0.0091**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-03	SAICK	U-234	0.0007 U
DR-BHZ-03	SAICK	U-235	-0.0002 U
DR-BHZ-03	SAICK	U-238	0.0021 U
		Total Uranium	**0.0026**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-04	SAICK	U-234	0.0043 J
DR-BHZ-04	SAICK	U-235	0.0031 J
DR-BHZ-04	SAICK	U-238	0.0038 U
		Total Uranium	**0.0112**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-04	SAICKD	U-234	0.0023 U
DR-BHZ-04	SAICKD	U-235	0.0026 U
DR-BHZ-04	SAICKD	U-238	0.0015 U
		Total Uranium	**0.0064**
		U-238/U-234 Ratio*	**ND**

Table 3-4. Isotopic Uranium in Background Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-BHZ-05	SAICK	U-234	0.0139 J
DR-BHZ-05	SAICK	U-235	0.0058 J
DR-BHZ-05	SAICK	U-238	0.0052 U
		Total Uranium	**0.0249**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-06	SAICK	U-234	0.0081 J
DR-BHZ-06	SAICK	U-235	0.0069 J
DR-BHZ-06	SAICK	U-238	0.0031 U
		Total Uranium	**0.0181**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-07	SAICK	U-234	0.071
DR-BHZ-07	SAICK	U-235	0.0015 U
DR-BHZ-07	SAICK	U-238	0.0018 U
		Total Uranium	**0.0743**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-08	SAICK	U-234	0.0106 J
DR-BHZ-08	SAICK	U-235	0.0021 U
DR-BHZ-08	SAICK	U-238	0.0011 U
		Total Uranium	**0.0138**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-09	SAICK	U-234	0.0079 U
DR-BHZ-09	SAICK	U-235	0.0009 U
DR-BHZ-09	SAICK	U-238	0.0053 U
		Total Uranium	**0.0141**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-10	SAICK	U-234	0.021 J
DR-BHZ-10	SAICK	U-235	-0.0001 U
DR-BHZ-10	SAICK	U-238	0.0059 U
		Total Uranium	**0.0268**
		U-238/U-234 Ratio*	**ND**
Liver Tissue			
DR-BHZ-01	SAICL	U-234	0.0024 U
DR-BHZ-01	SAICL	U-235	0.0016 U
DR-BHZ-01	SAICL	U-238	0.0033 U
		Total Uranium	**0.0073**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-02	SAICL	U-234	0.0127 J
DR-BHZ-02	SAICL	U-235	0.0024 J
DR-BHZ-02	SAICL	U-238	0.0014 U
		Total Uranium	**0.0165**
		U-238/U-234 Ratio*	**ND**

Table 3-4. Isotopic Uranium in Background Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-BHZ-02	SAICLD	U-234	0.0033 U
DR-BHZ-02	SAICLD	U-235	0.0005 U
DR-BHZ-02	SAICLD	U-238	0.0032 U
		Total Uranium	**0.007**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-03	SAICL	U-234	0.0068 J
DR-BHZ-03	SAICL	U-235	0.0011 U
DR-BHZ-03	SAICL	U-238	0.0026 U
		Total Uranium	**0.0105**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-04	SAICL	U-234	0.0063 U
DR-BHZ-04	SAICL	U-235	0.0013 U
DR-BHZ-04	SAICL	U-238	0.001 U
		Total Uranium	**0.0086**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-05	SAICL	U-234	0.0071 J
DR-BHZ-05	SAICL	U-235	0.0031 U
DR-BHZ-05	SAICL	U-238	0.0069 U
		Total Uranium	**0.0171**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-06	SAICL	U-234	0.009 U
DR-BHZ-06	SAICL	U-235	0.0041 U
DR-BHZ-06	SAICL	U-238	0.0065 U
		Total Uranium	**0.0196**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-07	SAICL	U-234	0.0062 J
DR-BHZ-07	SAICL	U-235	0.0009 U
DR-BHZ-07	SAICL	U-238	-0.0001 U
		Total Uranium	**0.007**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-08	SAICL	U-234	0.0085 J
DR-BHZ-08	SAICL	U-235	-0.001 U
DR-BHZ-08	SAICL	U-238	0.0092 J
		Total Uranium	**0.0167**
		U-238/U-234 Ratio*	**1.08**
DR-BHZ-09	SAICL	U-234	0.0033 U
DR-BHZ-09	SAICL	U-235	0.003 U
DR-BHZ-09	SAICL	U-238	0.0026 U
		Total Uranium	**0.0089**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-10	SAICL	U-234	0.0089 J
DR-BHZ-10	SAICL	U-235	-0.0005 U
DR-BHZ-10	SAICL	U-238	0.0029 U
		Total Uranium	**0.0113**
		U-238/U-234 Ratio*	**ND**

Table 3-4. Isotopic Uranium in Background Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
Muscle Tissue			
DR-BHZ-01	SAICM	U-234	0.0066 U
DR-BHZ-01	SAICM	U-235	0.0016 U
DR-BHZ-01	SAICM	U-238	0.0006 U
		Total Uranium	**0.0088**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-02	SAICM	U-234	0.0036 U
DR-BHZ-02	SAICM	U-235	0.0005 U
DR-BHZ-02	SAICM	U-238	0.0006 U
		Total Uranium	**0.0047**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-02	SAICMD	U-234	0.0072 J
DR-BHZ-02	SAICMD	U-235	0.0009 U
DR-BHZ-02	SAICMD	U-238	0.0056 J
		Total Uranium	**0.0137**
		U-238/U-234 Ratio*	**0.78**
DR-BHZ-03	SAICM	U-234	0.0052 U
DR-BHZ-03	SAICM	U-235	0.0017 U
DR-BHZ-03	SAICM	U-238	0.0077 J
		Total Uranium	**0.0146**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-04	SAICM	U-234	0.0073 J
DR-BHZ-04	SAICM	U-235	0.0014 U
DR-BHZ-04	SAICM	U-238	0.0023 U
		Total Uranium	**0.011**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-05	SAICM	U-234	0.0115 J
DR-BHZ-05	SAICM	U-235	0.0037 U
DR-BHZ-05	SAICM	U-238	0.0032 U
		Total Uranium	**0.0184**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-06	SAICM	U-234	0.0061 J
DR-BHZ-06	SAICM	U-235	-0.0004 U
DR-BHZ-06	SAICM	U-238	0.0016 U
		Total Uranium	**0.0073**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-07	SAICM	U-234	0.0046 J
DR-BHZ-07	SAICM	U-235	0.0009 U
DR-BHZ-07	SAICM	U-238	0.0006 U
		Total Uranium	**0.0061**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-08	SAICM	U-234	0.0107 J
DR-BHZ-08	SAICM	U-235	0.0008 U
DR-BHZ-08	SAICM	U-238	0.0021 U
		Total Uranium	**0.0136**
		U-238/U-234 Ratio*	**ND**

Table 3-4. Isotopic Uranium in Background Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-BHZ-09	SAICM	U-234	0.0121 J
DR-BHZ-09	SAICM	U-235	0.0051 U
DR-BHZ-09	SAICM	U-238	0.003 U
		Total Uranium	**0.0202**
		U-238/U-234 Ratio*	**ND**
DR-BHZ-10	SAICM	U-234	0.0081 J
DR-BHZ-10	SAICM	U-235	0.0024 U
DR-BHZ-10	SAICM	U-238	0.0034 U
		Total Uranium	**0.0139**
		U-238/U-234 Ratio*	**ND**

* Unitless.

** The negative values in the results column (pCi/g) indicate that the background count of the analysis was greater than the sample count. When a sample measurement is zero or very small (i.e., near the detection limit of the equipment), subtracting out equipment background can result in a negative number.

J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.

ND – Indicates that one or more isotopes were not detected; therefore, the calculation was not conducted.

U – Indicates that the data met all QA/QC requirements, and that the radionuclide was analyzed for but was not detected above the reported sample quantitation limit.

Table 3-5. Isotopic Uranium in Depleted Uranium Impact Area Deer Tissue Jefferson Proving Ground, Madison, Indiana

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
Bone Tissue			
DR-DUA-01	SAICB	U-234	0.066 J
DR-DUA-01	SAICB	U-235	0.0013 U
DR-DUA-01	SAICB	U-238	0.0016 U
		Total Uranium	**0.0689**
		U-238/U-234 Ratio*	**ND**
DR-DUA-02	SAICB	U-234	0.0067 U
DR-DUA-02	SAICB	U-235	0.0008 U
DR-DUA-02	SAICB	U-238	0.0003 U
		Total Uranium	**0.0078**
		U-238/U-234 Ratio*	**ND**
DR-DUA-03	SAICB	U-234	0.0058 J
DR-DUA-03	SAICB	U-235	0.0012 U
DR-DUA-03	SAICB	U-238	0.0036 U
		Total Uranium	**0.0106**
		U-238/U-234 Ratio*	**ND**
DR-DUA-04	SAICB	U-234	0.016 J
DR-DUA-04	SAICB	U-235	0 U
DR-DUA-04	SAICB	U-238	-0.0011 U**
		Total Uranium	**0.0149**
		U-238/U-234 Ratio*	**ND**
DR-DUA-04	SAICBD	U-234	0.0041 U
DR-DUA-04	SAICBD	U-235	0.0046 U
DR-DUA-04	SAICBD	U-238	0.0014 U
		Total Uranium	**0.0101**
		U-238/U-234 Ratio*	**ND**
DR-DUA-05	SAICB	U-234	0.0116 J
DR-DUA-05	SAICB	U-235	0.0026 U
DR-DUA-05	SAICB	U-238	0.0029 U
		Total Uranium	**0.0171**
		U-238/U-234 Ratio*	**ND**
DR-DUA-06	SAICB	U-234	0.0086 J
DR-DUA-06	SAICB	U-235	0.0022 U
DR-DUA-06	SAICB	U-238	0.0043 U
		Total Uranium	**0.0151**
		U-238/U-234 Ratio*	**ND**
DR-DUA-07	SAICB	U-234	0.02 J
DR-DUA-07	SAICB	U-235	-0.001 UJ
DR-DUA-07	SAICB	U-238	0.0094 UJ
		Total Uranium	**0.0284**
		U-238/U-234 Ratio*	**ND**

Table 3-5. Isotopic Uranium in Depleted Uranium Impact Area Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-DUA-08	SAICB	U-234	0.0037 U
DR-DUA-08	SAICB	U-235	0.0043 U
DR-DUA-08	SAICB	U-238	0.0026 U
		Total Uranium	**0.0106**
		U-238/U-234 Ratio*	**ND**
DR-DUA-09	SAICB	U-234	0.015 U
DR-DUA-09	SAICB	U-235	0.0034 U
DR-DUA-09	SAICB	U-238	0.0064 U
		Total Uranium	**0.0248**
		U-238/U-234 Ratio*	**ND**
DR-DUA-10	SAICB	U-234	0.0112 UJ
DR-DUA-10	SAICB	U-235	-0.0036 UJ
DR-DUA-10	SAICB	U-238	0.0061 UJ
		Total Uranium	**0.0137**
		U-238/U-234 Ratio*	**ND**
Kidney Tissue			
DR-DUA-01	SAICK	U-234	0.0049 U
DR-DUA-01	SAICK	U-235	0.0012 U
DR-DUA-01	SAICK	U-238	0.002 U
		Total Uranium	**0.0081**
		U-238/U-234 Ratio*	**ND**
DR-DUA-02	SAICK	U-234	0.0041 U
DR-DUA-02	SAICK	U-235	0.0005 U
DR-DUA-02	SAICK	U-238	-0.0001 U
		Total Uranium	**0.0045**
		U-238/U-234 Ratio*	**ND**
DR-DUA-03	SAICK	U-234	0.0024 U
DR-DUA-03	SAICK	U-235	0.0007 U
DR-DUA-03	SAICK	U-238	0.0016 U
		Total Uranium	**0.0047**
		U-238/U-234 Ratio*	**ND**
DR-DUA-04	SAICK	U-234	0.0022 U
DR-DUA-04	SAICK	U-235	0 U
DR-DUA-04	SAICK	U-238	0.0014 U
		Total Uranium	**0.0036**
		U-238/U-234 Ratio*	**ND**
DR-DUA-04	SAICKD	U-234	0.0034 U
DR-DUA-04	SAICKD	U-235	0.0015 U
DR-DUA-04	SAICKD	U-238	0.0018 U
		Total Uranium	**0.0067**
		U-238/U-234 Ratio*	**ND**

Table 3-5. Isotopic Uranium in Depleted Uranium Impact Area Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-DUA-05	SAICK	U-234	0.0075 J
DR-DUA-05	SAICK	U-235	0 U
DR-DUA-05	SAICK	U-238	0.0033 J
		Total Uranium	**0.0108**
		U-238/U-234 Ratio*	**0.44**
DR-DUA-06	SAICK	U-234	0.0062 J
DR-DUA-06	SAICK	U-235	0.0008 U
DR-DUA-06	SAICK	U-238	0.0057 U
		Total Uranium	**0.0127**
		U-238/U-234 Ratio*	**ND**
DR-DUA-07	SAICK	U-234	0.0074 U
DR-DUA-07	SAICK	U-235	0.0025 U
DR-DUA-07	SAICK	U-238	0.002 U
		Total Uranium	**0.0119**
		U-238/U-234 Ratio*	**ND**
DR-DUA-08	SAICK	U-234	0.0069 J
DR-DUA-08	SAICK	U-235	-0.0002 U
DR-DUA-08	SAICK	U-238	0.004 J
		Total Uranium	**0.0107**
		U-238/U-234 Ratio*	**0.58**
DR-DUA-09	SAICK	U-234	0.0114 J
DR-DUA-09	SAICK	U-235	0.0006 U
DR-DUA-09	SAICK	U-238	0.0022 U
		Total Uranium	**0.0142**
		U-238/U-234 Ratio*	**ND**
DR-DUA-10	SAICK	U-234	0.0055 U
DR-DUA-10	SAICK	U-235	-0.0002 U
DR-DUA-10	SAICK	U-238	0.0018 U
		Total Uranium	**0.0071**
		U-238/U-234 Ratio*	**ND**
Liver Tissue			
DR-DUA-01	SAICL	U-234	0.0039 U
DR-DUA-01	SAICL	U-235	0.0011 U
DR-DUA-01	SAICL	U-238	0.0019 U
		Total Uranium	**0.0069**
		U-238/U-234 Ratio*	**ND**
DR-DUA-02	SAICL	U-234	0.0105 J
DR-DUA-02	SAICL	U-235	0.0008 U
DR-DUA-02	SAICL	U-238	0.0019 J
		Total Uranium	**0.0132**
		U-238/U-234 Ratio*	**0.18**

Table 3-5. Isotopic Uranium in Depleted Uranium Impact Area Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-DUA-03	SAICL	U-234	0.0042 U
DR-DUA-03	SAICL	U-235	0 U
DR-DUA-03	SAICL	U-238	0.0022 U
		Total Uranium	**0.0064**
		U-238/U-234 Ratio*	**ND**
DR-DUA-04	SAICL	U-234	0.0106 J
DR-DUA-04	SAICL	U-235	0.0007 U
DR-DUA-04	SAICL	U-238	0.0028 U
		Total Uranium	**0.0141**
		U-238/U-234 Ratio*	**ND**
DR-DUA-04	SAICLD	U-234	0.0117 J
DR-DUA-04	SAICLD	U-235	0.0038 U
DR-DUA-04	SAICLD	U-238	0.0008 U
		Total Uranium	**0.0163**
		U-238/U-234 Ratio*	**ND**
DR-DUA-05	SAICL	U-234	0.0006 U
DR-DUA-05	SAICL	U-235	0 U
DR-DUA-05	SAICL	U-238	0.0035 U
		Total Uranium	**0.0041**
		U-238/U-234 Ratio*	**ND**
DR-DUA-06	SAICL	U-234	0.0084 J
DR-DUA-06	SAICL	U-235	0 U
DR-DUA-06	SAICL	U-238	0.001 U
		Total Uranium	**0.0094**
		U-238/U-234 Ratio*	**ND**
DR-DUA-07	SAICL	U-234	0.0044 U
DR-DUA-07	SAICL	U-235	0.0022 U
DR-DUA-07	SAICL	U-238	-0.0005 U
		Total Uranium	**0.0061**
		U-238/U-234 Ratio*	**ND**
DR-DUA-08	SAICL	U-234	0.0098 J
DR-DUA-08	SAICL	U-235	0.0013 U
DR-DUA-08	SAICL	U-238	0.0007 U
		Total Uranium	**0.0118**
		U-238/U-234 Ratio*	**ND**
DR-DUA-09	SAICL	U-234	0.0072 J
DR-DUA-09	SAICL	U-235	0.0023 U
DR-DUA-09	SAICL	U-238	-0.0006 U
		Total Uranium	**0.0089**
		U-238/U-234 Ratio*	**ND**
DR-DUA-10	SAICL	U-234	0.003 U
DR-DUA-10	SAICL	U-235	0.0022 U
DR-DUA-10	SAICL	U-238	0.0027 U
		Total Uranium	**0.0079**
		U-238/U-234 Ratio*	**ND**

Table 3-5. Isotopic Uranium in Depleted Uranium Impact Area Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
Muscle Tissue			
DR-DUA-01	SAICM	U-234	0.0061 J
DR-DUA-01	SAICM	U-235	-0.0006 U
DR-DUA-01	SAICM	U-238	0.0006 U
		Total Uranium	**0.0061**
		U-238/U-234 Ratio*	**ND**
DR-DUA-02	SAICM	U-234	0.0024 U
DR-DUA-02	SAICM	U-235	-0.0011 U
DR-DUA-02	SAICM	U-238	-0.0001 U
		Total Uranium	**0.0012**
		U-238/U-234 Ratio*	**ND**
DR-DUA-03	SAICM	U-234	0.0038 U
DR-DUA-03	SAICM	U-235	-0.0016 U
DR-DUA-03	SAICM	U-238	-0.0009 U
		Total Uranium	**0.0013**
		U-238/U-234 Ratio*	**ND**
DR-DUA-04	SAICM	U-234	0.0095 J
DR-DUA-04	SAICM	U-235	0.0045 U
DR-DUA-04	SAICM	U-238	0.0003 U
		Total Uranium	**0.0143**
		U-238/U-234 Ratio*	**ND**
DR-DUA-04	SAICMD	U-234	0.0073 J
DR-DUA-04	SAICMD	U-235	0.001 U
DR-DUA-04	SAICMD	U-238	0.0001 U
		Total Uranium	**0.0084**
		U-238/U-234 Ratio*	**ND**
DR-DUA-05	SAICM	U-234	0.0021 U
DR-DUA-05	SAICM	U-235	0 U
DR-DUA-05	SAICM	U-238	0.002 U
		Total Uranium	**0.0041**
		U-238/U-234 Ratio*	**ND**
DR-DUA-06	SAICM	U-234	0.0067 J
DR-DUA-06	SAICM	U-235	0.0026 U
DR-DUA-06	SAICM	U-238	0.0029 U
		Total Uranium	**0.0122**
		U-238/U-234 Ratio*	**ND**
DR-DUA-07	SAICM	U-234	0.0139 J
DR-DUA-07	SAICM	U-235	0.001 U
DR-DUA-07	SAICM	U-238	0.0038 U
		Total Uranium	**0.0187**
		U-238/U-234 Ratio*	**ND**

Table 3-5. Isotopic Uranium in Depleted Uranium Impact Area Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-DUA-08	SAICM	U-234	0.0052 U
DR-DUA-08	SAICM	U-235	0.0001 U
DR-DUA-08	SAICM	U-238	0.0021 U
		Total Uranium	**0.0074**
		U-238/U-234 Ratio*	**ND**
DR-DUA-09	SAICM	U-234	0.0027 U
DR-DUA-09	SAICM	U-235	-0.0002 U
DR-DUA-09	SAICM	U-238	0.0037 U
		Total Uranium	**0.0062**
		U-238/U-234 Ratio*	**ND**
DR-DUA-10	SAICM	U-234	0.007 U
DR-DUA-10	SAICM	U-235	0.0027 U
DR-DUA-10	SAICM	U-238	0.0013 U
		Total Uranium	**0.011**
		U-238/U-234 Ratio*	**ND**

* Unitless.

** The negative values in the results column (pCi/g) indicate that the background count of the analysis was greater than the sample count. When a sample measurement is zero or very small (i.e., near the detection limit of the equipment), subtracting out equipment background can result in a negative number.

J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.

ND – Indicates that one or more isotopes were not detected; therefore, the calculation was not conducted.

U – Indicates that the data met all QA/QC requirements, and that the radionuclide was analyzed for but was not detected above the reported sample quantitation limit.

Table 3-6. Isotopic Uranium in Nearby Hunting Zones Deer Tissue
Jefferson Proving Ground, Madison, Indiana

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
Bone Tissue			
DR-NHZ-01	SAICB	U-234	0.0054 J
DR-NHZ-01	SAICB	U-235	0.0009 U
DR-NHZ-01	SAICB	U-238	0.0054 U
		Total Uranium	**0.0117**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-02	SAICB	U-234	0.0112 J
DR-NHZ-02	SAICB	U-235	0.0052 U
DR-NHZ-02	SAICB	U-238	0.0021 U
		Total Uranium	**0.0185**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-02	SAICBD	U-234	0.021 J
DR-NHZ-02	SAICBD	U-235	0.0064 U
DR-NHZ-02	SAICBD	U-238	0.0049 U
		Total Uranium	**0.0323**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-03	SAICB	U-234	0.0041 J
DR-NHZ-03	SAICB	U-235	0.0048 J
DR-NHZ-03	SAICB	U-238	0.0041 J
		Total Uranium	**0.013**
		U-238/U-234 Ratio*	**1**
DR-NHZ-04	SAICB	U-234	0.0081 J
DR-NHZ-04	SAICB	U-235	0.0037 U
DR-NHZ-04	SAICB	U-238	0.0069 J
		Total Uranium	**0.0187**
		U-238/U-234 Ratio*	**0.85**
DR-NHZ-05	SAICB	U-234	0.0019 U
DR-NHZ-05	SAICB	U-235	-0.0002 U**
DR-NHZ-05	SAICB	U-238	0.0033 U
		Total Uranium	**0.005**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-06	SAICB	U-234	0.0055 U
DR-NHZ-06	SAICB	U-235	-0.0008 U
DR-NHZ-06	SAICB	U-238	0.0013 U
		Total Uranium	**0.006**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-07	SAICB	U-234	0.0077 J
DR-NHZ-07	SAICB	U-235	0.0013 U
DR-NHZ-07	SAICB	U-238	0.0021 U
		Total Uranium	**0.0111**
		U-238/U-234 Ratio*	**ND**

Table 3-6. Isotopic Uranium in Nearby Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-NHZ-08	SAICB	U-234	0.0013 U
DR-NHZ-08	SAICB	U-235	-0.002 U
DR-NHZ-08	SAICB	U-238	0.0011 U
		Total Uranium	**0.0004**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-09	SAICB	U-234	0.0062 J
DR-NHZ-09	SAICB	U-235	0.0008 U
DR-NHZ-09	SAICB	U-238	0.0032 U
		Total Uranium	**0.0102**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-10	SAICB	U-234	0.0116 J
DR-NHZ-10	SAICB	U-235	0.001 U
DR-NHZ-10	SAICB	U-238	0.001 U
		Total Uranium	**0.0136**
		U-238/U-234 Ratio*	**ND**
Kidney Tissue			
DR-NHZ-01	SAICK	U-234	0.01 J
DR-NHZ-01	SAICK	U-235	0.0056 J
DR-NHZ-01	SAICK	U-238	0.0066 J
		Total Uranium	**0.0222**
		U-238/U-234 Ratio*	**0.66**
DR-NHZ-02	SAICK	U-234	0.0017 U
DR-NHZ-02	SAICK	U-235	0.0035 U
DR-NHZ-02	SAICK	U-238	0.0053 U
		Total Uranium	**0.0105**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-02	SAICKD	U-234	0.0054 U
DR-NHZ-02	SAICKD	U-235	0.0036 U
DR-NHZ-02	SAICKD	U-238	0.0045 U
		Total Uranium	**0.0135**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-03	SAICK	U-234	0.0122 J
DR-NHZ-03	SAICK	U-235	0.005 U
DR-NHZ-03	SAICK	U-238	0.0042 U
		Total Uranium	**0.0214**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-04	SAICK	U-234	0.004 U
DR-NHZ-04	SAICK	U-235	-0.0002 U
DR-NHZ-04	SAICK	U-238	0.003 U
		Total Uranium	**0.0068**
		U-238/U-234 Ratio*	**ND**

