



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
11711 INTERSTATE HIGHWAY 35 NORTH, SUITE 110
SAN ANTONIO, TEXAS 78233-5498

June 1, 2011

Safety Office

Mr. Keith McConnell
Deputy Director
Decommissioning and Uranium Recovery Licensing Directorate
US Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. McConnell:

As Radiation Safety Officer on our source material application (Docket No. 040-9083), I am providing a revised script for the Army's statements at the Predecisional Enforcement Conference (PEC) in at your Region IV offices on May 10, 2011. The script includes eight attachments.

At the PEC you and your staff agreed that you would take our written remarks under consideration if you receive them within a reasonable time. Thank you for the opportunity to clarify and amplify statements we made at the PEC.

I am providing copies of this letter with enclosures to the Headquarters, Department of the Army (DACS-SF), 2221 South Clark Street, Room 1107, Arlington, Virginia 22202; US Army Public Health Command (MCHB-TS-OHP), 5158 Blackhawk Road, Aberdeen Proving Ground, Maryland 21010-5403; US Army Installation Management Command, Pacific Region, 132 Yamanaga Street, Fort Shafter, Hawaii 96858; and US Army Garrison, Hawaii, 851 Wright Avenue, Wheeler Army Air Field, Schofield Barracks, Hawaii 96857-5000.

You may reach me by telephone at (210) 424-8781 or by email at robert.cherry@us.army.mil.

Sincerely,

A handwritten signature in cursive script that reads "Robert N. Cherry, Jr.".

Robert N. Cherry, Jr.
Radiation Safety Staff Officer

Enclosure

Predecisional Enforcement Conference, May 10, 2011

US Army's Response to NRC's Request for Information Regarding Apparent Violations of NRC Regulations

The Nuclear Regulatory Commission (NRC) has scheduled this Predecisional Enforcement Conference (PEC) as the result of a 10 CFR 2.206 petition, in order to obtain information to determine whether the Army has violated the provisions of 10 CFR 40.3 by possessing depleted uranium (DU) without a license. Specifically, the NRC is concerned with the existence of spent Davy Crockett M101 spotting rounds, which are partially made of depleted uranium (DU), on some Army training ranges.

(Following the unrecorded conference NRC requested that the Army provide its position in writing. In addition, the NRC asked the Army to clarify a few specific matters. All issues discussed and requested have been included in the following text.)

It is the Army's position that while the existence of these spotting rounds has been confirmed on some Army ranges, no enforcement action is necessary or warranted. First, the Atomic Energy Commission (AEC) did issue the Army a license to possess DU in the form of the M101 spotting round in 1961, License #SUB-459, which the NRC allowed to expire in 1978. That license permitted the Army to distribute this round to, and expend the round on, Army installations without requiring the installations to possess individual licenses. The Army complied with the intent and conditions of that license. Second, since discovery of the round in 2005, the Army has reported it to the NRC, applied for a license from the NRC, and has taken interim measures to ensure the safety of populations on and near the installations. Third, no part of any range has been decommissioned, or released for restricted or unrestricted use. All ranges suspected of possessing DU are under restricted access. The only activities performed have been done on Schofield Barracks, HI, with NRC knowledge by Cabrera Services, an Army contractor.

In the NRC's notice of this PEC, the NRC Staff asked the Army to provide information regarding several specific issues pertaining to the apparent violations of NRC regulations. The Army's responses, detailing our position that enforcement action is neither necessary nor warranted, are as follows.

1. The Army's assessment of the root and contributing causes of the apparent violations.

The Atomic Energy Commission (AEC) issued the Army a license to possess depleted uranium (DU) in the form of the M101 spotting round, which was in effect from 1961 to 1978. Specifically, the original license authorized the fabrication and testing of the spotting round at three Army Arsenals: Frankford, Lake City, and Picatinny Arsenals. The license also authorized the distribution of the round to Army field units, and use of the M101 spotting round for military purposes. "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." 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. While we are not arguing against regulatory control of DU, this information is helpful to understand how we got here. And consequently, any significant enforcement action considered must factor in the following information.

