

NRC Form 313

Application for Materials License

ITEM

1. This is an application for (B) amendment to License Number SUC-1593

2. Name and address of applicant:

United States Army Installation Management Command
ATTN: IMSO, Building 2261
2405 Gun Shed Road
Fort Sam Houston, Texas, 78234-1223

3. Address where licensed material will be used or possessed (see additional information below):

United States Department of Army Installations at Schofield Barracks HI, Pohakuloa Training Area HI, Fort Knox KY, Joint Base Lewis-McChord/Yakima Training Center WA, Fort Riley KS, Fort Polk LA, Fort Benning GA, Fort Campbell KY, Fort Bragg NC, Fort Carson CO, Fort Gordon GA, Fort Hood TX, Fort Hunter Liggett CA, Fort Jackson SC, and Fort Sill OK

4. Name of person to be contacted about this application:

Robert Cherry
Business telephone number 210-466-0368
Business cellular telephone number 210-313-0952
Business email address robert.n.cherry.civ@mail.mil

5. Radioactive material

- A. Element and mass number: uranium (depleted)
- B. Chemical and/or physical: any
- C. Maximum amount that will be possessed at any time: 5600 kg (see additional information below about how this value was determined)

6. Purposes(s) for which licensed material will be used:

Activities necessary for the possession and management of depleted uranium (DU) M101 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.

7. Individual(s) responsible for radiation safety program and their training experience:

The License Radiation Safety Officer will have the following education, training, and experience:

- A. A Bachelors degree in the physical sciences, industrial hygiene, or engineering from an accredited college or university or an equivalent combination of training and relevant experience in radiological protection. Two years of relevant experience are generally considered equivalent to one year of academic study.
- B. At least one year of work experience in applied health physics, industrial hygiene, or similar work relevant to radiological hazards associated with site remediation. This experience should involve actually working with radiation detection and measurement equipment, not strictly administrative or “desk” work.
- C. A thorough knowledge of the proper application and use of all health physics equipment used for depleted uranium and its progeny, the chemical and analytical procedures used for radiological sampling and monitoring, methodologies used to calculate personnel exposure to depleted uranium and its daughters, and a thorough understanding of how the depleted uranium was used at the location and how the hazards are generated and controlled.

8. Training for individuals working in or frequenting restricted areas

The generic Radiation Safety Plan, tailored for each installation, specifies training requirements for individuals working in or frequenting restricted areas. A description of the generic radiation safety plan and how it will be tailored for each installation appears below.

9. Facilities and equipment

The DU M101 spotting rounds are in known impact areas on ranges at each installation specified in item 3 above. No facilities are associated with the Army’s possession of this DU.

The generic Radiation Safety Plan, tailored for each installation, specifies the radiation monitoring equipment that the garrison radiation safety officer at each installation will possess and use. A description of the generic radiation safety plan and how it will be tailored for each installation appears below.

10. Radiation safety program

The Radiation Safety Plan appears below.

11. Waste management

Section 18 of the Radiation Safety Plan describes waste management.

The decommissioning funding plan for Davy Crockett M101 depleted uranium impact areas at M101 DU-affected Ranges is in attachment 3.

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Item 3 Address where licensed material will be used or possessed

United States Department of the Army Installations at

- Fort Benning GA
- Fort Bragg NC
- Fort Campbell KY¹
- Fort Carson CO
- Fort Gordon GA
- Fort Hood TX
- Fort Hunter-Liggett CA
- Fort Jackson SC
- Fort Knox KY
- Fort Polk LAFort Riley KS
- Fort Sill OK
- Joint Base Lewis-McChord/Yakima Training Center WA
- Schofield Barracks/Pohakuloa Training Area HI

The list of M101 spotting round depleted uranium-affected installations that the Army originally provided to the NRC included Fort Dix NJ and Fort Greely AK. The Army requests the NRC to remove these two installations from the list for the following reasons.

First, unlike at the other installations, infantry units did not fire M101 rounds at Fort Dix and Fort Greely.