Table 3-6. Isotopic Uranium in Nearby Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-NHZ-05	SAICK	U-234	0.0074 J
DR-NHZ-05	SAICK	U-235	0 U
DR-NHZ-05	SAICK	U-238	0.0065 J
		Total Uranium	**0.0139**
		U-238/U-234 Ratio*	**0.88**
DR-NHZ-06	SAICK	U-234	0.0066 J
DR-NHZ-06	SAICK	U-235	0.0016 U
DR-NHZ-06	SAICK	U-238	0.0003 U
		Total Uranium	**0.0085**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-07	SAICK	U-234	0.007 U
DR-NHZ-07	SAICK	U-235	0.0003 U
DR-NHZ-07	SAICK	U-238	0.0034 U
		Total Uranium	**0.0107**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-08	SAICK	U-234	0.0038 U
DR-NHZ-08	SAICK	U-235	0.001 U
DR-NHZ-08	SAICK	U-238	0.0049 U
		Total Uranium	**0.0097**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-09	SAICK	U-234	0.0064 U
DR-NHZ-09	SAICK	U-235	-0.0008 U
DR-NHZ-09	SAICK	U-238	0.0057 U
		Total Uranium	**0.0113**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-10	SAICK	U-234	0.0039 U
DR-NHZ-10	SAICK	U-235	0.001 U
DR-NHZ-10	SAICK	U-238	0.0036 U
		Total Uranium	**0.0085**
		U-238/U-234 Ratio*	**ND**
Liver Tissue			
DR-NHZ-01	SAICL	U-234	0.0057 J
DR-NHZ-01	SAICL	U-235	0.0022 J
DR-NHZ-01	SAICL	U-238	0.003 U
		Total Uranium	**0.0109**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-02	SAICL	U-234	0.0086 U
DR-NHZ-02	SAICL	U-235	0.0014 U
DR-NHZ-02	SAICL	U-238	0.0016 U
		Total Uranium	**0.0116**
		U-238/U-234 Ratio*	**ND**

Table 3-6. Isotopic Uranium in Nearby Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-NHZ-02	SAICLD	U-234	0.0116 J
DR-NHZ-02	SAICLD	U-235	0.0041 J
DR-NHZ-02	SAICLD	U-238	0.0058 J
		Total Uranium	**0.0215**
		U-238/U-234 Ratio*	**0.5**
DR-NHZ-03	SAICL	U-234	0.0082 J
DR-NHZ-03	SAICL	U-235	-0.0007 U
DR-NHZ-03	SAICL	U-238	0.0036 U
		Total Uranium	**0.0111**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-04	SAICL	U-234	0.0067 U
DR-NHZ-04	SAICL	U-235	0.0029 U
DR-NHZ-04	SAICL	U-238	0.0015 U
		Total Uranium	**0.0111**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-05	SAICL	U-234	0.0073 U
DR-NHZ-05	SAICL	U-235	0.0003 U
DR-NHZ-05	SAICL	U-238	0.0011 U
		Total Uranium	**0.0087**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-06	SAICL	U-234	0.0102 J
DR-NHZ-06	SAICL	U-235	0.0019 U
DR-NHZ-06	SAICL	U-238	-0.0004 U
		Total Uranium	**0.0117**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-07	SAICL	U-234	0.0074 J
DR-NHZ-07	SAICL	U-235	0.002 U
DR-NHZ-07	SAICL	U-238	0.0127 U
		Total Uranium	**0.0221**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-08	SAICL	U-234	0.002 U
DR-NHZ-08	SAICL	U-235	0.0026 U
DR-NHZ-08	SAICL	U-238	0.0007 U
		Total Uranium	**0.0053**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-09	SAICL	U-234	0.0067 U
DR-NHZ-09	SAICL	U-235	0.0006 U
DR-NHZ-09	SAICL	U-238	0.0031 U
		Total Uranium	**0.0104**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-10	SAICL	U-234	0.0035 U
DR-NHZ-10	SAICL	U-235	0.0014 U
DR-NHZ-10	SAICL	U-238	0.0032 U
		Total Uranium	**0.0081**
		U-238/U-234 Ratio*	**ND**

Table 3-6. Isotopic Uranium in Nearby Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
Muscle Tissue			
DR-NHZ-01	SAICM	U-234	0.0139
DR-NHZ-01	SAICM	U-235	0.003 U
DR-NHZ-01	SAICM	U-238	0.0036 U
		Total Uranium	**0.0205**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-02	SAICM	U-234	0.0122 J
DR-NHZ-02	SAICM	U-235	0.0016 U
DR-NHZ-02	SAICM	U-238	0.0029 U
		Total Uranium	**0.0167**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-02	SAICMD	U-234	0.0135 J
DR-NHZ-02	SAICMD	U-235	0.0026 U
DR-NHZ-02	SAICMD	U-238	0.003 U
		Total Uranium	**0.0191**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-03	SAICM	U-234	0.0072 J
DR-NHZ-03	SAICM	U-235	0.0006 U
DR-NHZ-03	SAICM	U-238	-0.0002 U
		Total Uranium	**0.0076**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-04	SAICM	U-234	0.0076 J
DR-NHZ-04	SAICM	U-235	0.0028 U
DR-NHZ-04	SAICM	U-238	0.0032 U
		Total Uranium	**0.0136**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-05	SAICM	U-234	0.0043 U
DR-NHZ-05	SAICM	U-235	0.002 U
DR-NHZ-05	SAICM	U-238	0.0033 U
		Total Uranium	**0.0096**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-06	SAICM	U-234	0.0061 J
DR-NHZ-06	SAICM	U-235	0.0015 U
DR-NHZ-06	SAICM	U-238	0.0023 U
		Total Uranium	**0.0099**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-07	SAICM	U-234	0.0047 J
DR-NHZ-07	SAICM	U-235	0.0026 J
DR-NHZ-07	SAICM	U-238	0.0026 U
		Total Uranium	**0.0099**
		U-238/U-234 Ratio*	**ND**

Table 3-6. Isotopic Uranium in Nearby Hunting Zones Deer Tissue Jefferson Proving Ground, Madison, Indiana (Continued)

Sample Designation	Sample I.D.	Analyte	Result (pCi/g)
DR-NHZ-08	SAICM	U-234	0.0066 J
DR-NHZ-08	SAICM	U-235	0.0007 U
DR-NHZ-08	SAICM	U-238	0.004 U
		Total Uranium	**0.0113**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-09	SAICM	U-234	0.0045 U
DR-NHZ-09	SAICM	U-235	0.0005 U
DR-NHZ-09	SAICM	U-238	0.0065 J
		Total Uranium	**0.0115**
		U-238/U-234 Ratio*	**ND**
DR-NHZ-10	SAICM	U-234	0.0073 U
DR-NHZ-10	SAICM	U-235	0.0043 U
DR-NHZ-10	SAICM	U-238	0.0039 U
		Total Uranium	**0.0155**
		U-238/U-234 Ratio*	**ND**

* Unitless.

** The negative values in the results column (pCi/g) indicate that the background count of the analysis was greater than the sample count. When a sample measurement is zero or very small (i.e., near the detection limit of the equipment), subtracting out equipment background can result in a negative number.

J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.

ND – Indicates that one or more isotopes were not detected; therefore, the calculation was not conducted.

U – Indicates that the data met all QA/QC requirements, and that the radionuclide was analyzed for but was not detected above the reported sample quantitation limit.

4. COMPARISON WITH PREVIOUS RESULTS AT JPG AND OTHER MILITARY INSTALLATIONS

This section compares the results of the deer sampling conducted in December 2005 and February 2006 to historical deer sampling conducted at JPG (Ebinger and Hansen 1996; SEG 1996). In addition, this section includes a comparison of the results of the deer sampling at JPG to deer sampling at other installations that fired DU projectiles as part of a munitions testing program (i.e., Aberdeen Proving Ground [APG]).

4.1 HISTORICAL AND CURRENT RESULTS AT JPG

A total of 50 deer liver, kidney, or bone samples were collected and analyzed for U-234 and U-238 isotopes in 1984, 1987, 1992, and 1993 (Table 4-1) (Ebinger and Hansen 1996). The deer were collected from within the DU Impact Area. No deer were collected from a background or uncontaminated location as part of this investigation. Although measurements of total uranium did not include the U-235 isotope, U-235 is a very small portion of the total uranium concentration (see Section 1). Concentrations of total uranium isotopes analyzed in the samples were low (less than 0.4 pCi/g) and did not indicate an impact from DU (U.S. Army 2002). As discussed in Section 4, U-238/U-234 ratios of 2 or less are representative of natural uranium, whereas higher ratios are indicative of DU. The U-238/U-234 activity ratios ranged from 0.3 to 1.5. The analytical results of these sampling events have been reproduced and are presented in Appendix E (Table E-1).

Three deer tissue samples (one liver, one kidney, and one bone sample) were collected during the site characterization survey (Table 4-1) (SEG 1996). These tissue samples were collected from a 4- to 5-year-old female deer within the DU Impact Area. No deer were collected from a background or uncontaminated area as part of this investigation. Concentrations of total uranium in the samples were 0.09, 0.15, and 0.42 pCi/g for liver, kidney, and bone tissue samples, respectively. The U-238 to U-234 activity ratios of 0.63, 0.43, and 0.64 for the liver, kidney, and bone tissues, respectively, did not indicate the presence of DU contamination in the deer tissue. The analytical results of this sampling event have been reproduced and are presented in Appendix E (Table E-2).

Table 4-1. Historical Deer Sampling by Year at JPG Jefferson Proving Ground, Madison, Indiana

Year	Number of Deer	Number of Samples	Tissue Types	Associated Report
1984	9	19	Liver, kidney, and bone	Ebinger and Hanson (1996)
1984	4	4	Unspecified location or body part	Ebinger and Hanson (1996)
1987	16	16	Bone, kidney, or liver	Ebinger and Hanson (1996)
1992	3	6	Kidney, liver	Ebinger and Hanson (1996)
1993	5	5	Kidney*	Ebinger and Hanson (1996)
1996	1	3	Liver, kidney, and bone	SEG (1996)
Total	**38**	**53**		

* Organ is assumed to be kidney in Ebinger and Hansen 1996.

A more robust sampling was conducted as part of the JPG 2005/06 deer sampling described in this report. Samples were analyzed for isotopes of U-234, U-235, and U-238 from a total of 30 deer from 3 areas. A total of 120 tissue samples and the associated duplicates from the bone, liver, kidney, or muscle of the deer were analyzed. The results of this sampling event are presented in Tables 3-4 through 3-6. Similar to the previous deer sampling results from 1984 to 1993 discussed in Ebinger and Hanson (1996), concentrations of total uranium in the deer tissue samples were low and uranium isotopes often were

below method detection limits (0.0017 to 0.107 pCi/g). Concentrations of total uranium in the 2005/06 sampled deer tissue ranged from 0.0004 to 0.074 pCi/g. The maximum concentrations of total uranium in the 2005/06 deer were less than the maximum concentrations associated with the deer sampling results presented in both the Ebinger and Hansen report (Ebinger and Hansen 1996) and the site characterization survey (SEG 1996).

As noted previously (in Section 1), NRC was concerned that modest increases of total uranium concentrations in kidney (from 0.05 to 0.151 pCi/g) and bone (0.0003 to 0.416 pCi/g) compared to background were indicative of a potential trend of increasing concentrations of uranium in deer tissue that could affect human health (NRC 2004). However, based on the data collected from 1984 to 2006, total uranium concentrations in deer tissue are not increasing over time. For all of the samples where isotopes of both U-238 and U-234 were detected and a ratio could be calculated, the U-238/U-234 ratio was less than 2 in all of the sampling events, indicating the absence of DU in all deer tissues collected to date.

4.2 HISTORICAL RESULTS AT APG AND CURRENT RESULTS AT JPG

Since the 1970s, DU has been used as a penetrator in munitions and testing programs at APG. Activities that have resulted in deposition of DU in the environment have occurred at multiple locations at APG. The testing program has included testing of munitions on hard targets in an enclosed environment (i.e., Ranges 9, 14, 110, and Bomb Throwing Device Area), hard targets in an open outdoor environment (e.g., Transonic Range and Superbox Area), and soft targets in an open outdoor environment (i.e., DU Soft Target Range) (Williams et al. 1998). By 1995, approximately 70,000 kg of DU had been fired into outdoor APG impact areas for testing at both hard and soft targets, with approximately 20 percent of the penetrators fired recovered (Kennedy et al. 1995). As a result of the testing program at APG, 70,000 kg of DU has been deposited on more than 1,500 acres (Fan et al. 2005). Most penetrator impacts occurred within approximately 500 meters of the firing axis after the DU munitions passed through soft targets used to check accuracy and performance. During July and October 1992, a total of 30 deer (25 in the impact area of APG and 5 from a control group from the Eastern Shore of Maryland, approximately 10 miles east of APG) were collected for tissue residue analysis. Kidney, liver, muscle, and bone tissues were collected from the deer, dried, ashed, and analyzed by ICP-MS for uranium (Ebinger et al. 1996).

At APG, concentrations in kidney and bone samples were significantly higher in impact area deer than offsite deer, whereas liver and muscle tissue samples were not significantly different in the two groups. Although the APG deer sampling data suggest that impact area deer tissue showed higher uranium concentrations than offsite deer tissue because of probable exposures to DU from penetrator testing, the uranium concentrations in the samples from the impact area were too low to determine the isotopic ratio and, thus, the source (i.e., natural uranium or DU) (Ebinger et al. 1996). Although formal statistics were not conducted on the JPG deer because no DU was detected, the average and median total uranium activity was greater in three of the four tissue types collected from the background (BHZ) deer than from the DU Impact Area deer. The average and median total uranium activity between APG deer from impact area and offsite locations and JPG deer from impact area and background locations is presented in Table 4-2.

There were differences in the methodology (i.e., inductively coupled plasma used in conjunction with mass spectroscopy [ICP/MS] for APG deer versus alpha-spectrometry for JPG deer) that limit the direct comparability of the data from APG and JPG. In addition, the extremely low isotopic uranium levels limit the direct comparability of the data between the background (BHZ) and DU Impact Area deer tissue. Many of the isotopic activity results were estimated as the difference between the result and the associated uncertainty was less than the sample-specific minimal database concentration. Despite these limitations, it can be stated, in general, concentrations of total uranium in deer tissue from APG and JPG impact areas and control areas are low, with the highest total uranium concentration from all of the data sets being 0.42 pCi/g from a bone tissue sample collected from the JPG DU Impact Area (SEG 1996).

Table 4-2. Comparison of Historical APG and Current JPG Deer Tissue Results Jefferson Proving Ground, Madison, Indiana

Tissue	Average Activity (pCi/g)*	Median Activity (pCi/g)*	Number of Samples	Average Activity (pCi/g)*	Median Activity (pCi/g)*	Number of Samples
	APG Impact Area (Main Front Firing Range) Deer Sample Results			*JPG DU Impact Area Deer Sample Results*		
Kidney	4.3E-04	2.6E-04	24	8.6E-03	8.1E-03	11
Liver	2.1E-04	1.3E-04	25	9.6E-03	8.9E-03	11
Muscle	2.6E-04	2.0E-04	19	8.3E-03	7.4E-03	11
Bone	2.7E-03	2.0E-03	18	2.0E-02	1.5E-02	11
Tissue	**Average Activity (pCi/g)***	**Median Activity (pCi/g)***	**Number of Samples**	**Average Activity (pCi/g)***	**Median Activity (pCi/g)***	**Number of Samples**
	APG Control Area (Deer Sampled from Cecil County on the Eastern Shore)			*JPG Control Area (Deer Sampled from BHZ in Big Oaks NWR)*		
Kidney	1.3E-04	1.8E-04	3	1.9E-02	1.4E-02	11
Liver	4.0E-04	4.0E-04	2	1.2E-02	1.1E-02	11
Muscle	1.0E-04	NC	1	1.2E-02	1.4E-02	11
Bone	3.4E-04	3.4E-04	2	1.5E-02	1.4E-02	11

* The total uranium concentrations at APG deer samples include isotopes of U-234 and U-238. Total uranium concentrations of JPG deer samples include isotopes of U-234, U-235, and U-238.

NC = Not Calculated. A median value was not calculated as only one sample was analyzed.

pCi/g = picocuries per gram.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

5. CONCLUSIONS AND FUTURE SAMPLE RECOMMENDATIONS

This section presents the conclusions associated with the deer sampling event as well as recommendations for future deer and other biota sampling.

5.1 CONCLUSIONS

Based on the data presented in Section 3, consumption of deer tissue does not appear to be a potentially significant exposure pathway for DU at JPG. Of the 132 samples analyzed, DU was not detected in any tissue samples. Based on qualitative observation of the data, deer collected within the DU Impact Area did not have total uranium levels or uranium isotopic ratios that differed from either the NHZ or BHZ. If DU uptake were occurring in deer, higher total uranium levels and isotopic ratios greater than 2 would be expected in the deer from the DU Impact Area, where the greatest potential for exposures occur, but the total uranium levels were not elevated and all ratios were lower than 2.

The concentrations of uranium in deer are below those detected historically at JPG. There does not appear to be any increasing trends in the 2005/06 deer samples compared to the 1996 deer sample. At APG, where DU also has been tested as discussed in Section 4, the presence or absence of DU in deer tissue could not be confirmed. However, as DU testing commenced in the 1970s at APG, there has been another decade for degradation and subsequent uptake into deer compared to JPG. The use of hard targets at APG also would have created more finely dispersed uranium available for uptake. Although the ecosystems at APG and JPG are not exactly the same, it is reasonable to conclude that factors at APG are more conducive for bioaccumulation of DU. One attribute of increased uptake would be higher total uranium concentrations. As this does not appear to be the case (APG deer had lower total uranium concentrations than JPG deer), the APG data, while not conclusive, support that uptake of DU by deer is not a potentially significant exposure pathway to humans.

5.2 RECOMMENDATIONS

The 5-year site characterization study includes tentative plans for a verification round of the deer sampling, as well as initial and verification rounds for other biota. Sections 5.2.1 and 5.2.2 make recommendations concerning the need for such sampling.

5.2.1 Deer Sampling

As specified in the Field Sampling Plan (SAIC 2005a), if no DU was detected in the deer tissue from the NHZ and the DU Impact Area above background levels, verification sampling of deer in 2007 would not occur. The uranium isotope detections in the 2005/06 deer samples all were indicative of natural uranium. In particular, no DU was detected in the deer most likely to contain DU, those collected from the DU Impact Area. Based on the recently collected deer data, validation sampling of deer for DU is not warranted.

5.2.2 Other Biota Sampling

As specified in the Field Sampling Plan (SAIC 2005a) and Addendum (SAIC 2005f), the trigger to collect tissue data from other biota is based on a weight-of-evidence approach using the results of the abiotic sampling as well as the tissue sampling. Using the abiotic data, none of the existing JPG environmental reports provides conclusive evidence of elevated levels of DU migrating outside the DU Impact Area. No increasing or decreasing trends have been identified in the Environmental Radiation Program (SAIC 2005a). NRC expressed concern that total uranium concentrations (based on one deer sample) may continue to increase to levels that could affect human health (NRC 2004), and the Army agreed to conduct additional deer sampling and analysis as described in the Field Sampling Plan (SAIC 2005a) and applicable addenda. DU was not detected in any deer samples collected during the

most recent sampling, including those from the DU Impact Area, the area most likely for exposure and subsequent uptake. In fact, the concentrations of total uranium in deer are below those detected historically at JPG. As a result, there are no current triggers to support further testing of biota, and no additional biota testing, in accordance with the site characterization plan, is scheduled or anticipated.

6. REFERENCES

Clulow F.V, N. K. Dave, T. P. Lim, and R. Avadhanula. 1998. Radionuclides (lead-210, polonium-210, thorium-230, and thorium-232) and thorium and uranium in water, sediments, and fish from lakes near the city of Elliot Lake, Ontario, Canada. Environmental Pollution 99(2), 199-213.

Cramp, T.J., Y.S. Cuff, A. Davis, and J.E. Morgan. 1990. Review of Data for Uranium, Nickel, and Cobalt. Report 2150-R1. Associated Nuclear Services, Epson.

DOE (U.S. Department of Energy). 2000. Guide *of Good Practices for Occupational Radiological Protection in Uranium Facilities*, DOE-STD-1136-2000, U.S. Department of Energy. August.

Dushenkov, S., Vasudev D., Kapulnik, Y., Gleba D., Fleisher, D., Ting K. C., and Ensley, B. 1997. (reported in Royal Society 2002). Removal of Uranium from water using terrestrial plants. Environmental Science & Technology 31(12), 3468-3474.

Ebinger, M. and W. Hansen. 1996. JPG Data Summary and Risk Assessment. Submitted to the U.S. Army Test and Evaluation Command by Los Alamos National Laboratory, New Mexico.

Ebinger, M., P. Kennedy, O. Myers, W. Clements, H. Bestgen, and R. Beckman. 1996. Long-Term Fate of Depleted Uranium at Aberdeen and Yuma Proving Grounds, Phase II: Human Health and Ecological Risk Assessments. Submitted to the U.S. Army Test and Evaluation Command by Los Alamos National Laboratory, New Mexico.

Edenspace (Edenspace Systems Corporation). 2004. Phytoremediation of Depleted Uranium in an Arid Environment.

Erikkson, A. and S. Evans. 1983. (reported in Royal Society 2002). Uranium, thorium and radium in soils and crop s-calculations of transfer factors. Swedish Nuclear Fuel and Waste Management Co (SKB): Stockholm, Sweden.

Fan, M., T. Thongstri, L. Axe, and T. Tyson. 2005. Using a Probabilistic Approach in an Ecological Risk Assessment Tool: Test Case for Depleted Uranium. Chemosphere 60. pp 111-125.

Hu MZ-C, J.M. Norman, and B.D. Faison. 1996. Biosorption of uranium by pseudomonas aeruginosa strain CSU: characterization and comparison studies. Biotechnol Bioeng 51, 137-167.

Kennedy, P.L., W.H. Clements, O.B. Myers, H.T. Bestgen, and D.G. Jenkins. 1995. Evaluation of Depleted Uranium in the Environment at Aberdeen Proving Grounds, Maryland and Yuma Proving Grounds, Arizona. Final.

NRC (Nuclear Regulatory Commission). 2004. Request for Additional information to Support NRC's Evaluation of the Proposed Changes to the Environmental Radiation Monitoring Program Plan for Jefferson Proving Ground (License SUB-1435). Letter from Tom McLaughlin, Project Manager, Materials Decommissioning Branch, NRC to Colonel Mike Mullins, Rock Island Arsenal, U.S. Army. May 20.

Robb. J. 2006. E-mail communication from Joe Robb (USFWS) to Michael Barta (SAIC) regarding the deer sampling. June 8.

Royal Society. 2001. *The Health Hazards of Depleted Uranium Munitions Part 1.* May.

Royal Society. 2002. *The Health Hazards of DU Munitions Part II.* March.

SAIC (Science Applications International Corporation). 1997. Base Realignment and Closure Cleanup Plan. Version 3. Prepared for the U.S. Army Environmental Corps (USAEC) under Contract DACA31-94-D-0066, DO 0001. June.

SAIC. 2005a. Field Sampling Plan, Site Characterization of the Depleted Uranium Impact Area. Final. May.

SAIC. 2005b. Health and Safety Plan, Site Characterization of the Depleted Uranium Impact Area. Final. May.

SAIC. 2005c. Quality Control Plan, Site Characterization of the Depleted Uranium Impact Area. Final. May.

SAIC. 2005d. Memorandum, Airborne Transport of DU and Site Characterization Needs. From Corinne Shia, SAIC to Paul Cloud, BRAC Environmental Coordinator and Joyce Kuykendall, Radiation Safety Officer, U.S. Army. January 13.

SAIC. 2005e. Health and Safety Plan Addendum, Site Characterization, Deer Sampling of the Depleted Uranium Impact Area. Draft. November.

SAIC. 2005f. Field Sampling Plan Addendum, Site Characterization of the Depleted Uranium Impact Area. Final. November.

SEG (Scientific Ecology Group). 1995. JPG Depleted Uranium Impact Area, Scoping Survey Report. Volumes 1 - 3. March.

SEG. 1996. Jefferson Proving Ground Depleted Uranium Impact Area Characterization Survey Report. Volume 1. Oak Ridge, Tennessee. February.

Smith, W.P. 1991. *Odocoileus virginianus*. Mammalian species. 388:1-13.

Thomas, P.A. 2000. (reported in Royal Society 2002). Radionuclides in the terrestrial ecosystems near a Canadian uranium mill –Part 1: Distribution and doses. Health Physics 78(6), 614-624.

U.S. Army. 1995. Health and Environmental Consequences of Depleted Uranium Use in the U.S. Army: Technical Report. June.

U.S. Army. 2000. Memorandum of Agreement Between the U.S. Army, U.S. Air Force, and U.S. Fish and Wildlife Service.

U.S. Army. 2001. Controlled Burn Air Sampling Technical Report. Aberdeen Proving Ground. August.

U.S. Army. 2002. Decommissioning Plan for License SUB-1435. Jefferson Proving Ground, Madison, Indiana. Prepared for the U.S. Army SBCCOM by SAIC. June.