A. Regarding evidence in the record regarding specific AEC guidance to the Army pertaining to control of the M101 spotting round - in a letter sent to the AEC Division of Licensing and Regulation, dated 1 May 1961, 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 what the "proposed end use" was, and AEC acknowledged and accepted that as a condition of the license.¹ For example:

(1). The application for the original license stated on page one, block 9, "Depleted uranium will be ... distributed to subordinate military units, and utilized or expended in training or combat."²

(2). A health study was conducted by the Health Physicist at Watertown Arsenal in 1960. The study found that all radiation concentrations in the impact area did not vary significantly from background. The conclusion of that report was that "the use of the uranium in the M101 is not an epidemiological health hazard. The standard operating procedures as exercised in the use of any conventional weapon will be adequate." The standard procedure for every other conventional weapon fired on Army ranges is to leave the rounds on the impact area unless and until the land is intended to be cleared and reclaimed for other uses. In fact, that same report stated,

"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

¹ Attachment 1, pg. 6, Letter attached to original 1961 license application.

² Attachment 1, pg. 2, 1961 license application.

considered a radiation area. This suggestion was favorably considered by the above-mentioned Atomic Energy Laboratory.”³

(3). In the process of amending the license in 1962, the Army informed the AEC “there are no radiological health hazards associated with the artillery (*sic*) ammunition.”⁴ (The Davy Crockett weapon system was not artillery.) In so informing the AEC, the Army provided a Radiological Hygiene Special Study conducted at Lake City Arsenal, Independence, Missouri in 1961 by the U.S. Army Environmental Hygiene Agency. As part of that study, inspectors took radiation measurements of a 250-square-foot impact area where approximately 1000 rounds had been fired. Their findings were that radiation readings at waist level were not above background, that when measuring recent craters the reading was between 0.05 to 0.1 milliroentgen per hour (mR/h), and when measuring fragments on the ground, slightly above 0.2 mR/h. The report concluded that “there is no hazard to personnel from the fired rounds...” and that “...the hazard to personnel from unexploded ordnance would make decontamination undesirable.”⁵

(4). AEC inspected Lake City Arsenal in November 1963 and the inspector stated the following under “License Conditions” at Continuation Sheet #6:

“42. The following shows the status of compliance with the conditions of this license... The artillery (*sic*) rounds which had been manufactured had been distributed to various field units of the Army to be used for the spotting of impact areas. The use appears to be in accordance with the specifications of this license.”⁶

B. 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 50 years ago, it is not apparent from any of the surviving documents known to the Army. In fact, in 1969, following the end of the Davy Crockett era, the AEC Licensing Director authorized the Army to dispose of its remaining 44,000 live M101 rounds by dumping them in the sea. His rationale was due to the quote “insignificant radioactivity involved.”⁷ However, the Army decided to destroy the rounds at Lake City Arsenal rather than dispose of them by sea burial.

C. License Expiration. 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

³ Attachment 2, pg. 5, Health Physics Study dated 19 FEB 1960, Watertown Arsenal

⁴ Attachment 3, pg. 1, 1962 letter.

⁵ Attachment 3, pg. 8, Report of Radiological Hygiene Special Study No. 3993R21-62, dated 27 DEC 1961, Lake City Arsenal.

⁶ Attachment 4, pg. 7, Compliance Inspection Report dated November 20 and 21, 1963.

⁷ Attachment 5, letter from J.A. McBride dated April 11, 1969.

1989 GAO report 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.”⁸ 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.

D. At best, the institutions overlooked the M101 issue due to passage of time and changes in the license itself. Over time the license was amended to include other uses of DU and only two years after AEC issued the original license, AEC amended it to omit any specific mention of its original purpose – the M101 spotting round. The last amendment to the license also specifically prohibited distribution of explosive devices containing DU, which *could* explain why the NRC did not investigate the potential existence of DU on Army ranges prior to allowing the license to expire in 1978. But it still does not explain why nothing was done in 1994 after ORNL pointed out the fact that the rounds were distributed to Army Units. Some factors in the life cycle of the license:

(1). The license for possession of DU expired in 1978, 10 years after the weapon system was removed from use, and was last fired.

(2). AEC did not require the Army to retain records showing the receipt and disposal of source material possessed and used pursuant to AEC License No. SUB-459 for more than two years after that license expired.⁹

(3). The conditions of license SUB-459 were modified many times between 1961 and its expiration in 1978 without inquiry from the AEC/NRC about the location or ongoing possession of the M101. What follows is a brief license history based on Army and NRC records:

a. November 1961 – the original license granted the right of possession of “spotting rounds” containing uranium to the Department of the Army for fabrication at United States Army Munitions Command Complex, which included Lake City Arsenal, Frankford Arsenal, and Picatinny Arsenal. The license also authorized testing of the round, as well as distribution to field units to use for military purposes.

b. October 1962 – the license was modified to include the right of the Army to do all the above with not only spotting rounds but also with uranium-containing artillery rounds.

