DEPARTMENT OF THE ARMY
U.S. ARMY INSTALLATION MANAGEMENT COMMAND
2405 GUN SHED ROAD
FORT SAM HOUSTON, TEXAS 78234-1223

:PLY TO
ATTENTION OF

IMCG

September 10, 2012

Mr. Mark A. Satorius
Director, Office of Federal and State Materials and Environmental Management Programs
(Document Control Desk)
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Satorius:

In your July 23, 2012, letter, subject: U.S. Army Request to Delay Issuance of U.S. Nuclear Regulatory Commission Radioactive Materials License (Docket No. 04009083), you granted our request for the opportunity to provide a detailed, written response to the draft license conditions. This correspondence and the enclosure provides the U.S. Army Installation Management Command's response to the draft Nuclear Regulatory Commission's (NRC) proposed license conditions with regard to the presence on the Army's operational ranges of D38 Uranium Alloy (92 percent depleted uranium [DU] and 8 percent molybdenum) fragments from the M101 20mm Spotting Round used with the M28 series Davy Crockett Recoilless Rifle.

Thank you for your consideration of our written response to the draft license conditions. To summarize, the enclosure contains the following Army requests, with supporting data information, and rationale:

- Request an exemption for the US Army from licensing residual Davy Crockett M101 DU on its operational ranges under the provisions of 10 CFR § 40.13(c)(5) or 10 CFR § 40.14(a).

- If the NRC denies the Army's request for a license exemption, issue the source material license with no conditions other than those pertaining to possession and decommissioning.

- If the NRC denies the above requests, modify certain draft license conditions that place undue restrictions on the Army's use of its operational ranges in support of its national security mission and delete all license conditions that require environmental radiation monitoring based on prior testing and monitoring that shows no reduced risk to human health or the environment as a result.

FSME20

If you require any clarifications or additional information, please contact Dr. Robert Cherry at (210) 466-0368 or by email at robert.n.cherry.civ@mail.mil. A copy of this letter and enclosures will be forwarded to Headquarters, Department of the Army (DACS-SF), Army Safety Office, 9351 Hall Road, Building 1456, Fort Belvoir, Virginia 22060-5860 and to U.S. Army Institute of Public Health (MCHB-TS-OHP), 5158 Blackhawk Road, Aberdeen Proving Ground, Maryland 21010-5403

Thank you for your attention to this important action I am Ready to meet with you and your team as Required to Resolve this.

Sincerely,

Michael Ferriter
Lieutenant General, U.S. Army
Commanding

Enclosures

Army Response to US Nuclear Regulatory Commission (NRC) Proposed License Conditions for Davy Crockett M101 Spotting Round Depleted Uranium (DU)

1. General

The Army is completely committed to the safety and welfare of our Soldiers, civilian employees, and their families who live and work on the installations at issue, as well as good stewardship of the environment. To that end, upon discovery of DU on an operational range, the Army took action. On November 6, 2008, after notifying the US Nuclear Regulatory Commission (NRC) of the discovery, the Army applied for an NRC license to possess depleted uranium (DU) at two locations on Hawaii. That application noted, however, that the Army did not believe that a license was required. The Army continues to maintain that an NRC license is not required for possession of Davy Crockett M101 Spotting Round DU under the following alternative rationales: (1) the Army was already licensed to possess the DU and said license contained no end-use requirements, or; (2) the Army is entitled to an exemption under Title 10, Code of Federal Regulations (CFR) § 40.13(c) (5), or; (3) the Army is entitled to an exemption under 10 CFR § 40.14(a), either by request or by NRC determination.

Alternatively, the Army believes that a license, if deemed required by the NRC, should only address possession and decommissioning. No restrictions or requirements should be placed upon the Army. This alternative would essentially "renew" the lapsed license granted at the beginning of the Davy Crockett program.

Finally, as a final alternate course of action, the Army believes that many of the proposed license conditions[1] presented by the NRC at the July 12, 2012 technical meeting[2] unduly interfere with Army training and operations.[3] Several of the license conditions, relating to access and safety, are already in practice and mandated by DOD and Army regulations. Implementation of other proposed license conditions, notably the radiation monitoring (items d, e, and f), will not result in any apparent health benefits or reductions in risk to human health and the environment. The Army believes the extremely low risk that RESRAD[4] calculations indicate for residual Davy

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[1] Agencywide Documents Access and Management System (ADAMS) (NRC, 2012e) accession number ML12179A321, included as Attachment 1

[2] ADAMS ML12179A330

[3] Headquarters, US Army Installation Management Command (IMCOM), G7 (Sustainable Range Program) analyzed the training impacts resulting from the NRC imposed restrictions. This analysis, which did not address Hawaii and Alaska, focused on operational ranges on Fort Knox, Fort Lewis, Fort Hood, Fort Benning, and Fort Campbell. IMCOM considers these ranges to have critical to significant training impacts. IMCOM G7's analysis is in Attachment 2.

[4] RESRAD is a computer model code designed to estimate radiation doses and risks from RESidual RADioactive materials. Sponsored by the Office of Health, Safety and Security and the Office of Environmental Management, with support from the US Nuclear Regulatory Commission, Argonne National Laboratory (ANL) developed this

Crockett M101 depleted uranium (DU) on its ranges and the extremely low probability that this DU will leave its ranges do not justify the costs, both to soldier readiness and mission dollars, of implementing several of the proposed license conditions. The following response will provide data and information supporting the Army's position that no health benefits or reductions in risk to human health and the environment or enhancements to public safety are likely because of implementation of these conditions.

Modification or removal of these license conditions will not endanger human health and the environment, property, or the common defense and security and are otherwise in the public interest. It is "otherwise in the public interest" (NRC, 2012a) because it will:

- Support military training and soldier readiness which translates into lives saved,
- Rely on existing military restrictions at operational ranges for explosive safety purposes that explosive safety and range operators currently enforce rather than on NRC radiation safety restrictions for radiation safety purposes that garrison radiation safety officers would enforce,[5]
- Avoid wasting scarce Federal tax dollars on licensing related activities at operational ranges that provide no greater health protection or public safety, and
- Rely on the existing legal mandate of range clearance that will address DU remnants if any of these operational ranges are closed in the future.

This document provides detailed rationale for the Army's assertions, along with references and site-specific data, to support them.

Further, facts and data in the following sections support the Army's assertion that the NRC should grant an exemption from all requirements of the regulations in Title 10, Code of Federal Regulations (CFR), as it determines are authorized by law, in accordance with 10 CFR § 40.14(a) (NRC, 2012a).

Therefore, the Army requests the NRC to consider, in the order shown, the following:

a. Under the provisions of 10 CFR § 40.14(a), the "Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulation in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest." Title 10 CFR § 40.13(c)(5) (NRC, 2012b) also

family of codes. The Department of Energy (DOE) through ANL currently maintains code and version control (DOE, 2008).

[5] Unexploded ordnance on many of the Army M101 DU-affected ranges poses a real immediate danger. As shown below, the maximum credible lifetime cancer risk due to M101 DU on Army ranges is virtually zero.

applies. The Army hereby requests exemption from licensing under the provisions of 10 CFR § 40.13(c)(5) (NRC, 2012b). Alternatively, the Army hereby request exemption from licensing for residual Davy Crockett M101 DU on its operational ranges under the provisions of 10 CFR § 40.14(a) (NRC, 2012a). Information in support of this request and this application is provided in section 2 below.

b. If the Army's request for license exemption is denied, the Army alternatively requests the NRC issue the source material license with only those conditions pertaining to possession and decommissioning. Information in support of this application is provided in section 3 below.

c. Alternatively, If both requests "a" and "b" above are denied, the Army requests the NRC to:

- Modify certain draft license conditions that place undue restrictions on the Army's use of its ranges in support of its national security mission; and
- Delete all license conditions that require environmental radiation monitoring because the data and information presented below shows no additional protections or benefit to human health or the environment from this requirement.

Information in support of the alternative request for modification is provided in section 4 below.

A bibliography of all documents cited herein, except for those referenced in footnotes and available on ADAMS, is at the end of this document.

2. Application for exemption from licensing

Information in this section supports the Army's request an for exemption from licensing M101 DU on its operational ranges under the provisions of 10 CFR § 40.13(c)(5) (NRC, 2012b) or § 40.14(a) (NRC, 2012a).

a. The NRC should restore the exemption from licensing it granted, in effect, from 1961 to 2006, for M101 DU fired it on its operational ranges.

The M101 spotting round contained 6.7 ounces of D38 alloy, which provided the M101 the weight required to mimic the trajectory of the main warhead. D38 alloy consists of 92 percent DU and 8 percent molybdenum. Therefore, to manufacture, test, and train with the M101, the Army required a source material license from the Atomic Energy Commission (AEC), the NRC's predecessor.

An Army health physicist performed a study in 1960 of the manufacturing and of the tactical use of the XM101 (M101 designation during development) spotting round (Murphy, 1960). The report stated:

> "Earth samples were taken from Lake City Arsenal and Aberdeen Proving Ground where testing of the uranium XM101 was performed. ... All concentrations did not vary significantly from what would be expected anywhere on the earth's crust (3 to 9 micrograms of uranium per gram of soil). ... It is the recommendation of the Watertown Arsenal Health Physicist that all spotting rounds be left in the impact area and that the impact area not be considered a radiation area. This suggestion was favorably considered by the [Health and Safety Laboratory, Atomic Energy Commission, New York Operations Office]."

According to Murphy (Murphy, 1960), the Atomic Energy Commission concurred in 1960 with his recommendation "that all spotting rounds be left in the impact area and that the impact area not be considered a radiation area." Known continuous presence of DU remnants on Army operational ranges, from firing in 1962 until its "re-discovery" in 2006, with no license required by the AEC or its successor, the NRC, for post-use possession, provides supporting evidence for Murphy's statement.

The Army first applied to the AEC for a source materials license for the M101 spotting round on May 1, 1961.[6] The cover letter for that application read:

> "Transmitted herewith, approved, is a request from the Ordnance Corps for an Atomic Energy Commission license to obtain depleted uranium. It should be noted that the proposed use of the material includes not only machining of barstock alloy at Lake City Arsenal, but distribution of the assembled item to the Army Field Forces. We request that your reply include, in addition to the license, if it is feasible to issue such a license, guidance on controls required for the end use of the item."

The AEC issued the Army source material license number SUB-459, dated November 1, 1961.[7] That license authorized fabrication and testing of the M101. It also allowed distribution of the M101 to Army field units for use. The AEC license did not include any "guidance on controls required for the end use of the item," and no subsequent guidance has been issued despite numerous license amendments, license renewals, license

[6] ADAMS ML091820171

[7] See Attachment 3.

terminations, decommissioning actions, and mandated re-looks during the last 50 years (see Table 1, for example).

On May 10, 2011, during a public meeting,[8] the Army advised the NRC:

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> ... At no time during the lifecycle of the Army's license to possess DU did the AEC or NRC ever request that each installation that received the M101 apply for a separate license. The fact is that there is no evidence in the record that AEC or NRC ever directed, or had any intention to direct, the Army to collect the expended rounds. And collection of the spent rounds was not part of the Army procedures referenced in its 1961 application.
>
> In fact, all the available evidence indicates that DU was not believed to pose a health hazard and that AEC/NRC had no issue with the Army leaving the expended DU lying in situ on the ranges.
>
> ... [Evidence] in the record regarding specific AEC guidance to the Army pertaining to control of the M101 spotting round [includes] a letter sent to the AEC Division of Licensing and Regulation, dated 1 May 1961 [in which] the Army requested "guidance on controls required for the proposed end use of the item." The letter was also attached to the original license application submitted on 26 September 1961. The Army cannot find, nor has the NRC provided, any evidence that any restrictions or requirements were placed on the end use. Elsewhere in the original application, as well as various other times in the life of the license, the Army informed AEC [that] the "proposed end use" was [to leave the residuals on operational range impact areas], and AEC acknowledged and accepted that as a condition of the license. ...
>
> ... The Army used the license, and the round, as it had informed AEC it would. All 75,000 rounds manufactured were shipped to various Army installations and depots by 1963. An approximate total of only 30,000 rounds were ever fired on Army training ranges between manufacture and 1968, when the Davy Crockett system was discontinued. If there was some other intent when this license was issued [more than] 50 years ago, it is not apparent from any of the surviving documents known to the Army.

[8] ADAMS ML111670084

> ... Even if there was original intent to remove the DU on Army ranges short of decommissioning the ranges, the NRC's decision not to conduct a termination or confirmatory survey before allowing the license to expire indicates otherwise. Additionally, a 1989 GAO report [(GAO, 1989)] found that the NRC had decommissioned previously licensed materials sites in error and without requiring clean up. The GAO ordered follow up studies of all licenses terminated since 1965. The follow up report for license SUB-459 was conducted by Oak Ridge National Laboratories (ORNL) in approximately 1994, and found that it, as we know, authorized "various Army Units as locations of use."[9] It further reported that no termination or confirmatory survey was performed on this license, and that Army Units were eligible for the distribution of the rounds from 1961 to 1973. NRC's handling of the expiration, and failure to act on the follow up investigation, indicate that NRC was not concerned about the possibility that expended spotting rounds were left on Army ranges.

UNQUOTE

It is unclear why the NRC changed its position on exempting fired M101 rounds in late 2006 or early 2007.[10] The Army requests that the NRC restore the license-exempt status that it and its predecessor, the AEC, previously granted to the Army *de facto* on November 1, 1961 for fielded and fired M101 DU.

b. *The NRC may grant the Army an exemption from licensing M101 DU on its operational ranges under the provisions of 10 CFR § 40.13(c)(5).*

The NRC's "health physics position" HPPOS-135 PDR-9111210361 (NRC, 1995) is not strictly applicable for denying the Army's request for exemption from licensing.

HPPOS-135 says, "...as a matter of policy, the NRC will not use 10 CFR 40.14 to authorize exemptions from requirements to obtain a license." However, when read as a whole, HPPOS-135 limits its applicability to exemptions for rare earth mixtures in excess of 0.25 percent by weight thorium, uranium, or combination of thorium and uranium. Although HPPOS-135 does not specifically address DU alloy. It states:

[9] See Attachment 4.

[10] ADAMS ML070650224: November 2006, "NRC and the Army [had] preliminary discussions of whether an NRC license would be necessary."

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> The exemption in the regulations was based on the statutory exemption for unimportant quantities of source material contained in Section 62 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2092) which [states] in part ...: "Unless authorized by a general or specific license issued by the Commission, which the Commission is hereby authorized to issue, no person may transfer or receive in interstate commerce, transfer, deliver, receive possession of or title to, or import into or export from the United States any source material after removal from its place of deposit in nature, except that licenses shall not be required for quantities of source material which, in the opinion of the Commission, are unimportant." In carrying out its regulatory responsibilities, the NRC, like its predecessor the AEC, has consistently followed the practice of implementing the licensing requirements imposed by the Atomic Energy Act, including any statutory exemptions from those requirements, by promulgating regulations. The statutory exemption for unimportant quantities of source materials was implemented in 10 CFR 40.13 of the Commission's regulations.

UNQUOTE

Put simply, the NRC has promulgated 10 CFR § 40.13 to regulate "Unimportant quantities of source material;" an inherently different "material" than that addressed in HPPOS-135.10 CFR § 40.13(c)(5), states:

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> (c) Any person is exempt from the regulation in this part and from the requirements for a license set forth in section 62 of the Act to the extent that such person receives, possesses, uses, or transfers:
>
> ... (5) Uranium contained in counterweights installed in aircraft, rockets, projectiles, and missiles, or stored or handled in connection with installation or removal of such counterweights: *Provided*, That:
>
> (i) The counterweights are manufactured in accordance with a specific license issued by the Commission or the Atomic Energy Commission authorizing distribution by the licensee pursuant to this paragraph;

(ii) Each counterweight has been impressed with the following legend clearly legible through any plating or other covering: "Depleted Uranium";[2]

(iii) Each counterweight is durably and legibly labeled or marked with the identification of the manufacturer, and the statement: "Unauthorized Alterations Prohibited";[2] and

(iv) The exemption contained in this paragraph shall not be deemed to authorize the chemical, physical, or metallurgical treatment or processing of any such counterweights other than repair or restoration of any plating or other covering.

(v) Consistent with § 40.56, the counterweights are not manufactured for a military purpose using Australian-obligated source material.

[2] The requirements specified in paragraphs (c)(5) (ii) and (iii) of this section need not be met by counterweights manufactured prior to Dec. 31, 1969: Provided, That such counterweights were manufactured under a specific license issued by the Atomic Energy Commission and were impressed with the legend required by § 40.13(c)(5)(ii) in effect on June 30, 1969.

UNQUOTE

M101 spotting rounds were projectiles. The DU in the M101 spotting rounds served no purpose other than to provide the correct ballistics to simulate the firing of the Davy Crockett M28 tactical W-54 nuclear warhead. The DU present in the M101 spotting round should be treated as a "counterweight."[11] Therefore, the M101 DU the Army possesses on its operational ranges should be exempted from licensing under the provisions of 10 CFR § 40.13(c)(5).

The M101 DU was manufactured prior to December 31, 1969 in accordance with an AEC specific source materials license that did not require the markings specified in 10 CFR §§ 40.13(c)(5)(ii) and (iii). The absence of markings in 2012 should not dissuade the NRC from applying § 40.13(c)(5) to M101 DU on Army operational ranges because:

[11] By definition, a *counterweight* is an equivalent counterbalancing weight that balances a load. The DU in an M101 spotting round supplied an appropriate weight in the body of the round to simulate accurately the trajectory of the nuclear round. In a sense, the DU counterbalanced the weight of other portions of the M101spotting round to achieve the desired ballistic trajectory. Any distinction in definitions is not relevant to a determination that the NRC should apply this exemption because the DU in the M101 is not different in form or chemistry from that in an item that meets the strict definition of a "counterweight."

- The Army fired all of the M101 spotting rounds before the legend requirement contained in § 40.13(c)(5)(ii) became effective on June 30, 1969,
- Each round is only about three inches long (see Figure 1) so any markings would have been small even if they had been present, and
- Markings would have served no purpose in any event since any marking would be unlikely to remain on munitions after firing and the passage of time, and markings on items in an impact area would not affect the uses of an operational range in any event.

Individually, each M101 spotting round on an Army range clearly is "an unimportant quantity of source material"; it contains only about 6.2 ounces or 66 μCi of DU. Collectively, M101 DU is randomly scattered on various Army ranges in one-kilometer squares. Vegetation and soil cover most rounds that remain intact. The quantity in any given location is small, although items individually might be dense and inert. Moreover, the Army prohibits uncontrolled access to operational range impact areas, eliminating any concerns that persons would move or collect these items, thereby accumulating a number of M101 rounds that the NRC might consider to be important.[12] The NRC should determine DU on Army operational ranges from the M101 to be "an unimportant quantity of source material."

In 1969, after the Army decided to no longer field the Davy Crockett weapon system, the AEC Licensing Director authorized the Army to dispose of its remaining 44,000 live M101 spotting rounds by dumping them in the sea. The Director's rationale was due to the "insignificant radioactivity involved."[13] However, the Army decided to destroy the rounds at Lake City Arsenal rather than dispose of them by sea burial.

It appears that the provisions of 10 CFR §§ 40.13(c)(5) were applied by the AEC and NRC for almost 47 years without being explicit. The Army now requests that those provisions be specifically applied in accordance with the *status quo* over the past 47 years, and grant the Army's request for an exemption from applying for and obtaining a specific source material license to possess M101 DU on its operational ranges.

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[12] The number of M101 spotting rounds collectively that the NRC might consider to be "unimportant" is not known. Title 10 CFR §40(a), "Small quantities of source material," states (NRC, 2012i), "A general license is hereby issued authorizing commercial and industrial firms, research, educational and medical institutions and Federal, State and local government agencies to use and transfer not more than fifteen (15) pounds of source material at any one time for research, development, educational, commercial or operational purposes." So, less than 15 pounds of DU/6.2 ounces DU per M101 spotting round ≈ 38 M101 spotting rounds, is a "small quantity." It is not likely that anyone can find 38 M101 spotting rounds on an operational range before the Army apprehends them.

[13] See Attachment 5.

c. *Exempting M101 DU on Army ranges from licensing will not "endanger life or property or the common defense and security and [is] otherwise in the public interest."*

Title 10 CFR § 40.14(a) says, "The Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulation in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest."

M101 DU is on active Army ranges. A range is a "designated land or water area that is set aside, managed, and used for range activities of the Department of Defense. [Such] term includes (A) firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access, and exclusionary areas."[14] Army ranges provide impact areas for many types of military munitions that the Army and other Services use in live-fire training and testing. These munitions once included the M101 spotting round, which is no longer in the Army inventory.

Army Regulation (AR) 190-16 (HQDA, 1991), AR 200-1 (HQDA, 2007), AR 350-19 (HQDA, 2005), and AR 385-63 (HQDA, 2012) together help ensure that all activities on Army ranges do "not endanger life or property or the common defense and security." The presence of M101 DU on Army ranges is relatively innocuous in comparison to the live-fire training and testing that occurs on such ranges and the presence of explosive hazards (unexploded ordnance) on these ranges.

In particular, AR 350-19, paragraph 4-23 says:

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> *f.* Closure of an operational range, or changing the use of the range to a use that is incompatible with range activities, may require a response action[15] to remove or mitigate safety or health risks consistent with the proposed future use of the land. Because response actions can be time consuming and expensive, requirements for response actions may restrict reuse of the land.

[14] 10 U.S.C 101(e)(1)

[15] A response action is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-authorized action involving either a short-term removal action or a long-term removal response. This may include but is not limited to: removing hazardous materials from a site to an EPA-approved hazardous waste facility for treatment, containment or treating the waste on-site, identifying and removing the sources of ground-water contamination and halting further migration of contaminants.

g. The installation will immediately notify the range and munitions environmental support team, OACSIM[16] (DAIM–ED–M) to begin any planning and programming actions for response actions, when seeking approval for closure of a range.

UNQUOTE

It is a priority and in the interest of the Army to protect those nearest to these ranges, namely the Soldiers and their families who work, visit, and reside on the installation. To this end, the Army implements safety, environmental, and security measures on a daily basis to help ensure the long term sustainability of its ranges. These measures easily address all potentially adverse characteristics of DU. For example, many of the security requirements in chapter 5 of the proposed Physical Security Plan for the Army ranges in Hawaii[17] contain excerpts from Army regulations that must be met whether a DU license is in place or not.

d. Results of RESRAD *calculations show near-zero risk and miniscule, almost immeasurable, environmental impact.*

The Army used the "resident farmer" scenario,[18] even though this is not a reasonably foreseeable use of an operational range, to demonstrate the effects, or lack thereof, in an unrealistically high potential exposure scenario. In addition, the following parameters were used in its RESRAD calculations:

- The impact area was a square, 1000 meters (m) × 1000 m = 10^6 m^2; however, the area is assumed circular (radius ≈ 564 m) in the calculations (RESRAD default). This is so others can easily duplicate the calculations.
- One thousand M101 spotting rounds were fired into the impact area.
- Initially, M101 DU contamination in the impact area is uniform and confined to the top 15 centimeters of soil, resulting in activity concentrations in soil of 0.256

[16] Office of the Assistant Chief of Staff for Installation Management

[17] ADAMS ML110830582

[18] According to *NUREG-1757, Consolidated Decommissioning Guidance, Vol. 2, Rev. 3* (NRC, 2006), the resident farmer scenario accounts for exposure involving residual radioactivity that is initially in the surficial soil. A farmer moves onto the site and grows some of his or her diet and uses water tapped from the aquifer under the site. Pathways include external exposure from soil, inhalation to (re)suspended soil, ingestion of soil, ingestion of drinking water from aquifer, ingestion of plant products grown in contaminated soil and using aquifer to supply irrigation needs, ingestion of animal products grown onsite (using feed and water derived from potentially contaminated sources) and ingestion of fish from a pond filled with water from the aquifer.

picocurie per gram (pCi g^{-1}) ^{238}U, 0.00236 pCi g^{-1} ^{235}U, and 0.0337 pCi g^{-1} ^{234}U.[19]

- All other parameters were RESRAD defaults.

Figure 2 through Figure 17 are RESRAD graphical outputs.

Figure 2 shows a maximum annual dose of approximately 0.033 millirem (mrem). The annual dose declines continuously for more than 100 years to less than 0.0003 mrem and then rises to approximately 0.027 mrem at approximately 500 years later. These values are more than 100,000 to 1,000,000 times less than the average annual background dose per individual in the US population for ubiquitous background, 311 mrem (NCRP, 2009).

Figure 3 shows a maximum excess cancer risk of approximately 3.4×10^{-7}. Most (80 percent or 2.5×10^{-7}) of this risk is due to ground contamination. Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)[20] and its implementing regulation, the National Oil and Hazardous Substance Contingency Plan (NCP),[21] the acceptable risk range is defined as risk falling under one additional cancer in 10,000 (that is, total excess cancer risk under 10^{-4}).[22] The M101 DU calculated excess cancer risk based on an assumed exposure time that is greater than the reasonably foreseeable use is well under the CERCLA maximum acceptable risk, despite the unreasonably high potential exposure for the unrealistic resident farmer scenario. The risk calculations based on reasonably anticipated use of an operational range impact area would be far lower and well below the acceptable risk level established in the NCP.