USEPA (U.S. Environmental Protection Agency). 1998. Ionizing Radiation Fact Sheet Series Number 1, http://www.epa.gov/radiation/docs/ionize/402-f-98-009.htm).

USFWS (U.S. Fish and Wildlife Service). 2006. Big Oaks National Wildlife Refuge Overall Public Use Map, http://www.fws.gov/Midwest/bigoaks/maps.htm.

Williams, G.P., A.M. Hermes, A.J. Policastro, H.M. Hartmann, and D. Tomasko. 1998. Potential Health Impacts from Range Fires at Aberdeen Proving Ground, Maryland. Argonne National Laboratory, Argonne, IL. 84 pp.

WISE (World Information Service On Energy Uranium Project). 2006. *World Information Service On Energy Uranium Project*, http://www.wise-uranium.org/index.html

APPENDIX A

FINAL FIELD SAMPLING PLAN ADDENDUM
(Main Text and Appendix A)

THIS PAGE WAS INTENTIONALLY LEFT BLANK

FIELD SAMPLING PLAN ADDENDUM

Depleted Uranium Impact Area
Site Characterization: Deer Sampling (WBS 2.1.1)
Jefferson Proving Ground, Madison, Indiana

Final

Prepared for:

U.S. Department of Army
Installation Support Management Activity
5183 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5424

and

U.S. Army Corps of Engineers
Louisville District
600 Dr. Martin Luther King, Jr. Place
Louisville, Kentucky 40202-2230

Submitted by:

Science Applications International Corporation
11251 Roger Bacon Drive
Reston, Virginia 20190

Contract No: W912QR-04-D-0019
Delivery Order: 0012

November 2005

THIS PAGE WAS INTENTIONALLY LEFT BLANK

FIELD SAMPLING PLAN ADDENDUM
Depleted Uranium Impact Area
Site Characterization: Deer Sampling (WBS 2.1.1)
Jefferson Proving Ground, Madison, Indiana

Contract No: W912QR-04-D-0019
Delivery Order: 0012

Nuclear Regulatory Commission License SUB-1435

November 2005

Final

COMMITMENT TO IMPLEMENT THE ABOVE HEALTH AND SAFETY PLAN

Corinne M. Shia Project Manager	(703) 318-6993 Phone	11/15/05 Date
for Joseph E. Peters Quality Assurance Officer	(703) 318-4763 Phone	11/15/05 Date
Randy C. Hansen Health and Safety Officer	(314) 770-3027 Phone	11/15/05 Date
Michael W. Lambert Radiation Protection Manager	(314) 770-3000 Phone	11/15/05 Date
Seth T. Stephenson Field Manager	(765) 278-3520 Phone	11/15/05 Date

The approved Field Sampling Plan (FSP) Addendum will be provided to subcontractors (i.e., drillers, surveyors, and laboratories) at the time of subcontract execution.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

CERTIFICATION 4

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has prepared this Field Sampling Plan (FSP) Addendum for performing site characterization at Jefferson Proving Ground's Depleted Uranium Impact Area, located in Madison, Indiana. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan (QCP). During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions was verified. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

Corinne Shia — 11/15/05

Corinne M. Shia
Project Manager
Science Applications International Corporation

Date

Sheila A. Mag — 11/15/05

for Joseph E. Peters
Quality Assurance Officer
Science Applications International Corporation

Date

Corinne Shia — 11/15/05

Corinne M. Shia
Independent Technical Review Team Leader
Science Applications International Corporation

Date

Significant concerns and explanation of the resolutions are documented within the project file.

As noted above, all concerns resulting from independent technical review of the project have been considered.

11/04/05

Lisa D. Jones-Bateman
Vice President
Science Applications International Corporation

Date

THIS PAGE WAS INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
CHP	Certified Health Physicist
CSP	Certified Safety Professional
DO	Delivery Order
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DU	Depleted Uranium
EOD	Explosive Ordnance Disposal
FSP	Field Sampling Plan
HASP	Health and Safety Plan
IDW	Investigation-derived Waste
JPG	Jefferson Proving Ground
NGB	National Guard Bureau
NWR	National Wildlife Refuge
QC	Quality Control
SAIC	Science Applications International Corporation
SOP	Standard Operating Procedure
SOW	Statement of Work
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance

1. INTRODUCTION

This document is the first Addendum to the previous Field Sampling Plan (FSP) (SAIC 2005a) prepared for the Depleted Uranium (DU) Impact Area Site Characterization Project for Jefferson Proving Ground (JPG), Madison, Indiana in May 2005. Science Applications International Corporation (SAIC) has prepared this Addendum in accordance with the statement of work (SOW) requirements under the U.S. Army Corps of Engineers (USACE) Contract No. W912QR-04-D-0019, Delivery Order (DO) No. 0012.

This FSP Addendum documents and describes specific activities and details of the JPG DU Impact Area deer sampling task that were not addressed in the FSP or have been modified from the information presented in the FSP. With this understanding, this Addendum follows the same format and relevant sections of the FSP are referenced. This document is to be used in conjunction with the existing FSP, not as a replacement. The information provided in this plan was developed for use by SAIC in support of JPG's site characterization program to assist with the collection of deer tissue. SAIC assumes no liability for the use of this information for any other purpose than as stated in this Addendum or the FSP.

Kidney, liver, bone, and muscle samples will be collected from approximately 30 deer from the DU Impact Area, nearby adjacent hunting zones, and background hunting zones. These samples will be analyzed for total uranium, U-234, U-235, and U-238. Further details concerning the scope and objectives of the deer sampling were presented in Section 6 of the FSP (SAIC 2005a).

The following sections provide additional information on the project schedule (Section 2), sample packaging and shipping requirements (Section 3), investigation-derived waste (IDW) (Section 4), data use (Section 5) and references (Section 6). The following appendices provide supporting documentation:

- ***Appendix A. Deer Sampling Standard Operating Procedure (SOP)***—This appendix describes field procedures for collecting deer samples (liver, kidney, bone, and muscle) from the JPG DU Impact Area and surrounding hunting zones.
- ***Appendix B. Laboratory Analytical SOPs***—This appendix presents the laboratory analytical SOPs for the constituents of interest in the deer tissue.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

2. DEER SAMPLING PLAN

This section summarizes the deer sampling activities to be conducted at JPG in November and December 2005. The objective of this task is to collect samples of deer tissue and analyze them for uranium radioactivity. SAIC, in collaboration with the U.S Fish and Wildlife Service (USFWS), will slay and dissect 30 deer harvesting tissue samples from the livers, kidneys, bones, and muscles from 10 deer slain within the DU Impact Area, 10 deer slain in the area surrounding the DU Impact Area, and 10 deer slain in background locations.

For work in areas where unexploded ordnance (UXO) reasonably may be exposed at the surface, anomaly avoidance procedures will be followed. This includes the clearance of work areas by visual and instrument surveys conducted by one of SAIC's qualified UXO specialists (i.e., graduate of U.S. Department of Defense [DOD] Explosive Ordnance [EO] Disposal School in Indian Head, Maryland). The surveyed areas will be marked. Non-UXO personnel will operate only within the designated cleared areas. All field work in areas where UXO reasonably may be exposed at the surface will be subject to continuous surveillance by qualified UXO personnel. Additional procedures for work in UXO areas are included in Appendix D of the Health and Safety Plan (HASP) Addendum (SAIC 2005e).

Two USFWS personnel from the Big Oaks National Wildlife Refuge (NWR) will use a Remington® .22–250 rifle with a 3.5–10 × 50 scope to slay the deer. They will lure the deer to a location using bait, shoot the deer, and use a game cart to move each deer carcass from the field for dissection by SAIC personnel. Once samples have been collected from each deer, SAIC personnel will be responsible for sample preparation, custody, and shipment to the laboratory. USFWS personnel will be responsible for scavenging the deer (i.e., moving the carcasses and entrails) to a location selected by USFWS where the deer remains will decompose naturally. Paragon Laboratories, Inc. will analyze the samples for total and isotopic uranium (i.e., U-234, U-235, and U-238) activities.

SAIC personnel are required to comply with all of the policies and procedures specified in this FSP Addendum, associated plans (SAIC 2005a, b, c, d, and e), and other referenced documents. All equipment related to USFWS personnel are not required to adhere to these same policies and procedures, but may do so at their discretion. The following bullets summarize the roles and responsibilities of the SAIC personnel responsible for conducting the deer sampling:

- Ms. Corinne M. Shia is SAIC's overall JPG Project Manager. She is responsible for all activities conducted at JPG, including the deer tissue sampling and all external coordination.
- Mr. Michael L. Barta is SAIC's Lead Ecologist for the deer sampling activities. He is responsible for developing the plans associated with the deer sampling event and will be present at JPG during the first week. While present at JPG, he will be the primary point of contact for SAIC.
- Mr. Seth T. Stephenson will serve as the Field Manager and provide UXO avoidance support. He is a graduate of the EOD School in Indian Head, Maryland, and has served as the UXO Team Member and UXO Supervisor on surveys and removal actions at DOD sites. When Mr. Barta is not present at JPG, he will be the primary point of contact for SAIC and will be responsible for ensuring work activities are conducted in accordance with the procedures and policies specified in this HASP Addendum and other related project plans.
- Mr. Randy C. Hansen will serve as the Project Health and Safety Officer. He is a certified safety professional (CSP) and has supervised the environmental radiation protection program on remedial action projects involving radiological contamination. He has experience supporting field operations at JPG.

- Mr. Michael W. Lambert will serve as the Radiation Protection Manager. He is a certified health physicist (CHP) in SAIC's St. Louis office who specializes in environmental compliance, industrial hygiene, occupational safety, and radiation protection.
- Mr. Joseph E. Peters will be the Quality Control (QC) Manager for all of SAIC's work at JPG. He will conduct a laboratory surveillance to ensure that project personnel training requirements are properly documented and up to date. In addition, he will ensure that appropriate laboratory procedures are being followed. He is the QC Manager for USACE, National Guard Bureau (NGB), and U.S. Department of Energy (DOE) contracts and has extensive experience in working with laboratories and validating chemical and radiological data.
- Ms. Sara Haddox will be the Sample Manager. She is responsible for extricating, preparing, and shipping samples to Paragon Laboratories, Inc. for analysis. She also is responsible for ensuring sampling equipment and containers are available when needed.

SAIC is proposing to collect all deer in the first round of sampling between November 28 and December 16, 2005. Deer collection generally will occur every evening beginning at dusk Monday through Friday until all deer samples have been collected. If the bait stations are particularly successful in attracting deer, some sampling might start in the late afternoon. In the event that few deer (less than 5) are collected during the first week of sampling, the Army will consult with USFWS on whether to continue sampling as planned for the remaining 2 weeks or delay until February. The current sampling period was selected to occur after general hunting season ended (the week prior to November 28th). As a result, deer may be skittish and less responsive to the bait stations. In such an event, by February the deer should be less skittish and more responsive to bait. If after 3 weeks of sampling more than 20 but not 30 deer have been collected, the Army will consult with USFWS on what timeframe in December or January to conduct 1 more week's worth of sampling.

3. SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Information concerning sample packaging and shipping are provided in Section 8 of the HASP (SAIC 2005b). The HASP indicated that the biota samples would be stored in Ziploc® bags on dry ice. As the use of either dry ice or regular ice is acceptable and dry ice introduces additional logistical issues (e.g., nearby supplier), regular ice will be used instead of dry ice. In addition, the laboratory has requested that the samples be shipped in glass jars rather than Ziploc® bags. These changes are reflected in Section 3.1.

3.1 SAMPLE VOLUMES, TYPES, AND PRESERVATIVE REQUIREMENTS

The sample volumes, types, and preservative requirements for biota sampling are identified in Table 3-1.

Table 3-1. Sample Volumes, Types, and Preservative Requirements for Biota Samples Jefferson Proving Ground, Madison, Indiana

Sample Type	Analysis	Volume	Container	Preservative
Biota	Total and isotopic uranium	75-100 grams	Glass jars	Frozen upon collection or field dressing/dissection using regular ice

3.2 SAMPLE CONTAINER SHIPMENTS FROM PARAGON ANALYTICS

All sample containers, coolers, and associated equipment will be shipped from Paragon Analytics to the following address:

Jefferson Proving Ground
Attn: Ken Knouf/SAIC
Building 125
1661 West JPG Niblo Road
Madison, IN 47250-9700

The first shipment will occur prior to the start of sampling on November 28, 2005. If sample collection is successful during week 1, additional shipments will be made at the end of week 1 or the beginning of week 2. SAIC will coordinate with Paragon Analytics concerning specific shipping dates.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

4. INVESTIGATION-DERIVED WASTES

IDW generated during deer sampling includes equipment (e.g., knives and saw) decontamination liquids. Equipment decontamination liquid will be disposed of on the ground given that equipment will be surveyed and decontaminated using dry methods prior to proceeding with decontamination operations specified in Appendix A of this FSP Addendum. Any waste determined to be radioactive will be surveyed, packaged, stored, and transported in accordance with applicable regulations (10 Code of Federal Regulations [CFR] Part 20, 10 CFR Part 61, 49 CFR Parts 171-178 and, if shipped by air, International Air Transport Association requirements).

Once samples have been collected from deer, the carcasses will be scavenged (all remains including the entrails will be allowed to decompose naturally) at a location(s) designated by USFWS. The FSP (SAIC 2005a) indicated that meat collected from the adjacent hunting zones and northern hunting zones might be donated; however, due to logistical concerns, all of the deer collected from the adjacent hunting zones and northern hunting zones also will be scavenged. The USFWS will be responsible for deer scavenging. Scavenging within the DU Impact Area will be limited to areas adjacent to roads to minimize UXO hazards, and any pathways from the road will be cleared first by trained UXO personnel.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

5. DATA USE

A deer tissue sampling report will be prepared that summarizes all data collected for each individual deer and each sampling group. A brief comparison of the results to historical data will be presented. As specified in the FSP (SAIC 2005a), if no DU is detected in deer tissue from the nearby hunting zones and the DU Impact Area above background levels, verification sampling of deer in 2007 will not occur. If DU is detected at levels above background, supporting analyses will be conducted in the deer tissue sampling report to determine if additional deer samples will be collected in 2007 to verify the 2005 data. These supporting analyses include estimating food ingestion risks to hunters and analysis of abiotic (e.g., surface soil, surface water) sampling data.

In addition, the report will conclude with a recommendation as to whether other biota samples are required. The trigger to collect tissue data from other biota will be based on a weight-of-evidence approach using the results of the abiotic sampling as well as the deer tissue sampling.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

6. REFERENCES

SAIC (Science Applications International Corporation). 2005a. Field Sampling Plan, Site Characterization of the Depleted Uranium Impact Area. Final. May.

SAIC. 2005b. Health and Safety Plan, Site Characterization of the Depleted Uranium Impact Area. Final. May.

SAIC. 2005c. Quality Control Plan, Site Characterization of the Depleted Uranium Impact Area. Final May.

SAIC. 2005d. Memorandum, Airborne Transport of DU and Site Characterization Needs. From Corinne Shia, SAIC to Paul Cloud, BRAC Environmental Coordinator and Joyce Kuykendall, Radiation Safety Officer, U.S. Army. Final. January 13.

SAIC. 2005e. Health and Safety Plan Addendum, Site Characterization, Deer Sampling of the Depleted Uranium Impact Area. Draft. November.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX A

DEER SAMPLING SOP

THIS PAGE WAS INTENTIONALLY LEFT BLANK

1.0 PURPOSE

The purpose of this procedure is to define the requirements necessary for collection of deer tissue performed by and/or assisted by Science Applications International Corporation (SAIC). This procedure describes the methods and equipment commonly used for collecting deer, performing deer dissections, and collecting tissue and bone samples.

2.0 SCOPE

Deer collection and dissection and collection of deer samples is applicable to any site that contains habitat capable of supporting deer populations.

3.0 REFERENCES

3.1 Science Applications International Corporation Field Technical Procedure (SAIC FTP) 400, Equipment Decontamination.

3.2 Science Applications International Corporation Field Technical Procedure (SAIC FTP) 1215, Use of Field Logbooks.

3.3 SAIC. 2005. Field Sampling Plan (FSP), Site Characterization of the Depleted Uranium Impact Area. May.

3.4. SAIC. 2005. Field Sampling Plan (FSP) Addendum, Site Characterization, Deer Sampling, of the Depleted Uranium Impact Area. Draft. November.

3.5 SAIC. 2005. Health and Safety Plan (HASP), Site Characterization of the Depleted Uranium Impact Area. Final. May.

3.6 SAIC. 2005. Health and Safety Plan Addendum, Site Characterization of the Depleted Uranium Impact Area. Final. November.

3.7 SAIC. Var Dates. SAIC St. Louis, Missouri Health Physics Manual (HP-01) and Procedures (HP-02 to 52). SAIC, St. Louis, MO.

4.0 DEFINITIONS

None.

5.0 RESPONSIBILITIES

5.1 PROJECT MANAGER

The Project Manager is responsible for:

- 5.1.1 approving this procedure;
- 5.1.2 designating a qualified person to train personnel who will be using this procedure;
- 5.1.3 ensuring that all personnel are properly trained;
- 5.1.4 ensuring that this and all appropriate procedures, including all health and safety matters, are followed;
- 5.1.5 oversight of biota sampling; and

5.1.6 verifying that the appropriate training records are submitted to the Central Records Facility (CRF).

5.2 QUALITY ASSURANCE/QUALITY CONTROL OFFICER

The QA/QC Officer is responsible for:

5.2.1 approving this procedure; and

5.2.2 verifying that this and all appropriate procedures are being followed through scheduled surveillance.

5.3 SITE HEALTH AND SAFETY OFFICER

The SHSO is responsible for ensuring that appropriate SAIC and contractual H&S policies and procedures are in effect and verifying enforcement of same by line management.

5.4 BIOTA SAMPLING MANAGER

The Biota Sampling Manager is responsible for:

5.4.1 ensuring that all personnel are properly trained;

5.4.2 ensuring that this and all appropriate procedures are followed; and

5.4.3 verifying that the appropriate training records are submitted to the CRF.

5.5 FIELD MANAGER

The Field Manager is responsible for:

5.5.1 ensuring that all personnel perform their assigned duties in accordance with this procedure when it is applicable;

5.5.2 ensuring compliance with the Field Sampling Plan and Health and Safety Plan and related addenda; and

5.5.3 overall management of field activities.

5.6 HEALTH PHYSICS TECHNICIAN

The Health Physics Technician (HPT) is responsible for

5.6.1 implementing the health physics program and supporting procedures under the direction of the RSO or RPM

5.6.2 immediately reporting nonconformance with health physics procedures and policies to the RSO or RPM and the Field Manager

5.6.3 maintaining, in conjunction with the Field Manager, health physics training and qualifications current

5.6.4 stopping work or ordering an area evacuated, in consultation with the Field Manager, when in his/her judgment radiological conditions warrant such an action and such actions are consistent with site and personnel safety.

When the field crew is working within the boundaries of the DU Impact Area, a senior HPT will be assigned to perform this function. The HPT will perform these functions at all other locations.

6.0 GENERAL

6.1 It is SAIC policy to maintain an effective program to control employee exposure to chemical, radiological, and physical stress which is consistent with U.S. Army and Occupational Safety and Health Administration (OSHA) established standards and requirements.

6.2 Any deviations from specified requirements will be justified to and authorized by the Project Manager and/or his/her designee.

6.3 Deviations from requirements are sufficiently documented to allow re-creation of the modified process.

6.4 Refer to the site- or project-specific HASP and HASP Addendum for relevant H&S requirements.

6.5 Refer to the FSP and FSP Addendum for project/task-specific sampling and analysis requirements.

6.6 SAIC personnel who use this procedure must provide documented evidence of having been trained on the procedure to the Project Manager for transmittal to the CRF.

7.0 STANDARD OPERATING PROCEDURES

7.1 PREPARATION

7.1.1 Personnel executing the protocols described in this procedure are instructed in the use of the sampling equipment and in proper identification of deer tissues.

7.1.2 At least two days prior to sample collection, the U.S. Fish and Wildlife Service (USFWS) will place bait at locations in the Depleted Uranium (DU) Impact Area, nearby adjacent hunting zones, and the northern hunting zones. If possible, USFWS will place all bait stations near roads. Not only will this bait station placement expedite deer retrieval in all three collection areas but also minimize potential exposures to unexploded ordnance (UXO).

7.2 RADIATION PROTECTION MONITORING

7.2.1 General

1 All work (deer collection and tissue sampling) within the JPG DU Impact Area shall be performed in accordance with the requirements in HP-01, "Health Physics Manual." Personnel accessing these areas and providing radiological support shall be trained and qualified in accordance with HP-01 and HP-04, "Qualifications and Training."

2 The HPT supporting these activities shall maintain a logbook, independent of the project logbook, with appropriate entries made daily while tasks are performed in the DU Impact Area, as well as collection and packaging of samples. HP support activities shall be performed in accordance with HP-12, "Health Physics Oversight." This logbook is to be provided to the Field Manager at the conclusion of the field work and is subject to review and surveillance.

3 The HPT shall select and use instrumentation appropriate for the contaminants of concern in the DU Impact Area. Instruments shall be used and maintained in accordance with HP-30, "Radiological Instrumentation." Radioactive sources used at JPG for quality control verification of HP instrumentation performance shall be maintained in accordance with HP-23, "Radiological Source Control." Radioactive sources shall be secured from

unauthorized access, loss, or theft at all times while not in the immediate possession of the HPT.

4 The HPT shall brief all qualified radiological workers requiring access to the DU Impact Area or involved in deer collection and tissue sampling prior to initiating associated tasks or area access. HSWP briefings shall occur daily in conjunction with the daily safety briefings led by the Field Manager while access to the DU Impact Area is required and/or deer collection and sampling is performed. Briefings shall be performed and documented in accordance with HP-21, "Health and Safety Work Permits."

7.2.2 The HPT shall monitor the deer collection locations within the DU Impact Area, deer transport cart, sample collection locations, samples, sample media, used PPE, vehicles, and the external surfaces of each sample shipping container and generate the required records in accordance with HP-30, "Radiological Monitoring."

7.2.3 Personnel monitoring shall include the following protocol:

1 All personnel exiting the DU Impact Area shall perform a minimum of a hand and foot frisk to detect the presence of radioactive contamination.

2 Personnel handling and moving deer shall perform a whole body frisk prior to exiting the DU Impact Area.

3 Deer tissue samplers shall monitor hands periodically while handling deer and collecting/packaging samples.

7.2.4 If a personal injury occurs while inside the DU Impact Area (e.g., collecting deer, tissue sampling), the HPT shall perform radiological monitoring of the individual and/or wound site. At no time shall radiological monitoring interfere with or impede any actions necessary to render life saving first aid/medical treatment or stabilize the individual.

7.2.5 The HPT shall make appropriate notifications and generate reports as required by HP-22, "Radiological Reporting."

7.3 DEER COLLECTION

7.3.1 Around 4:30 PM each evening, USFWS and SAIC personnel will leave to collect from 1 to approximately 4 deer. Once within a few miles of a bait station, the USFWS vehicle will approach first approximately 0.5 miles ahead of the SAIC vehicle. Once USFWS personnel have spotted deer and indicated that an attempt to collect deer will occur, SAIC personnel will stop their vehicle approximately 0.5 miles behind and remain in their vehicle until USFWS personnel indicate via cell phone or radio that deer collection has occurred and retrieval can begin. SAIC personnel will not assist USFWS in spotting deer.

7.3.2 USFWS will kill deer using a rifle.

7.3.3 For work in areas where UXO reasonably may be exposed at the surface, such as off road paths leading to deer in the DU Impact Area, the work areas will be cleared by visual and instrument surveys conducted by a qualified UXO Specialist. The surveyed areas will be marked and non-UXO personnel will operate only within the designated cleared areas. All field work in areas where UXO reasonably may be exposed at the surface will be subject to continuous surveillance by qualified UXO personnel. UXO personnel will clear UXO areas as described in the HASP Addendum.

7.3.4 The location of deer collection and the deer killed within the DU Impact Area shall be surveyed by the HPT prior to movement of the deer. Particular attention shall be given the hooves and lower legs of the deer, as well as the side of the deer that makes contact with the ground (assistance with movement of the deer to facilitate this survey may be

allowed if initial radiological conditions permit). If radioactive contamination is detected on the deer in excess of the limits in Table 8-1 of the HASP or radiological surveys indicate the need for posting the area as a "Radiation Area," the deer shall not be handled, the area shall be posted and controlled in accordance with HP-20, "Radiological Posting," personnel shall not be allowed to access that location, and the HSWP shall be suspended pending review and any necessary revision.

7.3.5 Prior to movement of the deer, the exact location where the deer is collected will be documented using a global positioning system (GPS). If measurements are precluded at the precise location (e.g., tree canopy) where the deer falls, measurements will be taken at the closest location and will be recorded in the field logbook.