⁸ Attachment 6, pg. 3, ORNL Sites-Summary, date not listed.

⁹ Attachment 7, Letter from AEC Division of State and Licensee Relations, dated March 23, 1965.

c. August 1963 – the license was modified to grant the Army the right to do all the above with “small arms and artillery ammunition.” This license dropped the specific mention of the spotting round, even though it was considered a small arms round. At this time all spotting rounds had been manufactured and distributed.

d. April 1965 – the license was again modified, naming licensee as Department of the Army, Army Munitions Command (AMC), and changing the condition to the right of “fabrication of component parts used in explosive devices” to Frankford Arsenal only; and authorizing AMC to “distribute explosive devices containing uranium to field units of the Army for military purposes.”

e. April 1968 – the license was renewed, naming licensee as the Department of the Army again, but granting the same authorizations as the previous one.

f. October 1973 – the license was renewed authorizing “fabrication and testing of component parts used in explosive devices at the Frankford Arsenal,” limiting the quantity for the first time to 6,000 kilograms, and prohibiting distribution to field units.

g. November 1974 – the license was modified to add authorized possession of thorium at Frankford Arsenal.

h. December 1974 – the license was modified to name the licensee as Department of the Army, Franfort (*sic*) Arsenal.

In the end, the alleged violation for possessing the DU without a license happened because SUB-459 expired in 1978, at a time when neither the Army nor the NRC believed the spent M101 rounds posed a threat to health or environment. If there had been concern then something would have been done more than 30 years ago in 1978. While the threat posed by the round remains extremely low, the Army has been nonetheless cooperative at all stages of this process, from reporting the discovery of DU, to pursuing a new license to possess it. We believe that considering the license history, the Army’s history of compliance with the conditions of the license, and based on our ongoing efforts to comply with NRC regulations as currently interpreted, no enforcement action is necessary.

Question from NRC OGC, Brett Klukan: According to NRC regulations as they existed in 1978, was the NRC permitted to authorize the Army to possess DU in the quantities in question without a license?

Answer: According to 10 CFR 40, 1978, the NRC required a specific license for the possession of source material (in this case DU) in quantities over fifteen (15) pounds. The Army possessed more than 15 pounds of DU when the license was allowed to expire in the same year. What is not clear from the NRC’s regulations is what the NRC considered “possession” in 1978. However, based on the language, and NRC treatment, of license SUB-459 over its history (as previously delineated), the Army believes that since the NRC was not allowed to authorize possession of more than 15 pounds of DU without a specific license, the NRC must have considered possession to have terminated upon the “expenditure” of the M101. There is no other viable

conclusion, considering the Army was authorized by the license to expend the round; at no time was future licensing, or removal, of the spent round included as a condition of the license; and the NRC allowed the license to expire without investigation. In addition, the other contemporaneous documents cited earlier indicate there was no interest in licensing the spent rounds based on the fact that the impact areas are closed to the public, and present little, if any, threat to health and environment.

Bob Cherry, IMCOM Radiation Safety Staff Officer:

2. If additional installations have been identified since the November 16, 2010, meeting.

Yes, a history of use of the M101 round was discovered at Watervliet Arsenal and Springfield Armory. The Army reported the discovery to the NRC immediately. The Watervliet Arsenal DU is covered by an existing source material license, and the Springfield Armory was verified by the State of Massachusetts to be free of DU.

3. For each installation identified at the November 16, 2010, meeting:

a. Whether the Army has confirmed the amount of depleted uranium (DU) present.

“Confirmation” to date consists of record searches and ground surveys. Where possible, to include 16 of the ranges, the ASR team conducted searches for the three-foot piston, which provided evidence that the round could have been fired at the range. The team was able to conduct these searches since the piston fell within 200 yards of the firing point and did not require the team to go into the impact area. At Schofield Barracks, Pohakuloa Training Area, Fort Hood and Fort Carson, the Army was able to conduct radiation surveys. Three of these resulted in confirmation of DU, while the survey at Fort Carson did not. The Army has not performed any characterization surveys for DU on any of its ranges other than Schofield Barracks, Hawaii with NRC knowledge.

b. The timeframe for completing the evaluations to determine the amount of DU present if the amount is not yet known.