Figure 4 through Figure 6 show that the M101 DU soil concentration decreases significantly over the first hundred years, with an accompanying decrease in annual dose and potential excess cancer risk. Figure 7 through Figure 12 show that the rise in annual dose and potential excess cancer risk after the first 100 years is due to the M101 DU entering surface water and groundwater. Nevertheless, the greatest annual dose and excess cancer risk occur at the beginning of the scenario, but still fall below the CERCLA acceptable risk level.

Of course, the Army has no "resident farmer" on any of its M101 impact areas, which makes the "resident farmer" scenario more conservative than a realistic scenario. The

[19] Included in the calculation of the soil activity concentrations are the RESRAD default value of 1.5 g cm^{-3} for soil density and the relative mass abundances of 99.80 percent, 0.20 percent, and 0.0007 percent in DU and specific activities of 0.33 pCi g^{-1}, 2.2 pCi g^{-1}, and 6200 pCi g^{-1} for ^{238}U, ^{234}U, and ^{235}U, respectively (DOE, 2009).
[20] 42 U.S.C. §9601 et seq.
[21] 40 CFR Part 300
[22] 40 CFR §300.430(e)(2)(i)(A)(2)

operational ranges are located well within an installation, in an isolated and access-controlled area. A current worker's occupancy within the impact areas is usually less than 160 hours per year (the worker occupancy of the battle area complexes on the Hawaii ranges is not yet known but will be far less than a resident farmer occupancy). Thus, all pathways having to do with food and water intake are closed, or eliminated, in a "current worker" scenario, and occupancy times are much less than that of a "resident farmer." The following changes to RESRAD input better simulate real world conditions for a "current worker":

- The only pathways are external gamma, inhalation, and soil ingestion.
- Occupancy fractions are indoors = 0 and outdoors = 160 hours per year/8760 hours per year ≈ 0.02.

Figure 18 shows that the maximum annual dose to a "current worker" is approximately 1.1×10^{-3} mrem. Figure 19 shows that the maximum excess cancer risk to a "current worker" is approximately 1.2×10^{-8}. The highest M101 DU calculated excess cancer risk is much less than the CERCLA maximum acceptable risk.

The total DU activity concentration in soil input to RESRAD was approximately 0.29 pCi g^{-1}. For comparison, the typical activity concentration of natural uranium in surface soil is approximately 1.4 pCi g^{-1} (IAEA, n.d.). An Army contractor's characterization survey report (Cabrera Services, 2008a) for the Schofield Barracks background reference area provides a ^{238}U concentration of 1.6 ± 0.9 pCi g^{-1}.[23] However, a recalculation of the data using weighted averaging produced a background reference area ^{238}U concentration of 1.60 ± 0.08 pCi g^{-1}. Further, using results from unbiased soil sampling in the Schofield Barracks impact area and assuming that M101 DU did not affect these samples, calculations produced an M101 impact area DU background ^{238}U concentration of 1.14 ± 0.09 pCi g^{-1}.

Assuming that the ^{238}U activity is 48.8 percent of the total natural uranium activity, the total natural uranium concentrations in the background reference area and in the M101 DU impact area are 3.3 ± 0.2 pCi g^{-1} and 2.33 ± 0.18 pCi g^{-1}, respectively. This implies that the activity concentration of M101 DU from 1000 M101 spotting rounds, if uniformly distributed in the top 15 cm of a 10^6-m^2 area in Hawaii, is only about 10 percent or less of the natural uranium concentration in that soil. Since available records show that the Army fired no more than 714 M101 spotting rounds (less than 75 percent of

[23] All uncertainties in this document are at the 95 percent confidence level (two standard deviations).

the amount used for the calculations) at two locations in Hawaii with more than one firing point at each location, 10 percent is a conservative estimate.[24]

Assuming that the M101 DU concentration is uniform in the top 15 cm of the (rounded) impact area also is conservative. Experience in Hawaii and elsewhere in large part supports Murphy's 1960 recommendations (Murphy, 1960) and shows that:

- M101 spotting rounds remain mostly intact for many years and so their DU is not available for transport and uptake, and
- Even after almost 50 years since firing, M101 DU has remained in a small area around the resting place of the round.

An Army contractor produced baseline human health risk assessments (BHHRA) for residual DU for both Schofield Barracks (Cabrera Services, 2008c) and Pohakuloa Training Area (Cabrera Services, 2010). As part of the assessments, the contractor performed RESRAD calculations, using site-specific assumptions and input parameters different from those above.

The conclusion in the Schofield Barracks BHHRA (Cabrera Services, 2008c) said:

> "Investigations at the [Schofield Barracks impact area (SBIA)] have determined that DU is the contaminant of interest for the purposes of this risk assessment. The results of the risk assessment presented in this document demonstrate that the presence of DU in soil at the SBIA results in radiological dose as well as chemical and radiological risk that falls within the EPA limits for what considered safe by the USEPA and NRC. Therefore, no significantly increased risks for the human receptors considered in this document exist at SB. As a result, no adverse human health impacts are likely to occur as a result of exposure to the uranium present in the soil at SBIA. This is true for human receptors located on-site under current and potential future land use scenarios (e.g. range maintenance workers, cultural monitors, trespassers), as well as human receptors beyond the SBIA boundaries, as modeled by the highly conservative scenario of a subsistence farmer."

Similarly, the conclusion in the Pohakuloa Training Area BHHRA (Cabrera Services, 2010) said:

[24] In several places in 10 CFR Part 20 (NRC, 2012g), the NRC says that if a value is less than 10 percent of a relevant limit, it may be disregarded or no action is required.

> "The results of site-wide radiological dose and risk assessment showed that the soldier received the maximum risk due to presence of DU at the Site. The maximum risk is 4E-9, which is well below the USEPA acceptable risk range of 10^{-6} to 10^{-4}. Therefore, the results of the risk assessment demonstrate that the presence of DU in soil at the PTA results in radiological risk that falls well below the USEPA limits for what considered safe by the USEPA. Therefore, no significantly increased risks for the human receptors considered in this document exist at PTA. As a result, no adverse human health impacts are likely to occur as a result of exposure to the uranium present in the soil at PTA."

The Agency for Toxic Substances and Disease Registry (ATSDR), at the Army's request, reviewed the Schofield Barracks BHHRA as part of its assessment of public health risks from the presence of M101 DU at the Hawaii ranges. The report (ATSDR, 2008) says:

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> ATSDR representatives reviewed several reports and visited three sites to determine the public health implications of the presence of depleted uranium spotting rounds at firing ranges at Schofield Barracks, Pohakuloa Training Area, and potentially Makua Military Reservation. ... While in Hawaii, ATSDR representatives attended technical discussion meetings with Army and contractor representatives and the press conference at Fort Shafter in Honolulu on April 22, 2008, for the release of the *Schofield Barracks Impact Range Baseline Human Health Risk Assessment for Residual Depleted Uranium.*
>
> - Although ATSDR provided detailed comments and recommendations for this report, ATSDR agrees with the conclusion, based on the information reviewed and current knowledge about the site and past use of M101 spotting rounds containing depleted uranium at Schofield Barracks, that no adverse human health effects would be expected as a result of potential exposure to the depleted uranium in its current location.
> - Based on information about the condition of the spotting rounds, the site's environment, the limited environmental sampling results, the distance to populated areas, and restricted access at Pohakuloa Training Area's impact areas, ATSDR also concludes that no adverse human health effects would be expected as a result of potential exposure to depleted uranium at Pohakuloa Training Area if the depleted uranium rounds were left at their current locations.

UNQUOTE

Modification of the default parameters will produce results different from those presented here by the Army. However, reasonable modifications will produce results significantly similar to those contained herein. Based on the RESRAD calculations, exempting M101 DU on Army ranges from NRC licensing is appropriate because it will not "endanger life or property or the common defense and security and [is] otherwise in the public interest."

e. *Estimated M101 DU soil concentrations in impact areas already are far below NRC decommissioning guidelines for residual DU contamination in soil.*

The typical activity concentration of M101 DU averaged over the surface soil in an impact area, as shown above, conservatively is approximately 0.3 pCi g^{-1}. This assumes 1000 M101 spotting rounds have completely corroded and the corrosion products have entered the surface soil matrix, which is a conservative assumption.[25] In comparison to this conservative average of 0.3 pCi g^{-1}:

- A 1981 NRC branch technical position (NRC, 1981), which HPPOS-292 PDR-9306210248 reiterates (NRC, 1992), allows 35 pCi g^{-1} for residual DU contamination in soil.
- The NRC approved a derived concentration guideline level (DCGL)[26] of 469 pCi g^{-1} for a DU range at Eglin Air Force Base for residual DU contamination in soil (Spitzberg, 2005).
- Table B.2 of NUREG-1757 (NRC, 2006) provides "screening values" of 13 pCi g^{-1}, 8.0 pCi g^{-1}, and 14 pCi g^{-1} for ^{234}U, ^{235}U, and ^{238}U, respectively. This translates[27] to 13 pCi g^{-1} for DU. NUREG-1757 says, "The licensee may adopt

[25] Durante and Pugliese made a similar assumption (Durante & Pugliese, 2003) and justified it thusly:

> "The assumption of uniform distribution of DU in soil is incorrect, because studies of radiological contamination in the soil from impacted DU rounds suggest that dispersion and deposition are localized within 10 m from the hit target.... However, appropriate codes for predictions based on a non-uniform distribution of DU have not yet been developed .... The soil concentration used in this simulation should be the average quantity over the considered area. Although this leads to a general overestimation of the calculated doses, the presence of radioactive hotspots poses a health risk for individuals in direct contact with this highly contaminated area."

[26] *The Multi-Agency Radiation Survey and Site Investigation Manual* (*MARSSIM*) (NRC, 2000) provides guidance on how to demonstrate that a site is in compliance with a radiation dose- or risk-based regulation, otherwise known as a release criterion. *MARSSIM* uses DCGLs to help determine whether the release criterion is met. DCGLs refer to average levels of residual radioactivity above background levels for surface activity and soil contamination. DCGLs are obtained from regulatory guidance based on default parameters or from site-specific pathway modeling (using RESRAD, for example).

[27] Using the activity relative abundance for the uranium isotopes in DU, $(0.874 \times 13 \text{ pCi g}^{-1}) + (0.011 \times 8 \text{ pCi g}^{-1}) + (0.115 \times 14 \text{ pCi g}^{-1}) \approx 13 \text{ pCi g}^{-1}$.

> these screening DCGLs without additional dose modeling, if the site is suitable for screening analysis."

The typical activity concentration of M101 DU averaged over the surface soil in an impact area clearly is much less than all of these screening levels. Additionally, the Army must clear a range of all debris, including any fragments of M101 spotting rounds, before it can release the range for public use (HQDA, 2007). Therefore, since the Army already meets or exceeds soil cleanup criteria, a license, including a decommissioning license, is unnecessary.

f. The NRC has issued a categorical exclusion (CATX) for DU munitions in the context of environmental assessments and environmental impact statements.

NUREG-1748 (NRC, 2003a) contains a categorical exclusion for possession of depleted uranium munitions. Section 2 of NUREG-1748 says:

> "The purpose of CATXs is to focus extensive NEPA analysis onto major Federal actions that may significantly affect the quality of the human environment. The use of CATXs is a means of streamlining the NEPA process, saving time, effort, and resources.
>
> "Categorical exclusion "... means a category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency ... and for which, therefore, neither an Environmental Assessment nor an Environmental Impact Statement is required...""

NUREG-1748 section 2.2.7.15 CATX 51.22(c)(14)(xv) states:

> "Possession, manufacturing, processing, shipment, testing or other use of depleted uranium munitions, e.g., bullets and other projectiles, includes about 10 licenses held by U.S. military organizations and less than 10 licensees involved with the manufacturing process. The military tests involve the use of low specific activity depleted uranium (3.6×10^{-7} curies/gram) as metal alloy penetrators (rods) which vary in weight from a few grams to less than 10 kilograms. These rods are propelled at high velocities against metal targets such as armor plate. Testing of these munitions is carried out at remote desert locations on military reservations, in constructed enclosures, or over deep ocean waters. Any materials released to the environment are of low radioactive content, are highly dispersed, and are of chemical and physical form which is not readily

> incorporated into flora or fauna. Thus, radioactive releases to the environment which could affect human, animal or plant life from testing at any of the locations are negligible and occupational exposures from handling depleted uranium are so low that personnel monitoring is not required. Additionally, since the penetrators tested do not explode, cratering or other defacing of the environment is not experienced."

The above remarks pertain to direct-fire projectiles designed to penetrate hard targets. The M101 spotting round was an indirect-fire projectile that traveled at velocities much less than direct-fire projectiles and that was not designed to penetrate anything. The dispersal of M101 DU is much less than the dispersal of penetrator DU, posing an even lower risk to health or the environment. Therefore, the CATX should be applied to the M101 spotting round.

The CATX establishes an NRC policy decision that is inconsistent with the burdensome conditions the NRC has proposed for M101 DU on Army operational ranges and particularly inconsistent with the requirements for comprehensive environmental radiation monitoring.

3. Request for license conditions that pertain only to possession and decommissioning

Considering DOD- and Army-imposed controls and restrictions for operational ranges, the Army believes the NRC proposed restrictions on the Army's use of it ranges are redundant, unnecessary, and have the potential to create confusion. Additionally, environmental radiation monitoring is unnecessary because it is unlikely to detect any M101 DU outside of the impact area. The Army has found no indication at any range that M101 DU has migrated more than a meter from the M101 spotting round point of impact. The Army believes that environmental radiation monitoring is an inappropriate use of taxpayers' dollars.

The site-specific information that the NRC seeks for US Army Garrison Hawaii's M101 DU-affected ranges at Schofield Barracks and Pohakuloa Training Area is provided below. The Army is also providing generic information that corroborates the site-specific evidence and supports an NRC decision about the other installations with DU on operational ranges as well.

If the NRC does not grant the Army's request for exemption from licensing M101 DU on Army operational ranges, the Army requests that the NRC impose the minimum essential conditions that:

- Recognize the presence of M101 DU on Army ranges
- Authorize the Army to possess this M101 DU

- Acknowledge that the Army has all the proper and necessary controls to ensure that the Army possession "will not endanger life or property or the common defense and security and [is] otherwise in the public interest"
- Address such M101 DU per applicable NRC requirements, and applicable federal and state laws should the Army decide to close an M101 DU-affected range

Specifically, the Army requests that the NRC not require a Radiation Safety Plan, a Physical Security Plan, and an Environmental Radiation Monitoring Plan. Additionally, the Army requests that the NRC not place any restrictions on the Army's use of any of its M101 DU-affected ranges for their intended purpose (see Section 2c above) until such time as the Army notifies the NRC of its intent to close one or more of these ranges and clear them for unrestricted use in accordance with the provisions of 10 CFR Part 20, subpart E (NRC, 2012h).

a. General observations

The Army has already demonstrated that environmental radiation monitoring is unnecessary because the risk is well below CERCLA guidelines for a resident farmer in the M101 DU impact area. The risk is much lower for a realistic occupancy scenario or anyone who is outside the M101 DU impact area.

Figure 20 (Cabrera Services, 2008c) shows the physical condition of M101 spotting rounds in the environment at Schofield Barracks. Consequently, no appreciable quantity of M101 DU is available for transport into the environment (i.e.; surrounding soil, surface water, groundwater, air, and biota).

The US Army Environmental Policy Institute (USAEPI) wrote (USAEPI, 1995):[28]

> "The Army has used three principal centers for test firing DU penetrators, Aberdeen Proving Ground, Maryland; Jefferson Proving Ground, Indiana; and Yuma Proving Ground, Arizona. Firing sites at these three centers have been surveyed to evaluate transport mechanisms under a variety of environmental conditions. Because the radiological signature of DU is unique, it was possible to distinguish DU contamination from naturally

[28] The DU that much of the following text mentions is in DU penetrators, not M101 spotting rounds. The DU in DU penetrrators aerosolizes to a high degree upon impact with a hard target. M101 spotting rounds do not impact with hard targets and so the M101 DU does not aerosolize to a high degree. Therefore, a lesser percentage of M101 DU is available for environmental transport shortly after firing in comparison with DU penetrators. In addition, although M101 DU is alloyed with molybdenum and penetrator DU is usually alloyed with titanium, once the DU corrodes into yellowcake (U_3O_8), it behaves the same in the environment no matter how it was alloyed in the projectile.

> occurring uranium sources. Environmental monitoring studies at these firing sites did not find DU migration out of the impact areas .... It should be recognized, however, that the data from these sites cannot be broadly generalized for other sites."

Since similar results were found at every other DU site, USAEPI's last assertion appears to have been overcome by additional data at other locations that support the conclusion that DU does not migrate in the environment and create a human health or environmental concern.

Some of the following paragraphs refer to United Nations Environment Programme (UNEP) studies in Kosovo (UNEP, 2001), Serbia and Montenegro (UNEP, 2002), and Bosnia and Herzegovina (UNEP, 2003). As source term information, aircraft fired approximately 3000 kg of DU at 12 sites in Bosnia and Herzegovina in 1994-1995, approximately 9300 kg of DU at 85 locations in Kosovo in 1999 (DOD, 2001), and about 60 kg of DU in Serbia and Montenegro (UNEP, 2002) also in 1999.

UNEP "Key Findings" were (DOD, 2001):

- There was no detectable widespread DU contamination of the ground surface.
- Detectable DU ground surface contamination was limited to areas within a few meters of DU penetrators and points of concentrated contamination caused by penetrator impacts. Most of the contamination points were only slightly contaminated. In many cases, the radioactivity was so low that it was hardly detectable.
- In terms of the possible contamination of air, water, or plants, there was no significant risk related to those contamination points. However, the report said that while the radiological risk from the intake of contaminated soil or from touching the penetrator would be insignificant, the toxicological risk could be somewhat higher than applicable health standards.
- No DU-contaminated water, milk, objects, or buildings were found.

In their analysis of DU fired in the Gulf War, Fetter and von Hippel wrote (Fetter & von Hippel, 1999):

> "A total of 300 tons of DU was fired in the Gulf War over an area of several thousand square kilometers—an average concentration on the order of 0.1 grams (*sic*) per square meter. Although concentrations might be considerably higher in some areas, only a fraction of the DU—perhaps 10 percent—is in the form of biologically accessible aerosol or dust. The remainder is in the form of intact, or nearly intact, uranium metal

> penetrators, most of which are buried in the soil. And although a significant fraction of the aerosols generated by impacts are initially soluble, these are oxidized in the environment to insoluble chemical forms. Moreover, the radiation dose to animals from internal exposure to DU is only about half that of natural uranium (per milligram of uranium inhaled or ingested), and the external radiation dose rate from DU is more than ten times less than natural uranium in the soil (per gram of uranium per square meter of soil). Thus, when averaged over reasonably large areas, the environmental effects of DU are likely to be perturbations similar in magnitude to those resulting from variations in the concentration of natural uranium."

The Director of the NRC's Office of Nuclear Material Safety and Safeguards provided a "Director's Decision" to a petitioner and wrote, regarding environmental sampling in Vieques, Puerto Rico (Kane, 2001):

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> From May 29 to June 12, 2000, the U.S. Navy performed radiological surveys of the [Live Impact Area (LIA)]. ... The surveys conducted by the U.S. Navy, and independently observed by the NRC, concluded that there were no elevated exposure rates or count rates indicative of radioactive contamination on areas of the LIA exclusive of the North Convoy Site, where the DU was fired during the February 19, 1999, incident. While observing the U.S. Navy survey activities between May 31 and June 12, 2000, the NRC staff also performed numerous surveys and collected soil samples. Soil samples were collected from the areas where DU penetrators had already been excavated. In addition, soil samples were collected downhill of areas known to have been impacted by the DU penetrators. Soil, vegetation, water, and sediment samples were also collected in areas accessed by the general public and in nearby towns. The purpose was to independently assess the licensee's DU recovery performance and to determine whether the surrounding environment and members of the public had been exposed to DU.
>
> ... The NRC Inspection Reports dated July 13, 2000, and September 28, 2000, document the performance and results of the environmental samples taken in June 2000. Copies of these reports are available in ADAMS (ML003767608 and ML003755565). The NRC samples demonstrated that there was no spread of DU contamination to areas outside of the LIA and that contamination from the DU inside the LIA was limited to the soil

> immediately surrounding the DU penetrators. With the exception of the soil samples taken from holes where the Navy had recovered DU penetrators, neither the direct measurement nor the environmental sample results identified the presence of radioactive materials exceeding those associated with naturally occurring radioactive materials routinely found in the environment.

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b. *Generic reasons why the NRC should not require soil or sediment sampling for M101 DU (applies to all Army M101 DU-affected sites)*

A review of the UNEP reports (Papastefanou, 2002) summarized those reports:

> "There was no detectable widespread contamination of the ground surface by depleted uranium. This was in such low levels that it cannot be detected or differentiated from the natural uranium existing in soil globally. Detectable ground surface contamination by depleted uranium is limited to areas around and below penetrators and the associated points of concentrated contamination."

Uyttenhove *et al.* reported on independent measurements in Kosovo (Uyttenhove, et al., 2002):

> "Based on our [minimum detectable activity (MDA)]-considerations (and the experimental confirmation with calibration samples), we can state with good confidence that there is no DU present at our 50 sampling points in Kosovo, with MDA values as low as 15 Bq [corresponding approximately to a milligram DU in a typical sample (100–150 g)]. Some samples, taken near places where DU-ammunitions were used, have been re-examined very carefully with extra long measuring times (27.8 h), always with negative results."

The Air Force did not find DU outside range boundaries at Eglin Air Force Base (Spitzberg, 2005).

> "The licensee sampled the environs of the site as part of the site characterization process. Radioactive material in excess of the NRC-approved DCGLs was not identified offsite during recent site characterization studies suggesting that the DU material, a heavy metal, was not migrating outside of the site boundary."

The USAEPI wrote (USAEPI, 1995), "Investigations of DU migration at U.S. test sites have not identified significant migration in the environment."

An Army contractor that has performed environmental monitoring for DU at Jefferson Proving Ground for many years has never detected DU in soil or sediment samples outside the DU impact area (SAIC, 2005a) (SAIC, 2008a) (SAIC, 2006a) (SAIC, 2008b) (SAIC, 2010a) (SAIC, 2007a) (SAIC, 2005b) (SAIC, 2006b) (SAIC, 2009) (SAIC, 2010b) (SAIC, 2012) (SAIC, 2007b).

The US Department of the Army Soldier and Biological Chemical Command (USASSBC) took sediment samples at Jefferson Proving Ground and reported (USASSBC, 2002),

> "Sediment samples were collected at the same locations where surface water samples were obtained during the scoping survey. The total uranium concentration in sediment samples ranged from 0.88 to 1.09 pCi/g within the DU Impact Area. Along the firing line trajectories, the total uranium concentration in sediment was measured at 2 and 3 pCi/g along two different streams south of the DU Impact Area. The U-238 to U-234 activity ratio in the sediment samples collected during the scoping survey indicates that the uranium is naturally occurring."[29]

Also for Jefferson Proving Ground in 1995, an Army contractor (SEG, 1995) reported that all results of samples taken in the impact area showed U238-U234 ratios less than three.

In view of the above, the NRC should not require the Army to perform soil sampling for DU at its M101-impacted ranges because no scientific evidence exists to cause one to suspect that DU has migrated or will migrate beyond the immediate point of impact on the operational range.

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[29] The NRC often stipulates that a $^{238}U/^{234}U$ activity ratio less than three indicates the uranium in the sample is of natural origin. See, for example, ADAMS ML12053A391 and item 27c in attachment 1. However, Fleischer has written. (Fleischer, 2008): "... because of alpha-recoil effects, $^{234}U/^{238}U$ varies widely in natural systems, and for this reason ... [the variations] would cause $^{234}U/^{238}U$ ratios to be doubtful indicators of depleted uranium [for ratios determined by alpha spectroscopy]. ... [Mass] spectrometry ... would give more direct, reliable determinations." Nevertheless, alpha spectroscopy is employed much more often than mass spectrometry primarily for reasons of cost. Mass spectrometry (and the $^{238}U/^{235}U$ mass ratio determined thereby) generally is a backup for alpha spectrometry when definitive determinations between natural, depleted, and enriched uranium are necessary.

c. *Generic reasons why the NRC should not require air sampling for M101 DU (applies to all Army M101 DU-affected sites)*

Table 8.1 of National Council on Radiation Protection and Measurements Report (NCRP) No. 169 (NCRP, 2010) provides a typical ambient ^{238}U concentration in air of 5×10^{-6} pCi m^{-3}. Figure 15 shows that, if DU from 1000 M101spotting rounds was evenly dispersed in surface soil over 10^6 m^2, RESRAD predicts a maximum ^{238}U air concentration of about 6.5×10^{-6} pCi m^{-3}, which is comparable to the ambient ^{238}U air concentration. However, rounds found on the ranges so far seem to be mostly intact with corrosion products in or on the soil in the immediate area adjacent to round. This implies that the expected ^{238}U soil concentration and, hence, the expected ^{238}U air concentration due to dust will be much less than the typical ^{238}U ambient air concentration. In any event, the conservative RESRAD-predicted ^{238}U air concentration is more than three orders of magnitude less than 10 percent of the ^{238}U effluents limits (6×10^{-14} μCi mL^{-1} or 0.06 pCi m^{-3}) in 10 CFR Part 20, Appendix B, Table 2 (NRC, 2012c).