7.3.6 SAIC personnel will assist USFWS staff in loading the deer onto a deer cart. Deer will then be hauled to the road where sample collection will occur. In the event that a wounded deer flees the bait area, no chase will occur given the UXO hazards. If the deer drops within 30 yards of the bait area, then the UXO Technician will clear a path in order to retrieve the deer.

7.3.7 Once near the side of the road, the sampling location, weather conditions, sex, and weight of each deer as well as the presence of any external anomalies observed by USFWS will be noted and recorded on the Biota Sample Worksheet (Section 7 of the FSP) or field logbook prior to dissection. Individuals are weighed by suspending the animal within a net from a scale.

7.3.8 A site control zone will be established for field crew performing deer dissections in accordance with the FSP. Field vehicles will be positioned to protect the samplers from traffic during dissection.

7.4 TISSUE COLLECTION

7.4.1. Only one deer will be sampled at a time. Depending on the time of night after the first round of samples have been prepped, USFWS personnel may capture another one to four deer. If it is too late at night to continue sampling or weather precludes further sampling, the sampling teams will return to USFWS Headquarters, Building 125, which is located in the Cantonment Area of JPG.

7.4.2 Radiation monitoring procedures during deer dissection include the following:

1. Radiological contamination monitoring shall be performed using radiological instruments capable of detecting the radiation emitted from the contaminants of concern at JPG (i.e., depleted uranium) and with a detection sensitivity and survey technique sufficient to detect contamination at or below the applicable limit(s) in Table 8-1 of the HASP.
2. Prior to entering or exiting the site control zone, personnel radioactive contamination monitoring shall be completed to verify no detectable contamination above background. If contamination is detected, the HPT shall assist in confirming the contamination and direct decontamination in accordance with HP-10, "Personal and Equipment Decontamination."

7.4.3 The deer will be placed within the site control zone on the ground on plastic. All deer handlers will wear nitrile gloves. Staff performing gross and/or fine dissection will don protective gloves beneath the nitrite gloves.

7.4.4 Gross dissection to expose the abdominal cavity and muscle will be achieved with a knife.

7.4.5 Muscle, liver, and kidney samples then will be collected with a disposable scalpel. Bone tissues will be collected with a bone saw and all tissues will be scraped from the bone.

Tissue and bone samples then will be labeled, packed in glass jars, and frozen on ice. 100 grams each of muscle, liver, and kidney will be collected while about 30 grams of bone (3 to 4 inches [7.5 to 10 centimeters] from the foreleg will be collected. No tissue preservatives will be used.

7.4.6 A glass sample container will be wiped clean so that a label and security seal may be placed on it.

7.4.7 All material and equipment used to collect tissue and bone samples, as well as PPE that may have come into contact with the deer, deer samples, and deer sampling tools shall be surveyed by the HPT. If contamination is detected on the tissue or bone, the HPT shall contact the Project Manager to assess the need to further evaluate the radioactive content and classify and ship the samples as Class 7 hazardous material. All other material, tools, and equipment shall be decontaminated after use and a post-decontamination survey performed and recorded. Equipment and material shall not be used if post-decontamination surveys indicate the presence of radioactive contamination above background. All PPE, materials, tools, etc. with detectable contamination above background and which cannot be decontaminated shall be segregated and bagged as radioactive waste, labeled, and controlled in accordance with HP-25, "Storage and Control of Radioactive Waste."

7.4.8 Decontamination of knives and the bone saw will be conducted within a temporary decontamination pad. The decontamination pad will be designed so that all decontamination liquids are contained and can be disposed of into the surrounding environment after decontamination is complete. Nondedicated equipment will be decontaminated after each piece of sampling equipment is used. The procedure for decontamination of equipment will be as follows:

1. Survey equipment for removable radioactive contamination. If radioactive contamination is detected above background, the surface shall be decontaminated using dry methods. All equipment that cannot be decontaminated will be managed in accordance with Section 7.4.7.
2. Wash with approved water and phosphate-free detergent using various types of brushes required to remove particulate matter and surface films.
3. Rinse thoroughly with approved potable water.
4. Rinse thoroughly with American Society for Testing and Materials (ASTM) Type I or equivalent water.
5. Allow equipment to dry as long as possible.
6. Place equipment on clean plastic if immediate use is anticipated or wrap in aluminum foil or bags to prevent contamination if longer-term storage is required.. Decontamination liquids will be disposed of on the ground after all related operations are completed.

7.4.9 Sharp items, such as scalpels, which will be discarded, will be placed in a sharps box.

7.4.10 All samples will be surveyed and stored in a freezer in a secured location until shipping, which will not occur until after the samples are frozen solid (at least 48 hours in the freezer). During packaging for shipping to the analytical laboratory, the external surfaces of sample packages (coolers) shall be surveyed for removable radioactive contamination. If contamination is detected above background, the surface shall be decontaminated using dry methods.

7.4.11 Once samples have been collected from the deer, the carcasses will be scavenged (i.e., removed from the site control zone and disposed of) at a location designated by

USFWS. USFWS is responsible for completing all scavenging of the deer carcasses and entrails. However, scavenging within the DU Impact Area will be limited to areas adjacent to roads to minimize UXO hazards and any pathways from the road will be cleared first by trained UXO personnel.

7.4.12 Following completion of field work, all radioactive waste generated, if any, shall be turned over to the Department of Army for secured storage pending removal of the material from the site if removal is delayed.

8.0 RECORDS

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.

9.0 ATTACHMENTS

9.1 ATTACHMENT 1 – FIELD CHECKLIST

ATTACHMENT 1
FIELD CHECKLIST

____ Health and Safety Plan (HASP) and HASP Addendum
____ Field Sampling Plan (FSP) and FSP Addendum
____ HSP Addendum
____ FSP Addendum
____ Rifle with scope
____ Ammunition
____ Ear protection
____ Scale
____ Game cart
____ Knives
____ Bone saw
____ Net
____ Floodlights, headlights, and battery packs
____ Logbooks
____ Black indelible pen
____ Nitrile/leather gloves
____ Trash bags
____ Disposable scalpels
____ Decontamination equipment for knives and saw
____ Gloves, face shields
____ Safety shoes
____ Safety glasses or monogoggles
____ Cell phone/two-way radios
____ Magnetometer
____ Radiation Monitoring Equipment
____ Freezer
____ Lighting
____ Canopy
____ Coolers
____ Sample containers
____ Sharps box
____ Reflective vests
____ Generator
____ Digital camera
____ Duct/strapping tape
____ Alconox
____ First aid kit
____ GPS unit
____ Tyvek
____ Computer.

APPENDIX B

FIELD LOGBOOK

THIS PAGE WAS INTENTIONALLY LEFT BLANK

6

Location JPG Date 11/2005
Project/Client USACE

Signature Page

Name-print	Signature	Initials
Sarah Haddox	Sarah Haddox	SH
Seth Stephenson	Seth Stephenson	SPS
Jessie M. Muir	Jessie M. Muir	JM

7

Location Jefferson Proving Ground (JPG) Date 11/28/05
Project/Client USACE

Mobilization for Deer Sampling – Monday

1230 Seth Stephenson & Sarah Haddox (SAIC) arrive on site at the U.S. Fish & Wildlife site management building (Bld # 125) Jared Meese (SAIC) also on site finishing RAD equipment set up. Unload supplies and then leave site to meet Mike Barta.

1345 Arrive back on site from lunch. Seth Stephenson, Sarah Haddox, Mike Barta & Jared Meese are on site to unpack supplies.

Weather – Tornado Watch until 7 P.M tonight. Heavy rains with 20 mph winds (Gusts 30+ mph)

Mike Barta discusses schedule with U.S. Fish & Wildlife while we inventory equipment.

1430 Fish and Wildlife suggest to wait to see weather conditions to determine if we should start today.

Submitted

8

Location JPG Date 11/28/05

Project / Client USACE

Office set up, Mobilization, & Equipment Inventory

1530 Mike Barta, Seth Stephenson, Jared Meese, and Sarah Haddox watch U.S. Fish and Wildlife video briefing for health & Safety. (20 minute site video)

1600 U.S. Fish and wildlife decide due to the weather to wait until tomorrow to begin the deer hunting/sampling. Continue unpacking equipment & Inventory.

1700 Leave site to go to Walmart for supplies.

NOTE: No health & Safety briefing due to no field work.

All UXO, field, and sample notes will be in this logbook. RAD notes on instrumentation QC checklog. Copies to Corinne at END of job. 11/28/05

9

Location JPG Date 11/29/05

Project / Client USACE

Deer Sampling prep — Tuesday

1230 Arrive onsite at U.S Fish & Wildlife site management office. Set up printer. No USB Cord. Mike Barta (SAIC) briefs Seth Stephenson, Jared Meese, and Sarah Haddox on deer sampling procedures. Prep go bokes with: Trash bags, Tyvec, 1st Aid kits, (for UXO clearing →) 6 yalume glow sticks, safety glasses, face sheilds, earplugs, Kevlar & nitrile gloves, reflective safety vests, hammer, sharps box, disposable scalpels sample jars, bone saw, knife, plastic sheeting, GPS, ~~Schonstedt~~ Trimble, fire extinguishers, eye wash kits RAD equipment, Schonstedt, hospital maps, generator, digital camera, tent w/ lights, Caution tape, gas can, labels, Sharpies

10

Location JPG Date 11/29/05

Project / Client USACE

Deer Sampling prep cont.

Jared Meese calibrates RAD equipment. Background 10 μR per hour for samples.

1430 Meet with U.S. Fish & Wildlife Joe Robb and Dan Matiatos. (812)7018737 / 812 701 3151

Paul Cloud (USACE) → 4434211475

to discuss plan of action, procedures and duties.

1500 Print labels & leave to go to bait stations

1445 Discuss sampling teeth to help determine the age of deer. We agree to pull teeth & will send them to Paragon Labs to hold for later analysis if necessary.

1600 Arrive at first bait station – no deer here. U.S. Fish and wildlife move to second bait station. No deer at second bait location. Continue driving with U.S Fish & wildlife in the lead to "F" Road. Then go to East side of property.

11

Location JPG Date 11/29/05

Project / Client USACE

Deer searching continued.

1645 Continue following U.S. Fish & Wildlife (sign for Jefferson County line) Wait at bridge while U.S. Fish and wildlife continues ahead to check bait station. Continue to East perimeter road (where E Road crosses E Perimeter Road) to wait for further instruction from U.S. Fish and Wildlife.

1715 Turn Right on E Perimeter Rd. & wait. Fish and wildlife return.

1815 Turn around & head back to other side of property.

1845 Wait at "F" Road and Morgan Road intersection. Fish & Wildlife turn Right to check bait station.

1930 U.S. Fish & Wildlife return to where we are waiting. No deer. Turn around & return to East area of property (E Perimeter Rd.).

2035 Notice light snow starting. Continue waiting on East Road.

12

Location JPG Date 11/29/05

Project / Client USACE

2TO 11/30/05 2050 Decide to call it a night. Snow stops.

2106 Return to U.S. Fish & Wildlife site management building #125. to unload truck. Load printer to print a few items such as a mapquest to hospital, mapquest to fedEX & email about dumping water

2120 Leave Site for the day.

11/29/05

13

Location JPG Date 11/30/05

Project / Client USACE

Wednesday

1230 Seth Stephenson & Sarah Haddox go to Mailboxes off of Clifty Rd. to pick up FedEx supplies.

1300 Go to Walmart for some additional supplies.

1330 Return to hotel to meet Mike Barta (SAIC) & Jared Meese (SAIC). See John Carter once we turn into base property.

1400 Arrive at field office and begin loading equipment for deer Sampling. Jared Meese does quality control check on RAD equipment (bench counter (model 2929) 2360/43-89 meter (detects alpha & beta) and micro-R).

1430 Rinse bone saw, 2 small knives, and 3 larger knives with DI Water from lab (0110201 Q)

1500 Print labels for tooth & ovary samples just in case U.S. Fish and wildlife wants us to Sample teeth (aging) &/or ovaries (ovulation timeframe)

Sarah Haddox

14

Location JPG Date 11/30/05

Project Client U.S.A.C.E

Deer Searching & prep for sampling

1530 Continue printing sample labels while Seth Stephenson gives health & safety meeting to John Carter (QA Audit), Mike Barta (SAIC), Jared Meese (SAIC), and Sarah Haddox (SAIC).

1550 Put aluminum foil around deconned knives and saws. Wrap up & load up into vehicles. Put cooler with ice packs in trucks. SAIC 11:30/05

1615 Meet up with Paul Cloud (USACE) and U.S. Fish & Wildlife to drive to North portion of property. (Background hunting zone).

1645 Leave site to eat dinner.

1800 Arrive at 200S & 600W which puts us at East Perimeter Road & "L" Road on the background hunting zone area of property.

1945 Continue to wait for U.S. Fish & Wildlife to call us on the radio.

Sarah Haddox

15

Location JPG Date 11/30/05

Project Client USACE

Deer searching continued

2015 U.S Fish and Wildlife call us on radio and direct us to travel west then south and then west onto Serano Brett Road off of Machine Gun Road. No deer within gunshot seen.

2146 Relocate to Serano Brett Road & shaped charge Road intersection

2154 Hear gunshot and then get call on radio that a deer has been shot.

2205 Seth Stephenson gets out and clears approximately 100 yards off road. -NOUXO. GPS coordinates for DR-BHZ-01

US Fish and Wildlife review deer. Female. Older (Ovary sample not needed) Molar will be Sampled (see diagrams on page 16) SAIC 11/30/05

Deer Weight = 125

Deer shot in Area 7.

Sarah Haddox

16

Location JPG Date 11/30/05

Project / Client USACE

GPS coordinates for DR-BHZ-01 (Drop location)
N 4321587.160
E 365251.883
pdop 4.48

2230 Sample DR-BHZ-01 SAICT (tooth)

2240 Sample DR-BHZ-01 SAICB (bone) SAICM (muscle), SAICL (liver) & SAICK (Kidney)

2345 Complete sampling & begin cleanup of deer & equipment. Jared scanned personnel hands and feet. Everyone good.

2400 Jared scanning samples for dose rate.

DR-BHZ-01 (1st deer)	Muscle	6 µR/hr	Exckgd. RAD = 10 µR/hr
	Kidney	8 µR/hr	
	Bone	7 µR/hr	
	Liver	8 µR/hr	

0015 Arrive back at field office. Unload equipment and put samples ~~0111/30~~ in freezer. Discuss schedule for tomorrow.

Sarah Kelly

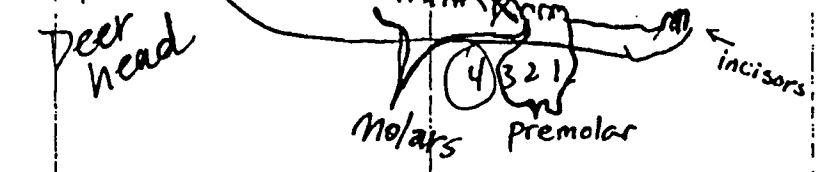
17

Location JPG Date 11/30/05

Project / Client USACE

Diagram of deer head and of tooth location. Sample → (4th tooth back from Incisors) 1st tooth after 3 pre-molars

~~done sat 11/30/05~~ started by Joe Robb



0130 Leave site for the day.

Sarah Kelly 11/30/05

18

Location JPG Date 12/1/05

Project / Client USACE

Weather: Snowing and cold Thursday

1515 Arrive at JPG site management office (Bldg #125) Re-decon equipment and layout to dry. Print more ovary and teeth labels in case we need to sample both on any deer we may kill for sampling tonight. Sharpen knives before wrapping in ~~tin foil~~ 12" wide aluminum foil. Load vehicles with equipment and cooler with ice packs.

1630 Leave building #125 to go to Near hunting zone. Stop on "D" road just to left after road security gate. Wait to hear from U.S Fish & Wildlife See Page 144 for Health & Safety briefing given by Seth Stephenson (SAIC) to Mike Barta (SAIC), Jared Meese (SAIC), Sarah Haddox (SAIC) and Paul Cloud (USACE).

Sarah Haddox

19

Location JPG Date 12/1/05

Project / Client U.S. A.CE

Deer searching

1740 U.S Fish and wildlife direct us to come down "D" Road to East perimeter Road. we turn Right and travel

1800 North. Stop after bridge on outer perimeter Road for U.S. Fish and wildlife to give us the ok. to proceed. Sit on "K" Road by creek just before East outlet Road.

1835 U.S. Fish and Wildlife call on radio and ask us to proceed to Machine Gun Rd., We turn Right onto Machine Gun Rd. (before fence) & proceed until Serano Bratt Road. (1st area 8 & 9)

2050 Continue to wait to hear from U.S. Fish and wildlife (still No word) Still snowing also.

2215 U.S. Fish and Wildlife return and ask us to sit tight while they circle the lake.

2422 Arrive back at building #125 after deciding to call it a night

1240 ~~Unload & leave for day~~ Sarah Haddox

20 Location JPG Date 12/2/05
Project / Client USACE.

WEATHER: Cold; scattered clouds, high-32° low-26° FRIDAY

1430 Arrive at building #125 to prep for sampling. Print extra labels. Prep cooler with ice packs & thermometer. Make matrix for sample tracking.

1615 Leave building #125 to go to North of the property. Stop at intersection of "K" Road and W Perimeter Road and wait while U.S. Fish and wildlife to call us on the radio.

1800 Move to intersection of "K" Rd. and Northwest exit Road intersection.

2050 U.S ~~and~~ 12/2/05 Fish & Wildlife return & ask us to follow about 100 yards behind them and stop & stay put when/if we see breaks. Go right on Northwest Exit Road.

2058 ~~FT~~ 12/2/05 U.S Fish & Wildlife Brake Sarah Z

21 Location JPG Date 12/2/05
Project / Client U.S.ACE.

and ~~the~~ we 12/2/05 Stop. After a moment, we hear a gunshot.

2100 Confirm that a deer was shot in the back. Get out & begin set up while Seth Stephenson clears a path to the deer to verify no UXO using the schonstedt. Seth clears path using Jared takes cart back to pick up deer. U.S Fish and wildlife confirm that they want us to sample the ovaries as the deer is a young female. (Area C is the hunting area she was shot - BHZ)

Deer (She) weight - 75 Lbs.

GPS coordinates of where she died.
N 431818.071 E. 633244.061

2120 Set up deer for sampling tooth.

2125 DR-BHZ-02 SAICT collected by Jared Meese.

2130 Sample DR-BHZ-02 SAICK, & duplicate SAICB & SAICL & SAICM (SAICO) Sarah Z

22

Location JPG Date 12/2/05
Project / Client USACE

~~1035~~ 2235 (12/2/05) Jared completes sampling DR-BHZ-02 sample and duplicate. (No Kidney dup)

NO DUP. for Kidney - may have destroyed with bullet

SAICB, SAICM, SAICL, SAICK
SAICBD, SAICMD, SAICLD ~~& SAICKD.~~

~~1045~~ 2245 Jared Meese scans tools and got no reading

DR-BHZ-02 dose rate for		duplicate
Muscle	6 μR/hr	6 μR/hr
Kidney	6 μR/hr	NS
Bone	5 μR/hr	5 μR/hr
Liver	6 μR/hr	6 μR/hr

Seth decons tools while I pack up samples. Jared scans personel and noone had readings.

2300 Finished ~~sampling and~~ packing up equipment and call U.S. Fish and Wildlife.

2345 Arrive back at building # 125 to unload equipment and prep to leave for the weekend.

2430 Leave site for day after putting sample on ice, custody sealing freezer, unloading equipment, & locking office.

[signature]

23

Location JPG Date 12/2005
Project / Client USACE - Deer Sampling Summary for Background Hunting Zone (BHZ)

BHZ - Sample Summary

Sample/Site I.D	Date & Time	B	L	K	M	QA	Hunt Area #	XTRA Samples for U.S Fish & Wildlife O	T	F
DR-BHZ-01	11/30/05 2240	✓	✓	✓	✓	N/A	7		✓	-
DR-BHZ-02	12/2/05 2130	✓	✓	✓	✓	Dup-No Kidney	6	✓	✓	-
DR-BHZ-03	2/23/06 1935	✓	✓	✓	✓	—	6	✓	✓	2
DR-BHZ-04	2/23/06 2000	✓	✓	✓	✓	Dup (Kidney)	6	✓	✓	2
DR-BHZ-05	2/23/06 2056	✓	✓	✓	✓	—	8	✓	✓	2
DR-BHZ-06	2/23/06 2304	✓	✓	✓	✓	—	10	✓	✓	2
DR-BHZ-07	2/24/06 0031	✓	✓	✓	✓	—	4	✓	✓	-
DR-BHZ-08	2/24/06 2110	✓	✓	✓	✓	—	3	✓	✓	1
DR-BHZ-09	2/24/06 2153	✓	✓	✓	✓	—	13	—	✓	-
DR-BHZ-10	2/24/06 2248	✓	✓	✓	✓	—	6	✓	✓	2

[signature]

24

Location JPG Date 12/2005
Project / Client USACE - Sampling Summary for NHZ

Sample site/ID	Date & Time	B	L	K	M	QA	Hunt Area #	O	T	Fetus	F/M
DR-NHZ-Ø1	2/21/06 1946	✓	✓	✓	✓	—	57	—	✓	2	F
DR-NHZ-Ø2	2/21/06 2031	✓	✓	✓	✓	DUP (no ovary) dup	57	✓	✓	1	F
DR-NHZ-Ø3	2/21/06 2236	✓	✓	✓	✓	—	52	✓	✓	2	F
DR-NHZ-Ø4	2/22/06 2012	✓	✓	✓	✓	—	61	—	✓	—	M
DR-NHZ-Ø5	2/22/06 2030	✓	✓	✓	✓	—	54	✓	✓	1	F
DR-NHZ-Ø6	2/22/06 2117	✓	✓	✓	✓	—	54	✓	✓	2	F
DR-NHZ-Ø7	2/22/06 2222	✓	✓	✓	✓	—	57	—	✓	—	M
DR-NHZ-Ø8	2/22/06 2319	✓	✓	✓	✓	—	52	✓	✓	-	F
DR-NHZ-Ø9	2/22/06 2345	✓	✓	✓	✓	—	52	✓	✓	—	F
DR-NHZ-1Ø	2/23/06 0000	✓	✓	✓	✓	—	52	✓	✓	1	F

25

Location JPG Date 12/2005
Project / Client USACE - Sampling Summary for DUA

Sample Site/ID	Date & Time	B	L	K	M	QA	Hunt Area #	O	T
DR-DUA-Ø1	12/5/05 2232	✓	✓	✓	✓	N/A	DU Area		✓ 2217
DR-DUA-Ø2	12/6/05 0018	✓	✓	✓	✓	N/A	DU Area		✓ 0013
DR-DUA-Ø3	12/6/05 1717	✓	✓	✓	✓	N/A	DU Area		✓ 1715
DR-DUA-Ø4	12/6/05 1818	✓	✓	✓	✓	~~N/A~~ DUP	DU Area		✓ 1812
DR-DUA-Ø5	12/6/05 1855	✓	✓	✓	✓	~~DUP~~ N/A	DU Area		✓ 1853
DR-DUA-Ø6	12/6/05 2255	✓	✓	✓	✓	N/A	DU Area		✓ 2253
DR-DUA-Ø7	12/7/05 1833	✓	✓	✓	✓	N/A	DU Area		✓ 1830
DR-DUA-Ø8	12/7/05 1946	✓	✓	✓	✓	N/A	DU Area		✓ 1941
DR-DUA-Ø9	12/7/05 2148	✓	✓	✓	✓	N/A	DU Area		✓ 2145
DR-DUA-1Ø	12/7/05 2253	✓	✓	✓	✓	N/A	DU Area		✓ 2248

26

Location JPG Date 12/5/05

Project / Client USACE

1445 Arrve on s.t. Redecon equipmt and allow to dry. Start loading vehicle. Seth Stephenson go to talk to USFWS about setting video tape for new persael to watch and to see what time they want to go out to the DU area.
-1520 Jessie Muir and Steve struck watch safety video.
-1550 Tailgate safety briefing w/ Seth S., Steve, Jessie M, & Jared R.
-1615 Arrive north of firing line. USFWS go ahead on Morgan Rd. SAIC trucks wait back.
-2211 [2122] USFW call that they have a [5/16/05 for 12/05/05] deer, OFF OF WONJU ROAD, eastern boundary of DU Area.
-2142 SETH and Steve go to clear path. Jessie and Jared set up truck [5/16/05 for 12/05/05]
-2200 having difficulty locating the deer. during Seth's check he states there is a lot of UXO present.