The evaluation of Army records and the estimates used to “determine the amount of DU present” is complete. The Army has no plans to perform physical measurements (characterization surveys) to determine the amount of DU at any installation.

c. For each installation with DU confirmed to be present, the date the Army made the determination that DU was present as well as the date the Army believes it came into possession of DU at the installation.

*Please see the attached table.*¹⁰

4. Whether the Army has completed an evaluation to determine if DU is present at installations other than those identified in the November 16, 2010, meeting. If no such evaluation has been completed or planned, the Army should be prepared to discuss its basis for concluding that DU is not potentially present at other installations.

Mr. Edwin Valdez, US Army Corps of Engineers, St. Louis District, evaluated 65 Army installations worldwide as possible sites where the Army might have fired the M101. He chose these installations because of the presence of Army Infantry units that might have trained with the Davy Crockett system. During his analysis, he identified 21 installations (including Watervliet Arsenal and Springfield Armory) where the Army likely fired the M101. Sixteen of those installations are IMCOM installations and are subjects for the IMCOM license application process. These were identified to NRC at the November 16, 2010 meeting. Four others are already covered under NRC licenses. The Army transferred the remaining installation, Springfield Armory, to the Department of the Interior in the 1970s. Mr. Valdez is prepared to discuss his evaluation process for selecting and excluding installations from his search for the presence of M101 depleted uranium, if the NRC desires more clarity on the matter.

Question from NRC: What was the scope, process, and evaluation criterion used to identify the installations at which DU M101 munitions were fired? What is the certainty that all affected installations were identified?

Answer: In October 2007, the U.S. Army Joint Munitions Command (JMC) Safety/Radiation Waste Team tasked the U.S. Army Corps of Engineers (USACE), St. Louis District, with this project. The project consisted of an archive search effort to collect and analyze information concerning the use of the Cartridge, 20mm Spotting M101 during training with the Davy Crockett Light Weapon M28 at U.S. Army installations.

Before any installations were identified, a study of the Davy Crockett Weapon System was undertaken and a comprehensive report written. The report, RO-7 *Davy Crockett Weapon System*, described the weapon, its technical aspects, deployment scheme, training, and field use.

During the writing of RO-7, the research team studied the U.S. Army deployment concept for the weapon system. The team collected the Tables of Organization and Equipment (TO&E) that identified the authorization of the weapon to infantry battalions in Infantry, Mechanized, and Armored Divisions. We then collected the TO&Es for the authorized units that were active between 1961 and 1968.

¹⁰ Attachment 8, Table created by research team.

After we identified the units that were authorized to field the Davy Crockett weapon system, we identified their home locations/installations where they were posted and trained. We made a concerted effort to identify all potential installations these units could have been. Casting a very wide net, the search identified sixty-five (65) installations at which the weapons system could have been fielded and fired.

Prior to visiting the installations, the team conducted an extensive (6 person-months) research at the National Archives and Records Administration (NARA) at College Park, Maryland, as well as searches at other Regional NARA archives. Additional research was conducted at numerous other Federal and local repositories. This provided the project team with a broad view of the Davy Crockett weapon system, its deployment, and its world-wide use.

The team then developed eleven criteria that we used to determine and verify whether or not the Cartridge, 20mm Spotting M101 was used at a specific installation. Relevant findings were compiled and evaluated against these eleven criteria to determine which, if any, of the criteria were met.

Then, over a three-year period, each of the 65 installations was visited. Local research, interviews, and when possible, range inspections were conducted. The same rigor and detailed process was applied to the research and analysis of each installation. In writing the ASRs, information found pertaining to a particular installation was not generalized and applied to other installations, unless it was clearly an Army-wide standard. Based on all the research and application of this evaluation process, we were able to eliminate the majority of installations and ranges from the list of potential locations of DU use.

Installation-specific ASRs were written for all the installations that we determined received and/or fired the Cartridge, 20mm Spotting M101. Each ASR is a standalone report and contains only citable information and conclusions specific to the particular installation. These reports form the basis for follow-on work currently being conducted by affected installations.