The NRC did not require the Air Force to perform air sampling during DU remediation at a range at Eglin Air Force Base (Spitzberg, 2005): "... perimeter sampling was only required at the discretion of the on-site radiation safety officer. The permittee planned to establish environmental controls to prevent erosion, to manage storm water runoff, and to minimize dust emissions. The permittee subsequently discontinued some of these environmental controls because reclamation activities had a minimal impact on the environment."

The NRC has never required the Army to perform air sampling at Jefferson Proving Ground (JPG) since test operations ceased there in 1995. "The monitoring of DU in soil, groundwater, surface water, and sediment continues on a bi-annual (*sic*)[30] basis. (NRC, 2012d)" The NRC source materials license number SUB-1435 allows JPG to possess up to 80,000 kg of DU at a single site,[31] which is more than ten times greater than the estimated total of all M101 DU at 16 Army installations.

The Army provided a contractor-prepared report to the NRC[32] (Shia, 2005), which said:

> "The assessments at [Jefferson Proving Ground], [Los Alamos National Laboratory], and [Aberdeen Proving Ground], among other sites indicate that risks associated with potential transport of DU in the air from controlled burns are negligible. The benefit/cost ratio of an air sampling

[30] Sampling occurs on a semiannual basis.
[31] ADAMS ML073030415
[32] ADAMS ML070090201

> program is extremely low (i.e., the benefits are small and the costs of the program high). Therefore, an air monitoring program is not recommended given the low probability of DU release and transport and the negligible effects on receptors."

So far, the NRC has followed that recommendation for Jefferson Proving Ground. The Army believes the NRC should apply the same recommendation to the Army's M101 DU-affected ranges.

The Enewetak Cleanup Project (1977-1980) was a joint DOD-Department of Energy (DOE) project to remove debris and radioactive contamination (mostly uranium and plutonium, not fission products) from the islands and lagoon of the atoll. Since both are actinides, uranium and plutonium behave similarly in the environment. The DOD operated air samplers whenever contaminated soil movements were underway. The report of the project (DNA, 1981) concluded:

> "Throughout the cleanup project, over 760,000 cubic meters of air were sampled on the controlled islands plus more than 211,000 cubic meters at Lojwa. Nearly 5,200 air samplers [*sic*] filters were analyzed by the lab. No significant airborne radioactivity of any type (including beta) was detected. It is clear from these results – as it was from resuspension experiments performed during early [Radiation Safety Advisory and Inspection Team] visits to the atoll – that the Enewetak contamination situation was not conducive to creation of a resuspension hazard."

The Environmental Protection Agency (EPA, 2006) says, "The amount of uranium in the air is usually very small and effectively insignificant for remedial operations. ... The high density of DU in most particulate forms limits the air transport of DU to relatively small particles. ... It is reported that most of the DU dust will be deposited within a distance of 100 meters from the source."

In view of the above, the NRC should not require the Army to perform air sampling for DU at any of its M101-impacted ranges.

d. Generic reasons why the NRC should not require surface water and groundwater sampling for M101 DU (applies to all Army M101 DU-affected sites)

The Environmental Protection Agency (EPA, 2006) says:

> "Uranium oxides include U_3O_8, UO_2, and uranium trioxide (UO_3). Both U_3O_8 and UO_2 are solids that are relatively stable over a wide range of environmental conditions, with a low solubility in water. ... U_3O_8 is the

> most stable form of uranium and is the form most commonly found in nature. The most common form of U_3O_8 is 'yellow cake,' a solid produced during mining and milling operations, and named for its characteristic yellow color. UO_2 is a solid ceramic material, and the form of uranium most commonly used in nuclear reactor fuel. At ambient temperatures, UO_2 gradually converts to U_3O_8."[33]

A reviewer of the UNEP reports wrote (Papastefanou, 2002):

> "There were no signs of DU in water [in Kosovo]. ... However, in a sample of public water selected from the Bosnia region, depleted uranium as high as 2.5 μg DU per kg water (30.7 mBq DU per kg water) and 4.5 μg total uranium per kg water (56 mBq total uranium per kg water) were measured."

The highest DU activity concentration in water that the reviewer reported is more than 300 times less than the NRC effluent limit for DU in water (NRC, 2012c).[34]

The USAEPI reported (USAEPI, 1995):

> "Groundwater samples at Aberdeen Proving Ground and Jefferson Proving Ground were analyzed; no DU was detected. At Aberdeen, localized soil contamination was discovered at depths of 20 centimeters (7.9 inches) below a penetrator corroding on the soil surface. This suggested that DU can become soluble and migrate to a limited degree even through soil in a wetland environment. At Yuma Proving Ground, where a high evaporation rate results in little vertical infiltration, soil contamination near a corroding penetrator decreased to back ground levels at a depth of eight centimeters (3.2 inches)."

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[33] The Army is aware of numerous studies that show the rate at which DU and its oxides enter and transport through various environmental media depend on many factors, such as soil pH, precipitation rates, depth of burial, etc.. See for example, (Dong, et al., 2006), (Oxenberg, et al., 2006), (USAEPI, 1995), and (EPA, 2006). According to (EPA, 2006), "Oxidation-reduction processes play a major role in the occurrence and behavior of uranium in the aqueous environment. The dominant uranium valence states that are stable in the geologic environment are the uranous (U^{4+}), and uranyl (U^{6+}, UO_2^{2+} ion) states; the former is much less soluble while the latter can form many complexes and is regarded as a dominant feature of uranium chemistry. For the metal, the oxidation rate is likely to be controlled by variables such as temperature, metal size and shape, presence or absence of coatings, soil matrix, and presence of water and other contaminants." Nevertheless, according to the Army's literature search as reported in this document, the reality is that DU has not been detected outside of any controlled area to any significant degree.

[34] The NRC effluent limit for DU in water is 3×10^{-7} μCi $mL^{-1} \approx 11{,}000$ mBq kg^{-1} (NRC, 2012c).

An Army contractor has performed environmental monitoring for DU at Jefferson Proving Ground for many years and has never detected DU in surface water or groundwater samples outside the DU impact area (SAIC, 2005a) (SAIC, 2008a) (SAIC, 2008b) (SAIC, 2006a) (SAIC, 2010a) (SAIC, 2007a) (SAIC, 2005b) (SAIC, 2006b) (SAIC, 2009) (SAIC, 2010b) (SAIC, 2012) (SAIC, 2007b).

The US Department of the Army Soldier and Biological Chemical Command took surface water samples at Jefferson Proving Ground and reported (USASSBC, 2002):

> "The total uranium concentrations in surface water that flowed through the DU Impact Area ranged from 0.21 to 4.11 pCi/L. The uranium concentration in surface water samples collected from streams intersecting the trajectories south of the firing line ranged from 1.42 to 1.87 pCi/L. The U-238 to U-234 activity ratio in the surface water samples collected during the scoping survey ranged from 0.35 to 1.0, indicating that the uranium is naturally occurring."

Similarly, the USASSBC took groundwater samples at Jefferson Proving Ground and reported (USASSBC, 2002):

> "Total uranium ranged from 0.43 to 3.609 pCi/L in 11 groundwater samples. These levels were well below the guideline level of 15 pCi/L. There was no indication of contamination when background concentration was subtracted. ... [Several] monitoring wells were completed around the DU firing range between 1984 and 1994. These wells were bored to various depths that ranged to over 40 ft from the surface. ... Overall, the data indicate that DU contamination has not moved to the groundwater or surface water from the DU Impact Area. This conclusion was further supported by the isotopic composition of uranium in the groundwater samples."

Regarding DU transport at Aberdeen Proving Ground, Dong et al. (Dong, et al., 2006) found:

> "Directly adjacent to the Chesapeake Bay lies the Aberdeen Proving Ground, a U.S. Army facility where testing of armor-piercing ammunitions has resulted in the deposition of > 70,000 kg of depleted uranium (DU) to local soils and sediments. Results of previous environmental monitoring suggested limited mobilization in the impact area and no transport of DU into the nation's largest estuary."

In view of the above, the NRC should not require the Army to perform surface and groundwater sampling for DU at its M101-impacted ranges.

e. *Generic reasons why the NRC should not require biota sampling for M101 DU (applies to all Army M101 DU-affected sites)*

It is well known (ATSDR, 2011) that "migration of uranium in soil and subsoil and uptake in vegetation are usually quite local involving distances from several centimeters to several meters. ... Uranium is transported poorly from soils to plants."

The Environmental Protection Agency (EPA, 2006) says:

> "Following airborne transport, the migration of DU will ultimately become subject to water, soil, and biological transport mechanisms. In general, DU deposited by airborne transport will be present on or near the soil surface and shows minimal uptake by plant roots. DU is not effectively transported through the food chain, as low-level organisms tend to excrete the soluble uranium species quickly."

The USASSBC took vegetation samples at Jefferson Proving Ground and reported (USASSBC, 2002):

> "Twenty vegetation samples were collected during the scoping survey using the same methods for soil sampling. Fourteen samples were obtained from within the DU Impact Area, and six samples were obtained along the firing line trajectories. The total uranium concentration in vegetation samples was less than 0.7 pCi/g in all samples. Two lichen samples from the south-central portion of the DU Impact Area had U-238 to U-234 activity ratios of 2.3 and 2.6, which indicate DU contamination."

The UNEP also detected DU in lichen in the three areas it surveyed (UNEP, 2003) (UNEP, 2001) (UNEP, 2002). According to UNEP, "This indicates that at least some of the penetrators at these sites hit hard targets and surfaces, partly aerosolized into dust, and dispersed into the air" (UNEP, 2003). The M101 DU spotting rounds hit no such hard targets and surfaces, therefore no aerosolizing occurred.

The USASSBC took biological samples at Jefferson Proving Ground and reported (USASSBC, 2002):

> "A total of eight biological samples were collected from deer, freshwater clams, fish, and a soft-shelled turtle. All of the biological samples from Big Creek were collected from the area adjacent to the DU Impact Area.

> The total uranium concentrations ranged from 0.091 pCi/g in deer liver to a maximum of 0.774 pCi/g in a freshwater clam. ... The U-238 to U-234 activity ratio ranged from 0.4 to 1.2 and does not indicate the presence of DU contamination."

In view of the above, the NRC should not require the Army to perform biota sampling for DU at its M101-impacted ranges.

f. Hawaii-ranges site-specific reasons why the NRC should not require soil or sediment sampling for M101 DU (also applies to all Army M101 DU-affected sites)

A University of Hawaii geochemist prepared a report for the National Center for Defense Environmental Excellence (Rubin, 2008) that says:

> "Most soil types in Hawaii bind U to soil particles generally limiting U mobility. ... General geochemical arguments suggest that metallic DU particles or DU-oxide particles from M101 spotting rounds fired in Hawaii are not highly mobile in local environments. Contamination should be restricted to the immediate area of use. Chemical analysis of environmental samples in the affected areas conducted by US Army contractors thus far show very limited dispersion of DU from the point of use, indicating low mobility of such particles here. ... There is currently no evidence of DU contamination outside of the confines of the US Army firing ranges where it was used in the 1960s."

As presented in paragraph 2d above, a recalculation of an Army contractor's data (Cabrera Services, 2008a) using weighted averaging produced a background reference area ^{238}U concentration of 1.60 ± 0.08 pCi g^{-1}. Then, using results from only unbiased soil samples in the impact area, calculations produced an M101 DU impact area background ^{238}U concentration of 1.14 ± 0.09 pCi g^{-1}. The ^{238}U in many of the biased samples (chosen using gamma walkover measurements) were significantly greater than both these values. This implies that M101 DU has not spread out significantly from locations where the M101 spotting rounds impacted, even within the impact area.

In 2010, an Army contractor reported (Cabrera Services, 2010) that during 2008, the contractor "performed scoping and characterization surveys at the Pohakuloa Training Area. ... A total of 10 [*sic*][35] biased surface soil and sediment samples were collected from areas where sediment had accumulated from past runoff/erosion events and around the perimeter of the suspected impact areas where visual and radiological indicators of

[35] Only nine results appear in the report and, hence, in Table 3 of this document.

the Davy Crockett weapons system were identified.... Activity concentrations were reported for ... ^{234}U, ... ^{235}U, and ^{238}U. All of the results are consistent with naturally occurring concentrations of uranium. None of the results indicate uranium depletion ...."

Table 3 displays soil concentration data from the report of that 2008 survey at Pohakuloa Training Area (Cabrera Services, 2008d). It also shows the calculated $^{238}U/^{234}U$ activity ratios, all of which are consistent with natural uranium. Figure 21 shows the locations where the contractor took soil samples at Pohakuloa Training Area.

The contractor also noted (Cabrera Services, 2008c):

> "While the soil samples collected around the perimeter and impacted areas of the range did not indicate the presence of DU, these data do not represent a statistically significant data set. A statistical field sampling design focused on the suspect Davy Crockett impact areas would hopefully yield more representative results. However, due to the general lack of the presence of traditional well developed soil, slightly weathered or unweathered volcanic rock predominates in some locales; thus, obtaining traditional soil samples typically used for risk assessment purposes will be problematic."

Figure 22 shows the terrain at the M101 impact areas at Pohakuloa Training Area. Volcanic rock in the area, known as *aa*, has rough surfaces and spiky features. Soil is poorly developed or non-existent on the impact areas.

In view of the above, the NRC should not require the Army to perform soil sampling for DU at its M101-impacted ranges.

g. *Hawaii-ranges site-specific reasons why the NRC should not require air sampling for M101 DU (also applies to all Army M101 DU-affected sites)*

In 2006, an Army contractor report (Cabrera Services, 2008b) provided results of inductively coupled plasma-mass spectrometry (ICP-MS) analysis for uranium isotopes of air filters taken for total suspended particulate sampling at seven locations surrounding the Pohakuloa Training Area. Figure 23 shows the locations of the air samplers. The report says:

> "The analysis of 437 filters from air sampling stations surrounding [Pohakuloa Training Area] indicates that the level of total uranium in the air is significantly below both the World Health Organization (WHO) guidance level of 1 $\mu g/m^3$ and the Agency for Toxic Substances and Disease Registry (ATSDR's) most restrictive minimal risk levels (MRLs)

> for highly soluble uranium salts of 0.0003 mg/m^3 (0.3 μg/m^3). ... The maximum total uranium content detected on any single filter was 0.0017 μg ... with a total sample air volume of 7.070 m^3. This represents a maximum concentration of 0.00024 μg/m^3 (2.4 E-04 μg/m^3)."

The report also found:

> "Based on observations of the DU found at [Pohakuloa Training Area] the predominant chemical form of DU present appears to be solid metal fragments with very minor amounts in the form of uranium oxide. The chemical form present at [Pohakuloa Training Area] also reduces its hazard compared to the chemical form assumed (soluble uranium salts) as the basis for the ATSDR's MRL guidance. Concentrations of uranium in the air surrounding PTA are below both WHO and ATSDR recommendations and appear to present no hazard to the surrounding population."

After almost 50 years in the Pohakuloa Training Area environment, the M101 DU is still in mostly metallic form, which means it is not available for transport into air, water, biota, and soil (of which little exists at this site).

An Army contractor (Cabrera Services, 2007) "... performed air, soil, and vegetation sampling to evaluate potential airborne emissions of depleted uranium (DU) during prescribed reference and test range burns that occurred 10-13 July 2007 at Schofield Barracks, Hawaii. The reference and test burns were performed on areas non-impacted (i.e., without DU) and impacted by DU contamination, respectively. ... High velocity air samplers using particulate filters were set up downwind of the burn areas to collect both pre-burn and during-burn air samples. ... All samples were sent [to a radiochemistry laboratory] for analysis by alpha spectroscopy. ... [Test] burn results do not demonstrate a consistent and significant increase in U concentrations from pre-burn samples to during-burn samples, ... demonstrating that residual U is not being released during the burns"

Table 5 shows air sampling results and $^{238}U/^{234}U$ isotopic ratios calculated from those results. The calculations show no evidence of DU in the air samples.[36]

[36] The report (Cabrera Services, 2007) also says, "In addition to the soil analytical results from the test burn area, visual observations confirmed Uranium Oxide (yellowcake) was present in the test and full range burn areas. With the known behavior of U and likely forms of U present at the test burn site, it is likely that the elevated concentrations observed in the vegetation sample are the result of DU contamination on the plant surfaces rather

An Army contractor working at Schofield Barracks took air samples for workplace monitoring purposes. The samples were archived and so were available for uranium isotopic analysis. Results of the new analyses included isotopic analysis (Mason, 2012). None of the results for individual samples indicated the presence of DU. However, the relative uncertainties in the $^{238}U/^{234}U$ ratios were large. The activity on each sample was calculated by multiplying each laboratory-supplied activity concentration by the corresponding sample volume and then the activities were summed. A composite ratio for the downwind samples was calculated to be 0.91 ± 0.19, which is consistent with natural uranium. See Table 2.

A report (USAESC, 2012) summarizes Pohakuloa Training Area battle area complex (BAX) construction support activities. Appendix I of the report discusses all radiological support activities.

The contractor analyzed the air sampler filters for gross alpha/beta counts only but then assumed all counts were due to the ^{234}U component of DU. The report said:

QUOTE

> The limiting air concentration for uranium effluents from 10 CFR 20 is 5×10^{-14} microCuries per milliliter (μCi/ml) for ^{234}U. For DU, ^{238}U concentrations would be significantly greater than ^{234}U concentrations; thus, using the 10 CFR 20 air effluent concentration value for ^{234}U is conservative when applied to DU. The action level for the airborne concentration was set at 20% of the ^{234}U limit for effluents from 10 CFR 20 for all U isotopes or 1×10^{-14} μCi/ml. None of the results exceeded the project action levels. ...
>
> ... The radionuclide of concern for [the Pohakuloa Training Area] site was DU. None of the radiological data identified any contamination prior to, during, or after construction activities at Range 11T. No DU was found during construction work activities. Therefore, no investigation derived waste (IDW) was generated. The exposure rate measurements, gamma walkover data, radiological surveys, and air sample results were consistent with background levels of radiation.

UNQUOTE

than direct uptake of DU by the plant." The current document is concerned with M101 DU that might be leaving the impact area. Results that indicate that DU is inside the impact area are not surprising and not relevant to the current document.

In 2008, an Army contractor performed air sampling during prescribed range burns at Schofield Barracks (Cabrera Services, 2009). Table 6 lists the results of that air sampling and Table 7 lists the global positioning coordinates for the placement of the four air samplers. Figure 24 depicts the locations of the air samplers. The air sampling results show no evidence of DU in the air sampler filters.

A privately funded project found no DU from Pohakuloa Training Area in a 20-year accumulation of windblown dust (Bigelow, 2008). The final report stated:

QUOTE

> Waiki'i Ranch is the closest civilian community to [Pohakuloa Training Area]. The prevailing surface wind blows directly towards the Ranch from the areas where the DU fragments are located, some 8-10 miles away.
>
> The method agreed upon as being valid was to find a building exposed to the prevailing wind, and take dust samples from a rain sheltered area of the building. We selected our polo pavilion, which is an open sided building exposed to the wind from [Pohakuloa Training Area]. The interior beams of the building have never been washed, and have a 20 year accumulation of airborne dust.
>
> The Ranch Manager ... and I jointly collected a sample of dust from the building, and split the sample into two portions. I sent one portion to the Geosciences Laboratory, and [the ranch manager] retained the second sample in his custody in case there is ever any future question as to methodology or integrity of the tests.
>
> The test, which has the capability of detecting even the most minute amounts of DU, indicates that any DU in the sample is at the very lowest level of detection possible with present day equipment. Hawaii rock (and dust) contains a minute trace of naturally occurring uranium. The DU level of 1/100 the level of naturally occurring uranium in the sample indicates only a trace within a trace. The level of DU in the dust sample is so low as to be *statistically insignificant* [emphasis added]. Please see the details in the laboratory report.
>
> From this we can conclude that we have not been exposed to DU. Since Waiki'i Ranch is the closest community to the source, it also is unlikely that any other inhabited areas of the Big Island have been exposed.

UNQUOTE

From February 2009 to March 2010, a one-year air sampling project was performed at Pohakuloa Training Area from February 2009 to March 2010 [see (Morrow, 2009), (Morrow, 2010a), (Morrow, 2010b), (Morrow, 2010c), and (Morrow, 2010d)]. The sampling method and results are described below:

> "An airborne uranium monitoring project at the U. S. Army's Pohakuloa Training Area (PTA) commenced on 4 March 2009. Portable samplers operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on PTA .... The samplers were originally set to collect total suspended particulate matter (TSP) from midnight to midnight on sample days. However, due to the very low uranium content of the TSP samples, the run time was increased to 72 hours on 19 Apr 09 and has continued at that rate in an effort to raise the collected uranium mass above the practical reporting level (PRL)."

Morrow also noted that all total uranium results, including "'elevated' uranium levels were ... well below the WHO and EPA health effects guidelines." Uranium isotopic analyses were not performed on the air sampler filters.

At the conclusion of the project, Morrow's executive summary (Morrow, 2010d) found:

> "Two hundred and ten (210) total suspended particulate matter (TSP) air samples were collected at three (3) sites at the U. S. Army's Pohakuloa Training Area (PTA) and submitted to a certified laboratory for uranium (U) analysis. The analysis method was inductively coupled plasma -mass spectrometry (ICP-MS), a method capable of detecting U down to the picogram (1.0 E-12 gram) level. The concentrations of total airborne U were found to be several orders of magnitude below both U. S. and international chemical and radiological public health guidelines. The concentrations of U found in the TSP were comparable to that found in Hawaiian soils and rock thus suggesting that Army activities had made no significant contribution to airborne U."

In view of the above, the NRC should not require the Army to perform air sampling for DU at its M101-impacted ranges.

h. Hawaii-ranges site-specific reasons why the NRC should not require surface water or groundwater sampling for M101 DU (also applies to all Army M101 DU-affected sites)

US Army Garrison Hawaii Department of Public Works personnel performed surface water sampling in the period March 12, 2007 through April 21, 2008. Samples were analyzed for isotopic uranium (Cabrera Services, 2008d). Table 4 provides the results of

laboratory analysis along with the $^{238}U/^{234}U$ isotopic ratios calculated from those results. Figure 25 and Figure 26 show the locations where the surface water samples were taken. No evidence of DU in the samples was found.

In view of the above, the NRC should not require the Army to perform surface water and groundwater sampling for DU at its M101-impacted ranges.

4. NRC-proposed license conditions

If the NRC denies the Army's above requests, then the Army requests modifications to the NRC-proposed draft license conditions (Attachment 1). The following subsections discuss the NRC-proposed license conditions.

a. Item 1, Licensee's name

The licensee's name should be "United States Army Installation Management Command."

b. Item 2, Licensee's address

The licensee's address should be "ATTN: IMSO, Building 2261, 2405 Gun Shed Road, Fort Sam Houston, Texas 78234-1223."

c. Item 8, Maximum amount that licensee may possess at any one time under this license

The Army requests the NRC to change "8000 kg" to "125 kg."[37] Item 10 clearly states that the "authorized places of possession" will be Schofield Barracks and Pohakuloa Training Area. The quantity should reflect the amount at those locations, not the total amount at all possible locations.

As the Army applies for amendments to add the other M101 DU-affected installations, it will increase the "maximum amount" appropriately to include the added amount of DU.

[37] The Army believes that it fired no more than 714 M101 spotting rounds collectively at Schofield Barracks and Pohakuloa Training Area. 714 M101 spotting rounds × 6.2 ounces DU/round × 1 pound/16 ounces × 1 kg/2.2 pound ≈ 125 kg DU.

d. Item 9, Authorized use

Regarding item 9C,[38] the Army will request below that the NRC not require environmental radiation monitoring plans as a license condition for all M101 DU-affected sites.

e. Item 11, Documents incorporated by reference

The Army requests that the NRC not require an environmental radiation monitoring plan as a license condition. If that request is approved, the Army further requests that the NRC not include references to such plans in this license condition.

Section 11.1 of the referenced Radiation Safety Plan dated June 22, 2011[39] includes requirements for contamination surveys of personnel, equipment and vehicles as they exit a Radiation Controlled Area (RCA). The Army recognized these requirements as a health physics standard of practice and so included them in the Radiation Safety Plan.

However, the Army included these requirements without considering the significant impacts on training in the new Battle Area Complexes (BAX) at Schofield Barracks and Pohakuloa Training Area. In an internal document (see Attachment 2), Army training personnel wrote,

> "Personnel, vehicles and equipment entering these RCAs in the future will be subject to safety restrictions within the area and screening by radiation monitors prior to departure from the area. This monitoring costs 2 to 4 hours of unit training and transition time between training areas and ranges. These delays result in a degradation of training, specifically the valuable lessons learned that would normally be gleaned during the After Action Review process conducted immediately following training events."