The Fort Dix archive search report (USACE St Louis 2009) says,

- Frankford Arsenal personnel conducted tests of M101 rounds on the Frankford Arsenal Range at Fort Dix (USACE St Louis 2009a). No units authorized to field the Davy Crockett weapon by Table of Organization and Equipment (TO&E) were at Fort Dix during the Davy Crockett era (1958-1968).
- A 1963 message from CO (Commanding Officer), USARMISA (Acronym not known) to the CG, USARWPNSCOMD (U.S. Army Weapons Command) did not list any M28 Light Weapons assigned to Fort Dix.

The Fort Greely archive search report (USACE St Louis 2008e) says,

- No documents produced by the [Arctic] Test Board, U.S. Army Test [and] Evaluation Command at Fort Greely pertaining to the M28 Light Weapon or the M101 spotting cartridge were found by the project team. A 1963 weapon inventory message from CO, USARMISA to the CG, USARWPNSCOMD did not list any M28 Light Weapons at Fort Greely.

¹ Fort Campbell straddles the Kentucky-Tennessee border. The headquarters building provides the Kentucky address. Figure 6 in the Fort Campbell archive search report (USACE St Louis 2008c) indicates that the former M101 impact area is in Tennessee while the former firing point is in Kentucky.

- No U.S. Army infantry unit authorized by Table of Organization and Equipment (TO&E) to field the Davy Crockett Weapon System was garrisoned at Fort Greely during 1961 through 1971.

Second, the Army fired no more than a small number of M101 rounds at Fort Dix and, likely, fired no M101 rounds at Fort Greely.

The Fort Dix archive search report (USACE St Louis 2009a) says,

- The Army fired less than 50 Cartridges, 20mm Spotting M101 at Fort Dix.² The amount of additional XM101 20mm cartridges potentially fired at Fort Dix could not be determined.
- No records of Davy Crockett Light Weapon M28 being shipped directly to Fort Dix were found. This weapon system was brought to Fort Dix by personnel from the Frankford Arsenal to perform tests on the weapon and its ammunition. The weapon was borrowed from the Army Weapons Command, Aberdeen Proving Ground, or from industrial stocks.
- [Records] from the manufacturer of the Cartridge, 20mm Spotting M101 identified a total of 50 rounds shipped directly to Frankford Arsenal, Pennsylvania for use in tests.
- No direct shipment to Fort Dix was identified in documents collected for this report. However, 20mm spotting rounds could have been obtained from prototype stock, ammunition depots, or from rounds shipped directly to Frankford Arsenal.
- [It] is estimated that a maximum of 50 cartridges, 20mm Spotting M101 were fired at Fort Dix.

The Fort Greely archive search report (USACE St Louis 2008e) says,

- Recovered DD Form 550 ammunition shipment manifests do not list any Cartridges, 20mm Spotting M101 as being sent directly to Fort Greely.
- The Davy Crockett Weapon System was tested at Fort Greely. However, only the M29 Heavy Weapon³ has been documented to have been fired at Fort Greely. A conclusive determination as to the use of the M101 spotting round at Fort Greely cannot be made from recovered information.
- No evidence was found that documents the use of the Davy Crockett Light Weapon M28 and the Cartridge, 20mm Spotting M101 at Fort Greely. However, it has been documented that the M29 Heavy Weapon was tested at Fort Greely.⁴

² Less than 50 M101 rounds contains less than 9.5 kg (3.5 millicuries) of DU.

³ The M29 weapon system's spotting round did not contain depleted uranium.

⁴ This paragraph in the ASR goes on to say, "Considering that the Davy Crockett Weapon System consisted of both the M28 Light Weapon and the M29 Heavy Weapon, it is highly probable that the M28 was in fact tested at Fort Greely and that documentation to support this fact either was not found or has been destroyed." The Army currently believes this conjecture of "high probability" is not supported by anything other than the fact that the Army tested the M29 system at Fort Greely. All other facts support low or no probability that the Army fired M101 rounds at Fort Greely.

- A conclusive determination as to the use of the M101 spotting round at Fort Greely cannot be made from recovered information.
- [A] conclusive determination as to the use of the [M101] spotting round at Fort Greely cannot be made from collected information.