12/5/05

27

Location JPG Date 12/5/05 - 12/6/05

Project / Client USACE

2212 [5/16/05 for 12/05/05]
-2312 bring deer back to the truck
~~N 4304897.917~~ GPS
E 6388259.422 / Coordinates
N 4304897.917

JR & STEVE weigh deer – 110 lbs/male
-2217 collected teeth sample (jaw)
-2232 collected bone from front right leg, liver (1st), kidney & tissue.
-2250 finish collecting samples. dispose of deer body. de-con knives and packed up supplies
-2257 contacted USFW, they spotted more deer, will wait to hear back from them.
2337 USFW call with there 2nd deer
-2344 arrive at location MORGAN RD, SOUTH OF C, SETH starts his UXO clearance check.
0001 - get deer back to truck
weight = 75 lbs / ~~female~~ [5/16/05 for 12/04/05]

GPS Coordinates N: 4303022.388
E: 6366933.543

[5/16/05 for 12/05/05]
12/6/05

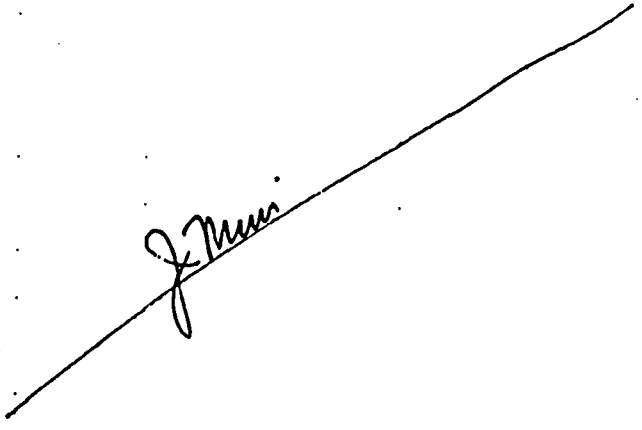
DR-DUA-01

28

Location JPG Date 12/6/05

Project / Client USACE

0009- begin cutting jaw
0013- get jaw for teeth sample DR-DUA-02T
0018 kidney, liver, muscle, bone Sam
0030 finish sampling, decon, reload truck
0038 wait on USFW who have another deer within target
0051 USFW call off hunt. go back to office and unload trucks and supplies. put samples in freezer.



J Miller 12/6/05

29

Location JPG Date 12/06/05

Project / Client USACE

1510 Arrive at site. Re-decon equipment Restock supplies as needed. JARed went to store to get new saw since our blades were so dull. We are waiting at the office until we get word from USFWS that they've killed a deer.

1635 GET the call from USFW they have a deer along Wonju road. north of C ROAD (east side) * shot in DU area ran across road to east side

1647 arrive at site of kill. (lightly snowing) JARed does UXO clearance and GPS
NORTH 4304331.907
EAST 638253.309

1710 weight = 75 lbs MALE
back to truck to weigh

1715 get jaw (teeth) sample. notice a 2" scar along deer's nose

1717 get DR-DUA-03 bone, muscle, liver, & kidney

1726 finish taking samples, decon, and reload supplies

J Miller 12/06/05

30

Location JPG Date 12/6/05

Project/Client USACE

1730 GOT CALL FROM USFWS they have 2 more deer along Morgan Rd, north of "C" Road

1748 get to kill site, Seth out to do UXO & GPS (both deer w/i ~50 yds of each other)
NORTH 4303654.400
EAST 636617.123

1759 get deer to truck
Weight = 170 lbs female
DR-DUA-04 and DUPLICATE

1812 get jaw for tooth sample

1816 get B, M, L, K samples

1832 finished collecting samples decon equipment & prepare for second deer.

1836 Seth and Steve out to 2nd deer, check for UXO & rad

1843 deer brought up to truck
weight 125 female
GPS N 4303680.464
E 636632.613

1852 get jaw (teeth) sample for
Sample DR-DUA-05

12/6/05

31

Location JPG Date 12/6/05

Project/Client USACE

1855 get B, M, K, & L samples

1910 finish with sampling, decon knives, and repack truck. head back to USFWS to put up samples in freezer and get more supplies as neccesary.

1925 repack samples in freezer, decon knives again, get more supplies, wait to hear from USFW

2205 get call from USFW they have a deer on north wonju

2218 arrive at kill site. on Wonju road north of "C" Road

2221 SETH AND Steve out to kill site for UXO and rad check.

2240 bring deer back to truck
Weight = 160 sex = Male (.9pt)
GPS N = 4304364.643
E = 638245.371

2253 get the jaw for teeth sample
DR-DUA-06

2255 get the M, B, L, & K samples

2308 finish with sample collection, decon

12/6/05

32

Location JPG Date 12/06/05

Project / Client USACE

2308cont. and load truck
2316 · check in w/ USFW. Paul wants to try for another 30 min and call it a night if they dont get anything
2349 didnt find anymore deer so we went back to USFW office. Unloaded truck and Supplies
0020 left USFWS office

J Muir

33

Location JPG Date 12/07/05

Project / Client USACE

1200 Arrive at USFWS to pack samples from last week (SETH & JESSIE)
1207 Collect sample Source - DI SA1C01 from DI machine located in Bldg 125.
1212 Collect Rinsate sample DR-DUA-07, SA1RB01
1215 Start packing cooler.
1245 leave USFWS office to take samples to Fed-ex place
1500 Arrive back at USFWS office. Get supplies ready, decon knives & sharpen. Begin packing up extra supplies into office (trying to take inventory)
1745 Get call from USFW they have a deer on Wonju Rd, north of "C" Rd (east)
1804 arrive at kill site. Seth/Steve out for UXO and rad clearance
GPS N 4304540.769
E 638283.172
1820 deer brought back to truck
weight 130 sex male (8pt)
1830 jaw collected for teeth sample
DR-DUA-07

J.M. Muir
5/12/06 for 12/7/05

34 Location JPG Date 12/07/05
Project / Client USACE

1833 collected B, M, K & L samples
1841 finish collecting samples, decon and repack supplies onto truck get call USFW has another deer
1900 arrive at kill site. deer along "C" road, north of road. Seth and Steve go out for UXO and rad. deer ~170 yds north of road.
1926 deer back to truck
N=4304597.113
E=637527.931
Weight = 150 sex = doe
1941 got jaw for teeth sample
1946 got B, M, K, & L samples
1956 finish collecting samples, decon and repack supplies onto truck check in w/ USFWS - nothing in site so we went back to office to get more supplies and wait
2055 get call from USFWS they have a deer killed off Morgan Rd, north of "E" road.
2117 arrive at kill site, deer ~70 yds off of road. Seth and

12/07/05 JM Muir 5/12

35 Location JPG Date 12/7/05
Project Client USACE

Steve do UXO and rad clearance
2136 get deer back to truck
N = 4307297.307
E = 636589.621
Weight = 140 lbs sex = male (~7pt)
2146 get jaw for teeth sample
DR-DUA-09
2148 get B, M, K, & L samples
2165 finish w/ sampling, cleanup, and load truck
USFWS ready for us to get next deer.
2211 arrive at kill site, off of "C" RECOVER Rd., east of road, ~200 yds off road Seth and Steve out to kill site for UXO and RAD clearance
2237 deer back to truck.
GPS N = 4306084.465
E = 637182.038
Weight = 115 sex = female
2248 get jaw for teeth sample
DR-DUA-10
2253 get B, M, L, K samples
2300 finish with sampling

JM Muir 5/12(12/7)

Location JPG Date 12/7/05 - 12/8/05

Project / Client USACE

2305 get word from USFW they have 3 possible deer in NHZ area. waiting to hear back

2315 didnt get a shot - so we all head back to office unload trucks, decon

2400 leave USFW office.

Seth Stark 12/8/05

Location JPG Date 12/8/05

Project / Client USACE

-1015 Seth Stephenson, Jared Merse ad Jessie Muir arrive on site to clean equipment and store equipmat until the return of field crew.

-1100 Seth Goes to power wash deer cart and net.

-1200 Seth returns to office. Lunch

-1300 Everyone leves site.

Seth Stark 12/8/05

38

Location JPG Deer Sampling Date: 12/12/05
Project / Client USACE

-0930 Arrive on site. Will be packing samples and loading equipment to take back to NECD.
-1100 Go to store to get more zip lock bags.
-1145 Return to office.

39

Location JPG DEER SAMPLING Date: 02/21/06
Project / Client USACE

1430 BARTA, SKIBINSKI, MEESE, MUIR, & STEPHENSON ARRIVE AT ONSITE OFFICE. GO THROUGH SUPPLIES AND PREPARE FIELD KITS.
1730 TAILGATE SAFETY MEETING
1745 USFWS LEAVES OFFICE AND GOES INTO FIELD. SAIC PERSONNEL WAITING AT SITE OFFICE UNTIL GET WORD FROM USFWS.
1830 USFWS CALL WITH A KILL IN AREA 57.
1843 ARRIVE AT 1ST KILL SITE. TWO FEMALES KILLED. JARED, MIKE, & SETH OUT TO RETRIEVE 1st DEER. (DECISION MADE TO TAKE DEER AWAY FROM SITE EDGE & ROAD)

DR-NH201
[13T 18 13812 4 N] GPS Coordinates
[409810.078 E]
[11 MR/hr] RAD Reading

1910 GET 1st deer into truck, drive to site of 2nd deer. MIKE, JARED, SETH OUT TO RETRIEVE SECOND DEER. (DECISION TO MOVE DEER FROM KILL SITE TO GET AWAY FROM ROAD.

J.M. Muir 5/12/06 for 02/21/06

40

Location JPG DEER SAMPLING Date 2/21/06

Project / Client - /

1932 2nd deer (more southerly) NHZ02
8 μR/hr) RAD
1321814.497 N] GPS Coord.
409809.940 E
SEX: FEMALE
WEIGHT: 145 lbs

1946 NHZ-01
pregnant w/ 2 fetuses, Weight 125lbs
collected L, K, M, (2) fetus, bone
had trouble locating ovaries
so no ovary sample collected
decon knives & bone saw

2031 NHZ-02 and NHZ-02Dup
pregnant w/ 1 fetus
collected L, K, 1 fetus, bone
ovaries difficult to find, potential
cysts. only got 1 ovary, no
ovary duplicate.

2117 Completed taking samples for
NHZ01 and NHZ02(&dup), decon equip
refer to page 24 for sample log

5/12/06 for 2/21/06

41

Location JPG DEER SAMPLING Date 2/21/06

Project / Client USACE

2141 USFWS call with their 3rd killed
deer in hunting zone 52

2200 ARRIVE AT KILL SITE. OFF OF
JONESTOWN ROAD. MIKE, SETH, & JARED
OUT TO DEER FOR RAD & UXO
CLEARANCE (down hill)

2223 DEER BACK TO TRUCK
GPS READINGS: 132876.497 N
38906.558 E
RAD READING: 7 μR/hr
SEX: Female WEIGHT: 115

2236 NHZ-03
pregnant w/ 2 fetuses
collected K, L, OV, Fetus, H, & B
decon knives & saw

2301 finish decon, pack up supplies
and head to ~~site of 4th kill~~ site. office to unload supplies
5/16/06 for 2/21/06

2327 arrive @ field office. unload
trucks

2356 leave field office

5/12/06 for 2/21/06

42

Location JPG Deer Sampling Date 02/22/06
Project / Client USACE

1500 MUIR, REESE, & STEPHENSON ARRIVE AT FIELD OFFICE. PREPARE FIELD KITS AND SUPPLIES
WEATHER: COLD, FOGGY/DRIZZLY

1528 SETH COLLECTED RINSE BLANK
DR-NHZ-03 SAIC802

1600 JOE OF USFWS TOOK THE OVARY SAMPLES FROM NHZ02 AND NHZ03, WENT INTO FIELD.

1835 RECEIVED CALL FROM USFWS WITH THEIR FIRST KILL.

1850 ARRIVE AT KILL SITE. BRING DEER TO TRUCK AND THEN WILL MOVE TO DIFFERENT LOCATION FOR ~~LOCAT~~ DISSECTION. (5/12/06 For 02/22/06)

might be slightly off

→ GPS: 1328677.097N / 389006.517E
RAD: 8 μR/hr and 0
SEX: MALE HUNTING ZONE 61 (EAST)
~50 YARDS OFF OF ROAD (NEAR PUBLIC ROAD) HAD TROUBLE INITIALLY LOCATING DEER.

DR-NHZ-04

1945 ARRIVE AT SITE OF 2ND DEER KILL. SETH, MIKE, & JARED OUT FOR UXO & RAD CLEARANCE.

J.M. Muir 5/12/06 for 2/22/06

43

Location JPG DEER SAMPLING Date 02/22/06
Project / Client USACE

1958 BRING 2ND DEER BACK TO TRUCK.
GPS: 1327734.135N
411355.842E
location of DR-NHZ-05
RAD: 7 μR/hr and 0
SEX: FEMALE

2007. WEIGH MALE DEER
WEIGHT: 110
DR-NHZ-04

2012 COLLECT T, L, K, M, B
2020 FINISH WITH NHZ-04
2025 WEIGH FEMALE DR-NHZ-05
WEIGHT - 102 LBS PREGNANT, 1 FETUS
2030 COLLECT T, L, K, M, B, O
2047 FINISH WITH NHZ-05, HEAD TO SITE OF 3RD KILL DEER. AREA 54
2053 ARRIVE AT SITE
GPS: 1325893.2.725N
407740.127E
RAD: 5 μR/hr and 0
SEX: FEMALE WEIGHT: 130 lbs.

NHZ-06

2117 COLLECT DR-NHZ-06
PREGNANT, 2 FETUSES
2135 FINISH AND LEAVE FOR NEXT KILL SITE

J.M. Muir 5/12/06 for 2/22/06

44

Location JPG DEER SAMPLING Date 2/22/06
Project / Client USACE

ARRIVE AT KILL SITE FOR 4th deer.
2140 TOOK RAD, UXO READINGS. AREA 57.
NHZ-07
GPS: 1323351.546 N
411013.204 E
RAD: 5MR/hr, 0
LOADED DEER INTO TRUCK TO TAKE TO ANOTHER LOCATION FOR DISSECTION.
DEER NEXT TO ROAD (ALONG PUBLIC ROAD)
2200 ARRIVE AT NEW LOCATION FOR DISSECTION. SET UP TRUCK & EQUIP.
SEX: MALE WEIGHT: 130 LBS
2222 TAKE DR-NHZ-07
COLLECT L, K, M, B
2235 FINISH SAMPLING, DECON. EQUIPMENT
LEAVE FOR NEXT KILL SITE, USFWS LEAVE SITE.
2242 ARRIVE AT KILL SITE. NHZ #52
DEER ALONG ROADSIDE (JINESTOWN RD)
GPS: 1326835.449 N
388770.010 E (DR-NH7-08)
RAD: 7MR/hr, 0
TAKING DEER TO LOCATION OF LAST 2 DEER KILLED. (LAST 3 OF NHZ)
ARRIVE AT KILL SITE OF LAST 2 DEER
NHZ #52.

J.M. Muir 5/12/06 for 2/22/06

45

Location JPG DEER SAMPLING Date 2/22/06 2/23/06
Project / Client USACE

2300 ARRIVE AT KILL SITE OF LAST TWO DEER.
DR-NH7-08
WEIGHT: 80 LBS
SAMPLE TIME SEX: Female (young, not pregnant)
2319 TAKE DR NH7 08 SAMPLE
T, L, K, M, O, B
DECON EQUIP.
· SETH HAS ALREADY CLEARED UXO PATH TO SITE OF 2 KILL DEERS
· SETH, MIKE, JARED OUT TO TAKE RAD READINGS BOTH DEER ~ 100 YDS OFF THE ROAD
GPS: 1324381.220 N NHZ9
391392.153 E
RAD: 9MR/hr, 0
WEIGHT: 75 LBS SEX: FEMALE
GPS: 1324301.762 N NHZ 10
391875.439 E
RAD: 9MR/hr, 0
WEIGHT: 110 LBS SEX: FEMALE
2345 COLLECT DR-NHZ09
2358 FINISH TAKING 09 SAMPLES, DECON
2402 COLLECT DR-NHZ-10
0000 PREGNANT, 1 FETUS

J.M. Muir 5/16/06 for 2/23/06
J.M. Muir 5/12/06 for 2/23/06

46

Location JPG DEER SAMPLING Date 2/23/06
Project / Client USACE

0011 FINISH COLLECTING SAMPLES. DECON EQUIP, LOAD TRUCKS AND HEAD BACK TO FIELD OFFICE.
0045 ARRIVE AT FIELD OFFICE. UNLOAD TRUCKS.
0100 LEAVE FIELD OFFICE AND SITE

J Munn
5/12/06 for 2/23/06

47

Location JPG DEER SAMPLING Date 2/23/06
Project / Client USACE

1245 JARED, JESSIE, & MIKE ARRIVE AT FIELD OFFICE. SETH AT LOWE'S TO PICK UP MORE GLOWSTICKS. JESSIE SEPARATES TEETH, OVARY, AND FETUSES FROM OTHER SAMPLES. JARED & MIKE LOOKING FOR "LOST" RADIO OUT IN FIELD. SETH & JESSIE CONTINUE TO PREPARE AND RESTOCK FIELD KITS. WEATHER: SUNNY
1315 LEFT FIELD OFFICE W/ USFWS FOR LUNCH. PAUL CLOUD MET US THERE.
1720 ARRIVE AT THE NORTH AREA FOR BACKGROUND SAMPLING
1900 USFWS CALL TO SAY THEY HAVE 2 DEER KILLED ALONG NORTH "K" ROAD. HEAD TO THE KILL LOCATION.
1909 ONE DEER IS ALONG THE ROADSIDE. THE OTHER ONE IS ~50 YARDS IN THE WOODS. HUNTING AREA 6.
JARED, MIKE, & SETH OUT TO SECOND DEER FOR UXO & RAD READINGS: AFTER TAKING READINGS ON 1st DEER ALONG THE ROAD.

5/12/06 for 2/23/06

48

Location JPG DEER SAMPLING Date 2/23/06

Project / Client USACE

GPS: 1371692.003 N
383185.522 E
RAD: 7 mR/hr
WEIGHT: 150 lbs.
SEX: FEMALE
PREGNANT W/ 2 FETUSES

BHZ-03

GPS: 1371654.871 N
383342.076 E
RAD: 8 mR/hr
WEIGHT: 105
SEX: FEMALE
PREGNANT, 2 FETUSES

BHZ-04

1935 BEGIN COLLECTING DR-BHZ-03
*USFWS REQUESTED WE TAKE PICTURES OF THE FEMALES IF PREGNANT (INARDS INTAKES)

1955 FINISH WITH BHZ03 SAMPLING WEIGH 2ND DEER (BHZ04)

2000 BEGIN COLLECTING DR-BHZ04
COLLECT T, O, F, B, L, K, & M

2020 FINISH COLLECTING. MOVE ONTO SITE OF 3RD KILLED DEER.

2/23/06

49

Location JPG DEER SAMPLING Date 2/23/06

Project / Client USACE

2034 ARRIVE AT SITE OF 3RD DEER.
HUNTING ZONE 8
DEER WAY OUT IN WOODS. DOWN HILL, UP NEXT HILL
SETH, JARED, & MIKE OUT TO GET DEER.

2053 DEER BACK AT TRUCK, WEIGH

BHZ-05

GPS: 1375048.113 N
393825.239 E
RAD: 8 mR/hr
WEIGH: 130 LBS SEX: FEMALE

2056 BEGIN COLLECTING DR-BHZ-05
COLLECT O, F(2), L, K, M, B
PREGNANT W/ 2 FETUSES

2107 FINISH COLLECTING SAMPLES. DECON EQUIPMENT. DRIVE TO A NEW SPOT TO WAIT FOR WORD FROM USFWS

2235. CALL FROM USFWS WITH 4TH DEER DOWN. GO TO THEIR LOCATION
SETH, JARED, & MIKE OUT TO DEER FOR UXO & RAD READINGS.
HUNTING ZONE 10
BRING DEER BACK TO TRUCK.

2/23/06

50

Location JPG DEER SAMPLING Date 2/23/06
Project/Client USACE 2/24/06

GPS: 1380104.994N
402314.096E
RAD: 7mR/hr 0
SEX: FEMALE
WEIGHT: 120 LBS

0 2304 BEGIN COLLECTING DR-BHZ-06
TAKE PICTURES OF OVARIES
PREGNANT W/ 2 FETUSES
2320 FINISH TAKING SAMPLES AND HEAD TO ANOTHER LOCATION TO MEET UP WITH USFWS. THEY KILLED 5TH DEER
2329 ARRIVE AT SITE W/ USFWS. DEER IS ON OTHER SIDE OF LAKE. JARED, MIKE, & SETH OUT TO GET DEER & READINGS
0026 BRING DEER TO TRUCK, WEIGH DEER
GPS: 1383761.520N
406243.416E
RAD: 7mR/hr
SEX: Female (young, ~ 2/year)
WEIGHT: 60
HUNTING ZONE: 4
TOOK ALONG TIME TO FIND DEER!

J.M. Muir 5/12/06 for 2/24/06

51

Location JPG DEER SAMPLING Date 2/24/06
Project/Client USACE

0031 COLLECT SAMPLE DR-BHZ-07
no fetuses, too young
0042 FINISH COLLECTING SAMPLE BHZ07
PACK UP SUPPLIES AND TRUCKS. DECON EQUIP. HEAD BACK TO FIELD OFFICE
0135 ARRIVE AT FIELD OFFICE. UNLOAD TRUCKS AND SAMPLES
0200 LEAVE FIELD OFFICE AND SITE.

J.M. Muir 2/24/06

52

Location JPG DEER SAMPLING Date 2/24/06
Project / Client USACE

1200 SETH AND JESSIE ARRIVE AT FIELD OFFICE. PACK SAMPLES NHZ01 – NHZ03 (from Tues) FOR SHIPMENT.

1250 SETH COLLECTED RINSE BLANK DR-BHZ07-SAIRB03

1330 LEFT FIELD OFFICE TO TAKE PACKED SAMPLES TO FEDEX

1515 SETH, JARED, & JESSIE ARRIVE AT FIELD OFFICE. PACK TRUCKS. GIVE JOE OF USFWS THE OVARIES FROM PREVIOUS EVENING.

1600 USFWS HEAD OUT TO THE BHZ AREA

1645 HEAD OUT TO NORTH BHZ AREA.

MIKE GETS TO FIELD OFFICE

1715 ARRIVE AT WAITING SPOT NEAR BRIDGE #28. WAIT HERE [illegible] WE GET WORD FROM USFWS.

2048 ARRIVE AT SITE OF 1st DEER. HZ#3
SETH, JARED, & MIKE OUT TO DEER FOR UXO & RAD READINGS
GPS: 1380843.461N
393695.540E
RAD: 6 uR/hr, 0
SEX: FEMALE WEIGHT: 135

JM Moir 5/12/06
for 2/24/06

53

Location JPG DEER SAMPLING Date 2/24/06
Project / Client USACE

2106 DEER BACK TO TRUCK. WEIGH.

2110 BEGIN COLLECTING DR-BHZ-08
O, F, T, L, K, & M (Pregnant, 1fetus)

2128 FINISH TAKING SAMPLES, DECON EQUIP, & PACK TRUCKS BACK UP.

2140 ARRIVE AT SITE OF 2nd KILLED DEER. HUNTING ZONE #13.
SETH, MIKE, & JARED OUT TO DEER FOR RAD & UXO READINGS.
DEER BACK TO TRUCK.
GPS: 1374406.487N
393183.152E
RAD: 6 uR/hr, 0
SEX: MALE WEIGHT: 100

2153 COLLECT DR-BHZ-09
L, K, M, T

2208 LOAD UP TRUCKS, DECON EQUIP
CHECK IN WITH USFWS.

2228 ARRIVE AT SITE OF LAST DEER.
SETH, MIKE, & JARED OUT TO DEER FOR UXO & RAD READINGS.
HUNTING ZONE 6

2/24/06

Location JPG DEER SAMPLING Date 2/24/06
Project Client USACE 2/25/06

2242 DEER BACK AT TRUCK
GPS: 1373178.426 N
385670.999 E
RAD: 6 MR/hr, 0
SEX: Female
WEIGHT: 145
PREGNANT, 2 FETUSES
2248 COLLECT SAMPLE DR-BHZ-10
O, 2F, L, K, M, T
2304 FINISH COLLECTING SAMPLE. DECON EQUIP, PACK TRUCKS UP, HEAD BACK TO OFFICE.
2400 ARRIVE BACK AT OFFICE
[5/11/06 for 2/25/06] PACK UP SUPPLIES AND TRUCKS CLEAN OFFICE, ORGANIZE SAMPLES
JARED TOOK SWIPES OF TRUCKS (LEFT REAR) & RIGHT DEER CART
~~0040~~ LEAVE FIELD OFFICE & ALL AT BCKGD
0030
AND FLOORBOARD OF DRIVER'S SIDE FOR ALPHA & BETA.