In addition to degradation of troop readiness, US Army Garrison Hawaii does not have the equipment or personnel to support exit monitoring following BAX training exercises. Contractor support likely will be necessary. This situation is unique to the Hawaii ranges as BAX sites do not overlap M101 DU impact areas at other M101 DU-affected installations.

Therefore, the Army requests that the NRC grant an exception to exit monitoring requirements following BAX training exercises for exercise participants. The exception

[38] "Activities necessary to monitor the radiological environmental conditions in and around the authorized places of use to determine if licensed material is being transported in the environment"
[39] ADAMS 11193A227

would not apply for routine exit monitoring following other activities, such as range maintenance, in portions of the BAX that overlap an RCA. The Army supports this request by noting that Army personnel and contractors have never detected personnel, equipment, or vehicle DU contamination since 1995 at Jefferson Proving Ground (after active testing ceased) and since 2006 at the Hawaii ranges (since the M101 DU contamination was "re-discovered"). In addition, the UNEP teams have never detected any DU contamination on personnel. UNEP wrote in one of their reports (UNEP, 2002):

> "After every site visit, and prior to breaks for lunch in the field, all team members were measured for possible DU contamination on the soles of their footwear, on gloves and on clothes. No such contamination was found at any time."

f. Item 12, Schedule for incorporating other M101 DU-affected sites

The Army requests relief from all environmental radiation monitoring requirements for all M101 DU-affected sites. Support for this request is in Section 2 and Section 3 above.

g. Item 14, Newly identified M101 DU-affected installations

All Army requests regarding this license for the named installations will apply also to newly identified M101 DU-affected installations.

h. Item 15, Change in garrison Radiation Safety Officer (RSO)

The Army requests that the NRC rely on the License RSO (who is a qualified health physicist and will be named on the license) to maintain records of garrison Radiation Safety Officer qualifications. This request is a matter of privacy and prevents individual names from appearing in the NRC's public record. The Army recommends that the NRC change this condition accordingly and add that the License RSO will provide garrison RSO contact information to the NRC and update that information whenever a garrison RSO changes.

All garrison RSOs must meet certain qualifications that the Army maintains and reviews; Garrison RSOs at M101 DU-affected installations must meet additional training requirements of the license that are contained in the Radiation Safety Plan. Section 2.2 of the Radiation Safety Plan says:

> "The NRC allows no activities within any RCAs until the License RSO has determined that the Garrison RSO meets the training qualifications in Section 2.4.1. The License RSO will maintain documentation that

demonstrates Garrison RSO compliance with these training qualifications."

i. *Item 16, Consultation with the US Fish and Wildlife Service (USFWS)*

The Army requests that the NRC delete this license condition.

Item 16 is redundant and unnecessary as it attempts to place a requirement, or additional burden, on the Army. The obligations placed upon the Army in regards to threatened and endangered species are set out in the Endangered Species Act (16 U.S.C. §§ 1531-1599). Specifically, Section 7 of the Endangered Species Act requires an assessment and "consultation" with the Secretary (USFWS) if an Agency takes an action that may impact a critical habitat or a threatened or endangered species (16 U.S.C. § 1536). Section 7 contemplates cooperation and an agreement between the USFWS and the agency taking the action.

In this case, the NRC is attempting to add a condition to the license that requires the Army to follow existing statute, and add an additional party to an agreement; an addition not allowed for in the Endangered Species Act. The NRC does not have the authority to administer the Endangered Species Act, conduct consultations, or in any way interfere with the process. Therefore, the NRC should remove item 16 of the proposed license.

j. *Item 19, Firing of high-explosive (HE) munitions on ranges containing DU*

The NRC relies upon DOD Directive 4715.11 (DOD, 2004) regarding the firing of high explosives (HE) on ranges containing DU. However, paragraph 5.4.9.2 of the directive states, "*When possible*,... high-explosive munitions shall not be fired into the same area as DU" [emphasis added]. This language dovetails appropriately with the stated license condition that requires notice to the NRC fourteen working days prior to firing of HE munitions into ranges containing DU. Neither DODI 4715.11 or the NRC's proposed license prohibit firing HE into DU containing ranges, but simply add a layer of oversight.

However, the notice requirement is onerous and overly restrictive of live-fire training. This training is essential to the success and survival of our Soldiers. The Army often improvises training to facilitate real world scenarios, including continuously changing battlefield conditions.

The Army requests that the NRC delete this license condition or otherwise change it to read, "When possible, the Army will not fire high explosive munitions into M101 DU-affected areas. When the use of high explosive munitions in such areas is necessary, the Army will make a record of such uses and provide them to the NRC upon request or annually."

An Army contractor's report (Morrow, 2008) says:

QUOTE

> In order to evaluate the potential air quality impact of M-101 rounds at [Pohakuloa Training Area], we conducted a computer modeling analysis using onsite wind data along with a number of conservative assumptions regarding atmospheric stability conditions and the fate of M101 spotting rounds lying on the surface within the impact zone at PTA. The EPA's Industrial Source Complex - Short Term (ISCST) model[40] was employed in a screening mode with the following input:
>
> - wind direction and wind speed data from four (4) monitoring stations at PTA
> - neutral stability (Class 4) assumed during the period 8:00 a.m. - 10:00 p.m. daily
> - stable atmosphere (Class 6) during the period 11:00 p.m. - 7:00 a.m. daily when wind speed was less than 4 meters per second
> - 100 intact M-101 rounds [per day] were struck by a high explosive round and 100% aerosolized
> - three (3) scenarios were modeled: detonation at 8:00 a.m., 2:00 p.m. or 12:00 midnight (to reflect different meteorological conditions)
> - the detonation was assumed to occur every day of the year at the specified hour
> - annual average uranium (U) concentrations were computed at 966 receptor locations spaced at 100 meter intervals on the PTA boundary

UNQUOTE

The highest result Morrow obtained from this "worst-case" analysis was an annual average DU mass concentration in air of 0.25 $\mu g\ m^{-3}$, which, Morrow points out, is "below the World Health Organization's recommended public exposure level of 1.0 microgram per cubic meter … of air for soluble forms of DU."

However, Morrow's result requires additional study. Using the specific activity of DU, 3.77×10^{-7} Ci g^{-1} = 3.77×10^{-7} $\mu Ci\ \mu g^{-1}$, the annual average DU activity concentration in

[40] EPA developed the ISCST model to provide estimates of air concentrations and deposition rates of the stack emissions of contaminants from industrial sources located in varied terrain (e.g., from simple to complex terrain) (EPA, 1986).

air for the above highly conservative scenario is approximately 9.4×10^{-8} μCi m^{-3} = 9.4×10^{-14} μCi mL^{-1}. For comparison, the NRC effluent standard for DU in air is 6×10^{-14} μCi mL^{-1} (NRC, 2012c), so Morrow's highly conservative scenario produces an average DU activity concentration in air that marginally exceeds the NRC effluent standard for DU in air.

Morrow then adopts a more realistic but still highly conservative scenario. Because no more than 714 M101 spotting rounds were available for aerosolization by HE munitions on the two Hawaii ranges, he changed his scenario from 100 M101 spotting rounds per day aerosolized over a year to two M101 spotting rounds per day aerosolized over a year. This reduces the maximum DU activity concentration in air by a factor of 50 to 1.9×10^{-15} μCi mL^{-1}, which is less than 1/30th of the NRC effluent limit for DU in air. A realistic but still conservative scenario, such as one HE munitions direct hit per week on an M101 spotting round, would reduce the hypothetical maximum DU activity concentration in air to much less than one percent of the NRC effluent limit for DU in air.

Clearly, the hypothetical aerosolization of M101 DU by HE munitions on Army ranges would produce DU air concentrations that "are authorized by law and will not endanger life or property or the common defense and security."

k. Item 20, Posting of "Caution – Radioactive Material" signs

The Army appreciates the NRC's favorable response to its request to place "Caution – Radioactive Material" in safe locations. The Army will modify the Radiation Safety Plan accordingly and submit it to the NRC for approval once all changes to the Radiation Safety Plan are known.

l. Item 21, Collection or removal of "found" DU

The Army requests that the NRC delete this condition or modify it to more closely match the Section 3.2 of the Radiation Safety Plan,[39] which states:

> "Deliberate searches for and removal of DU are not authorized within [a radiation controlled area (RCA)] except for [explosive ordnance disposal (EOD) unexploded ordnance] blow-in-place activities (see Section 4.2). However, unintended discovery of M101 spotting round DU debris in an RCA and its location will be reported immediately to the Garrison RSO. The Garrison RSO, in consultation with the EOD personnel and the License RSO, will determine whether it is more reasonable to pick up the DU and hold it for appropriate disposal (see Section 18) than it is to leave it in place."

Section 18 of the Radiation Safety Plan describes proper handling of M101 spotting round fragments.

Army EOD personnel are highly qualified to make decisions within their area of expertise. The NRC requires the License RSO to be a qualified health physicist and requires the garrison RSO to meet more than basic qualifications. The Army requests that these individuals be authorized to make the appropriate, on-the-spot decision rather than request authorization from NRC personnel.

The Army would be pleased to notify the NRC when and if it decides to retrieve and dispose of residual M101 DU found on a range. This condition could be appended to the end of the above extract from the Radiation Safety Plan.

m. Item 22, NRC- or Agreement State- licensed contractors

The Army requests that the NRC change "NRC or Agreement State licensed contractors" to "NRC- or Agreement State-licensed contractors and NRC-licensed Department of Defense agencies." In the future, an agency or command of the Department of Defense or one of the Services (for example, the US Army Corps of Engineers) may have a requirement to clean up all or a portion of an M101-affected range under the provisions of its own license rather than that of a contractor. This flexibility in the license will aid in proper and timely fulfillment of that obligation.

n. Item 23, Six-month advance notification to the NRC

The Army requests that the six-month notice requirement for the NRC to review and approve any "ground disturbing" activity on an Army range be eliminated. In the past, the Army has directly contracted NRC-licensed companies to provide radiological support. The Army is not aware of any other licensee held to this requirement. Typically, the NRC requires the Army's contractor to notify the NRC either as an NRC licensee or, through reciprocity agreements, as an Agreement State licensee.

The time is of significant concern and is in direct conflict with NRC licenses issued to service contracts, which require a 14-day notification to the specific NRC Regional Office that issued the license. As written, the process to perform activities on ranges could take up to a year to gain approval. An additional concern is the potential effect on current activities and contract actions that have fixed price scope and specific periods of performance.

The Army requests that the NRC delete this license condition and allow existing NRC regulations and contractor license conditions to determine what and when notifications and advance notices are necessary.

o. *Item 24, Programmatic Agreement between the Army and Hawaii historic preservation interests*

The referenced 2004 Programmatic Agreement is inapplicable to DU located at Schofield Barracks or the Pohakuloa Training Area. The Programmatic Agreement states that it applies to construction projects that related specifically to the conversion of the 2nd Brigade of the 25th Infantry Division (Light) to a Stryker Brigade Combat Team. The authority for this agreement lies in the National Historic Preservation Act, 16 U.S.C. §§470 et. seq.

The NRC does not have the authority to designate National Historic Sites, or enforce the requirements of the National Historic Preservation Act. The US Army is obligated to follow the mandates of the National Historic Preservation Act and currently does so in cooperation with the State of Hawaii historic preservation officer. This condition is redundant, unnecessary and irrelevant to the issue of DU located on impact ranges.

The Army requests that the NRC remove this license condition.

p. *Item 25, Annual environmental radiation monitoring report*

This condition is dependent upon the NRC decisions to Army requests on other proposed license conditions.

q. *Item 26, Continuous air sampling*

The Army requests that the NRC delete this license condition. Sections 2 and 3 above support this request at the Hawaii ranges and at all other sites.

The NRC has told the Army off-line that "risk has nothing to do" with the NRC's demands for environmental radiation monitoring for DU outside the radiation controlled areas at the Hawaii ranges and at other Army sites. However, the Army has great difficulty justifying the expenditure of mission dollars (taxpayer money) in an attempt to detect radioactive material that poses risk so low that it is essentially not measurable.

The Army cannot prove the negative, that no M101 DU is leaving the radiation control areas. If some small amount is leaving the radiation control area, testing has shown that the amount is too small to be measured by any reasonable means. Additionally, if DU were detected at minimum detectable concentrations, the risk to someone exposed to it would be orders of magnitude below risks acceptable to both the NRC and the Environmental Protection Agency.

The dose the resident farmer receives in the first year of monitoring, according to Figure 2, is approximately 0.03 mrem. Using a conservative estimated cost of $100,000 for a year of environmental monitoring and ignoring all other costs, this conservative estimate indicates a cost per dose reduction of more than $100,000/0.03 mrem ≈ $330,000,000 per mrem avoided for the resident farmer.[41]

The NRC contracted a study that ended in 1994 (Baum, 1994). The researcher reviewed "recent" literature information on the cost per life saved in various health and safety activities, and the related value of dose avoided in radiation protection. In addition, he contacted agencies and organizations in several countries for information on the values they used or considered. The study concluded, "A nominal value of $1,000 per person-[mrem] seems appropriate in light of the many uncertainties involved in deducing these values." $330,000,000 per mrem avoided is much more than $1,000 per mrem avoided. Although the Army uses these calculations as a guide, these numbers are somewhat academic as the true "avoidance" is accomplished by restricting access and avoiding any dose, no matter how small. Monitoring is therefore unnecessary as migration data and information show that detection is unlikely or well below acceptable levels.

The Army repeats its request to the NRC to delete requirements for an environmental radiation monitoring plan and program for all of the Army's M101 DU-affected installations.

r. *Item 27, Revisions to the Environmental Radiation Monitoring Plan*

This license condition is moot if the NRC grants the Army's request that the NRC not require an environmental radiation monitoring plan for any of the Army's M101 DU-affected installations. However, the Army provides comments concerning this license condition should parts or all of it remain.

The reason that the Army should sample plants next to or near M101 DU contamination in accordance with 27A is not clear. First, the Army has no plans to look for depleted uranium in any of its M101 DU-affected ranges. Second, if the Army inadvertently finds M101 DU, the Army plans to retrieve it for proper disposal as a reasonable measure to keep doses as low as reasonably achievable.[42] No future uptakes will occur. Thus, this analysis is only an academic exercise. Third, and most important, any found DU would

[41] If one insists that more than one person may avoid the dose, then the Army would insist on a more reasonable scenario, including remediation, that would drive the individual cost per dose avoided much higher.

[42] The Army has requested that the NRC delete item 21. Failing that, the Army may choose to leave the DU in place.

be in a radiation controlled area.[43] The purpose of an environmental radiation monitoring plan is to attempt to detect M101 DU that has left the radiation controlled area. Sampling biota within the radiation controlled area does not meet that purpose.

The Army requests that the NRC delete that portion of condition 27A regarding sampling inside a radiation controlled area.

5. Synopsis

The Army takes seriously its commitment to the protection of the public it serves from all types of hazards that may be related to its operational ranges, as well as the proper preparation and protection of our Soldiers and completion of its assigned missions. Our Soldiers, retirees, Department of the Army Civilians, and their families live, work, and play on the installations at issue and in the surrounding communities. Their safety and health will not be compromised. Additionally, having the ability to fight and win the nations wars, while protecting the lives of our Soldiers, requires significant, relevant, and realistic training. The proposed restrictions severely limit this training, putting our Soldiers at unnecessary and unacceptable risk.

The Army wants to work with the NRC to achieve a reasonable balance of competing demands associated with the Army's need for effective training for National Defense and the collective responsibility to protect the public and military communities. The Army is making a good faith effort to that end and believes that all of its above requests are reasonable, scientifically supported, do not endanger life or property or the common defense and security, and are otherwise in the public interest.

[43] Section 3.2 of the Radiation Safety Plan says, "The Garrison RSO and License RSO will be notified when M101 spotting round debris is discovered on US Army Garrison Hawaii ranges outside of known RCAs. The Garrison RSO will establish a new or extended RCA to address this discovery."

Tables

Table 1 M101 DU AEC/NRC License History Selections

Amendment	Date	Location	Purpose/Use	Remarks
Original	1 Nov 61	Lake City Arsenal, Independence, MO; Frankford Arsenal, Philadelphia, PA	Testing, fabrication, distribution to field units in accordance with procedures in 19 Sep 61 application; export for military purposes	Initial application
No number	25 Oct 62	Lake City Arsenal, Independence, MO; Frankford Arsenal, Philadelphia, PA; other locations not specified	Testing, fabrication, distribution to field units in accordance with procedures in 19 Sep 61 application; export for military purposes	Clarifies procedures
No number	23 Aug 63?	Lake City Arsenal, Independence, MO; Frankford Arsenal, Philadelphia, PA; other locations not specified	Testing, fabrication, distribution to field units in accordance with procedures in 19 Sep 61 application; export for military purposes	Single Army DU license
Renewal, no number	21 Apr 65	Frankford Arsenal, Philadelphia, PA; other locations not specified	Fabrication; distribute to field units in accordance with procedures in 19 Sep 61 application	
No number	24 Aug 68	Frankford Arsenal, Philadelphia, PA; other locations not specified	Fabrication in accordance with procedures in 25 Mar 68 application; distribute to field units and use in accordance with procedures in application dated 19 Sep 61	New application for fabricating component parts
#1	17 Oct 73	Frankford Arsenal, Philadelphia, PA	Fabrication and testing in accordance with procedures in 23 Apr 73 application and 12 Sep 73 letter; distribution to field units no longer authorized	Fabrication and testing only
#2, renewal in entirety	18 Nov 74	Frankford Arsenal, Philadelphia, PA	Fabrication and testing only	Adds thorium for coatings
#3	18 Dec 74	Frankford Arsenal, Philadelphia, PA	Fabrication and testing only	Distribution prohibited
#4	5 Mar 76	Frankford Arsenal, Philadelphia, PA	Fabrication and testing only	RSO changes; AEC changes to NRC
#5	4 Oct 77	Frankford Arsenal, Philadelphia, PA	Fabrication and testing only	RSO changes
—	30 Sep 77	Frankford Arsenal, Philadelphia, PA	License expires and replaced	
—	1978	Frankford Arsenal, Philadelphia, PA	License #SUB-1339 replaces license #SUB-459	Remediation of Frankford Arsenal
—	1980-1981	Frankford Arsenal, Philadelphia, PA	Remediation activities	
—	1983	Frankford Arsenal, Philadelphia, PA	License #SUB-1339 expires; remediation complete	License termination letter not found; remediation later revisited

This table is not complete or comprehensive.

Table 2 Uranium isotopic analysis of archived air sample filters from Schofield Barracks worksite on M101 impact area

	Sample ID	Activity Air Concentration (10^{-17} µCi mL^{-1})		$^{238}U/^{234}U$ ratio	Volume (10^8 mL)	Activity (10^{-8} µCi)	
		^{234}U	^{238}U			^{234}U	^{238}U
Reference Area	SB-AS-002	9.2 ± 8.6	4.1 ± 5.0	0.4 ± 0.7	1.60	1.5 ± 1.4	0.7 ± 0.8
	SB-AS-003	1.6 ± 8.6	7 + 10	4 ± 24	1.04	0.17 ± 0.89	0.7 ± 1.0
	SB-AS-004	18 + 26	9 ± 23	0.5 ± 1.5	69.1	1.2 ± 1.8	0.6 ± 1.6
	SB-AS-005	13 ± 10	8.3 ± 8.9	0.6 ± 0.8	1.19	1.6 ± 1.2	1.0 ± 1.1
	SB-AS-006	-24 ± 22	2 ± 13	—	1.13	-2.7 ± 2.5	0.2 ± 1.5
	SB-AS-007	-5 ± 17	7 ± 12	—	75.0	-0.4 ± 1.2	0.5 ± 0.9
	SB-AS-008	0.00 ± 0.87	5.0 ± 7.2	—	1.35	0.0 ± 1.2	0.7 ± 0.9
	SB-AS-009	-4 ± 12	0.00 ± 0.94	—	1.50	-0.6 ± 1.8	0.0 ± 1.4
	SB-AS-010	8 ± 15	7 ± 12	0.9 ± 2.2	1.48	1.2 ± 2.2	1.0 ± 1.8
	SB-AS-011	7 ± 13	-2.5 ± 8.5	—	1.33	0.9 ± 1.7	-0.3 ± 1.1
	SB-AS-012	-1.1 ± 7.2	3.3 ± 6.6	—	1.59	-0.2 ± 1.1	0.5 ± 1.1
	SB-AS-013	5 ± 12	11.0 ± 9.0	2.2 ± 5.6	1.02	0.5 ± 1.2	1.1 ± 0.9
	SB-AS-014	6.2 + 8.4	5.2 ± 6.9	0.8 ± 1.6	1.64	1.0 ± 1.4	0.9 ± 1.1
	SB-AS-015	8 ± 10	15 ± 11	1.9 ± 2.7	1.32	1.1 ± 1.3	2.0 ± 1.5
	SB-AS-016	3.5 ± 8.5	1.2 ± 5.8	0.3 ± 1.9	1.59	0.6 ± 1.4	0.2 ± 0.9
	SB-AS-017	1 ± 11	11.0 + 9.8	10 ± 120	1.39	0.1 ± 1.5	1.5 ± 1.4
	SB-AS-018	-3.5 + 7.7	2.3 ± 8.0	—	1.56	-0.5 ± 1.2	0.4 ± 1.3
	SB-AS-019	12.0 ± 7.4	6.5 ± 6.2	0.5 ± 0.6	1.74	2.1 ± 1.3	1.1 ± 1.1
	SB-AS-020	7 ± 13	0.0 ± 8.0	—	1.42	1.0 ± 1.9	0.0 ± 1.1
	SB-AS-021	9 ± 11	8.1 ± 8.4	0.9 ± 1.4	1.42	1.3 ± 1.6	1.2 ± 1.2
	SB-AS-022	9 ± 14	14 ± 12	1.6 ± 2.8	1.15	1.0 ± 1.6	1.6 ± 1.4
	SB-AS-023	9 ± 11	23 ± 17	2.6 ± 3.7	1.40	1.3 ± 1.5	3.2 ± 2.4
		Composite		**1.6 ± 1.1**		**12.1 ± 7.2**	**18.8 ± 6.1**
Downwind of Work Area	SB-AS-024	27 ± 15	23 ± 13	0.9 ± 0.7	1.19	3.2 ± 1.8	2.7 ± 1.6
	SB-AS-025	50 ± 26	10 ± 23	0.2 ± 0.5	1.13	5.7 ± 2.9	1.1 ± 2.6
	SB-AS-026	40 ± 20	19 ± 15	0.5 + 0.4	1.53	6.1 ± 3.1	2.9 ± 2.3
	SB-AS-027	16 ± 14	3.5 ± 9.6	0.2 ± 0.6	1.49	2.4 ± 2.1	0.5 ± 1.4
	SB-AS-028	74 ± 29	85 ± 30	1.1 ± 0.6	1.05	7.8 ± 3.1	8.9 ± 3.2
	SB-AS-029	64 ± 25	74 ± 25	1.2 ± 0.6	1.02	6.5 ± 2.6	7.6 ± 2.6
	SB-AS-030	19 ± 13	13 ± 11	0.7 ± 0.7	1.19	2.3 ± 1.6	1.6 ± 1.3
	SB-AS-031	62 ± 37	51 ± 31	0.8 ± 0.7	93.5	5.8 ± 3.5	4.8 ± 2.9
	SB-AS-032	26 ± 14	31 ± 13	1.2 ± 0.8	1.53	4.0 ± 2.1	4.7 ± 2.0
	SB-AS-033	11 ± 19	22 ± 16	2.0 ± 3.7	1.10	1.2 ± 2.1	2.4 ± 1.8
	SB-AS-034	36 ± 28	64 ± 33	1.8 ± 1.7	1.44	5.2 ± 4.0	9.2 ± 4.8
	SB-AS-035	62 ± 21	51 ± 19	0.8 ± 0.4	1.19	7.4 ± 2.5	6.1 ± 2.2
	SB-AS-036	12 ± 16	21 ± 15	1.8 ± 2.6	1.19	1.4 ± 1.9	2.5 ± 1.8
	SB-AS-037	73 ± 25	56 ± 20	0.8 ± 0.4	1.27	9.3 ± 3.2	7.1 ± 2.5
	SB-AS-038	35 ± 18	31 ± 16	0.9 ± 0.6	1.02	3.6 ± 1.8	3.2 ± 1.6
		Composite		**0.91 ± 0.19**		**72 ± 10**	**65 ± 9**

Activity air concentration and sample volume data from a communication from Tony Mason, Cabrera Services, to Hans Honerlah, US Army Corps of Engineers, July 19, 2012, subject: Summary of Occupational Air Sampling Results During Range Construction at Schofield Barracks, Hawaii (Mason, 2012)

Table 3 Alpha spectrometry results for Pohakuloa Training Area soil samples and calculated $^{238}U/^{234}U$ ratios