A study of trace metals at Fort Greely (Douglas, et al. 2014) says,

- All of the surface soil total uranium concentrations were at or below the global mean crustal uranium concentration. None of the populations of samples we collected and analyzed yield statistically significantly unique uranium values and the highest population of values in our dataset are from the two comparison locations where no U.S. Army training has ever been reported. Further, most of our samples yield values at or below the crustal average for most common rock types on earth.
- The $^{235}\text{U}/^{238}\text{U}$ values in our entire soil dataset are statistically significantly similar to one another and to typical crustal $^{235}\text{U}/^{238}\text{U}$ values. There is no indication of the presence of depleted uranium in any of our surface soil samples. However, we stress that our samples only represent a fraction of the training ranges in the area and our samples were collected from only the upper 3 cm of the soil column.

Third, the Army believes that the testers likely retrieved most if not all of the M101 (or XM101) rounds immediately or shortly after firing them, because the associated Davy Crockett Light Weapon M28 system was classified and because the testers probably needed to verify proper release of the white smoke.

The Fort Dix archive search report (USACE St Louis 2009a) says,

- Minimal Davy Crockett weapon and/or M101/XM101 20mm spotting rounds debris is expected to be found on the Frankford Arsenal Range at Fort Dix.
- No Explosive Ordnance Disposal (EOD) incident reports or explosive ordnance demolition reports pertaining to the recovery or disposal of the Davy Crockett weapon ammunition at Fort Dix were found.
- No Fort Dix written, general or specific, munitions disposal practices were identified for the various ammunition components associated with the Davy Crockett Weapon System.
- No reports addressing the demilitarization of unused 20mm spotting rounds at Fort Dix were found during research for this ASR.
- The range was inspected starting at the firing point and continued down range to 1,500 meter where the impact area of the Davy Crockett Weapon System would have been ... The "impact" area was inspected... No Davy Crockett weapon or munitions debris was found.

The Fort Greely archive search report (USACE St Louis 2008e) says,

- A Davy Crockett Range on Fort Greely was identified and confirmed to have been used for tests involving the Davy Crockett Weapon System. No weapon system or munitions debris was found by the project team during an inspection of the range.

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Item 5 Radioactive material

- a. Element and mass number: uranium (depleted)
- b. Chemical and/or physical: any
- c. Maximum amount that will be possessed at any time: 5600 kg

Installation	Number of rounds	Reference	DU mass (kg) ^a
Fort Benning GA	9700 ^b	(USACE St Louis 2008a)	1838.9
Fort Bragg NC	4212 ^d	(USACE St Louis 2008b)	798.5
Fort Campbell KY	681 ^b	(USACE St Louis 2008c)	129.1
Fort Carson CO	1404 ^d	(USACE St Louis 2008d)	266.2
Fort Gordon GA	135 ^e	(USACE St Louis 2009b)	25.6
Fort Hood TX	4038 ^b	(USACE St Louis 2008f)	765.5
Fort Hunter Liggett CA	135 ^f	(USACE St Louis 2009c)	25.6
Fort Jackson SC	135 ^e	(USACE St Louis 2009d)	25.6
Fort Knox KY	3956 ^b	(USACE St Louis 2008g)	750.0
Fort Polk LA	1923 ^c	(USACE St Louis 2008i)	364.6
Fort Riley KS	105 ^b	(USACE St Louis 2008j)	19.9
Fort Sill OK	585 ^d	(USACE St Louis 2009e)	110.9
Joint Base Lewis-McChord/Yakima Training Center WA	1756 ^b	(USACE St Louis 2008h)	332.9
Schofield Barracks/Pohakuloa Training Area HI	714 ^b	(USACE St Louis 2007)	135.4
Total	29479		5588.5^g

^a Each M101 round contains (3180 ± 25) grains [(0.2061 ± .0015) kg] of molybdenum-DU alloy (USACE St Louis 2011). The molybdenum-DU alloy is 92 percent DU, so each M101 round contains about 0.190 kg of DU.

^b Value based on actual number of rounds shipped to installation according to shipping records.

^c Shipping records were not available. Estimate is based on estimated size of training classes, number of years used, and training protocols.

^d Shipping records were not available. Estimate is based on number of M28 squads present on the installation, number of years used, and training protocols.