2/25/06

55

Location JPG DEER SAMPLING Date 2/27/06
Project Client USACE

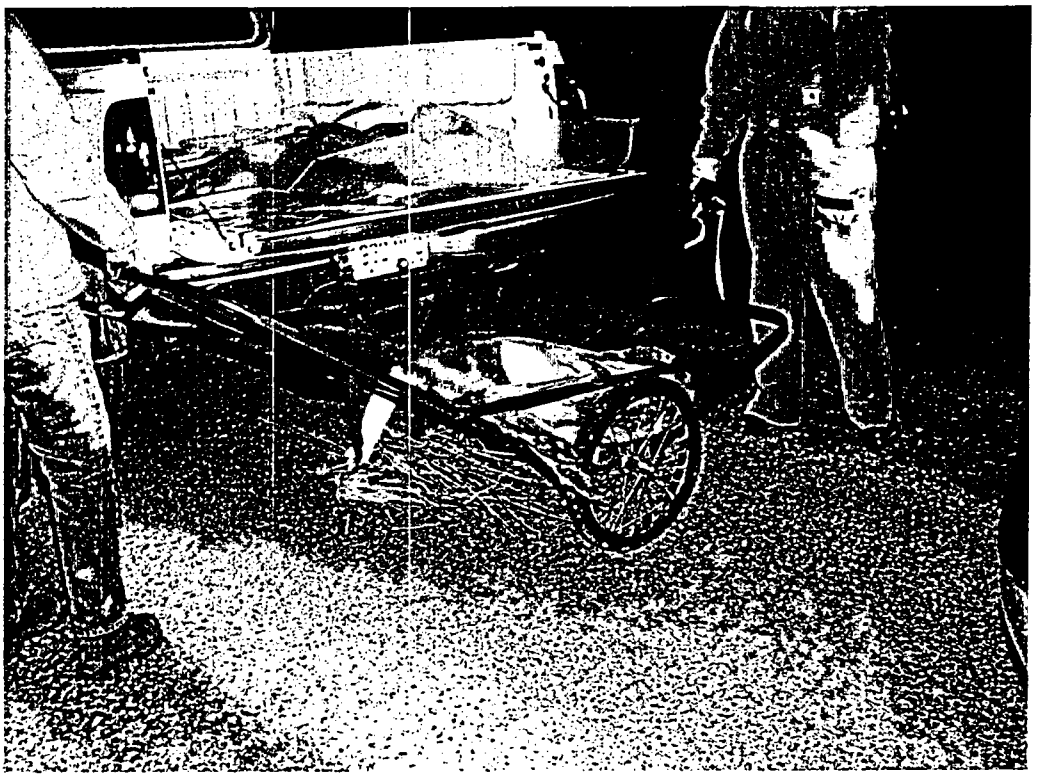
- 1130 Arrive on site. I will be packing samples, cleaning and moving equipment to Bldg 723.
- 1145 Take Deer cart and net to car wash for power washing.
- 1245 Return to site. Start packing coolers.
- 1400 Finish packing coolers. Start loading equipment to take to building 723.
- 1500 Finish moving equipment leave site for Fed.Ex

2/27/06

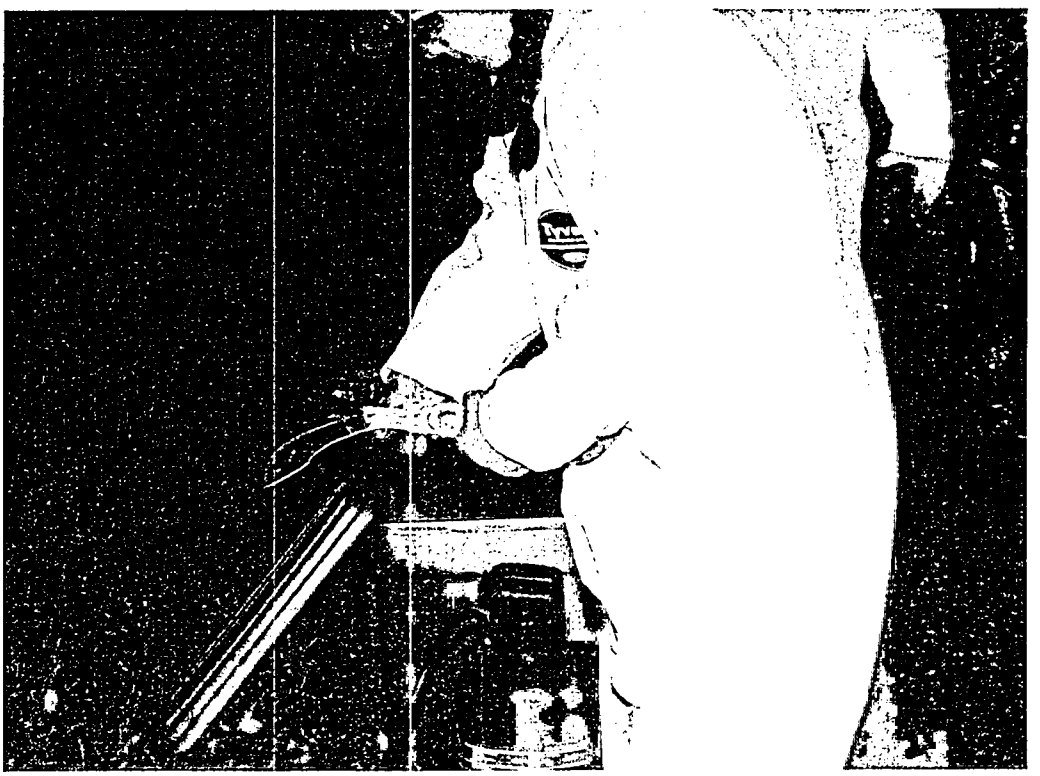
THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX C
PHOTOGRAPHS

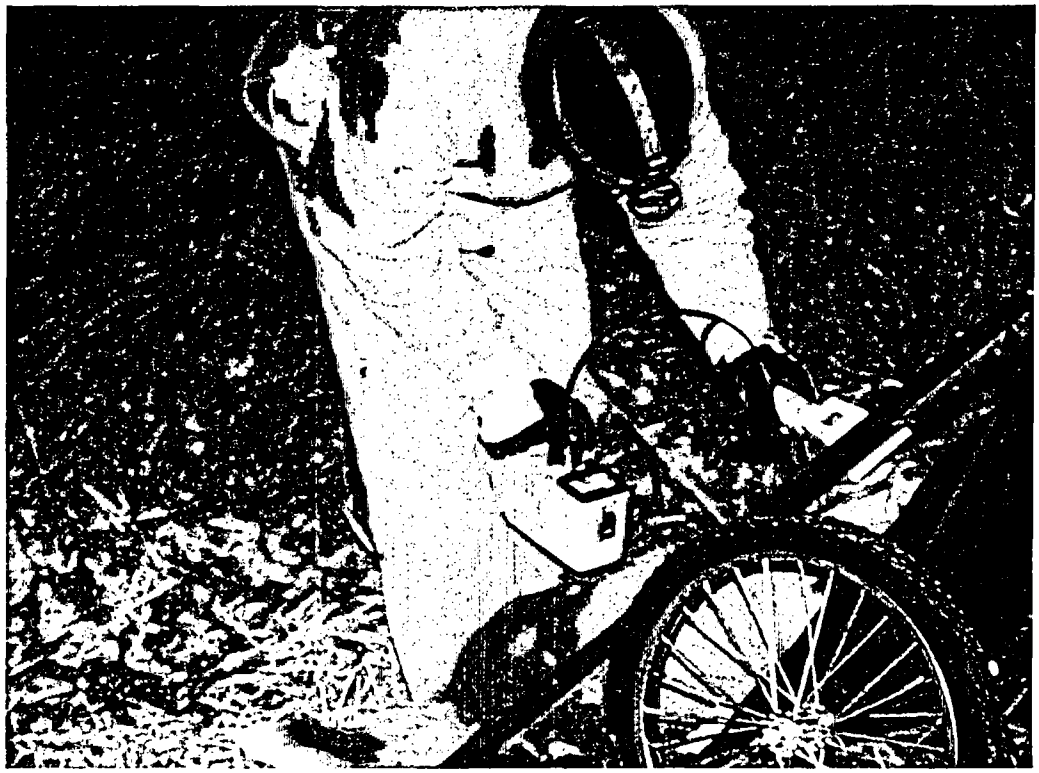
THIS PAGE WAS INTENTIONALLY LEFT BLANK



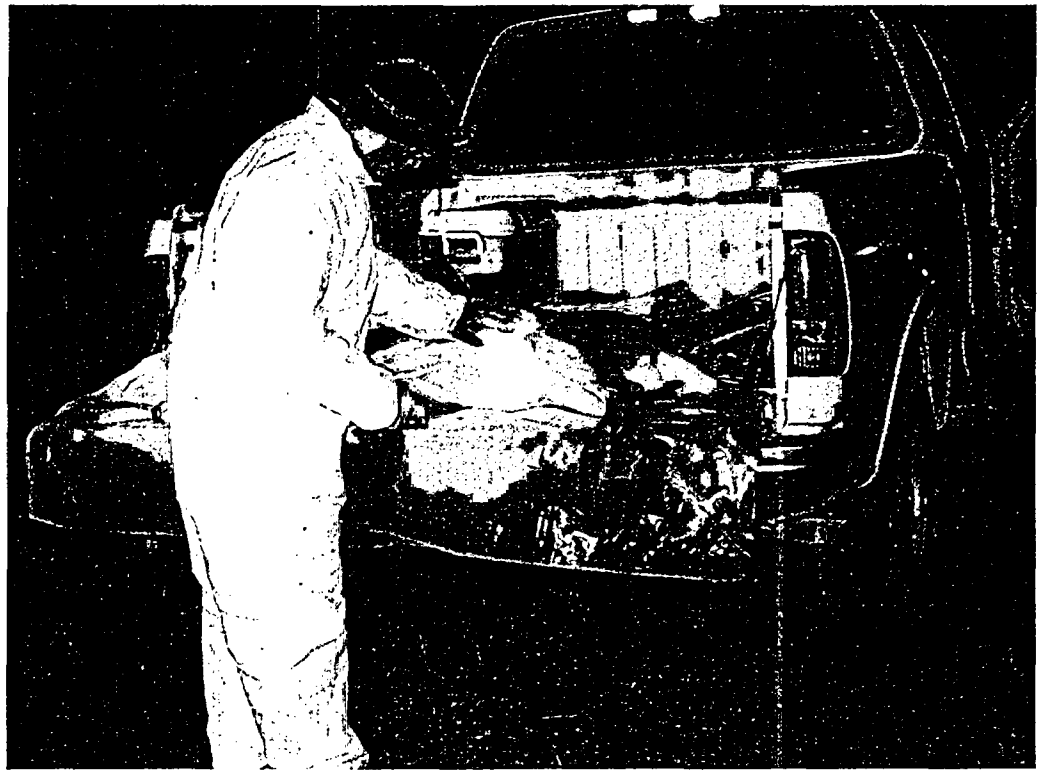
Deer Transported in Cart to Vehicle



Fur and Tissue Scraped from Foreleg for Clean Bone Sample

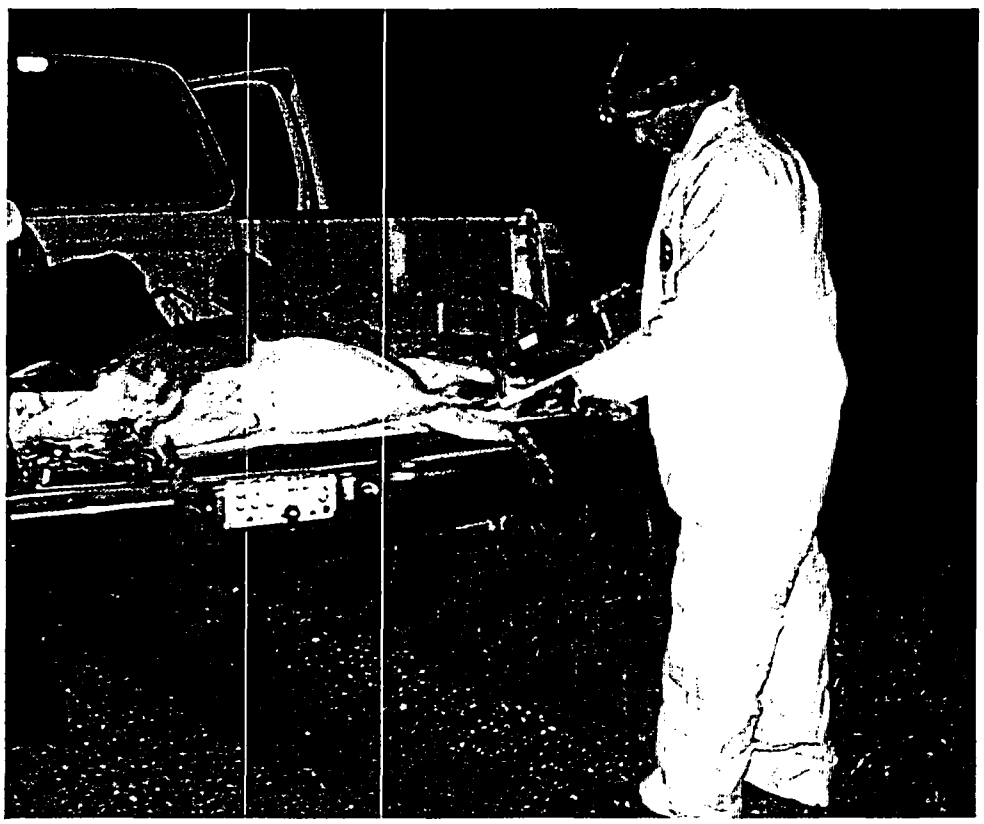


Health Physics Technician Collecting Radiological (Dose) Readings

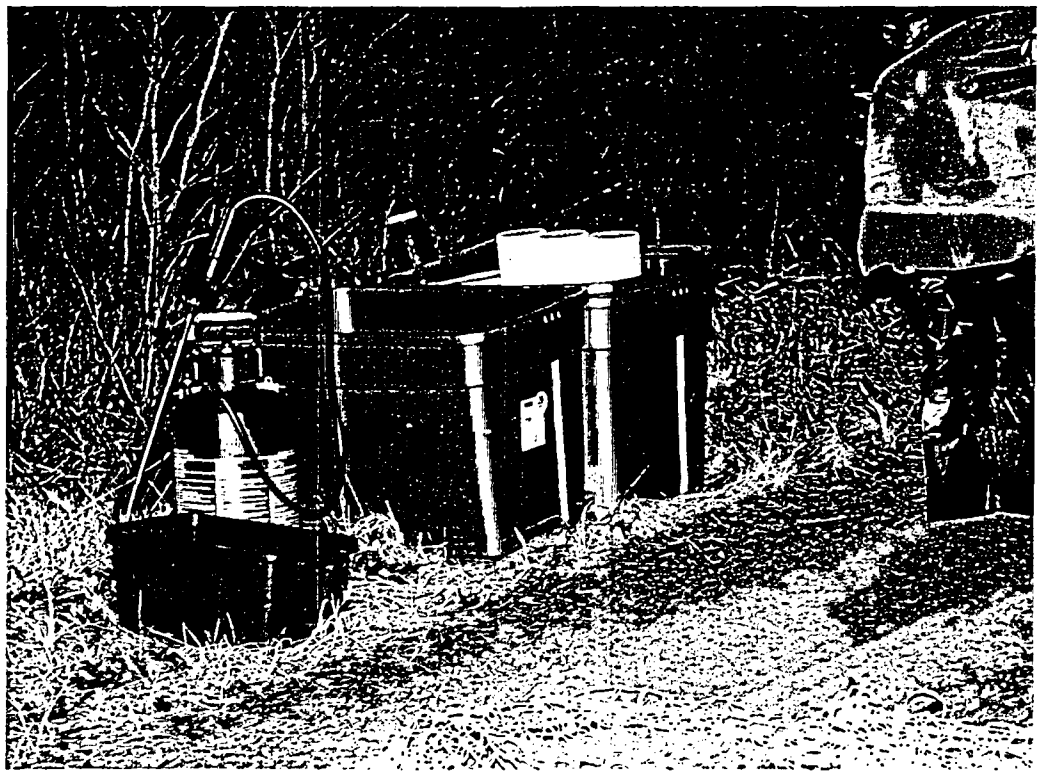


Initiating Deer Dissection

Recording GPS Location of Deer Sampled in the NHZ Area



Removal of the Foreleg Bone for Bone Sample



Sampling and Cleaning Equipment

Senior UXO Supervisor Clearing a Path in DU Impact Area

APPENDIX D

DATA VALIDATION SUMMARY

THIS PAGE WAS INTENTIONALLY LEFT BLANK

D. DATA VALIDATION SUMMARY

D.1 PARAGON ANALYTICS SDGs #05-12-068 and #06-02-205

This report contains the results from the data validation technical review for the Jefferson Proving Ground (JPG) deer tissue samples (i.e., muscle, bone, liver, and kidney) and associated field quality control (QC) samples and analyses that are associated with the above-referenced laboratory and sample delivery groups (SDGs). These data points have been selected for data validation, and the sample data summary sheets on the following pages specifically identify the samples and analyses associated with this validation review.

The JPG validation technical review was performed in accordance with the U.S. Environmental Protection Agency's (USEPA's) *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (July 2002) and Science Applications International Corporation's (SAIC's) Quality Assurance Technical Procedure No. TP-DM-300-7, *Data Validation* (February 2004). The technical review was based on the information and documentation supplied by the associated laboratory. The analyses were evaluated against criteria established in the related analytical procedures and the JPG data quality requirements.

Attachment D1 to this report provides the Sample Data Summary Sheets for the samples associated with the above-referenced SDGs. These summary sheets identify the analytical values and the qualifiers for each sample and parameter. Attachment D2 outlines the validation qualifiers and reason codes used in the validation of the data.

Report Summary	
Total Number of Samples	136
Total Number of Data Points	408
Total Number of Rejected Data Points	0
Percent Completeness (approval to rejection ratio)	100%

Sample Index

Laboratory:	*SDG #:*
Paragon Analytics	**05-12-068, 06-02-205**

Client Sample I.D.	Laboratory Sample I.D.	Date Collected	Analyses Performed
DR-BHZ-01-SAICM	512068-1	30-Nov-05	Isotopic Uranium
DR-BHZ-01-SAICB	512068-2	30-Nov-05	Isotopic Uranium
DR-BHZ-01-SAICL	512068-3	30-Nov-05	Isotopic Uranium
DR-BHZ-01-SAICK	512068-4	30-Nov-05	Isotopic Uranium
DR-BHZ-02-SAICM	512068-5	02-Dec-05	Isotopic Uranium
DR-BHZ-02-SAICMD	512068-6	02-Dec-05	Isotopic Uranium
DR-BHZ-02-SAICB	512068-7	02-Dec-05	Isotopic Uranium
DR-BHZ-02-SAICBD	512068-8	02-Dec-05	Isotopic Uranium
DR-BHZ-02-SAICL	512068-9	02-Dec-05	Isotopic Uranium
DR-BHZ-02-SAICLD	512068-10	02-Dec-05	Isotopic Uranium
DR-BHZ-02-SAICK	512068-11	02-Dec-05	Isotopic Uranium
DR-DUA-07-SAIRB01	512068-12	07-Dec-05	Isotopic Uranium
SOURCE-DI-SAIC01	512068-13	07-Dec-05	Isotopic Uranium
DR-DUA-01-SAICM	512068-14	05-Dec-05	Isotopic Uranium
DR-DUA-01-SAICB	512068-15	05-Dec-05	Isotopic Uranium
DR-DUA-01-SAICL	512068-16	05-Dec-05	Isotopic Uranium
DR-DUA-01-SAICK	512068-17	05-Dec-05	Isotopic Uranium
DR-DUA-02-SAICM	512068-18	06-Dec-05	Isotopic Uranium
DR-DUA-02-SAICB	512068-19	06-Dec-05	Isotopic Uranium
DR-DUA-02-SAICL	512068-20	06-Dec-05	Isotopic Uranium
DR-DUA-02-SAICK	512068-21	06-Dec-05	Isotopic Uranium
DR-DUA-03-SAICM	512068-22	06-Dec-05	Isotopic Uranium
DR-DUA-03-SAICB	512068-23	06-Dec-05	Isotopic Uranium
DR-DUA-03-SAICL	512068-24	06-Dec-05	Isotopic Uranium
DR-DUA-03-SAICK	512068-25	06-Dec-05	Isotopic Uranium
DR-DUA-04-SAICM	512068-26	06-Dec-05	Isotopic Uranium
DR-DUA-04-SAICMD	512068-27	06-Dec-05	Isotopic Uranium
DR-DUA-04-SAICB	512068-28	06-Dec-05	Isotopic Uranium
DR-DUA-04-SAICBD	512068-29	06-Dec-05	Isotopic Uranium
DR-DUA-04-SAICL	512068-30	06-Dec-05	Isotopic Uranium
DR-DUA-04-SAICLD	512068-31	06-Dec-05	Isotopic Uranium
DR-DUA-04-SAICK	512068-32	06-Dec-05	Isotopic Uranium
DR-DUA-04-SAICKD	512068-33	06-Dec-05	Isotopic Uranium
DR-DUA-05-SAICM	512068-34	06-Dec-05	Isotopic Uranium
DR-DUA-05-SAICB	512068-35	06-Dec-05	Isotopic Uranium
DR-DUA-05-SAICL	512068-36	06-Dec-05	Isotopic Uranium
DR-DUA-05-SAICK	512068-37	06-Dec-05	Isotopic Uranium

Client Sample I.D.	Laboratory Sample I.D.	Date Collected	Analyses Performed
DR-DUA-06-SAICM	512068-38	06-Dec-05	Isotopic Uranium
DR-DUA-06-SAICB	512068-39	06-Dec-05	Isotopic Uranium
DR-DUA-06-SAICL	512068-40	06-Dec-05	Isotopic Uranium
DR-DUA-06-SAICK	512068-41	06-Dec-05	Isotopic Uranium
DR-DUA-07-SAICM	512068-42	07-Dec-05	Isotopic Uranium
DR-DUA-07-SAICB	512068-43	07-Dec-05	Isotopic Uranium
DR-DUA-07-SAICL	512068-44	07-Dec-05	Isotopic Uranium
DR-DUA-07-SAICK	512068-45	07-Dec-05	Isotopic Uranium
DR-DUA-08-SAICM	512068-46	07-Dec-05	Isotopic Uranium
DR-DUA-08-SAICB	512068-47	07-Dec-05	Isotopic Uranium
DR-DUA-08-SAICL	512068-48	07-Dec-05	Isotopic Uranium
DR-DUA-08-SAICK	512068-49	07-Dec-05	Isotopic Uranium
DR-DUA-09-SAICM	512068-50	07-Dec-05	Isotopic Uranium
DR-DUA-09-SAICB	512068-51	07-Dec-05	Isotopic Uranium
DR-DUA-09-SAICL	512068-52	07-Dec-05	Isotopic Uranium
DR-DUA-09-SAICK	512068-53	07-Dec-05	Isotopic Uranium
DR-DUA-10-SAICM	512068-54	07-Dec-05	Isotopic Uranium
DR-DUA-10-SAICB	512068-55	07-Dec-05	Isotopic Uranium
DR-DUA-10-SAICL	512068-56	07-Dec-05	Isotopic Uranium
DR-DUA-10SAICK	512068-57	07-Dec-05	Isotopic Uranium
DR-NHZ-01-SAICM	602205-1	21-Feb-06	Isotopic Uranium
DR-NHZ-01-SAICB	602205-2	21-Feb-06	Isotopic Uranium
DR-NHZ-01-SAICL	602205-3	21-Feb-06	Isotopic Uranium
DR-NHZ-01-SAICK	602205-4	21-Feb-06	Isotopic Uranium
DR-NHZ-02-SAICM	602205-5	21-Feb-06	Isotopic Uranium
DR-NHZ-02-SAICMD	602205-6	21-Feb-06	Isotopic Uranium
DR-NHZ-02-SAICB	602205-7	21-Feb-06	Isotopic Uranium
DR-NHZ-02-SAICBD	602205-8	21-Feb-06	Isotopic Uranium
DR-NHZ-02-SAICL	602205-9	21-Feb-06	Isotopic Uranium
DR-NHZ-02-SAICLD	602205-10	21-Feb-06	Isotopic Uranium
DR-NHZ-02-SAICK	602205-11	21-Feb-06	Isotopic Uranium
DR-NHZ-02-SAICKD	602205-12	21-Feb-06	Isotopic Uranium
DR-NHZ-03-SAICM	602205-13	21-Feb-06	Isotopic Uranium
DR-NHZ-03-SAICB	602205-14	21-Feb-06	Isotopic Uranium
DR-NHZ-03-SAICL	602205-15	21-Feb-06	Isotopic Uranium
DR-NHZ-03-SAICK	602205-16	21-Feb-06	Isotopic Uranium
DR-NHZ-03-SAIRB02	602205-17	22-Feb-06	Isotopic Uranium
DR-BHZ-07-SAIRB03	602205-18	24-Feb-06	Isotopic Uranium
DR-NHZ-04-SAICM	602205-19	22-Feb-06	Isotopic Uranium
DR-NHZ-04-SAICB	602205-20	22-Feb-06	Isotopic Uranium
DR-NHZ-04-SAICL	602205-21	22-Feb-06	Isotopic Uranium
DR-NHZ-04-SAICK	602205-22	22-Feb-06	Isotopic Uranium