Sample ID	Soil Concentration (pCi g^{-1})		$^{238}U/^{234}U$ ratio
	^{234}U	^{238}U	
4010	0.117 ± 0.040	0.132 ± 0.042	1.1 ± 0.5
4011	0.157 ± 0.047	0.215 ± 0.056	1.4 ± 0.5
4012	0.344 ± 0.078	0.324 ± 0.075	0.9 ± 0.3
4013	0.098 ± 0.037	0.114 ± 0.040	1.2 ± 0.6
4014	0.120 ± 0.043	0.127 ± 0.044	1.1 ± 0.5
4015	0.100 ± 0.037	0.086 ± 0.035	0.9 ± 0.5
4016	0.302 ± 0.068	0.238 ± 0.059	0.8 ± 0.3
4017	0.254 ± 0.061	0.220 ± 0.056	0.9 ± 0.3
4018	0.285 ± 0.067	0.239 ± 0.061	0.8 ± 0.3

(Cabrera Services, 2008d)

Table 4 Surface water sampling results at Schofield Barracks with calculated $^{238}U/^{234}U$ activity ratios

Collect Date	Sample ID	Surface Water Concentration (pCi L^{-1})[a]		$^{238}U/^{234}U$ ratio
		^{234}U	^{238}U	
12 Mar 07	RAB-SW-4-1	0.142 ± 0.140	0.087 ± 0.108	0.6 ± 1.0
	RAB-SW-3-2	0.0207 ± 0.111	−0.0533 ± 0.0426	—
	RA1-SW-6FF-1	0.761 ± 0.273	0.803 ± 0.276	1.1 ± 0.5
	RA2-SW-5-2	0.392 ± 0.217	0.554 ± 0.264	1.4 ± 1.0
	RA1-SW-3-2	0.0298 ± 0.113	−0.00532 ± −0.0591	—
16 Mar 07	RA1-SW-2-4	0.422 ± 0.243	0.537 ± 0.271	1.3 ± 1.0
	RA1-SW-4FF-1	0.534 ± 0.262	0.558 ± 0.270	1.0 ± 0.7
	RA1-SW-4C-1	1.18 ± 0.425	1.71 ± 0.512	1.4 ± 0.7
	RA2-SW-3-4	0.159 ± 0.195	0.119 ± 0.158	0.7 ± 1.4
	RA2-SW-3-6	0.332 ± 0.206	0.290 ± 0.199	0.9 ± 0.8
	RA2-SW-3-22	0.171 ± 0.196	−0.0275 ± 0.155	—
	RA2-SW-3-17	0.275 ± 0.276	0.608 ± 0.352	2.2 ± 2.6
25 Mar 07	RAB-SW-3-3	0.0541 ± 0.107	0.0541 ± 0.103	1.0 ± 2.7
	RAB-SW-4-2	0.106 ± 0.131	0.106 ± 0.118	1.0 ± 1.7
16 Apr 07	RAB-SW-3-4	0.120 ± 0.142	0.135 ± 0.141	1.1 ± 1.8
	RAB-SW-4-3	0.0807 ± 0.131	0.108 ± 0.128	1.4 ± 2.7
4 Nov 07	RA6-SW-3-1	1.77 ± 0.487	0.206 ± 0.179	0.12 ± 0.11
	RA7-SW-3-2	0.118 ± 0.177	0.125 ± 0.159	1.1 ± 2.1
	RA7-SW-3-3	0.0655 ± 0.100	0.0586 ± 0.101	0.9 ± 2.1
	RA7-SW-4-1	0.145 ± 0.152	−0.00927 ± 0.0778	—
	RA7-SW-4-2	0.437 ± 0.238	0.191 ± 0.190	0.4 ± 0.5
	RA-MK-1	0.0933 ± 0.206	0.0246 ± 0.132	0.3 ± 1.5
	RA3-SW-4-FF-1	0.179 ± 0.194	0.358 ± 0.274	2.0 ± 2.7
	RA3-SW-4-2	0.00116 ± 0.0632	−0.014 ± 0.0193	—
	RA3-SW-2-1	0.279 ± 0.200	0.0768 ± 0.118	0.3 ± 0.5
12 Dec 07	RA4-SW-7FF	0.169 ± 0.154	0.0303 ± 0.0854	0.2 ± 0.5
	RA4-SW-10FF	−0.0561 ± 0.116	−0.0323 ± 0.0831	—
11 Dec 07	RA4-SW-4C	0.159 ± 0.146	0.0313 ± 0.0881	0.2 ± 0.6
	RA4-SW-4FF	0.0014 ± 0.0761	−0.0084 ± 0.0165	—
	RA4-SW-3-0	0.0349 ± 0.118	0.0285 ± 0.138	0.8 ± 4.8
	RA4-SW-2-1	0.447 ± 0.242	0.118 ± 0.156	0.3 ± 0.4
	RA4-SW-2-2	0.396 ± 0.293	0.222 ± 0.218	0.6 ± 0.7
	RA4-SW-2-4	0.317 ± 0.202	0.348 ± 0.211	1.1 ± 1.0
	RA4-SW-2-6	0.188 ± 0.158	0.0612 ± 0.106	0.3 ± 0.6
	RA4-SW-2-12	0.179 + 0.161	-0.0272 ± 0.0615	—
	RA4-SW-3-1	0.124 ± 0.147	0.165 ± 0.160	1.3 ± 2.0
	RA4-SW-3-2	0.118 ± 0.133	0.00134 ± 0.0727	0.0 ± 0.6
	RA4-SW-3-3	0.00846 ± 0.0641	0.0157 ± 0.0625	2 ± 16
18 Jan 08	RAS-SW-3-3	0.0857 ± 0.137	0.0777 ± 0.138	0.9 ± 1.5
	RAS-SW-4-3	−0.0444 ± 0.0923	−0.0902 ± 0.101	—
5 Feb 08	RAS-SW-3-4	0.0429 ± 0.0969	0.0778 ± 0.138	1.8 ± 5.2
7 Feb 08	RAS-SW-4-4	0.0778 ± 0.113	0.0145 ± 0.0575	0.2 ± 0.8
17 Feb 08	RAS-SW-3-5	0.00135 ± 0.0733	−0.0148 ± 0.0766	—
	RAS-SW-4-5	0.0568 ± 0.112	0.00126 ± 0.0685	0.0 ± 1.2
9 Mar 08	RA3-SW-3-5	0.409 ± 0.359	−0.0534 ± 0.157	—
13 Apr 08	RA3-SW-4-1	−0.0737 ± 0.167	−0.0368 ± 0.159	—
18 Apr 08	RA3-SW-3-0	0.0193 ± 0.146	0.0881 ± 0.199	5 ± 36
30 Mar 08	RA3-SW-3-12	0.330 ± 0.373	0.0751 ± 0.278	0.2 ± 0.9
13 Apr 08	RA3-SW-5-3	0.0896 ± 0.202	−0.014 ± 0.156	—
21 Apr 08	RA3-SW-3-19	0.949 ± 0.674	0.204 ± 0.282	0.2 ± 0.3

[a] Laboratory (GEL Laboratories, LLC, 2040 Savage Road, Charleston, South Carolina) reports are available upon request.

Table 5 Air Sampling results at Schofield Barracks downwind of a test burn with calculated $^{238}U/^{234}U$ isotopic ratios

Sample ID	Air Concentration (µCi/mL)		$^{238}U/^{234}U$ ratio
	^{234}U	^{238}U	
EF-TB-PB-1037-FP	6.8 ± 8.0	0.8 ± 5.4	0.11 ± 0.80
EF-TB-AS-1045-FP	0.77 ± 3.9	—	—
EF-TB-PB-1038-FP	2.3 ± 4.7	0.8 ±5.5	0.3 ± 2.5
EF-TB-AS-1046-FP	2.0 ± 2.9	—	—
EF-TB-PB-1039-FP	-2.3 ± 4.7	5 ± 11	—
EF-TB-AS-1047-FP	—	2.7 ± 3.2	—
EF-TB-PB-1040-FP	3.2 ± 6.5	—	—
EF-TB-AS-1048-FP	1.3 ± 3.0	0.9 ±1.9	0.7 ± 2.2
EF-TB-PB-1041-FP	2.7 ± 5.4	5.3 ± 7.6	2.0 ± 4.8
EF-TB-AS-1049-FP	3.0 ± 3.6	-1.3 ± 1.9	—
EF-TB-PB-1042-FP	—	2.4 ± 4.8	—
EF-TB-AS-1050-FP	—	$(1.0 \pm 2.0) \times 10^{-8}$ µCi	—
EF-TB-PB-1043-FP	3.8 ± 7.7	3.8 ± 7.6	1.0 ± 2.8
EF-TB-AS-1051-FP	4.4 ± 4.1	—	—
EF-TB-PB-1044-FP	2.9 ± 5.9	-1.0 ± 8.0	—
EF-TB-AS-1052-FP	0.93 ± 1.9	0.9 ± 1.9	1.0 ± 2.9

(Cabrera Services, 2007)

Table 6 Prescribed range burn air sampling results

Sample ID	Air Concentration (10^{-16} µCi mL^{-1})		$^{238}U/^{234}U$ ratio
	^{234}U	^{238}U	
SB-D1-PT1-PB	0.9 ± 1.2	0.5 ±1.0	0.5 ± 1.3
SB-D1-PT1-PB	1.4 ± 2.7	1.3 ± 2.3	0.9 ± 2.4
SB-D1-PT2-PB	0.44 ± 0.87	0.61 ± 0.67	1.4 ± 3.1
SB-D1-PT2-PB	1.6 ± 3.0	-0.9 ± 2.2	—
SB-D1-PT3-PB	0.39 ± 0.67	-0.08 ± 0.67	—
SB-D1-PT3-PB	1.0 ± 2.6	1.3 ± 2.7	1.3 ± 4.3
SB-D1-PT4-PB	0.61 ± 0.75	0.50 ±0.75	0.8 ± 1.6
SB-D1-PT4-PB	0.2 ± 2.0	1.3 ± 2.4	8 ± 103
SB-D2-PT1-PB	0.76 ± 0.76	0.26 ± 0.55	0.34 ± 0.80
SB-D2-PT1-PB	0.30 ± 0.97	0.8 ± 1.1	2.7 ± 9.4
SB-D2-PT2-PB	1.4 ± 1.0	0.58 ± 0.72	0.41 ± 0.55
SB-D2-PT2-PB	0.4 ± 1.0	1.2 ± 1.3	2.9 ± 7.5
SB-D2-PT3-PB	-0.05 ± 0.55	1.9 ± 1.1	—
SB-D2-PT3-PB	0.7 ± 1.2	0.08 ± 0.91	0.1 ± 1.3
SB-D2-PT4-PB	0.36 ± 0.62	0.10 ± 0.62	0.3 ± 1.8
SB-D2-PT4-PB	1.7 ± 1.4	0.20 ± 0.94	0.12 ± 0.56

From Table 2 of *Summary of Air Monitoring for the 2008 Prescribed Range Burns at Schofield Barracks* (Cabrera Services, 2009)

Table 7 2008 range burn air sampler global positioning system locations

Location	Northing (m)	Easting (m)
Point 1 (PT1)	2377499.96	595160.96
Point 2 (PT2)	2376175.53	592262.96
Point 3 (PT3)	2376566.32	591161.37
Point 4 (PT4)	2377409.88	591102.80

From Table 2 of Summary of Air Monitoring for the 2008 Prescribed Range Burns at Schofield Barracks (Cabrera Services, 2009)

Figures

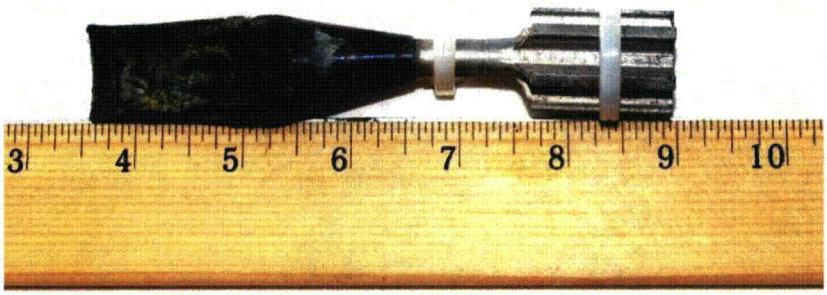


Figure 1 A mostly intact body of an M101 spotting round (DU is dark portion)

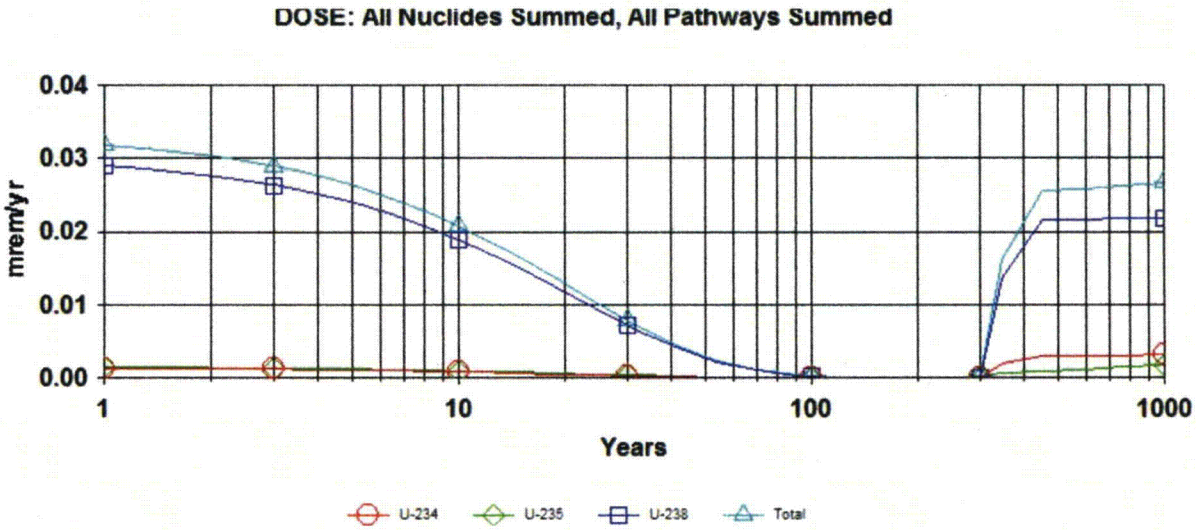


Figure 2 From RESRAD, total annual dose vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

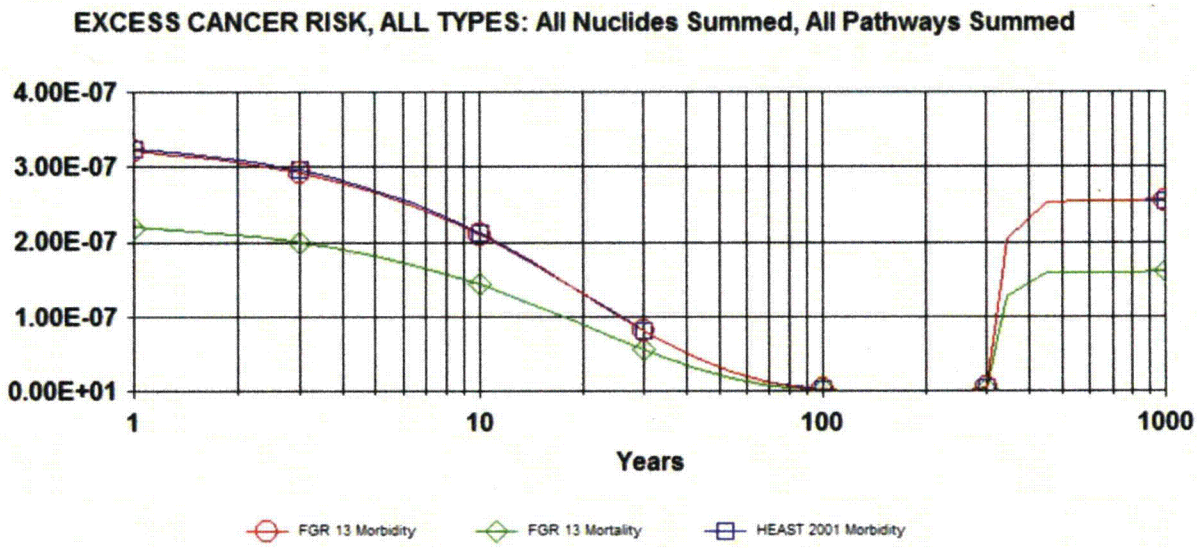


Figure 3 From RESRAD, total excess cancer risk vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

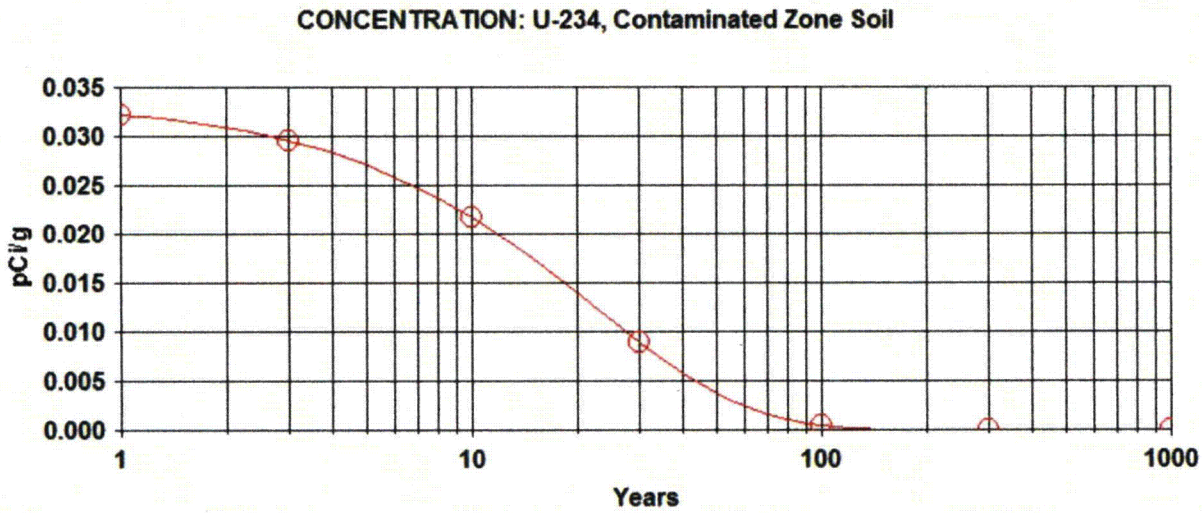


Figure 4 From RESRAD, ^{234}U soil concentration in impact area vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

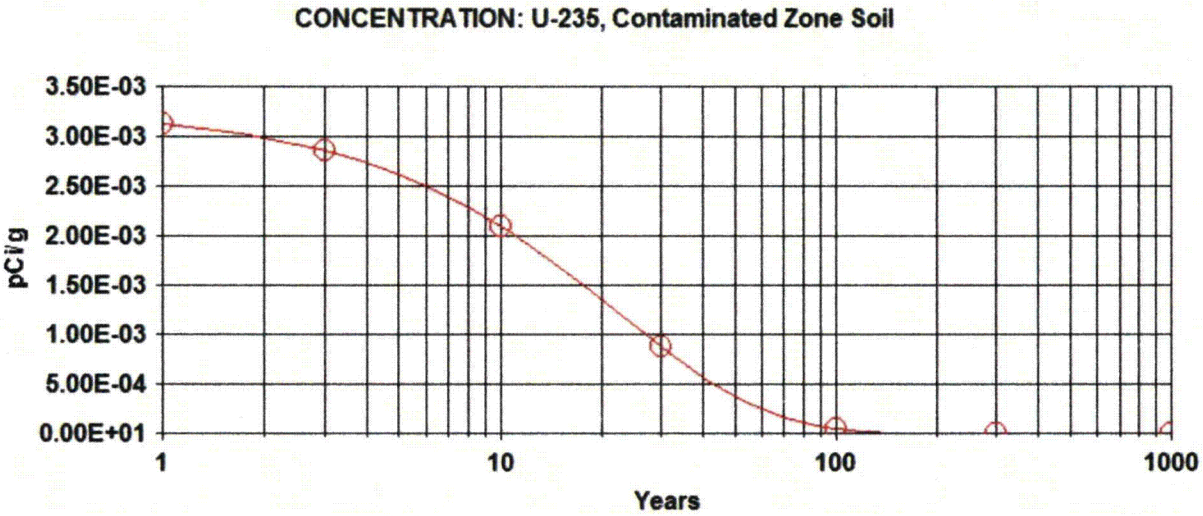


Figure 5 From RESRAD, ^{235}U soil concentration in impact area vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

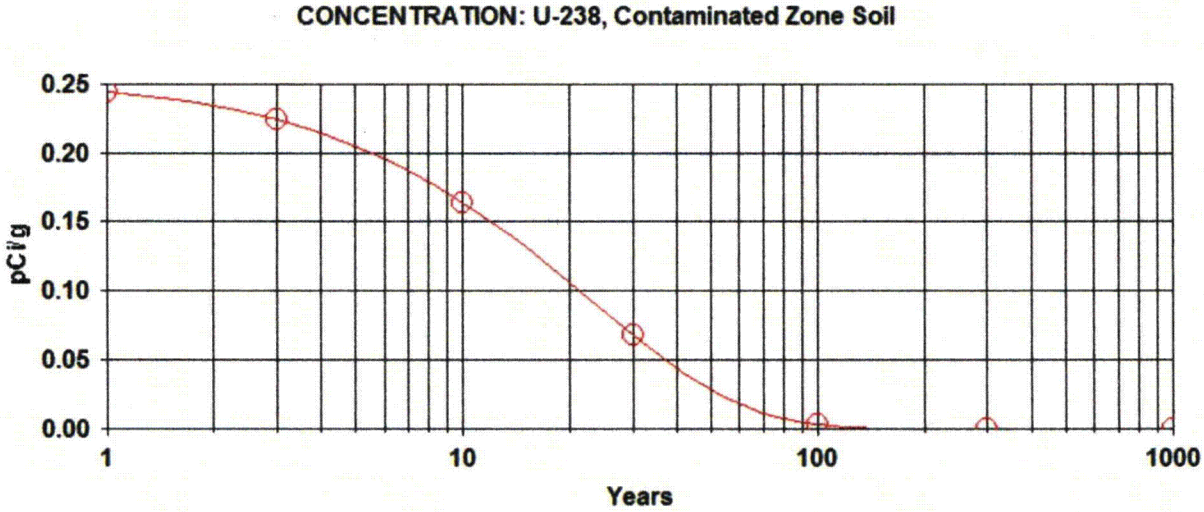


Figure 6 From RESRAD, ^{238}U soil concentration in impact area vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

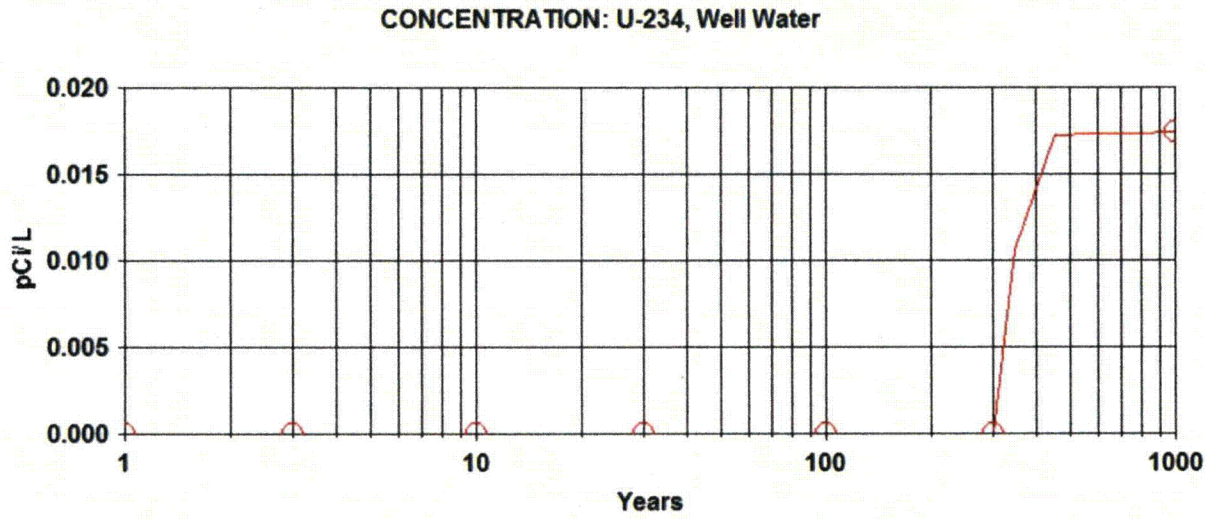


Figure 7 From RESRAD, ^{234}U concentration in well water vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