The eleven criteria we established to determine and verify the use of the Cartridge, 20mm Spotting M101 during training at specific installations are as follows:

- 1) Was there a unit garrisoned or that trained at the installation that was authorized to field the Davy Crockett weapon by a Table of Organization and Equipment (TO&E)?
- 2) Was the authorized unit at the installation during target time frame (1961 –1968)?
- 3) Were M28s and/or M29s issued to units garrisoned at the installation?
- 4) Were M101 20mm rounds recorded on Form DD 550 shipped to the installation?
- 5) Were M415 or M466 37mm rounds shipped to the installation?
- 6) Was there any historic textual information documenting usage?
- 7) Were there any historical still photographs or moving pictures information?
- 8) Were there any “Davy Crockett” ranges identified on range maps?
- 9) Were any of the ranges on the installation capable of meeting the surface danger area and security requirements of the Davy Crockett weapon system?
- 10) Was there any relevant information from personnel interviews?
- 11) Was Davy Crockett ammunition debris found during the range inspection?

Relevant findings were compiled and evaluated against these eleven criteria to determine which, if any, of the criteria were met. Based on this evaluation process, we were able to conclude with a high degree of confidence in all cases, whether or not the M101 was ever fired on a particular range.

5. A description, including dates, of all actions taken or planned by the Army since the initial discovery of DU, specifically addressing:

a. Restoring compliance with NRC requirements to maintain a license to possess DU.

The Army reported the discovery of DU to NRC in 2006, which led to numerous discussions between Army and NRC staffers during 2006 and 2007 to determine if a license was necessary. Following guidance that the NRC provided, the Commanding General of IMCOM applied to the NRC for a source material license to possess M101 DU on November 6, 2008. This license asked for possession of a maximum of 8,000 kilograms of depleted uranium at “US Department of the Army installations.” The application went on to list eight Army installations “where the M101 spotting round has been found” and stated that “the NRC will be notified upon confirmation that depleted uranium is present at a given installation and that installation will then be incorporated into this permit.” The License Radiation Safety Officer (RSO) at that time was Mr. Greg Komp.

On July 8, 2009, the Army sent generic and site-specific proposed Physical Security Plans and Environmental Radiation Monitoring Plans for the Hawaii ranges.

On February 10, 2010, the Commanding General (CG) of IMCOM amended the original application to name Dr. Robert Cherry as License RSO.

On March 11, 2010, the NRC sent a letter to the IMCOM Commander regarding the plans for the other seven Army installations mentioned in the original application. The Army had not yet written these plans because we were expecting comments from the NRC about the Hawaii plans that would guide us in preparing the additional plans.

With no such comments in hand from the NRC, the License RSO wrote plans for Fort Benning, Fort Campbell, Fort Knox, and Fort Carson modeled on the previously submitted Hawaii plans. We sent the environmental radiation monitoring plans for Fort Benning, Fort Campbell, and Fort Knox to the NRC on September 13, October 26, and October 28, 2010, respectively.

Before we could send the Fort Carson environmental radiation monitoring plan to the NRC, we received the NRC’s November 30, 2010, letter, which essentially said that all previously submitted plans were inadequate and that the NRC wanted a separate amendment application for each installation after the Hawaii installations.

In response to that letter, the License RSO responded to NRC comments and wrote a revised Radiation Safety Plan and a revised Physical Security Plan for the Hawaii ranges. We sent the comments and these plans to the NRC on February 17, 2011. The only remaining action to complete the application process is to provide revised Environmental Radiation Monitoring

Plans (ERMP) for the Hawaii ranges. However, our understanding was that the NRC would be able to issue a license while the ERMP is pending.

Amendment applications for the remaining installations should follow in rapid order. The ERMPs will require qualified expert help and will take longer to submit. However, last week we identified funding for qualified environmental experts to write the Environmental Radiation Monitoring Plans not only for the Hawaii ranges, but also for M101 impact areas on the other 15 affected IMCOM installations. We have two proposals and cost estimates that we are currently reviewing for selection. When we have made a selection and have a plan production schedule in place, we will inform the NRC.

We are awaiting an NRC letter commenting on the Radiation Safety Plan and Physical Security Plan for the Hawaii ranges. The NRC held a technical meeting by telephone on March 31, 2011, with “the purpose of [discussing] the results of the [NRC] staff’s review of the Army’s revised radiation safety plan and request, dated February 9, 2011, to continue operations at the Schofield Barracks and Pohakuloa Training Area during review of the Army’s license application.” During the conference NRC staff mentioned several alterations they want made to our plans, and said they would follow up the conference with a written summation along with the required changes. Our impression was that the NRC would approve the proposed Radiation Safety Plan after the Army makes the agreed-upon changes the NRC staff provided. However, we have not received the written listing of those required changes. Once we have the plan approved, we will then modify the Radiation Safety Plan and Physical Security Plans to be site-specific for the other installations.

b. Access control to areas containing or potentially containing DU.