Client Sample I.D.	Laboratory Sample I.D.	Date Collected	Analyses Performed
DR-NHZ-05-SAICM	602205-23	22-Feb-06	Isotopic Uranium
DR-NHZ-05-SAICB	602205-24	22-Feb-06	Isotopic Uranium
DR-NHZ-05-SAICL	602205-25	22-Feb-06	Isotopic Uranium
DR-NHZ-05-SAICK	602205-26	22-Feb-06	Isotopic Uranium
DR-NHZ-06-SAICM	602205-27	22-Feb-06	Isotopic Uranium
DR-NHZ-06-SAICB	602205-28	22-Feb-06	Isotopic Uranium
DR-NHZ-06-SAICL	602205-29	22-Feb-06	Isotopic Uranium
DR-NHZ-06-SAICK	602205-30	22-Feb-06	Isotopic Uranium
DR-NHZ-07-SAICM	602205-31	22-Feb-06	Isotopic Uranium
DR-NHZ-07-SAICB	602205-32	22-Feb-06	Isotopic Uranium
DR-NHZ-07-SAICL	602205-33	22-Feb-06	Isotopic Uranium
DR-NHZ-07-SAICK	602205-34	22-Feb-06	Isotopic Uranium
DR-NHZ-08-SAICM	602205-35	22-Feb-06	Isotopic Uranium
DR-NHZ-08-SAICB	602205-36	22-Feb-06	Isotopic Uranium
DR-NHZ-08-SAICL	602205-37	22-Feb-06	Isotopic Uranium
DR-NHZ-08-SAICK	602205-38	22-Feb-06	Isotopic Uranium
DR-NHZ-09-SAICM	602205-39	22-Feb-06	Isotopic Uranium
DR-NHZ-09-SAICB	602205-40	22-Feb-06	Isotopic Uranium
DR-NHZ-09-SAICL	602205-41	22-Feb-06	Isotopic Uranium
DR-NHZ-09-SAICK	602205-42	22-Feb-06	Isotopic Uranium
DR-NHZ-10-SAICM	602205-43	23-Feb-06	Isotopic Uranium
DR-NHZ-10-SAICB	602205-44	23-Feb-06	Isotopic Uranium
DR-NHZ-10-SAICL	602205-45	23-Feb-06	Isotopic Uranium
DR-NHZ-10-SAICK	602205-46	23-Feb-06	Isotopic Uranium
DR-BHZ-03-SAICM	602205-47	23-Feb-06	Isotopic Uranium
DR-BHZ-03-SAICB	602205-48	23-Feb-06	Isotopic Uranium
DR-BHZ-03-SAICL	602205-49	23-Feb-06	Isotopic Uranium
DR-BHZ-03-SAICK	602205-50	23-Feb-06	Isotopic Uranium
DR-BHZ-04-SAICM	602205-51	23-Feb-06	Isotopic Uranium
DR-BHZ-04-SAICB	602205-52	23-Feb-06	Isotopic Uranium
DR-BHZ-04-SAICL	602205-53	23-Feb-06	Isotopic Uranium
DR-BHZ-04-SAICK	602205-54	23-Feb-06	Isotopic Uranium
DR-BHZ-04-SAICKD	602205-55	23-Feb-06	Isotopic Uranium
DR-BHZ-05-SAICM	602205-56	23-Feb-06	Isotopic Uranium
DR-BHZ-05-SAICB	602205-57	23-Feb-06	Isotopic Uranium
DR-BHZ-05-SAICL	602205-58	23-Feb-06	Isotopic Uranium
DR-BHZ-05-SAICK	602205-59	23-Feb-06	Isotopic Uranium
DR-BHZ-06-SAICM	602205-60	23-Feb-06	Isotopic Uranium
DR-BHZ-06-SAICB	602205-61	23-Feb-06	Isotopic Uranium
DR-BHZ-06-SAICL	602205-62	23-Feb-06	Isotopic Uranium
DR-BHZ-06-SAICK	602205-63	23-Feb-06	Isotopic Uranium
DR-BHZ-07-SAICM	602205-64	24-Feb-06	Isotopic Uranium

Client Sample I.D.	Laboratory Sample I.D.	Date Collected	Analyses Performed
DR-BHZ-07-SAICB	602205-65	24-Feb-06	Isotopic Uranium
DR-BHZ-07-SAICL	602205-66	24-Feb-06	Isotopic Uranium
DR-BHZ-07-SAICK	602205-67	24-Feb-06	Isotopic Uranium
DR-BHZ-08-SAICM	602205-68	24-Feb-06	Isotopic Uranium
DR-BHZ-08-SAICB	602205-69	24-Feb-06	Isotopic Uranium
DR-BHZ-08-SAICL	602205-70	24-Feb-06	Isotopic Uranium
DR-BHZ-08-SAICK	602205-71	24-Feb-06	Isotopic Uranium
DR-BHZ-09-SAICM	602205-72	24-Feb-06	Isotopic Uranium
DR-BHZ-09-SAICB	602205-73	24-Feb-06	Isotopic Uranium
DR-BHZ-09-SAICL	602205-74	24-Feb-06	Isotopic Uranium
DR-BHZ-09-SAICK	602205-75	24-Feb-06	Isotopic Uranium
DR-BHZ-10SAICM	602205-76	24-Feb-06	Isotopic Uranium
DR-BHZ-10-SAICB	602205-77	24-Feb-06	Isotopic Uranium
DR-BHZ-10-SAICL	602205-78	24-Feb-06	Isotopic Uranium
DR-BHZ-10-SAICK	602205-79	24-Feb-06	Isotopic Uranium

D.1.1 Analytical Category: Radiochemical

- Uranium-234 (U-234), Uranium-235 (U-235), and Uranium-238 (U-238) were determined by alpha spectrometry (American Society for Testing and Materials [ASTM] D3972-90M).
- Deer tissue samples and associated field QC samples collected in November and December 2005 were analyzed in SDG 05-12-068 and deer tissue samples and associated field QC samples collected in February of 2006 were analyzed in SDG 06-02-205.

1. *The following items (as applicable) have been addressed during the validation review:*

- Sample custody, integrity and preservation
- Sample handling and preparation
- Holding times
- Instrument calibration and performance
- Dilution factors
- Detection limits
- Laboratory background and carry-over
- Overall appearance of the data
- QC:
  - Calibration checks and background
  - Preparation blanks
  - Chemical yield (tracer) recovery
  - Laboratory control samples
  - Laboratory duplicates
  - Field blanks (if available)
  - Field duplicates (if available).

2. *The above items were found to be acceptable, except as follows:*

- **Blank Contamination Associated with Tissue Samples**

  U-234 was present in the associated deer tissue method blanks at 0.0073 ± 0.0056 picocuries per gram (pCi/g) and 0.0077 ± 0.0027 pCi/g in SDG 05-12-068. U-238 was present in one associated deer tissue method blank at 0.0026 ± 0.0016 pCi/g in SDG 05-12-068. U-234 and U-238 were present in the associated water method blank at 0.063 ± 0.038 pCi/Liter (pCi/L) and 0.071 ± 0.042 pCi/L, respectively, in SDG 06-02-205. Those samples, where the normalized absolute difference between the sample and the method blank was less than 2.58, were qualified as estimated "J," with a reason code 6 for the U-234 and U-238 results via alpha spectroscopy. Although the blank contamination required qualification of associated sample data, the contamination was well below the requested minimum detectable concentration (MDC) of 0.02 pCi/g for deer tissue samples and 2.0 pCi/L for water samples.

- **Blank Contamination Associated with Equipment Rinse Blanks**

  The only tissue samples that the equipment rinse blanks would apply to are the bone samples. The muscle, liver, and kidney tissue were dissected from the deer using disposable scalpels. The bone saw and gutting knifes were rinsed after decontamination and the rinsate was collected and sent to the laboratory for analysis. For purposes of data validation, the equipment rinse blanks are not significantly different than the associated water method blank. The U-234 and U-238 were qualified "J" in both equipment rinse blanks due to method blank contamination, and the Uranium U-235 was nondetect in equipment rinse blank DR-BHZ-07-SAIRB03 and detected at 0.025 ± 0.024 pCi/L in equipment rinse blank DR-NHZ-03-SAIRB02. Due to the uncertainty in the equipment rinse blanks for U-234 and U-238 as a result of method blank contamination and the large relative error compared

to the equipment rinse blank concentration for U-235, the equipment rinse blanks were not used for validation of the deer bone samples.

- **Chemical Yield Summary (Tracer Recovery)**

  The chemical yield for samples DR-DUA-07-SAICB and DR-DUA-10-SAICB was below the lower control limit (LCL) of 30 percent at 17.7 percent and 13.6 percent, respectively. The U-234, U-235, and U-238 results for these two samples were qualified as estimated ("J" or "UJ") with a reason code of 38.

- **Overall Assessment of Data**

  U-234, U-235, and U-238 sample data with results greater than the MDC were qualified as estimated "J," reason code 37 in instances where the associated error was greater than 50 percent of the sample result.

3. Additional comments:

- The Case Narrative reports that the analytical method quantifies U-235 alpha activity in a specific region of interest corresponding to emission energies between those of U-234 and U-238. A potential limitation of this method is that measurable amounts of U-234 in the sample may cause a small amount of characteristic activity in the U-235 region of interest due to poorly resolved alpha activity at the boundary between the two regions. To minimize the potential for a high bias in the U-235 analytical results, the U-235 region of interest has been narrowed and limited to a lower energy region. An 85.1 percent abundance correction has been made to the final U-235 results. No action was taken during validation.
- The Case Narrative also reports the tracer of several samples have a Full Width at Half Maximum (FWHM) greater than 100 keV in SDG 06-02-205. FWHM is defined as the width of the peak distribution at a level that is half the maximum ordinate of the peak. All other peaks in these samples have good resolution, and all QC criteria were met for these samples. No action was taken during validation.
- It should be noted that the majority of the reported isotopic uranium activity results were at extremely low levels. In most instance, if the uncertainty is subtracted from the reported activity result, the value is less than the sample-specific MDC.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Attachment D1

Jefferson Proving Ground Sample Data Summary Sheets

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Sample Data Summary – Deer Tissue

Laboratory:	*SDG #:*
Paragon Analytics	**05-12-068, 06-02-205**

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	**Analyte**	**Result**	**Error**	**MDC**	**Units**	**Qualifier**	**Reason Code**
DR-BHZ-01-SAICM	U-234	0.0066	0.0060	0.0079	pCi/g	U	
	U-235	0.0016	0.0046	0.0085	pCi/g	U	
	U-238	0.0006	0.0039	0.0065	pCi/g	U	
DR-BHZ-01-SAICB	U-234	0.0047	0.0047	0.0080	pCi/g	U	
	U-235	-0.0004	0.0030	0.0070	pCi/g	U	
	U-238	0.0027	0.0037	0.0068	pCi/g	U	
DR-BHZ-01-SAICL	U-234	0.0024	0.0036	0.0071	pCi/g	U	
	U-235	0.0016	0.0033	0.0071	pCi/g	U	
	U-238	0.0033	0.0039	0.0067	pCi/g	U	
DR-BHZ-01-SAICK	U-234	0.0054	0.0051	0.0068	pCi/g	U	
	U-235	0.0012	0.0043	0.0032	pCi/g	U	
	U-238	0.0010	0.0036	0.0028	pCi/g	U	
DR-BHZ-02-SAICM	U-234	0.0036	0.0036	0.0047	pCi/g	U	
	U-235	0.0005	0.0033	0.0055	pCi/g	U	
	U-238	0.0006	0.0028	0.0062	pCi/g	U	
DR-BHZ-02-SAICMD	U-234	0.0072	0.0050	0.0022	pCi/g	J	6, 37
	U-235	0.0009	0.0034	0.0026	pCi/g	U	
	U-238	0.0056	0.0043	0.0022	pCi/g	J	37
DR-BHZ-02-SAICB	U-234	.0104	0.0070	0.0091	pCi/g	J	6, 37
	U-235	0.0015	0.0036	0.0060	pCi/g	U	
	U-238	0.0086	0.0059	0.0062	pCi/g	J	37
DR-BHZ-02-SAICBD	U-234	0.0108	0.0063	0.0054	pCi/g	J	6, 37
	U-235	0.0036	0.0039	0.0048	pCi/g	U	
	U-238	0.0016	0.0029	0.0022	pCi/g	U	
DR-BHZ-02-SAICL	U-234	0.0127	0.0063	0.0041	pCi/g	J	6, 37
	U-235	0.0024	0.0029	0.0022	pCi/g	J	37
	U-238	0.0014	0.0025	0.0019	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-BHZ-02-SAICLD	U-234	0.0033	0.0034	0.0044	pCi/g	U	
	U-235	0.0005	0.0031	0.0052	pCi/g	U	
	U-238	0.0032	0.0034	0.0049	pCi/g	U	
DR-BHZ-02-SAICK	U-234	0.0052	0.0046	0.0072	pCi/g	U	
	U-235	0.0023	0.0034	0.0064	pCi/g	U	
	U-238	0.0016	0.0029	0.0061	pCi/g	U	
DR-DAU-07-SAIRB01	U-234	0.038	0.040	0.060	pCi/L	U	
	U-235	0.008	0.032	0.022	pCi/L	U	
	U-238	0.013	0.028	0.053	pCi/L	U	
SOURCE-DI-SAIC01	U-234	0.072	0.066	0.107	pCi/L	U	
	U-235	-0.002	0.035	0.090	pCi/L	U	
	U-238	0.029	0.047	0.090	pCi/L	U	
DR-DUA-01-SAICM	U-234	0.0061	0.0045	0.0049	pCi/g	J	6, 37
	U-235	-0.0006	0.0031	0.0057	pCi/g	U	
	U-238	0.0006	0.0026	0.0057	pCi/g	U	
DR-DUA-01-SAICB	U-234	0.066	0.0051	0.0052	pCi/g	J	6, 37
	U-235	0.0013	0.0037	0.0068	pCi/g	U	
	U-238	0.0016	0.0032	0.0068	pCi/g	U	
DR-DUA-01-SAICL	U-234	0.0039	0.0037	0.0055	pCi/g	U	
	U-235	0.0011	0.0026	0.0044	pCi/g	U	
	U-238	0.0019	0.0029	0.0057	pCi/g	U	
DR-DUA-01-SAICK	U-234	0.0049	0.0044	0.0058	pCi/g	U	
	U-235	0.0012	0.0034	0.0063	pCi/g	U	
	U-238	0.0020	0.0029	0.0048	pCi/g	U	
DR-DUA-02-SAICM	U-234	0.0024	0.0038	0.0075	pCi/g	U	
	U-235	-0.0011	0.0028	0.0066	pCi/g	U	
	U-238	-0.0001	0.0024	0.0064	pCi/g	U	
DR-DUA-02-SAICB	U-234	0.0067	0.0055	0.0076	pCi/g	U	
	U-235	0.0008	0.0035	0.0076	pCi/g	U	
	U-238	0.0003	0.0030	0.0073	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-DUA-02-SAICL	U-234	0.0105	0.0056	0.0043	pCi/g	J	6, 37
	U-235	0.0008	0.0027	0.0021	pCi/g	U	
	U-238	0.0019	0.0023	0.0017	pCi/g	J	37
DR-DUA-02-SAICK	U-234	0.0041	0.0037	0.0044	pCi/g	U	
	U-235	0.0005	0.0031	0.0052	pCi/g	U	
	U-238	-0.0001	0.0027	0.0058	pCi/g	U	
DR-DUA-03-SAICM	U-234	0.0038	0.0056	0.0111	pCi/g	U	
	U-235	-0.0016	0.0046	0.0102	pCi/g	U	
	U-238	-0.0009	0.0039	0.0098	pCi/g	U	
DR-DUA-03-SAICB	U-234	0.0058	0.0052	0.0057	pCi/g	J	37
	U-235	0.0012	0.0043	0.0033	pCi/g	U	
	U-238	0.0036	0.0042	0.0063	pCi/g	U	
DR-DUA-03-SAICL	U-234	0.0042	0.0044	0.0051	pCi/g	U	
	U-235	0	0.0045	0.0035	pCi/g	U	
	U-238	0.0022	0.0039	0.0030	pCi/g	U	
DR-DUA-03-SAICK	U-234	0.0024	0.0033	0.0058	pCi/g	U	
	U-235	0.0007	0.0034	0.0047	pCi/g	U	
	U-238	0.0016	0.0029	0.0022	pCi/g	U	
DR-DUA-04-SAICM	U-234	0.0095	0.0062	0.0049	pCi/g	J	37
	U-235	0.0045	0.0048	0.0070	pCi/g	U	
	U-238	0.0003	0.0032	0.0060	pCi/g	U	
DR-DUA-04-SAICMD	U-234	0.0073	0.0059	0.0067	pCi/g	J	37
	U-235	0.0010	0.0042	0.0055	pCi/g	U	
	U-238	0.0001	0.0035	0.0072	pCi/g	U	
DR-DUA-04-SAICB	U-234	0.016	0.010	0.008	pCi/g	J	37
	U-235	0	0.0062	0.0048	pCi/g	U	
	U-238	-0.0011	0.0053	0.0100	pCi/g	U	
DR-DUA-04-SAICBD	U-234	0.0041	0.0043	0.0050	pCi/g	U	
	U-235	0.0046	0.0051	0.0069	pCi/g	U	
	U-238	0.0014	0.0038	0.0071	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-DUA-04-SAICL	U-234	0.0106	0.0083	0.0101	pCi/g	J	37
	U-235	0.0007	0.0056	0.0097	pCi/g	U	
	U-238	0.0028	0.0048	0.0096	pCi/g	U	
DR-DUA-04-SAICLD	U-234	0.0117	0.0078	0.0076	pCi/g	J	37
	U-235	0.0038	0.0047	0.0063	pCi/g	U	
	U-238	0.0008	0.0040	0.0090	pCi/g	U	
DR-DUA-04-SAICK	U-234	0.0022	0.0038	0.0029	pCi/g	U	
	U-235	0	0.0045	0.0034	pCi/g	U	
	U-238	0.0014	0.0038	0.0072	pCi/g	U	
DR-DUA-04-SAICKD	U-234	0.0034	0.0064	0.0137	pCi/g	U	
	U-235	0.0015	0.0063	0.0084	pCi/g	U	
	U-238	0.0018	0.0056	0.0137	pCi/g	U	
DR-DUA-05-SAICM	U-234	0.0021	0.0031	0.0053	pCi/g	U	
	U-235	0	0.0036	0.0028	pCi/g	U	
	U-238	0.0020	0.0031	0.0058	pCi/g	U	
DR-DUA-05-SAICB	U-234	0.0116	0.0076	0.0068	pCi/g	J	37
	U-235	0.0026	0.0046	0.0035	pCi/g	U	
	U-238	0.0029	0.0039	0.0061	pCi/g	U	
DR-DUA-05-SAICL	U-234	0.0006	0.0036	0.0056	pCi/g	U	
	U-235	0	0.0042	0.0032	pCi/g	U	
	U-238	0.0035	0.0041	0.0062	pCi/g	U	
DR-DUA-05-SAICK	U-234	0.0075	0.0060	0.0052	pCi/g	J	37
	U-235	0	0.0046	0.0035	pCi/g	U	
	U-238	0.0033	0.0039	0.0030	pCi/g	J	37
DR-DUA-06-SAICM	U-234	0.0067	0.0045	0.0032	pCi/g	J	37
	U-235	0.0026	0.0033	0.0054	pCi/g	U	
	U-238	0.0029	0.0031	0.0046	pCi/g	U	
DR-DUA-06-SAICB	U-234	0.0086	0.0064	0.0069	pCi/g	J	37
	U-235	0.0022	0.0043	0.0057	pCi/g	U	
	U-238	0.0043	0.0048	0.0074	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-DUA-06-SAICL	U-234	0.0084	0.0054	0.0043	pCi/g	J	37
	U-235	0	0.0033	0.0025	pCi/g	U	
	U-238	0.0010	0.0028	0.0052	pCi/g	U	
DR-DUA-06-SAICK	U-234	0.0062	0.0054	0.0050	pCi/g	J	37
	U-235	0.0008	0.0044	0.0069	pCi/g	U	
	U-238	0.0057	0.0054	0.0071	pCi/g	U	
DR-DUA-07-SAICM	U-234	0.0139	0.0084	0.0081	pCi/g	J	37
	U-235	0.0010	0.0045	0.0059	pCi/g	U	
	U-238	0.0038	0.0050	0.0089	pCi/g	U	
DR-DUA-07-SAICB	U-234	0.020	0.012	0.014	pCi/g	J	6, 37, 38
	U-235	-0.0010	0.0067	0.0142	pCi/g	UJ	38
	U-238	0.0094	0.0093	0.0142	pCi/g	UJ	38
DR-DUA-07-SAICL	U-234	0.0044	0.0049	0.0079	pCi/g	U	
	U-235	0.0022	0.0040	0.0085	pCi/g	U	
	U-238	-.0005	0.0034	0.0097	pCi/g	U	
DR-DUA-07-SAICK	U-234	0.0074	0.0064	0.0078	pCi/g	U	
	U-235	0.0025	0.0049	0.0065	pCi/g	U	
	U-238	0.0020	0.0042	0.0093	pCi/g	U	
DR-DUA-08-SAICM	U-234	0.0052	0.0063	0.0115	pCi/g	U	
	U-235	0.0001	0.0044	0.0089	pCi/g	U	
	U-238	0.0021	0.0044	0.0098	pCi/g	U	
DR-DUA-08-SAICB	U-234	0.0037	0.0053	0.0092	pCi/g	U	
	U-235	0.0043	0.0063	0.0108	pCi/g	U	
	U-238	0.0026	0.0054	0.0119	pCi/g	U	
DR-DUA-08-SAICL	U-234	0.0098	0.0069	0.0052	pCi/g	J	6, 37
	U-235	0.0013	0.0046	0.0036	pCi/g	U	
	U-238	0.0007	0.0039	0.0061	pCi/g	U	
DR-DUA-08-SAICK	U-234	0.0069	0.0053	0.0027	pCi/g	J	6, 37
	U-235	-0.0002	0.0041	0.0054	pCi/g	U	
	U-238	0.0040	0.0040	0.0027	pCi/g	J	6, 37