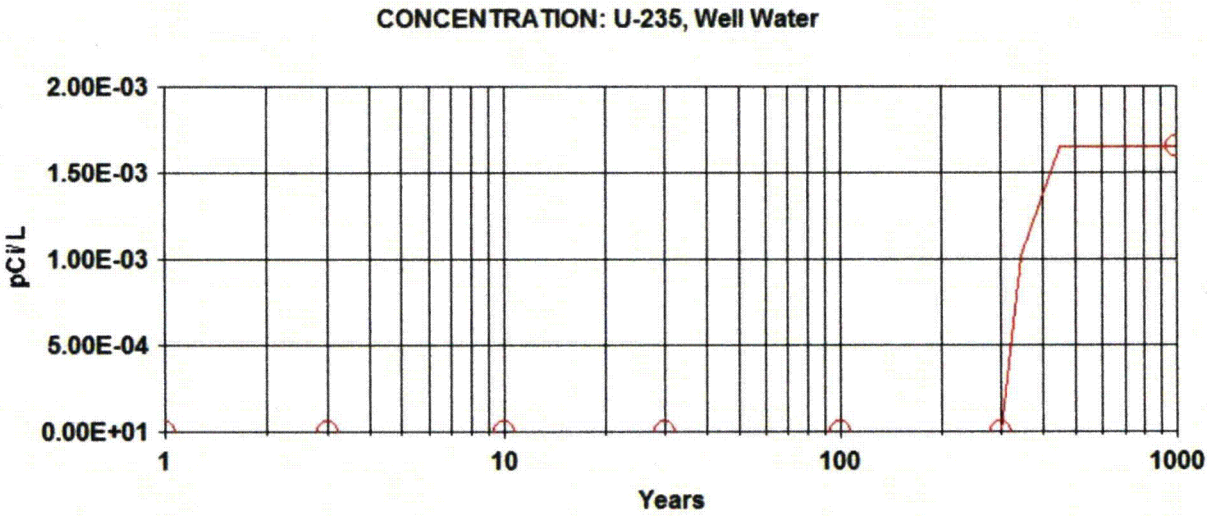


Figure 8 From RESRAD, ^{235}U concentration in well water vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

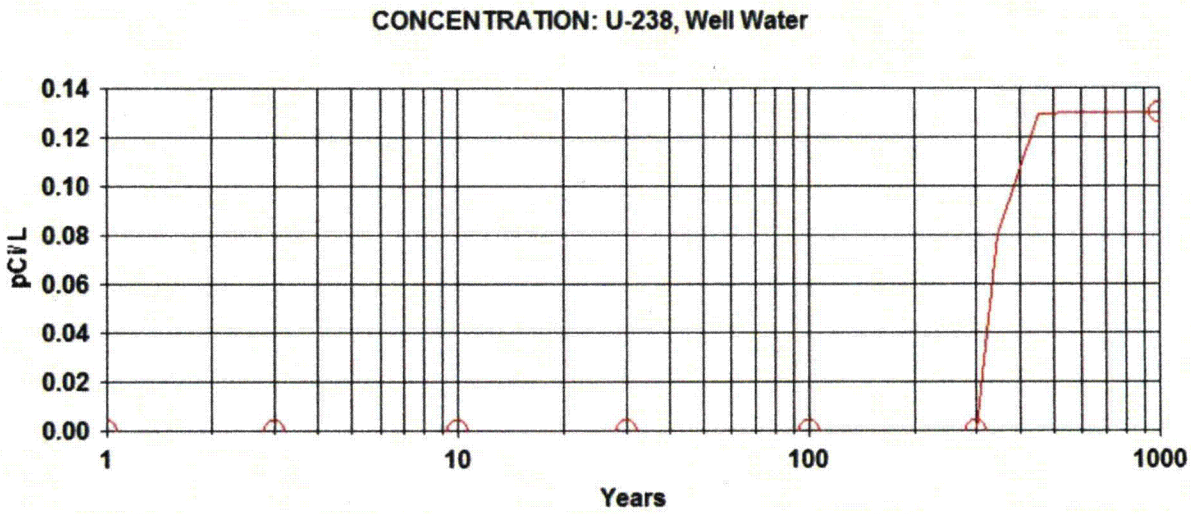


Figure 9 From RESRAD, ^{238}U concentration in well water vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

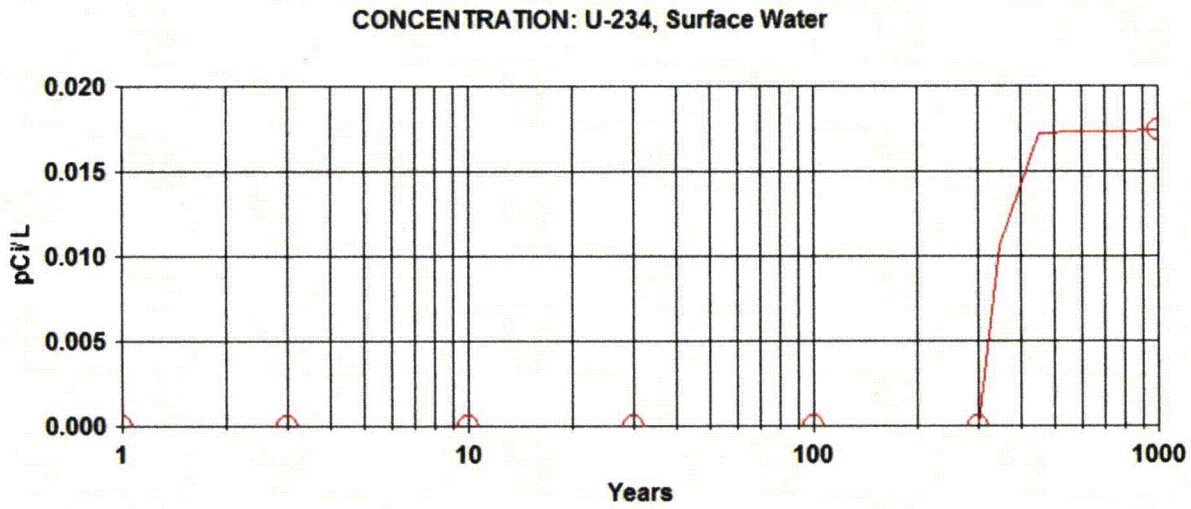


Figure 10 From RESRAD, ^{234}U concentration in surface water vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

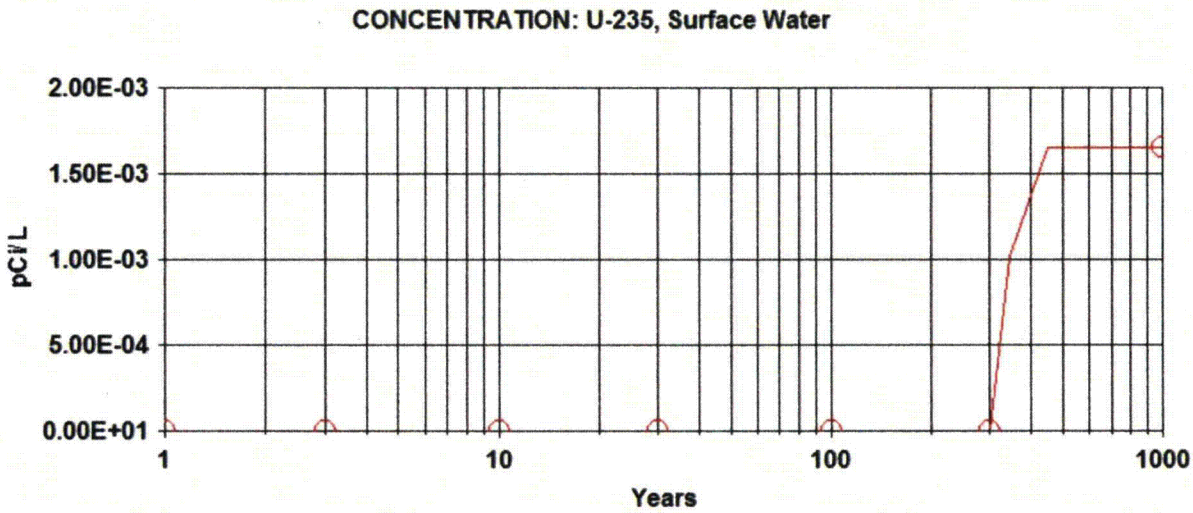


Figure 11 From RESRAD, ^{235}U concentration in surface water vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

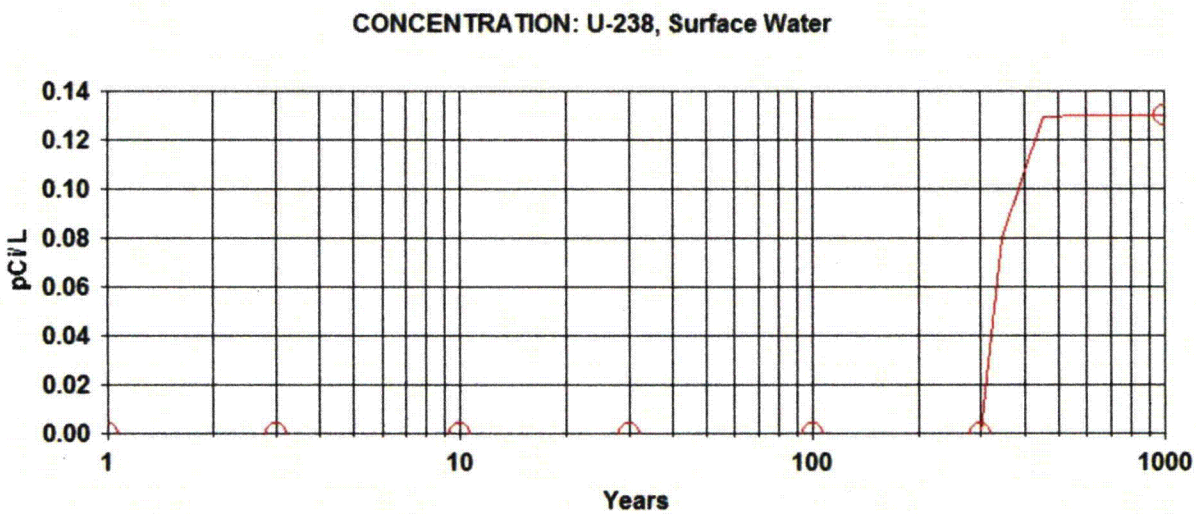


Figure 12 From RESRAD, ^{238}U concentration in surface water vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

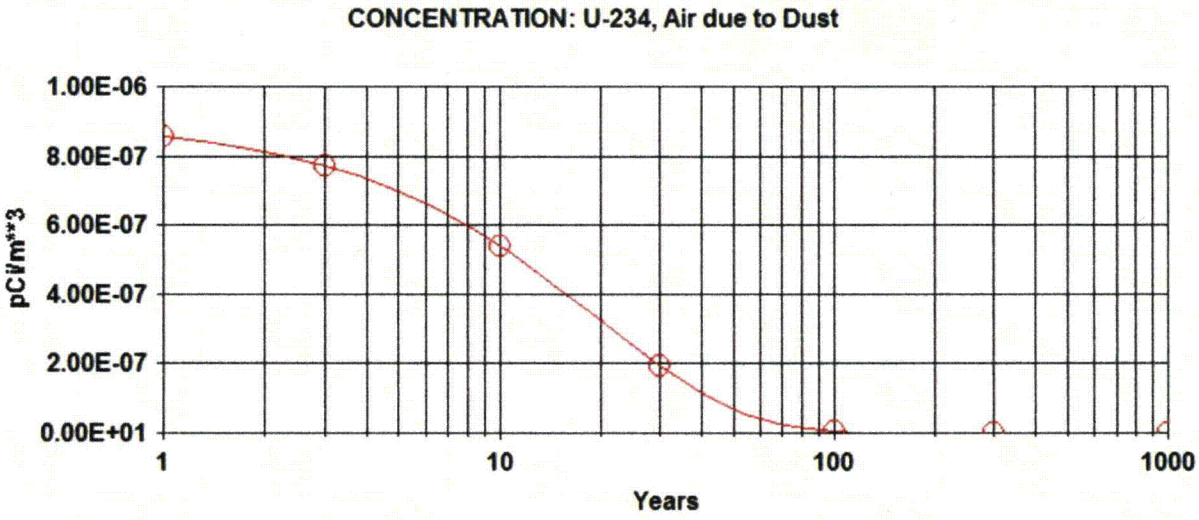


Figure 13 From RESRAD, ^{234}U concentration in air due to dust vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

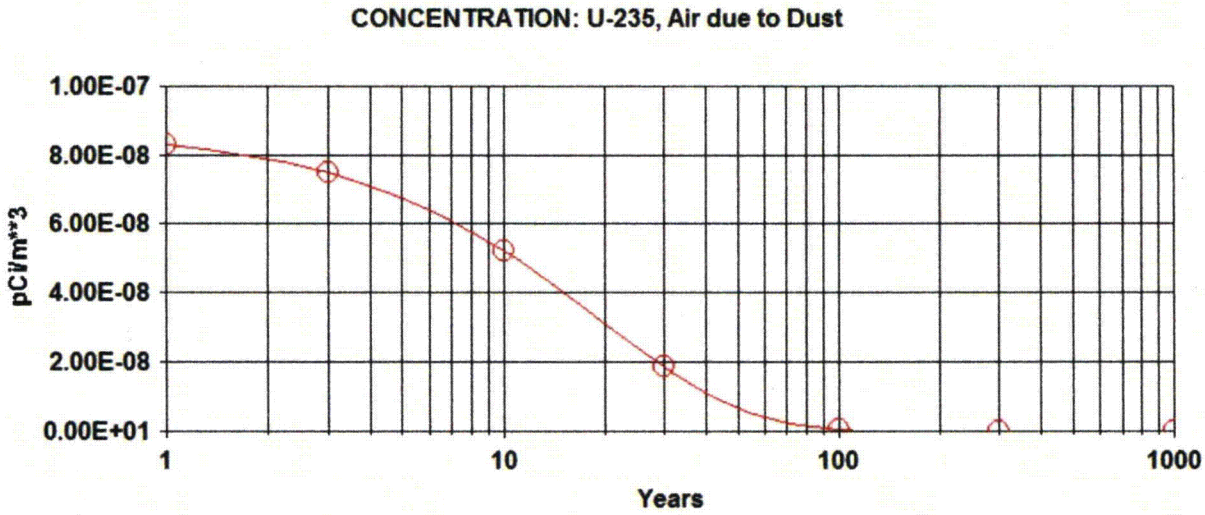


Figure 14 From RESRAD, ^{235}U concentration in air due to dust vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

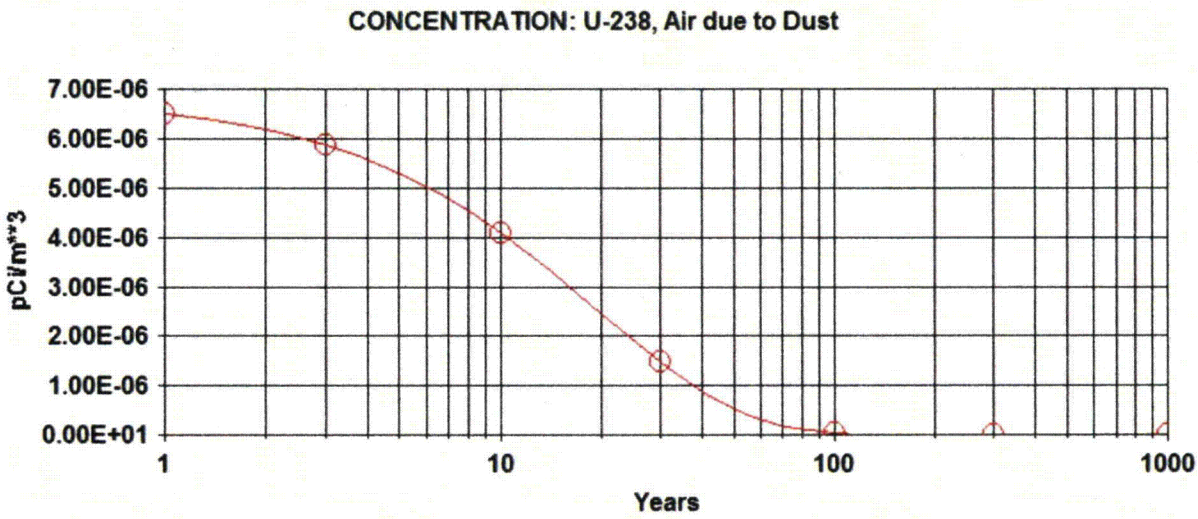


Figure 15 From RESRAD, ^{238}U concentration in air due to dust vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

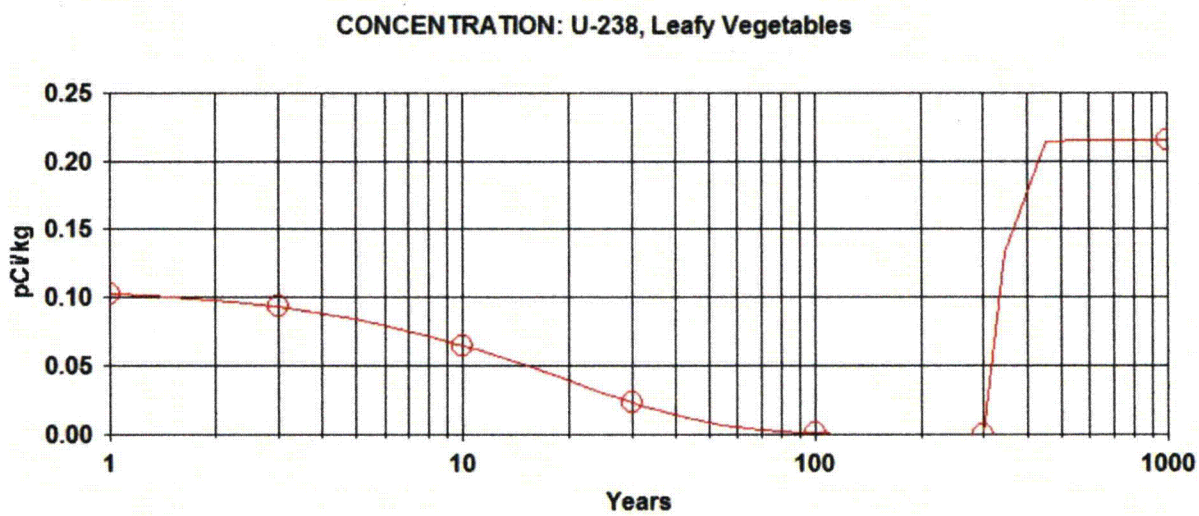


Figure 16 From RESRAD, ^{238}U concentration in leafy vegetables vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

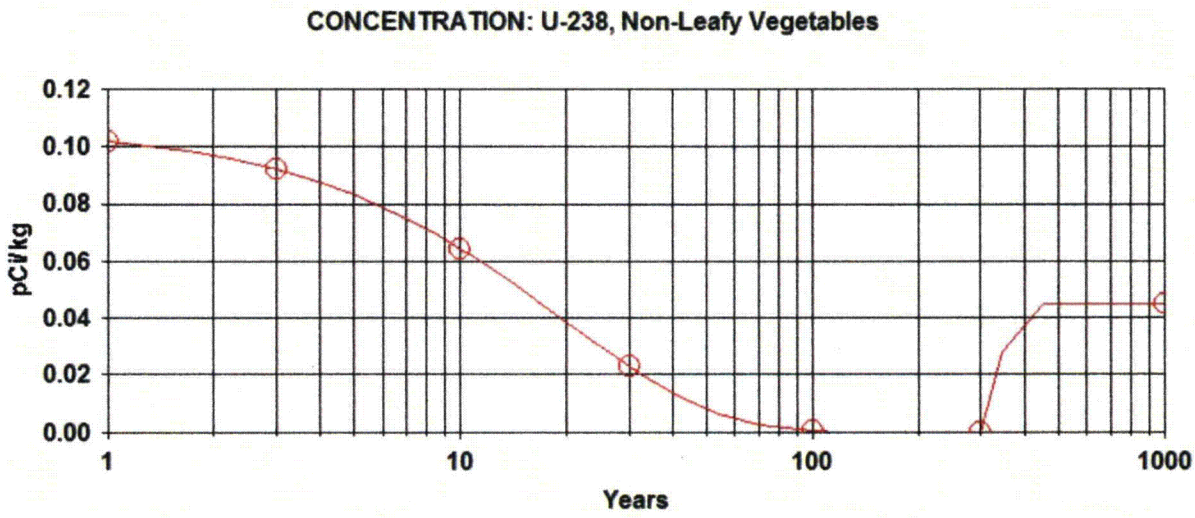


Figure 17 From RESRAD, ^{238}U concentration in non-leafy vegetables vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, resident farmer scenario

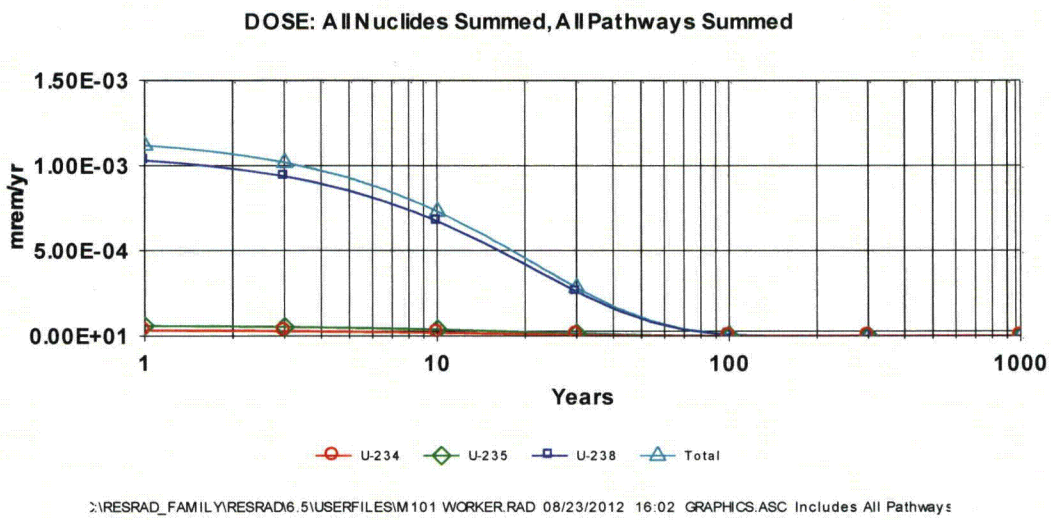


Figure 18 From RESRAD, total annual dose vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, current range worker scenario

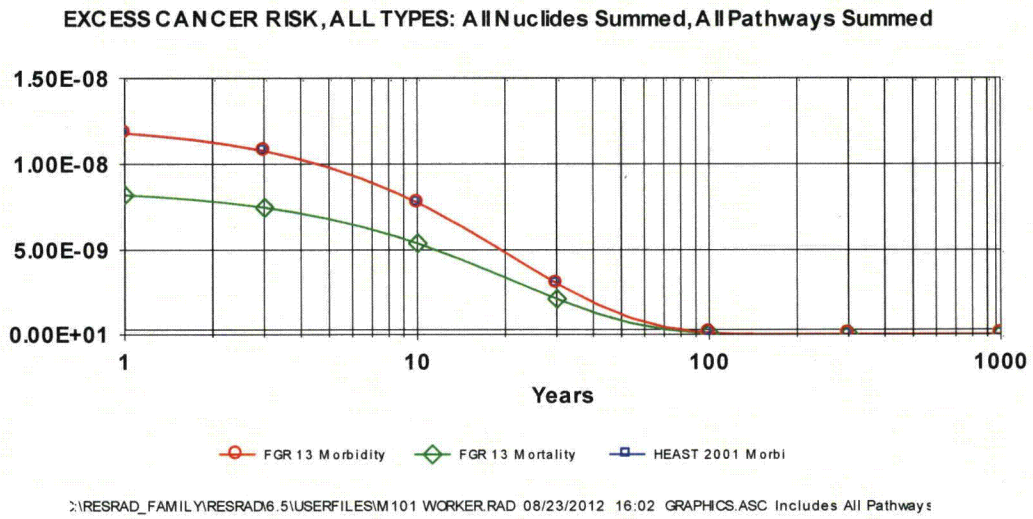


Figure 19 From RESRAD, total excess cancer risk vs. time for 1000 M101 spotting rounds in a circular impact area of 10^6 m^2, current worker scenario

Figure 20 Typical form of DU at Schofield Barracks (Cabrera Services, 2008c)