^e The archive search report for this installation did not provide a value for the number of M101 rounds fired. However, it said that M101 rounds may have been fired during firepower demonstrations. Therefore, the estimated value is based on the estimated number of rounds used in firepower demonstrations at Fort Polk (USACE St Louis 2008i).

^f The Fort Hunter-Liggett archive search report says, "The Davy Crockett Weapon System fired at identified ranges were either brought there by Fort Ord units conducting firepower demonstrations for recruits or by other units training at Fort Hunter Liggett." [The main document for the archive search reports (USACE St Louis 2011) says, "...no evidence was found indicating that the 20mm M101 ... were fired at (Fort Ord)"] While the number of M101 rounds fired at Fort Hunter Liggett is unknown, an estimated value of 135 could be based on the estimated number of rounds used in firepower demonstrations at Fort Polk (USACE St Louis 2008i). However, since "other units" apparently may have brought these rounds from other installations, use of the number 135 for Fort Hunter Liggett likely is counting these rounds twice. Nevertheless, as a conservative measure, we use 135 as the estimated number of rounds fired at Fort Hunter Liggett.

^g Discrepancy is due to round off.

Item 10 Radiation Safety Program

Attachment 1 contains the Radiation Safety Plan.

Attachment 2 contains figures showing the location of all radiation controlled areas (M101 DU impact areas on IMCOM ranges).

Attachment 3 contains “Decommissioning Funding Plan for Davy Crockett M101 Depleted Uranium Impact Areas at M101 DU-affected Ranges.”

Attachment 4 contains “Environmental Radiation Monitoring Plan (Programmatic Approach).”

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Bibliography

Douglas, Thomas A., Marianne Walsh, Jay Clausen, and Charles M. Collins. *Quantification of trace metals in soils at the Colorado, KD, and Georgia Small Arms Ranges on Donnelly Training Area East, Alaska*. Cold Regions Research and Engineering Laboratory, U.S. Army Engineer Research and Development Center, Fort Wainwright, Alaska: U.S. Army Engineer Research and Development Center, 2014.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Benning, Georgia*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008a.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Bragg, North Carolina*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008b.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Campbell, Kentucky*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008c.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Carson, Colorado*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008d.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20mm Spotting M101 Davy Crockett Light Weapon M28 at Fort Dix, New Jersey*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2009a.

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USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20mm Spotting M101 Davy Crockett Light Weapon M28 at Fort Greely, Alaska*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008e.

USACE St Louis. *Installation Specific Archive Search Report On the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Hood, Texas*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008f.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Hunter Liggett, California*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2009c.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Jackson, North Carolina*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2009d.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Knox, Kentucky*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008g.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Lewis and Yakima Training Center, Washington*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008h.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Polk, Louisiana*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008i.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Riley, Kansas*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2008j.

USACE St Louis. *Installation Specific Archive Search Report on the Use of Cartridge, 20MM Spotting M101 Davy Crockett Light Weapon M28 at Fort Sill, Oklahoma*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2009e.

USACE St Louis. *Installation Specific Archive Search Report: Use of Cartridge, 20mm Spotting M101 at Schofield Barracks and Associated Training Areas*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2007.

USACE St Louis. *Project Archive Search Report: Use of Cartridge, 20mm Spotting M101*. St Louis, Missouri: US Army Corps of Engineers, St Louis District, 2011.

Attachments

1. Radiation Safety Program
2. Radiation Controlled Areas (M101 DU-affected IMCOM ranges)
3. Decommissioning Funding Plan for Davy Crockett M101 Depleted Uranium Impact Areas at M101 DU-affected Ranges
4. Environmental Radiation Monitoring Plan (Programmatic Approach)

Attachment 1. Radiation Safety Program

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Attachment 2. Radiation Controlled Areas (M101 DU-affected IMCOM ranges)

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**Attachment 3. Decommissioning Funding Plan for Davy Crockett M101
Depleted Uranium Impact Areas at M101 DU-affected Ranges**

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Attachment 4. Environmental Radiation Monitoring Plan (Programmatic Approach)

Installation-specific environmental radiation monitoring plans will be prepared in accordance with the programmatic approach contained in this plan.

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