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-DUA-09-SAICM	U-234	0.0027	0.0034	0.0045	pCi/g	U	
	U-235	-0.0002	0.0040	0.0053	pCi/g	U	
	U-238	0.0037	0.0039	0.0045	pCi/g	U	
DR-DUA-09-SAICB	U-234	0.015	0.012	0.018	pCi/g	U	
	U-235	0.0034	0.0073	0.0114	pCi/g	U	
	U-238	0.0064	0.0072	0.0097	pCi/g	U	
DR-DUA-09-SAICL	U-234	0.0072	0.0059	0.0059	pCi/g	J	6, 37
	U-235	0.0023	0.0045	0.0060	pCi/g	U	
	U-238	-0.0006	0.0066	0.0066	pCi/g	U	
DR-DUA-09-SAICK	U-234	0.0114	0.0066	0.0052	pCi/g	J	6, 37
	U-235	0.0006	0.0035	0.0055	pCi/g	U	
	U-238	0.0022	0.0030	0.0047	pCi/g	U	
DR-DUA-10-SAICM	U-234	0.0070	0.0059	0.0082	pCi/g	U	
	U-235	0.0027	0.0039	0.0068	pCi/g	U	
	U-238	0.0013	0.0034	0.0082	pCi/g	U	
DR-DUA-10-SAICB	U-234	0.0112	0.0095	0.0134	pCi/g	UJ	38
	U-235	-0.0036	0.0072	0.0169	pCi/g	UJ	38
	U-238	0.0061	0.0065	0.0095	pCi/g	UJ	38
DR-DUA-10-SAICL	U-234	0.0030	0.0037	0.0061	pCi/g	U	
	U-235	0.0022	0.0038	0.0076	pCi/g	U	
	U-238	0.0027	0.0038	0.0069	pCi/g	U	
DR-DUA-10-SAICK	U-234	0.0055	0.0048	0.0059	pCi/g	U	
	U-235	-0.0002	0.0037	0.0049	pCi/g	U	
	U-238	0.0018	0.0031	0.0024	pCi/g	U	
DR-NHZ-01-SAICM	U-234	0.0139	0.0068	0.0048	pCi/g		
	U-235	0.0030	0.0035	0.0050	pCi/g	U	
	U-238	0.0036	0.0036	0.0052	pCi/g	U	
DR-NHZ-01-SAICB	U-234	0.0054	0.0043	0.0049	pCi/g	J	37
	U-235	0.0009	0.0031	0.0063	pCi/g	U	
	U-238	0.0054	0.0046	0.0065	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-NHZ-01-SAICL	U-234	0.0057	0.0039	0.0017	pCi/g	J	37
	U-235	0.0022	0.0027	0.0020	pCi/g	J	37
	U-238	0.0030	0.0029	0.0031	pCi/g	U	
DR-NHZ-01-SAICK	U-234	0.0100	0.0060	0.0047	pCi/g	J	37
	U-235	0.0056	0.0047	0.0025	pCi/g	J	37
	U-238	0.0066	0.0049	0.0053	pCi/g	J	37
DR-NHZ-02-SAICM	U-234	0.0122	0.0063	0.0058	pCi/g	J	37
	U-235	0.0016	0.0028	0.0057	pCi/g	U	
	U-238	0.0029	0.0037	0.0068	pCi/g	U	
DR-NHZ-02-SAICMD	U-234	0.0135	0.0072	0.0063	pCi/g	J	37
	U-235	0.0026	0.0034	0.0047	pCi/g	U	
	U-238	0.0030	0.0033	0.0040	pCi/g	U	
DR-NHZ-02-SAICB	U-234	0.0112	0.0070	0.0067	pCi/g	J	37
	U-235	0.0052	0.0050	0.0054	pCi/g	U	
	U-238	0.0021	0.0039	0.0081	pCi/g	U	
DR-NHZ-02-SAICBD	U-234	0.021	0.011	0.006	pCi/g	J	37
	U-235	0.0064	0.0061	0.0067	pCi/g	U	
	U-238	0.0049	0.0052	0.0076	pCi/g	U	
DR-NHZ-02-SAICL	U-234	0.0086	0.0077	0.0101	pCi/g	U	
	U-235	0.0014	0.0059	0.0078	pCi/g	U	
	U-238	0.0016	0.0050	0.0101	pCi/g	U	
DR-NHZ-02-SAICLD	U-234	0.0116	0.0076	0.0031	pCi/g	J	37
	U-235	0.0041	0.0048	0.0037	pCi/g	J	37
	U-238	0.0058	0.0053	0.0031	pCi/g	J	37
DR-NHZ-02-SAICK	U-234	0.0017	0.0040	0.0092	pCi/g	U	
	U-235	0.0035	0.0046	0.0072	pCi/g	U	
	U-238	0.0053	0.0056	0.0088	pCi/g	U	
DR-NHZ-02-SAICKD	U-234	0.0054	0.0053	0.0064	pCi/g	U	
	U-235	0.0036	0.0049	0.0076	pCi/g	U	
	U-238	0.0045	0.0047	0.0055	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-NHZ-03-SAICM	U-234	0.0072	0.0053	0.0052	pCi/g	J	37
	U-235	0.0006	0.0035	0.0055	pCi/g	U	
	U-238	-0.0002	0.0030	0.0040	pCi/g	U	
DR-NHZ-03-SAICB	U-234	0.0041	0.0049	0.0037	pCi/g	J	37
	U-235	0.0048	0.0057	0.0044	pCi/g	J	37
	U-238	0.0041	0.0049	0.0037	pCi/g	J	37
DR-NHZ-03-SAICL	U-234	0.0082	0.0061	0.0049	pCi/g	J	37
	U-235	-0.0007	0.0043	0.0075	pCi/g	U	
	U-238	0.0036	0.0043	0.0064	pCi/g	U	
DR-NHZ-03-SAICK	U-234	0.0122	0.0088	0.0118	pCi/g	J	37
	U-235	0.0050	0.0056	0.0076	pCi/g	U	
	U-238	0.0042	0.0048	0.0064	pCi/g	U	
DR-NHZ-03-SAIRB02	U-234	0.070	0.043	0.049	pCi/L	J	6, 37
	U-235	0.025	0.024	0.014	pCi/L	J	37
	U-238	0.022	0.023	0.030	pCi/L	U	
DR-BHZ-07-SAIRB03	U-234	0.094	0.041	0.027	pCi/L	J	6, 37
	U-235	0.002	0.024	0.051	PCi/L	U	
	U-238	0.042	0.029	0.034	PCi/L	J	6, 37.
DR-NHZ-04-SAICM	U-234	0.0076	0.0052	0.0023	pCi/g	J	37
	U-235	0.0028	0.0035	0.0046	pCi/g	U	
	U-238	0.0032	0.0034	0.0039	pCi/g	U	
DR-NHZ-04-SAICB	U-234	0.0081	0.0064	0.0056	pCi/g	J	37
	U-235	0.0037	0.0049	0.0077	pCi/g	U	
	U-238	0.0069	0.0059	0.0056	pCi/g	J	37
DR-NHZ-04-SAICL	U-234	0.0067	0.0055	0.0067	pCi/g	U	
	U-235	0.0029	0.0039	0.0061	pCi/g	U	
	U-238	0..0015	0.0033	0.0052	pCi/g	U	
DR-NHZ-04-SAICK	U-234	0.0040	0.0047	0.0070	pCi/g	U	
	U-235	-0.0002	0.0047	0.0063	pCi/g	U	
	U-238	0.0030	0.0041	0.0063	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-NHZ-05-SAICM	U-234	0.0043	0.0048	0.0078	pCi/g	U	
	U-235	0.0020	0.0040	0.0056	pCi/g	U	
	U-238	0.0033	0.0039	0.0056	pCi/g	U	
DR-NHZ-05-SAICB	U-234	0.0019	0.0053	0.0120	pCi/g	U	
	U-235	-0.0002	0.0036	0.0097	pCi/g	U	
	U-238	0.0033	0.0044	0.0082	pCi/g	U	
DR-NHZ-05-SAICL	U-234	0.0073	0.0058	0.0077	pCi/g	U	
	U-235	0.0003	0.0037	0.0069	pCi/g	U	
	U-238	0.0011	0.0031	0.0059	pCi/g	U	
DR-NHZ-05-SAICK	U-234	0.0074	0.0056	0.0048	pCi/g	J	37
	U-235	0	0.0040	0.0082	pCi/g	U	
	U-238	0.0065	0.0052	0.0048	pCi/g	J	37
DR-NHZ-06-SAICM	U-234	0.0061	0.0049	0.0056	pCi/g	J	37
	U-235	0.0015	0.0035	0.0059	pCi/g	U	
	U-238	0.0023	0.0030	0.0042	pCi/g	U	
DR-NHZ-06-SAICB	U-234	0.0055	0.0059	0.0103	pCi/g	U	
	U-235	-0.0008	0.0039	0.0097	pCi/g	U	
	U-238	0.0013	0.0041	0.0097	pCi/g	U	
DR-NHZ-06-SAICL	U-234	0.0102	0.0069	0.0095	pCi/g	J	37
	U-235	0.0019	0.0035	0.0026	pCi/g	U	
	U-238	-0.0004	0.0029	0.0049	pCi/g	U	
DR-NHZ-06-SAICK	U-234	0.0066	0.0049	0.0053	pCi/g	J	37
	U-235	0.0016	0.0033	0.0047	pCi/g	U	
	U-238	0.0003	0.0028	0.0069	pCi/g	U	
DR-NHZ-07-SAICM	U-234	0.0047	0.0039	0.0043	pCi/g	J	37
	U-235	0.0026	0.0031	0.0023	pCi/g	J	37
	U-238	0.0026	0.0030	0.0043	pCi/g	U	
DR-NHZ-07-SAICB	U-234	0.0077	0.0051	0.0064	pCi/g	J	37
	U-235	0.0013	0.0026	0.0037	pCi/g	U	
	U-238	0.0021	0.0026	0.0042	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-NHZ-07-SAICL	U-234	0.0074	0.0054	0.0052	pCi/g	J	37
	U-235	0.0020	0.0037	0.0028	pCi/g	U	
	U-238	0.0127	0.0040	0.0068	pCi/g	U	
DR-NHZ-07-SAICK	U-234	0.0070	0.0055	0.0073	pCi/g	U	
	U-235	0.0003	0.0035	0.0066	pCi/g	U	
	U-238	0.0034	0.0043	0.0077	pCi/g	U	
DR-NHZ-08-SAICM	U-234	0.0066	0.0049	0.0053	pCi/g	J	37
	U-235	0.0007	0.0033	0.0047	pCi/g	U	
	U-238	0.0040	0.0040	0.0058	pCi/g	U	
DR-NHZ-08-SAICB	U-234	0.0013	0.0037	0.0087	pCi/g	U	
	U-235	-0.0020	0.0042	0.0103	pCi/g	U	
	U-238	0.0011	0.0037	0.0091	pCi/g	U	
DR-NHZ-08-SAICL	U-234	0.0020	0.0046	0.0105	pCi/g	U	
	U-235	0.0026	0.0053	0.0074	pCi/g	U	
	U-238	0.0007	0.0045	0.0075	pCi/g	U	
DR-NHZ-08-SAICK	U-234	0.0038	0.0065	0.0136	pCi/g	U	
	U-235	0.0010	0.0045	0.0114	pCi/g	U	
	U-238	0.0049	0.0056	0.0097	pCi/g	U	
DR-NHZ-09-SAICM	U-234	0.0045	0.0049	0.0082	pCi/g	U	
	U-235	0.0005	0.0038	0.0062	pCi/g	U	
	U-238	0.0065	0.0052	0.0060	pCi/g	J	37
DR-NHZ-09-SAICB	U-234	0.0062	0.0049	0.0045	pCi/g	J	37
	U-235	0.0008	0.0038	0.0053	pCi/g	U	
	U-238	0.0032	0.0037	0.0054	pCi/g	U	
DR-NHZ-09-SAICL	U-234	0.0067	0.0073	0.0089	pCi/g	U	
	U-235	0.0006	0.0075	0.0139	pCi/g	U	
	U-238	0.0031	0.0064	0.0089	pCi/g	U	
DR-NHZ-09-SAICK	U-234	0.0064	0.0069	0.0100	pCi/g	U	
	U-235	-0.0008	0.0063	0.0105	pCi/g	U	
	U-238	0.0057	0.0061	0.0075	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-NHZ-10-SAICM	U-234	0.0073	0.0061	0.0079	pCi/g	U	
	U-235	0.0043	0.0051	0.0076	pCi/g	U	
	U-238	0.0039	0.0054	0.0103	pCi/g	U	
DR-NHZ-10-SAICB	U-234	0.0116	0.0073	0.0050	pCi/g	J	37
	U-235	0.0010	0.0044	0.0059	pCi/g	U	
	U-238	0.0010	0.0038	0.0081	pCi/g	U	
DR-NHZ-10-SAICL	U-234	0.0035	0.0037	0.0059	pCi/g	U	
	U-235	0.0014	0.0031	0.0048	pCi/g	U	
	U-238	0.0032	0.0034	0.0049	pCi/g	U	
DR-NHZ-10-SAICK	U-234	0.0039	0.0042	0.0048	pCi/g	U	
	U-235	0.0010	0.0043	0.0057	pCi/g	U	
	U-238	0.0036	0.0042	0.0063	pCi/g	U	
DR-BHZ-03-SAICM	U-234	0.0052	0.0048	0.0067	pCi/g	U	
	U-235	0.0017	0.0037	0.0057	pCi/g	U	
	U-238	0.0077	0.0058	0.0070	pCi/g	J	37
DR-BHZ-03-SAICB	U-234	0.0015	0.0036	0.0062	pCi/g	U	
	U-235	0.0010	0.0042	0.0056	pCi/g	U	
	U-238	0.0057	0.0051	0.0056	pCi/g	J	37
DR-BHZ-03-SAICL	U-234	0.0068	0.0048	0.0049	pCi/g	J	37
	U-235	0.0011	0.0031	0.0058	pCi/g	U	
	U-238	0.0026	0.0030	0.0045	pCi/g	U	
DR-BHZ-03-SAICK	U-234	0.0007	0.0028	0.0037	pCi/g	U	
	U-235	-0.0002	0.0033	0.0044	pCi/g	U	
	U-238	0.0021	0.0028	0.0044	pCi/g	U	
DR-BHZ-04-SAICM	U-234	0.0073	0.0054	0.0044	pCi/g	J	37
	U-235	0.0014	0.0039	0.0073	pCi/g	U	
	U-238	0.0023	0.0033	0.0057	pCi/g	U	
DR-BHZ-04-SAICB	U-234	0.0049	0.0048	0.0058	pCi/g	U	
	U-235	0.0008	0.0043	0.0068	pCi/g	U	
	U-238	0.0031	0.0037	0.0075	pCi/g	J	37

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-BHZ-04-SAICL	U-234	0.0063	0.0051	0.0076	pCi/g	U	
	U-235	0.0013	0.0033	0.0056	pCi/g	U	
	U-238	0.0010	0.0028	0.0052	pCi/g	U	
DR-BHZ-04-SAICK	U-234	0.0043	0.0041	0.0042	pCi/g	J	37
	U-235	0.0031	0.0037	0.0028	pCi/g	J	37
	U-238	0.0038	0.0041	0.0059	pCi/g	U	
DR-BHZ-04-SAICKD	U-234	0.0023	0.0029	0.0039	pCi/g	U	
	U-235	0.0026	0.0035	0.0054	pCi/g	U	
	U-238	0.0015	0.0029	0.0039	pCi/g	U	
DR-BHZ-05-SAICM	U-234	0.0115	0.0068	0.0062	pCi/g	J	37
	U-235	0.0037	0.0042	0.0057	pCi/g	U	
	U-238	0.0032	0.0036	0.0048	pCi/g	U	
DR-BHZ-05-SAICB	U-234	0.0079	0.0060	0.0057	pCi/g	J	37
	U-235	-0.0004	0.0043	0.0067	pCi/g	U	
	U-238	0.0119	0.0075	0.0064	pCi/g	J	37
DR-BHZ-05-SAICL	U-234	0.0071	0.0055	0.0067	pCi/g	J	37
	U-235	0.0031	0.0043	0.0079	pCi/g	U	
	U-238	0.0069	0.0055	0.0071	pCi/g	U	
DR-BHZ-05-SAICK	U-234	0.0139	0.0074	0.0062	pCi/g	J	37
	U-235	0.0058	0.0048	0.0026	pCi/g	J	37
	U-238	0.0052	0.0045	0.0055	pCi/g	U	
DR-BHZ-06-SAICM	U-234	0.0061	0.0051	0.0058	pCi/g	J	37
	U-235	-0.0004	0.0039	0.0061	pCi/g	U	
	U-238	0.0016	0.0033	0.0052	pCi/g	U	
DR-BHZ-06-SAICB	U-234	0.0056	0.0051	0.0071	pCi/g	U	
	U-235	0.0071	0.0060	0.0068	pCi/g	J	37
	U-238	0.0016	0.0040	0.0092	pCi/g	U	
DR-BHZ-06-SAICL	U-234	0.0090	0.0068	0.0092	pCi/g	U	
	U-235	0.0041	0.0051	0.0087	pCi/g	U	
	U-238	0.0065	0.0055	0.0071	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-BHZ-06-SAICK	U-234	0.0081	0.0059	0.0027	pCi/g	J	37
	U-235	0.0069	0.0060	0.0056	pCi/g	J	37
	U-238	0.0031	0.0042	0.0072	pCi/g	U	
DR-BHZ-07-SAICM	U-234	0.0046	0.0043	0.0044	pCi/g	J	37
	U-235	0.0009	0.0039	0.0052	pCi/g	U	
	U-238	0.0006	0.0033	0.0052	pCi/g	U	
DR-BHZ-07-SAICB	U-234	0.0060	0.0064	0.0074	pCi/g	U	
	U-235	0.0012	0.0065	0.0102	pCi/g	U	
	U-238	0.0023	0.0056	0.0097	pCi/g	U	
DR-BHZ-07-SAICL	U-234	0.0062	0.0050	0.0051	pCi/g	J	37
	U-235	0.0009	0.0038	0.0051	pCi/g	U	
	U-238	-0.0001	0.0033	0.0070	pCi/g	U	
DR-BHZ-07-SAICK	U-234	0.071	0.019	0.006	pCi/g		
	U-235	0.0015	0.0033	0.0051	pCi/g	U	
	U-238	0.0018	0.0028	0.0052	pCi/g	U	
DR-BHZ-08-SAICM	U-234	0.0107	0.0063	0.0039	pCi/g	J	37
	U-235	0.0008	0.0035	0.0046	pCi/g	U	
	U-238	0.0021	0.0030	0.0051	pCi/g	U	
DR-BHZ-08-SAICB	U-234	0.0116	0.0079	0.0066	pCi/g	J	37
	U-235	0.0040	0.0050	0.0066	pCi/g	U	
	U-238	0.0020	0.0043	0.0066	pCi/g	U	
DR-BHZ-08-SAICL	U-234	0.0085	0.0067	0.0058	pCi/g	J	37
	U-235	-0.0010	0.0051	0.0097	pCi/g	U	
	U-238	0.0092	0.0072	0.0076	pCi/g	J	37
DR-BHZ-08-SAICK	U-234	0.0106	0.0072	0.0060	pCi/g	J	37
	U-235	0.0021	0.0046	0.0071	pCi/g	U	
	U-238	0.0011	0.0039	0.0030	pCi/g	U	
DR-BHZ-09-SAICM	U-234	0.0121	0.0075	0.0086	pCi/g	J	37
	U-235	0.0051	0.0050	0.0060	pCi/g	U	
	U-238	0.0030	0.0038	0.0062	pCi/g	U	

Isotopic Uranium							
ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
DR-BHZ-09-SAICB	U-234	0.0025	0.0036	0.0062	pCi/g	U	
	U-235	0.0015	0.0042	0.0079	pCi/g	U	
	U-238	0.0025	0.0036	0.0062	pCi/g	U	
DR-BHZ-09-SAICL	U-234	0.0033	0.0042	0.0076	pCi/g	U	
	U-235	0.0030	0.0038	0.0050	pCi/g	U	
	U-238	0.0026	0.0033	0.0043	pCi/g	U	
DR-BHZ-09-SAICK	U-234	0.0079	0.0067	0.0093	pCi/g	U	
	U-235	0.0009	0.0044	0.0100	pCi/g	U	
	U-238	0.0053	0.0054	0.0081	pCi/g	U	
DR-BHZ-10-SAICM	U-234	0.0081	0.0060	0.0048	pCi/g	J	37
	U-235	0.0024	0.0043	0.0033	pCi/g	U	
	U-238	0.0034	0.0042	0.0069	pCi/g	U	
DR-BHZ-10-SAICB	U-234	0.019	0.012	0.008	pCi/g	J	37
	U-235	0.0050	0.0068	0.0105	pCi/g	U	
	U-238	0.0094	0.0081	0.0076	pCi/g	J	37
DR-BHZ-10-SAICL	U-234	0.0089	0.0068	0.0064	pCi/g	J	37
	U-235	-0.0005	0.0048	0.0075	pCi/g	U	
	U-238	0.0029	0.0041	0.0071	pCi/g	U	
DR-BHZ-10-SAICK	U-234	0.021	0.012	0.012	pCi/g	J	37
	U-235	-0.0001	0.0062	0.0133	pCi/g	U	
	U-238	0.0059	0.015	0.0113	pCi/g	U	

KEY TO THE DATA VALIDATION QUALIFIERS

QUALIFIERS

	Indicates that the data met all quality assurance/quality control (QA/QC) requirements, and that the radionuclide has been positively identified and the associated concentration value is accurate.
U	Indicates that the data met all QA/QC requirements, and that the radionuclide was analyzed for but was not detected above the reported sample quantitation limit.
J	Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.
UJ	Indicates that the radionuclide was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of a radionuclide for which there is presumptive evidence to make a "tentative identification."
R	Indicates that the sample results for the radionuclide are rejected or unusable due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the radionuclide cannot be verified.

DATA VALIDATION REASON CODES

6	Method blank contamination.
37	Associated error was greater than 50 percent of the sample result.
38	Chemical yield exceeded the control limits.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX E

HISTORICAL JPG DEER SAMPLING RESULTS

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Table E-1. Data from Historical Deer Samples Reported in Ebinger and Hanson (1996)

Sample Year	Deer Sample I.D.	Location	Tissue Type	U-234 Activity (pCi/g)	U-234 Error (pCi/g)	U-238 Activity (pCi/g)	U-238 Error (pCi/g)
1984	8322120	Near SS 57	Liver	0.016	0.007	0.024	0.008
	8322120	Near SS 57	Kidney	-0.032		-0.0022	
	8322121	Near SS 6	Liver	-0.032		-0.0022	
	8322121	Near SS 6	Kidney	0.055	0.027	-0.0022	
	8322121	Near SS 6	Bone	-0.032		0.0003	0.0004
	8322122	Near SS 57	Liver	-0.032		0.0003	0.0004
	8322122	Near SS 57	Kidney	-0.032		-0.0022	
	8322122	Near SS 57	Bone	-0.032		-0.0022	
	8322123	Near SS 57	Liver	0.054	0.014	0.04	0.013
	8322124	Near SS 54	Liver	0.017	0.008	0.005	0.005
	8322124	Near SS 54	Kidney	-0.032		0.049	0.022
	8322125*	Near SS 57, 60	Liver	0.021	0.009	0.035	0.012
	8322125*	Near SS 57, 60	Kidney	0.021	0.01	0.016	0.008
	8322125*	Near SS 57, 60	Bone	-0.032		-0.0022	
	8322126	Near SS 57	Liver	-0.032		0.013	0.004
	8322126	Near SS 57	Kidney	-0.032		-0.0022	
	8322126	Near SS 57	Bone	-0.032		0.0002	0.0005
	8322127	Near SS 57	Liver	0.028	0.01	0.028	0.1
	8322127	Near SS 57	Bone	-0.32		0.0002	0.0004
	Deer #1	Unspecified	Unspecified	-0.001		-0.001	
	Deer #2	Unspecified	Unspecified	-0.001		-0.001	
	Deer #3	Unspecified	Unspecified	-0.001		-0.001	
	Deer #4	Unspecified	Unspecified	-0.001		-0.001	
1987	Deer	Area 52	Bone	0.0007	0.0004	0.0001	0.0002
	Deer	Area 52	Bone	0.0004	0.0002	0.0001	0.0001
	Deer	Area 52	Bone	-0.01	0	0.0005	0.0004
	Deer	Area 52	Bone	-0.01	0	0.0003	0.0002
	Deer	Area 52	Kidney	-0.01	0	0.0062	0.011
	Deer	Area 52	Kidney	-0.01	0	0.0003	0.0005
	Deer	Area 52	Liver	0.0023	0.0034	0.0025	0.0034
	Deer	Area 52	Liver	0.0001	0.0002	0.0001	0.0002
	Deer	Area 52	Liver	0.0088	0.0049	0.0079	0.0046
	Deer	Area 52	Liver	0.0003	0.0002	0.0003	0.0002
	Deer	Area 63	Bone	0.0003	0.0003	0.0005	0.0004
	Deer	Area 63	Bone	0.0002	0.0002	0.0003	0.0002
	Deer	Area 63	Kidney	0.0105	0.00992	0.0124	0.0095
	Deer	Area 63	Kidney	0.0006	0.0005	0.0007	0.0005
	Deer	Area 63	Liver	0.0175	0.0092	0.0016	0.0038
	Deer	Area 63	Liver	0.0008	0.0004	0.0001	0.0002
1992	Deer (48)	Not Specified	Kidney	-0.0003		-0.0003	
	Deer (48)	Not Specified	Liver	-0.001		-0.002	
	Deer (60)	Not Specified	Liver	-0.002		-0.002	
	Deer (60)	Not Specified	Kidney	-0.0009		-0.0009	
	Deer (62)	Not Specified	Kidney	-0.0003		-0.0003	
	Deer (62)	Not Specified	Liver	-0.001		-0.0008	
1993	Deer 1	-0.01		-0.01			
	Deer 2	-0.02		-0.02			
	Deer 3	-0.02		-0.02			
	Deer 4	-0.01		-0.01			
	Deer 5	-0.01		-0.01			

*Composite of two deer.

Table E-2. Data from Historical Deer Samples Reported in SEG (1996)

Sample Year	Location	Tissue Type	U-234 Activity (pCi/g)	U-235 Activity (pCi/g)	U-238 Activity (pCi/g)	Total Uranium Activity (pCi/g)
1996	DU Impact Area	Liver	0.051	0.008	0.032	0.091 ± 0.03
	DU Impact Area	Kidney	0.091	0.021	0.039	0.151 ± 0.05
	DU Impact Area	Bone	0.221	0.053	0.142	0.416 ± 0.07