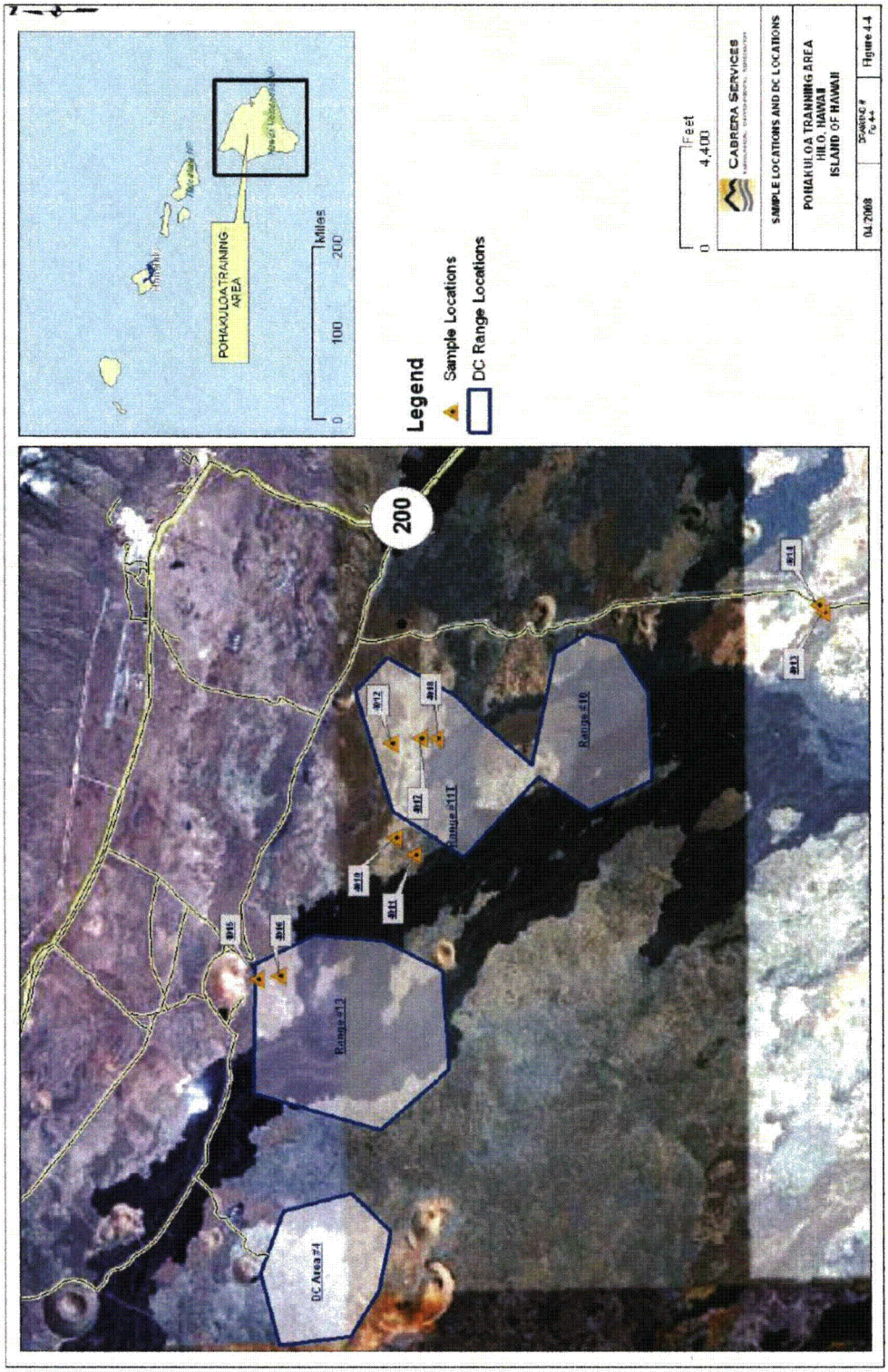
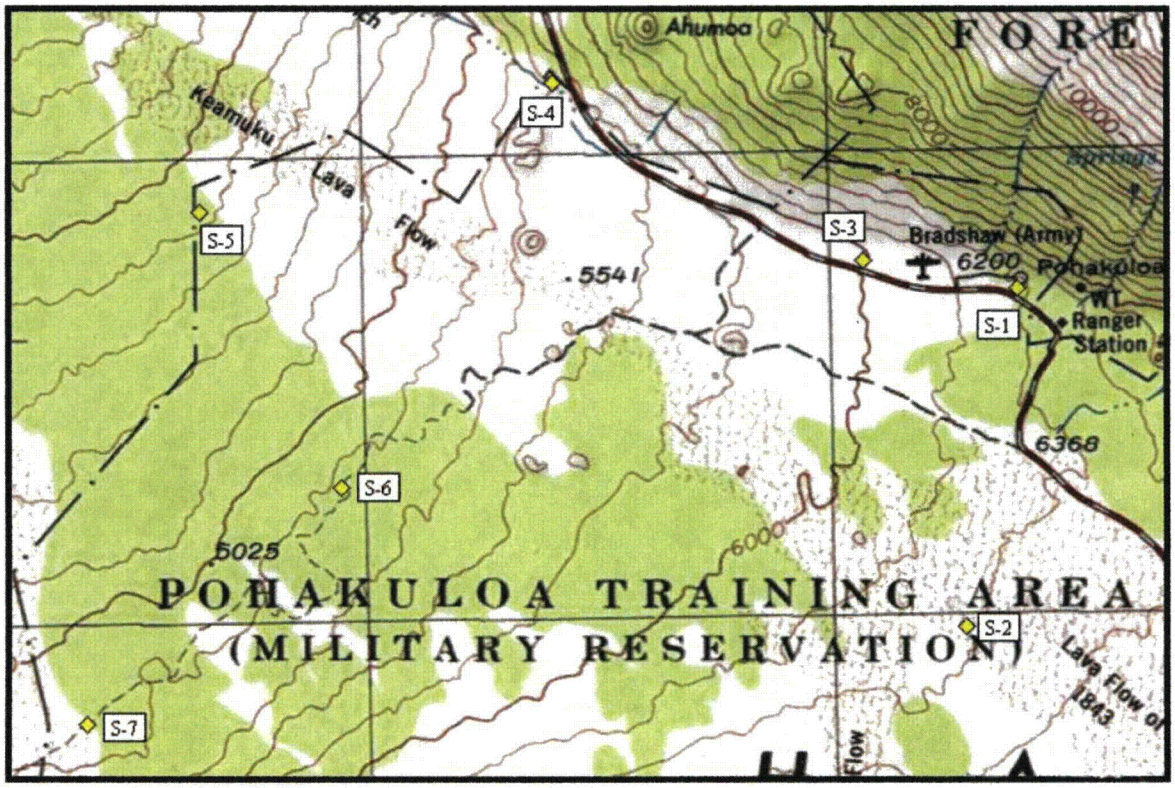


Figure 21 Soil sample locations at Pohakuloa Training Area (Cabrera Services, 2008d)

Figure 22 Type of "soil" that dominates on and near the M101 impact areas at Pohakuloa Trainng Area (ATSDR, 2008)

PTA AIR MONITORING SITES (2006)



J. W. Morrow
10/23/07

Figure 23 Pohakuloa Training Area air monitoring site locations (Cabrera Services, 2008b)

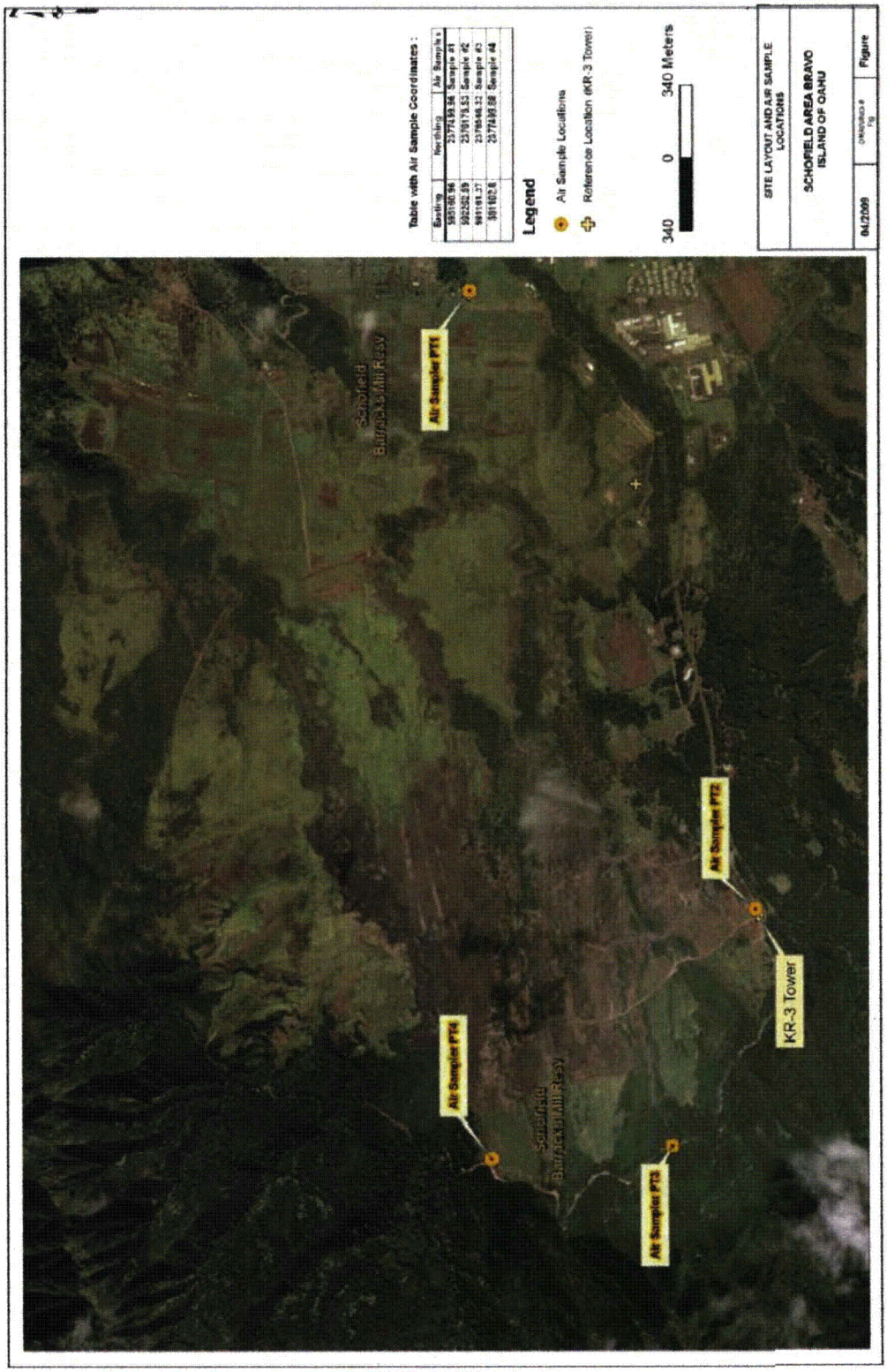


Figure 24 Schofield Barracks 2008 range burn air sampler locations (Cabrera Services, 2009)

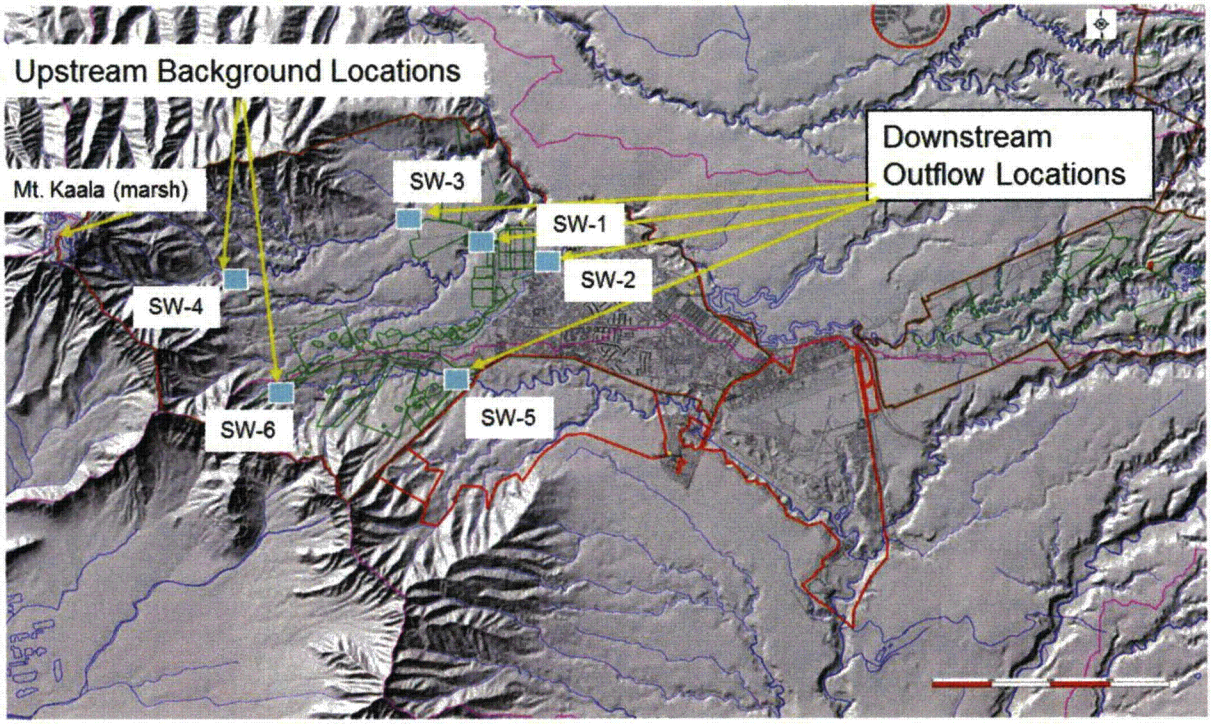


Figure 25 Schofield Barracks surface water sampling locations[44]

[44] Email, August 24, 2012 from Steve Turnbull, Hydrologist (contractor), Schofield Barracks, to Robert Cherry, Radiation Safety Staff Offcer, Headquarters, IMCOM

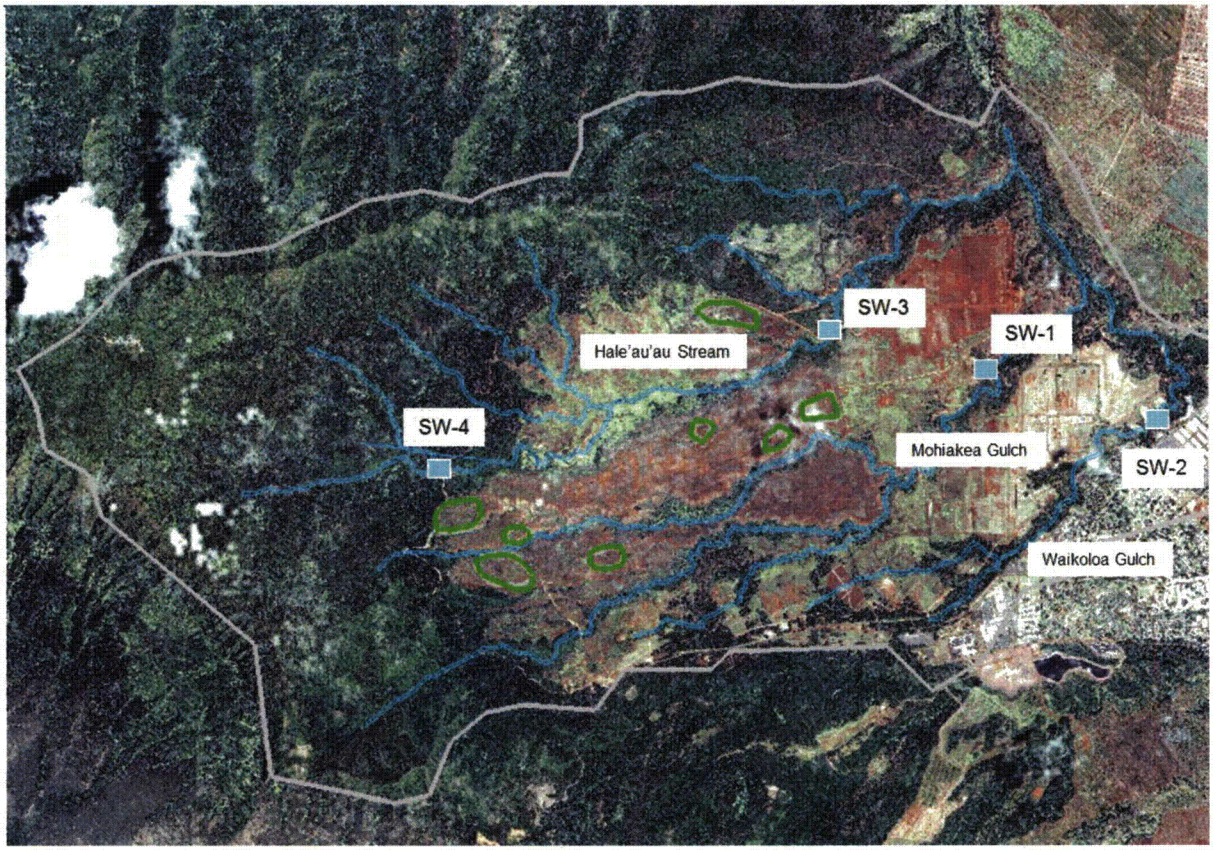


Figure 26 Locations of DU relative to water sampling locations (stream locations shown in blue, DU locations in green) [44]

Attachment 1 NRC's proposed license conditions

NRC FORM 374

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and the applicable parts of Title 10, Code of Federal Regulations, Chapter I, Parts 19, 20, 30, 31, 32, 33, 34, 35, 36, 39, 40, 51, 70, and 71, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. United States Army Installation Command	3. License Number
2. 2511 Jefferson Davis Highway Arlington, Virginia 22202	4. Expiration Date December 31, 2022 5. Docket No. 40-9083 Reference No.

6. Source Material	7. Chemical and/or Physical Form	8. Maximum amount that Licensee May Possess at Any One Time Under This License
Uranium (depleted)	Any	8,000kg

9. Authorized Use: Activities necessary for the possession and management of depleted uranium spotting rounds and fragments as a result of previous use of depleted uranium at US Army installations. These activities include:

A. Activities necessary to maintain the facilities in a safe condition and to prevent the unauthorized removal of licensed material from the authorized places of use;
B. Activities necessary to determine the presence of licensed material at US Army facilities;
C. Activities necessary to monitor the radiological environmental conditions in and around the authorized places of use to determine if licensed material is being transported in the environment; and
D. Activities necessary for the packaging, transport and disposal of incidentally identified licensed material to a licensed/permitted disposal facility.

LICENSE CONDITIONS

10. The authorized places of possession shall be United States Department of Army Installations at Schofield Barracks HI, and Pohakuloa Training Area, HI.

11. The licensee shall conduct operations in accordance with the commitments, representations, and statements contained in the License Application dated November 6, 2008, the Physical Security Plan dated February 17, 2011, the Radiation Safety Plan dated June 22, 2011, and the Pohakuloa training Area and Schofield Barracks Environmental Radiation Monitoring Plans dated February 3, 2012 (jointly referred to as the approved license application). The approved license application is hereby incorporated by reference, except where superseded by license condition(s) below.

12. The licensee will provide the Nuclear Regulatory Commission (NRC) with a schedule for the submission

MATERIALS LICENSE SUPPLEMENTARY SHEET

License Number

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40-9083

Amendment No.

of license amendment requests to incorporate the following list of sites: Forts Benning and Gordon (Georgia); Fort Campbell (Kentucky); Fort Carson (Colorado); Fort Hood (Texas); Fort Knox (Kentucky); Joint Base Lewis-McChord and the Yakima Training ..Center (Washington); Fort Bragg (North Carolina); Fort Polk (Louisiana); Fort Sill (Oklahoma); Fort Jackson (South Carolina); Fort Hunter Liggett (California); Fort Greeley (Alaska); Fort Dix (New Jersey); and Fort Riley (Kansas) on this license by [**insert date 90 days from date of issuing license**]. Any revisions to the site list will be submitted to NRC.

12a. The licensee shall submit the license amendment requests in accordance with this schedule.

12b. Each amendment request will include site/installation-specific Radiation Safety Plans, Environmental Radiation Monitoring Plans, Physical Security Plans, decommissioning Financial Assurance, and the names, training, and qualifications specific to depleted uranium of the Garrison Radiation Safety Officer.

13. If the licensee identifies information indicating that Davy Crockett-related depleted uranium may be present at a US Army installation not identified in License Condition 10 or included on the schedule developed under License Condition12, the licensee will notify the NRC in writing within 15 days of the identification of this information. The licensee will evaluate the information and provide the NRC with a schedule for evaluating the presence of depleted uranium at the installation within 90 days of the identification of the information.

14. If it is determined that Davy Crockett-related depleted uranium is present at an US Army installation not listed in License Condition 10 or 12 the licensee shall submit a request to include the installation on this license. The request will include a Radiation Safety Plan, an Environmental Radiation Monitoring Plan, a Physical Security Plan, decommissioning Financial Assurance and the names, training and qualifications specific to depleted uranium of the Garrison Radiation Safety Officer. Any additional procedures necessary to ensure compliance with License Conditions 9A - 9D that are not included in the licensee's application dated November 6, 2008 will also be included in the request.

15. The licensee shall notify the NRC within 60 days of a change in the Garrison Radiation Safety Officer. The notification shall include the name, training, and qualifications specific to depleted uranium of the assigned Garrison Radiation Safety Officer.

16. The licensee shall consult with the U.S. Fish and Wildlife Service prior to taking any action relating to the depleted uranium that may impact a critical habitat or a threatened or endangered species.

17. The licensee shall submit site-specific financial assurance instruments and decommissioning cost estimates, consistent with the requirements in 10 CFR Part 40, for the Schofield Barracks and Pohakuloa Training Area within 90 days of the issuance of this license.

18. The licensee shall submit an updated site/installation specific decommissioning cost estimate and financial assurance instrument for each Army installation listed in License Condition 10 on a tri-annual basis, by December 31 of each year.

19. The licensee shall not fire high-explosive munitions into areas containing depleted uranium without first informing NRC 14 working days prior to the date that the high-explosive munitions will be fired.

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20. The licensee shall post "Caution - Radioactive Material" signs at a sufficient number of locations around the Radiation Control Area to ensure that individuals entering the Radiation Control Area are aware of the presence of depleted uranium. The signs may be placed at the perimeter of the range impact areas if posting them at the Radiation Control Area boundary is unsafe due to the presence of unexploded ordnance.

21. The licensee shall not perform any decommissioning or ground disturbing activities to collect or remove depleted uranium fragments or contaminated soil that is identified during routine range activities at the Schofield Barracks or Pohakuloa Training Area without prior authorization from NRC.

22. NRC or Agreement State licensed contractors may undertake decommissioning or ground disturbing activities to collect or remove depleted uranium fragments or contaminated soil that is identified during routine range activities at the Schofield Barracks or Pohakuloa Training Area consistent with the conditions and commitments of their license(s).

23. When the licensee engages an NRC or Agreement State licensed contractor to undertake decommissioning or ground disturbing activities to collect or remove depleted uranium fragments or contaminated soil that is identified during routine range activities at the Schofield Barracks or Pohakuloa Training Area, the licensee will notify NRC 6 months prior to the commencement of the activity. The licensee shall provide NRC with the contractor's site-specific decommissioning plans and all other documents associated with radiation safety and environmental monitoring associated with the proposed decommissioning or ground disturbing activities at least 6 months prior to the commencement of the activity. If issues are identified by NRC that could impact radiological health and safety, they will be resolved prior to the commencement of the activity.

24. The licensee will ensure that, prior to any decommissioning or ground disturbing activities to collect or remove depleted uranium fragments or contaminated soil that is identified during routine range activities at the Schofield Barracks or Pohakuloa Training Area, the area is evaluated in accordance with the 2004 Programmatic Agreement (PA) entitled "Programmatic Agreement (PA) among the United States Army Garrison Hawaii, the Hawaii State Historic Preservation Office and the Advisory Council on Historic Preservation for Section 106 Responsibilities for the Army Transformation of the 2nd Brigade, 25th Infantry Division (light) to a Stryker Brigade," or its successor document.

25. The licensee shall prepare a detailed Environmental Radiation Monitoring Report and submit it to NRC within 60 days of January 1 of each year.

26. The licensee shall perform continuous air sampling at both the Pohakuloa Training Area and Schofield Barracks in a minimum of four (4) suitable locations that are downwind from the Radiation Control Area for each facility. Locations shall be based on wind rose maps of at the Pohakuloa Training Area and Schofield Barracks ranges. Samples should be taken and analyzed on a quarterly basis.

27. The licensee shall revise the Environmental Radiation Monitoring Plans for the Schofield Barracks and Pohakuloa Training Area as outlined below. The licensee shall implement the environmental monitoring in accordance with the revised Environmental Radiation Monitoring Plans.

a) The licensee shall sample the plant species that are located next to or near depleted uranium

fragments in both the Schofield Barracks and Pohakuloa Training Area Radiation Control Areas to determine if the depleted uranium is being absorbed by the plants. The licensee shall also take plant samples in those locations where air sampling is conducted to determine if there has been any depleted uranium uptake by plants at those locations.

b) The licensee shall perform soil sampling as close as practicable to the Pohakuloa Training Area and Schofield Barracks Radiation Control Areas to determine if depleted uranium is being, or has been, blown outside of the Radiation Control Area. The soil samples shall be collected at the locations of air sampling and be determined based upon the Pohakuloa Training Area and Schofield Barracks wind rose data and potential exposure pathways to members of the public. If depleted uranium is identified on a vehicle leaving the Radiation Control Area and the vehicle is washed down to remove the depleted uranium, the wash water and soil in the wash down area will be evaluated for depleted uranium.

c) When analytical sampling results from locations outside of the Radiation Control Area indicate that the U-238/U-234 activity ratio exceeds 3, the licensee shall notify NRC within 30 days and collect additional environmental samples within 30 days of the notification of NRC, unless prohibited by the absence of the sampling media.

d) The licensee shall provide a map or diagram with greater clarity identifying where the soil sampling locations at the Pohakuloa Training Area are relative to the Radiation Control Area and the egress points. The Figure shall include the global positioning system (GPS) coordinates of the sample locations.

e) The licensee shall include depleted uranium analysis of the groundwater samples from the existing groundwater monitoring program and the remedial investigation to demonstrate that depleted uranium is not impacting groundwater at the Schofield Barracks.

f) The licensee shall reevaluate the surface water sampling program and provide a map clearly identifying the locations of surface water sampling locations at the Schofield Barracks. The number of sampling locations should be adequate to determine if depleted uranium is being transported out of the Radiation Control Area and be as close as practicable to the Radiation Control Area boundary.

g) The licensee shall obtain sediment samples in streambeds located immediately downstream of the Schofield Barracks Radiation Control Area and as close as practicable to the Schofield Barracks Radiation Control Area boundary.

28. All written notices and reports to NRC required under this license shall be addressed to: ATTN: Document Control Desk, Deputy Director, Decommissioning and Uranium Recovery Licensing Directorate, Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs, Mailstop T8 F5, U. S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by express delivery to 11545 Rockville Pike, Two White Flint North, Rockville, MD 20852-2738. Required telephone notifications shall be made to the NRC Operations Center at (301) 816-5100, unless otherwise specified in the license conditions.

MATERIALS LICENSE SUPPLEMENTARY SHEET

License Number

Docket or Reference Number
40-9083

Amendment No.

FOR THE NUCLEAR REGULATORY COMMISSION

Dated: _____

Keith I. McConnell, Deputy Director
Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Attachment 2 Training Impact of the US Nuclear Regulatory Commission-Imposed Restrictions on Operational Ranges in the United States

D38 Residue from M101 20 mm Spotting Round

Headquarters, Department of the Army (HQDA) funded the US Army Corps of Engineers (USACE) to conduct archive research to identify those installations and ranges on which the US Army conducted operations, including live-fire training and demonstration, involving the M101 spotting round. This effort identified 22 installations within the United States and several outside the United States on which the Army conducted operations involving the M101 spotting round.

Of these, the Army has identified 16 installations in the United States within the NRC's jurisdiction and not already licensed that have operational ranges on which D38 is known or suspected to be present. At many installations, the M101 was used on more than one operational range.

On 5 May 2011, Headquarters, Installations Command (IMCOM) issued Operational Order 11-397 that requires D38-affected IMCOM garrisons to comply with NRC restrictions, including keeping people from entering areas where D38 is known or suspected to be present, until the NRC approves IMCOM's radiation safety program that addresses such areas. NRC restrictions preclude the use of munitions containing high explosives (HE) on operational where D38 is present.

IMCOM's G7 Sustainable Range Program analyzed the training impacts resulting from the NRC imposed restrictions. This analysis, which did not address Hawaii and Alaska, focused on operational ranges on Fort Knox, Fort Lewis, Fort Hood, Fort Benning, and Fort Campbell. IMCOM considers these ranges to have critical to significant training impacts. These are described below.

- **Fort Knox**: Heins Qualification Training Range (QTR) is located north of the Garvin and O'Brien impact area, and on the base line. Training at Heins QTR is impacted to the extent that range personnel are not able to service (maintain) targets and HE munitions cannot be used. Once targets are no longer serviceable, the range will operate in a degraded mode. This degraded mode directly affects the installations ability to conduct machine gun qualification as it does not have another training facility to meet this requirement. As a result, approximately 1,100 Soldiers have not been able to qualify on the M2 machinegun this calendar year.
- **Fort Lewis**: The radiation control areas (RCA) are located in artillery and mortar impact areas that supporting Fort Lewis' mortar and artillery firing. The restrictions imposed cause Fort Lewis to lose approximately half of its Artillery Impact Area, directly affecting approximately 70 artillery- and over a hundred mortar-crew training. To

conduct the live-fire (HE) training required to meet mission training requirements, Soldiers must travel 340 miles (round trip) to Yakima Training Center. This effects Soldiers who are already experiencing a high operational tempo and requires expenditure of funds not programmed. Additionally, range 53, which supports machine gun qualification cannot be used to meet qualification requirements nor can it be modernized. This directly degrades training for all machinegun crews assigned to the three STRYKER Brigades and the 75th Ranger Battalion. Fort Lewis' I Corps Commander has requested relief from NRC-imposed restrictions.

- **Fort Hood**: RCA (confirmed) is located (partially) on the far end of Trapnell Multi Purpose Training Range (MPTR) - a tank and Bradley Fighting Vehicle crew qualification range. Movement into the restricted area is required to service target mover 6 and several stationary armor targets (SAT). The RCA also falls partially within the impact area restricting some mortar firing. Although this restriction does affect maintenance and replacement of targets, it caused Fort Hood to close this range until the NRC license is obtained. Although Fort Hood has through detailed scheduling been able to offset the impact, the maintenance and sustainment of target berms and lifting devices is becoming increasingly critical as maintenance on other supporting ranges is denied because of the need to shift firing to other ranges.
- **Fort Benning**: NRC-imposed restrictions impact HE firing on five ranges (Duke; Coolidge; Cactus; Patton; and Red Cloud). These ranges support the Army's Infantry and Armor initial entry, non-commissioned officer and officer training programs. Duke and Coolidge ranges support both anti-armor and live fire training. Cactus and Red Cloud ranges support tank and Bradley gunnery crew training in support of the Armor and Infantry Schools. The restrictions on these ranges have caused Fort Benning to adjust its training program of instruction (POI) to meet only minimal training objectives. The RCA in impact area K15 effect firing at targets supporting the tank and Bradley battle runs conducted on Cactus range. Additionally, the closure of Molnar Range impacts Fort Benning's MOUT training capabilities.
- **Fort Campbell**: The RCA (confirmed) is located in the North-South Impact Area, which supports artillery and mortar training (live-fire). The NRC-imposed restrictions significantly impact live-fire training with regard target areas B and C. This restriction, which may also impact firing from vicinity OP4, is having an impact on the readiness training of artillery and mortar crews throughout the entire 101st Airmobile Division. This restriction has caused Fort Campbell to relocate firing points and move hard targets into another impact area with limited training value given restriction, with to support artillery crew live-fire exercises. The area to which they moved is impact area.

The Commanding General, US Army Pacific has indicated with great concern that the NRC-imposed restrictions are negatively impacting USARPAC training. The Army identified four RCA (confirmed) fans on Pohakuloa Training Area (PTA) on the island of Hawaii, and one at Schofield Barracks (SB) on the island of Oahu. The firing of HE munitions into these areas,

which is prohibited, is affecting the multi-weapon, MK-19, and artillery direct fire ranges; four mortar firing points; and an aerial bombing "box" impact area. Personnel, vehicles and equipment entering these RCAs in the future will be are subject to safety restrictions within the area and screening by radiation monitors prior to departure from the area. This monitoring costs 2 to 4 hours of unit training and transition time between training areas and ranges. These delays result in a degradation of training, specifically the valuable lessons learned that would normally be gleaned during the After Action Review process conducted immediately following training events. Additionally, range and target maintenance, and required environmental monitoring and surveying in these areas to include the Battle Area Complexes (BAX) currently under construction on SB, where the RCA covers over 75 percent of the range and PTA are directly affected by these restrictions. Issuance of an NRC license beyond September 2012 may result in additional construction support costs; delay the opening and operation of the BAXs, which are the only digital ranges that support the Oahu-based Stryker brigade, putting at risk Soldier and unit training, and readiness.

Attachment 3 Source material license #SUB-459, 1 November 1961

Form AEC—410 (5-61)

UNITED STATES
ATOMIC ENERGY COMMISSION

SOURCE MATERIAL LICENSE

Pursuant to the Atomic Energy Act of 1954, and Title 10, Code of Federal Regulations, Chapter 1, Part 40, "Licensing of Source Material," and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, possess and import the source material designated below; to use such material for the purpose(s) and at the place(s) designated below; and to deliver or transfer such material to persons authorized to receive it in accordance with the regulations in said Part. This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954 and is subject to all applicable rules, regulations, and orders of the Atomic Energy Commission, now or hereafter in effect, including Title 10, Code of Federal Regulations, Chapter 1, Part 20, "Standards for Protection Against Radiation," and to any conditions specified below.

Licensee	
1. Name: Department of the Army	3. License No.: SUB-459
2. Address: Washington, D. C.	4. Expiration Date: October 31, 1964
	5. Docket No.: 40-6639
6. Source Material: Uranium	7. Maximum quantity of source material which licensee may possess at any one time under this license: No quantity limitations.

CONDITIONS

8. Authorized use (Unless otherwise specified, the authorized place of use is the licensee's address stated in Item 2 above.)

For fabrication of spotting rounds at Lake City Arsenal, Independence, Missouri, and Frankfort Arsenal, Philadelphia, Pennsylvania, and for the testing of spotting rounds in accordance with the procedures described in applications for license submitted by the Ordnance Corps dated May 1, June 2, and September 26, 1961. The licensee is further authorized to distribute spotting rounds to field units of the Army and to use such rounds for military purposes in accordance with the procedures described in the licensee's September 19, 1961, application. This license authorizes the export of spotting rounds containing uranium for military purposes.

DICTATED ----------
APPROVED ----------

For the U. S. ATOMIC ENERGY COMMISSION

Date of issuance NOV 1 1961

Division of Licensing and Regulation

☆ U.S. GOVERNMENT PRINTING OFFICE: 1961—O-581021

ORNL SITES - SUMMARY

License No.:	SUB-00459	ORNL Score:	482
Docket No.:	040-06639		
Licensee:	Department of the Army	Review Status:	**File Reviewed**
Site Address(es):	Frankford Arsenal Bridge and Tacony Streets Philadelphia, Pennsylvania 19137 Lake City Arsenal Independence, Missouri Picatinny Arsenal Dover, NJ Army Units		
Site Contact:	none		
Telephone No.:	none		
SDMP Site:	no		
Related License(s):	37-01091-07, SUB-01339, [SBE-07228, SUB-00307, SUB-00348: NOT ON LIST]		
NRC Reviewer:	Mark R. Bouwens		
Review Abstract:	License No. SUB-00459 authorized the possession, use, and export of unlimited quantities of DU for use in artillery rounds. Some remediation was conducted at Frankford Arsenal and Lake City Arsenal; however, there is no record of a termination or confirmatory survey for this license. License No. SUB-01339 was issued for the remediation of the Frankford Arsenal, therefore, the review of this site will be closed out from License No. SUB-00459 and reviewed under License No. SUB-01339.		
Recommendations:	Review License No. SUB-00307 for additional history about Frankford Arsenal, Lake City Arsenal, and Picatinny Arsenal. Determine if Lake City Arsenal is currently licensed for DU and, if so, the location and nature of use. Determine what DU was used for at Picatinny Arsenal; this may be possible with additional file review. Notify NMSS of the low level radioactive waste disposal at sea.		

OK JDL 10-11-94

Summary: License No. SUB-00459 authorized the possession and use of unlimited quantities of depleted uranium (DU) for use in spotting rounds (1961-1968) and armor piercing projectiles; and the export of these rounds for military purposes (1961 to about 1965). The license authorized the Frankford Arsenal, Lake City Arsenal, Picatinny Arsenal, and various Army Units as locations of use. License No. SUB-00459 also authorized the possession and use of thorium for thin coatings on optical lenses.

License No. SUB-00459 superseded License Nos. SUB-00307 and SUB-00348. License No. SUB-00307 authorized the fabrication, testing, and export of DU rounds at the Frankford Arsenal and Lake City Arsenal. License No. SUB-00348 authorized

the possession of DU artillery component parts at Picatinny Arsenal. The authority to export DU components as part of explosive devices was transferred to License No. SBE-07228 in about 1965, at which time SUB-00459 was amended so that it no longer authorized the export of DU rounds. There was a request for termination of License No. SBE-07228 in 1973; the license was due to expire in 1973. DU was never exported under this license. License No. SUB-00459 was superseded by License No. SUB-01339 which was issued for the decontamination of the Frankford Arsenal.

In 1969, 44,000 DU rounds were disposed at sea. The exact weight and location are specified in the file.

There is no termination or confirmatory survey for this license.

The following sections provide information about the authorized locations of use.

Frankford Arsenal

DU operations at Frankford arsenal were authorized by License No. SUB-00459 from 1961 to about 1978. DU was used for the fabrication and testing of DU spotting rounds and armor piercing projectiles. Application dated 1973 requested the use of DU in GAU-8, Phalanx, and Bushmaster weapon systems. Testing of the DU rounds was conducted in indoor firing ranges. As of about 1965, waste was not disposed at the Frankford Arsenal. Waste was sent primarily to the Edgewood Arsenal. In 1973, waste was disposed at the Radioactive Material Disposal Facility at Aberdeen Proving Ground, Maryland.

Additional information about specific buildings at the facility is listed in Attachment 1. Byproduct material that is referred to was authorized by License No. 37-01091-07.

Lake City Arsenal

Lake City Arsenal, located 5 miles east of Independence, Missouri, was an authorized place of use by License No. SUB-00459 from 1961 to about 1965, although DU operations apparently ceased sometime prior to the end of 1963. DU operations began at Lake City Arsenal in 1960, apparently under AEC contract. In 1961, DU operations were authorized by License No. SUB-00307. In 1963, DU operations were authorized by License No. SUB-00459. The facilities at the Lake City Arsenal were operated by Remington Arms Company for the fabrication of 20 mm DU spotting rounds.

There was a 1600 yard impact area for testing DU rounds. The area consisted of 250 square feet of clay. About 1000 rounds impacted the area. The fuse and anterior body of a round went about one-half foot deep into the clay surface at impact. There was an industrial waste holding pond used to retain facility effluent

prior to release to West Creek which flowed into Little Blue River. The licensee sampled the holding pond overflow and the creek. Some of the creek samples were identified as having radioactive material concentrations above effluent limits. The licensee stated that the levels were probably due to natural occurring radium.

Additional information about specific buildings is listed in Attachment 2.

Picatinny Arsenal
Picatinny Arsenal was an authorized location of use from 1963 to 1965. In September 1964, 4000 kg of DU was obtained under AEC contract.

Army Units
Army Units were eligible for the distribution of artillery rounds from 1961 to sometime prior, but close, to 1973.

EXPERT SYSTEM LICENSE EVALUATION
EVALUATION REPORT FOR LICENSE SUB-00459

Licensee: DEPARTMENT OF THE ARMY
Site of operation: 3 ARSENALS(PICATINNY,LAKE CITY, & FRANKFORD) AND ARMY FIEL
Units

| The final ranking for SITE CONTAMINATION is: 482 |

DESCRIPTION OF ACTIVITY OR FACILITY: MILITARY-NONREACTOR

--Type and form of materials licensed--

Material--	--Form--
DEPLETED URANIUM	Loose material
THORIUM OR TH232	Loose material

--For evaluation purposes, amounts of the following materials were obtained-

Material--	--Form--	--Amount--	--Unit--
DEPLETED URANIUM	LOOSE	216157.00	lb
THORIUM OR TH232	LOOSE	10.12	lb

Rank of the license based on the loose materials licensed: 56

DESCRIPTION OF FIRST SITE AT WHICH SUB-00459 WAS USED

FRANKFORD ARSENAL USED DURING THE ENTIRE TERM OF THIS LICENSE FOR FABRICATION AND TESTING ON INDOOR FIRING RANGES. THE FRANKFORD SITE WAS COVERED BY A SUPERSEDING LICENSE UNDER DOCKET 40-8702.

DESCRIPTION OF SECOND SITE AT WHICH SUB-00459 WAS USED

LAKE CITY ARSENAL AT INDEPENDENCE, MO. USED FOR FABRICATION FROM THE ISSUANCE OF THE LICENSE IN NOV.,61, UNTIL POSSIBLY APRIL,65. PICATINNY ARSENAL ADDED AS A SITE IN AUG.,63. FIELD UNITS WERE ELIGIBLE FOR DISTRIBUTION OF THE ARTILLERY.

1. The license was superceded by another license. The reviewer overrode the decision to eliminate because of some extenuating circumstance (usually site closed out during license period.See the reviewer's comments below for reasons
2. License was for loose materials, or materials handled loose
3. Military license with depleted uranium

--- continued on next page ---

4. Depleted uranium was being processed by machining
5. There was more than one identifiable site with this license.The final score will be the maximum score for the sites used under this license. Succeeding conclusions will indicate which site
6. Each site (or two groups) will be evaluated, with the assumption that all materials authorized on the license could have been used at each site. The final score will be the maximum of the site scores.
7. FIRST SITE: There was insufficient information in file to determine the likelihood of release to atmosphere or to environment from activities at this site.
8. FIRST SITE: Some likelihood that building onsite could have been left with contamination. Score=score*1.0

Reviewer's comments concerning potential CONTAMINATION
LICENSEE FABRICATED EXPLOSIVE DEVICES FROM UNLIMITED AMOUNTS OF LOOSE MATERIAL AND ALSO TESTED THE EXPLOSIVE DEVICES AT FRANKFORD.
LICENSEE FABRICATED EXPLOSIVE DEVICES FROM UNLIMITED AMOUNTS OF LOOSE MATERIAL AT LAKE CITY ARSENAL.

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9. FIRST SITE: Some likelihood that meaningful outdoor contamination could have occurred at site. Score=score*1.0
10. The evaluator judged that the activity carried out under this license at this site made decontamination at closeout INAPPROPRIATE. — because this site had a superseding license.
11. Information insufficient to judge frequency of turnover for operation Score not changed
12. FIRST SITE: There was limited use of glove boxes, hoods, or protective clothing
13. FIRST SITE: Possible inappropriate disposal or abandonment of contaminated material from glove boxes,hoods,clothing. Score=score*1.1
14. FIRST SITE: There was significant generation of waste material in routine cleanup of facility. Score=score*1.5
15. FIRST SITE: Possible inappropriate disposal or abandonment of contaminated material from cleanup. Score=score*1.2
16. FIRST SITE: There was adequate documentation of the disposition of materials. Score=score*0.7
17. FIRST SITE: There was NO closeout survey for this site. Score multiplied by 1.8
18. FIRST SITE: There was NOT an NRC FINAL INSPECTION of the facility.
19. SECOND SITE: There was inconclusive evidence of releases or there was evidence of limited release. Score=1.2*score
20. SECOND SITE: Some likelihood that building onsite could have been left with contamination. Score=score*1.0

--- continued on next page ---

21. SECOND SITE: Some likelihood that meaningful outdoor contamination could have occurred at site. Score=score*1.0
22. SECOND SITE: There was NO verifiable decontamination of the site at closeout. Score=score*1.2
23. Information insufficient to judge frequency of turnover for operation Score not changed
24. SECOND SITE: There was limited use of glove boxes, hoods, or protective clothing
25. SECOND SITE: Possible inappropriate disposal or abandonment of contaminated material from glove boxes,hoods,clothing. Score=score*1.1
26. SECOND SITE: There was significant generation of waste material in routine cleanup of facility. Score=score*1.5
27. SECOND SITE: Possible inappropriate disposal or abandonment of contaminated material from cleanup. Score=score*1.2
28. SECOND SITE: There was either no documentation of materials disposition or the documentation was inadequate. Score=score*1.2
29. SECOND SITE: There was NO closeout survey for this site. Score multiplied by 1.8
30. SECOND SITE: There was NOT an NRC FINAL INSPECTION of the facility. Score not changed.

CATEGORY FOR POTENTIAL SITE CONTAMINATION:
HIGHEST PRIORITY-Category 1A

The final ranking for SITE CONTAMINATION is: 482

Description of THE LICENSEE ACTIVITY AUTHORIZED by this license

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FABRICATION OF ROUNDS AND ARTILLERY FROM DEPLETED URANIUM;TESTING ON INDOOR FIRING RANGES AT FRANKFORD ARSENAL;AND DISTRIBUTION OF ROUNDS TO FIELD UNITS. THE THORIUM WAS USED IN A THIN FILM COATING PROCEDURE.

--- continued on next page ---

Reviewer's comments concerning license SUB-00459

License SUB-459 is listed on the file cover as covered by docket 40-8702, but this coverage appears to be only for one facility-Frankford Arsenal under the decontamination license SUB-1339 on docket 40-8702. Therefore license SUB-459 was evaluated as the file shows fabrication work with the potential to contaminate was performed at Lake City Arsenal in Independence Mo. The burning of paper protective clothing at the Lake City site may signify some release of depleted uranium to the environment. There is no information in the file on the activities at Picatinny Arsenal. In the spring of 1969, the licensee was given permission by J.A. McBride to dispose at sea of 44,000 Davy Crockett depleted uranium spotting rounds when a moratorium was in effect against this type of disposal.

EXPERT SYSTEM EVALUATION WAS BASED ON THE
INVENTORY RECORD IN JOB 0081, BOX 15

Docket 40-06639

Licensee: DEPARTMENT OF THE ARMY
Address: WASHINGTON D.C. Zip: 60044
This license was listed as SUPERCEDED BY ANOTHER LICENSE
Contents of the new license field FOLDER SAYS COVERED BY 40-8702
State of operation: MU
Disposition information present: LICENSEE LETTER STATING DISPOSITION
Contents of letter: 8-2-73:DISPOSAL IS THROUGH ABERDEEN PROVING GROUND
Matl. Transfrd to: ABERDEEN PROVING GROUND
License to which transferred: UNKNOWN
Remarks:
JOB NUMBER: 0081 BOX NUMBER: 15

Date of last evaluation/revision: 12/08/92 Reviewer: PAB

Attachment 5 NRC letter to US Army authorizing disposal of DU at sea

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY MATERIEL COMMAND
WASHINGTON, D.C. 20315

IN REPLY REFER TO
AMCSF-P

21 March 1969

Director, Materials Licensing
U. S. Atomic Energy Commission
ATTN: Chief, Source & Special Nuclear Branch
Washington, D.C. 20545

MAR 24 1969

Dear Mr. Nussbaumer:

For the last several months the U.S. Army has explored various methods for disposing of 44,000 each 20mm Davy Crockett spotting rounds. Attached Ammunition Procurement and Supply Agency letter, dated 18 February 1969, discusses various disposal methods. Each method was rejected because of hazard or cost. While land burial is the usual method for disposal of radioactive material, this method was rejected because of adverse experience from burial of munitions after World War II.

During May through June 1969 a deep sea dump of chemical ammunition will be conducted out of U. S. Naval Ammunition Depot, Earle, New Jersey. Space is available to include the 20mm spotting rounds.

With your permission the spotting rounds will be included in the scheduled sea dump. The munitions will be secured below deck in liberty ship hulls (types C1B and C2). The hulls will be scuttled in an established munitions dumping area approximately 250 miles due east of Atlantic City beyond the continental shelf where the ocean depth is in excess of 7,000 feet. Dump site is located at 39° N Latitude, 71° W Longitude. This site is identified on maritime maps as a munition dump area. The U. S. Navy has concurred in including the spotting rounds in the scheduled sea dump. Radiological safety control as well as explosive ordnance support will be furnished by the U.S. Army Technical Escort Unit, Edgewood Arsenal, Md. This unit is trained in the safe movement of hazardous material, in explosive ordnance demolition and in the handling and escort of radioactive shipments.

Approval of proposed sea dump of the spotting rounds is needed prior to 18 April 1969 to take advantage of the scheduled chemical munition disposal operation. If sea disposal cannot be approved by the Commission, direct assistance of the Commission is requested to effect equally safe, economical disposal of the spotting rounds.

AMCSF-P 21 March 1969

This letter confirms information furnished your staff and Dr. Forest Western (Director, Division of Radiation Protection Standards) during phone conversations, 10-20 March 1969, with Mr. D. Taras, this Headquarters.

Sincerely,

G. L. FEAZELL
Chief
Safety Office

1 Incl
as

CF:
DCSLOG,ATTN: LOG/PE-LSB w/Incl
CG, MUCOM,ATTN: AMSMU-SS-SD w/o Incl

APR 1 1 1969

Department of the Army
Headquarters United States
Army Materiel Command
Washington, D. C. 20315

Attention: Mr. G. L. Feazell, Chief
Safety Office

Gentlemen:

Please refer to your letter of March 21, 1969 (your reference AMCSF-P), in which you requested permission to dispose of approximately 44,000 "Davy Crockett" spotting rounds containing depleted uranium as part of your scheduled disposal of chemical ammunition during May through June, 1969.

In view of the insignificant radioactivity involved, the Army Materiel Command is authorized to conduct such disposal in accordance with the procedures described in your letter of March 21, 1969.

Sincerely,

Original Signed by
J. A. McBride

J. A. McBride, Director
Division of Materials Licensing

DISTRIBUTION:
Docket file
DR Reading file
Division Reading file
Branch Reading file
J. A. McBride, DML
H. Shapar, OGC
H. L. Price, DR
Secretary (2)

21

4/10/69

OFFICE ▶	DML	DML	OGC	DR		
SURNAME ▶	Nussbaumer/mad	JAMcBride		HLPrice		
DATE ▶	4/8/69	4/11/69	4/9/69			

Form AEC-318 (Rev. 9-53) AECM 0240 U.S. GOVERNMENT PRINTING OFFICE: 1968 O—296-411

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