General access control (that is, access control for purposes other than radiation safety) has been in effect continuously at all affected IMCOM ranges since the Army fired the M101 in training. M101 impact areas are co-located with artillery and mortar unexploded ordnance. The general public does not have access to these areas. US Army Garrison Hawaii placed radiation safety access controls on areas at Schofield Barracks after the initial scoping survey in November 2006.

At Pohakuloa Training Area (PTA), radiation safety controls were put in place after the Draft ASR was published (May 2007) and listed PTA as a potential Davy Crockett range area and then further refined the controls after DU was confirmed by scoping survey in August 2007. These controls have remained in place since then. The IMCOM Commander issued an operations order on May 4, 2011 forbidding personnel to enter DU impact areas at all posts, and prohibiting firing high explosive munitions (HE) into potential DU areas.

At the October 29, 2010, meeting between the NRC and IMCOM, NRC staffers and NRC Office of General Council attorneys expressed strong concerns that USACE Battle Area Complex (BAX) construction has occurred and additional BAX construction was imminent in the DU-affected areas at Schofield Barracks without NRC authorization. I alerted US Army Garrison Hawaii about these concerns. A “pause in construction work at [Schofield Barracks battle area complex (BAX) and [the Pohakuloa Training Area] BAX” occurred immediately. Work did not

resume until a letter, dated November 24, 2010, from the NRC authorized resumption under terms of the contractor's NRC license.

c. Prevention of the spread of DU contamination.

In November 2006, after the Army confirmed the presence of DU on the Schofield Impact area, additional access controls were implemented. Access controls were already in place for the impact areas because of unexploded ordinance and live fire hazards. The DU controls included DU awareness training and required contamination monitoring of personnel and vehicles exiting the impact area. In May 2007, similar controls were put into place for Pohakuloa Training Area after the Archives Search Report identified potential DU impact areas.

It is important to understand that access to range areas is strictly controlled because of the dangers posed by unexploded ordnance and live rounds that are still fired during training. All personnel entering the range area must report in and report out with range control. It is also important to understand that the typical range complex in the Army has an interior impact area that is surrounded by numerous firing ranges. Each firing range has defined boundaries and is designed for a specific type of weapon system. Surface danger zones and safety boundaries exist for every weapon system. Access and use of each firing range is controlled and entry is limited to those using or maintaining the range. Entry into the central impact area is further restricted and rarely done because of the previously mentioned hazards.

Schofield Barracks, because of its small size is not a typical range complex. There are several ranges that overlap. That creates areas in which a small arms target may be in a location that was previously used by a system such as the Davy Crockett. To ensure the health and safety of range maintenance personnel, additional radiation safety controls were put in place. Additionally, the construction of the battle area complex created a situation that required additional radiological and chemical safety controls to be established. To my knowledge, these unique situations do not occur at other Army ranges. So no additional controls, other than restrictions on entry, and firing high explosive munitions, into potential DU areas have been established.

The Army staff office responsible for designing and upgrading Army ranges has been provided the list of potentially affected DU areas. No new targets or construction such as that occurring at Schofield Barracks are currently being considered for areas with DU residue. And as Major General Aycock mentioned, the Army safety Office has issued instructions requiring radiation monitoring of all potentially contaminated debris or scrap removed from ranges.

d. Utilization of the firing range containing DU contamination.

The Department of Defense has a longstanding policy prohibiting firing of high explosive munitions into areas containing DU. The Army has reiterated compliance with that policy in the following ways. IMCOM Radiation Safety Officer instructed all range operators not to allow firing of high explosive rounds into DU impact areas on several occasions since 2009. The IMCOM Commander issued an operations order on May 4, 2011 forbidding firing of HE rounds into DU impact areas at all posts. Non-HE rounds are still allowed into the impact areas.

e. Assuring that NRC regulatory limits on exposure to members of the public and to workers will be met.

There is a DOD policy, DODI 4715.11, which prohibits firing high explosives into an area containing DU. The physical characteristics of the M101 depleted uranium, its dispersal over impact areas, and limited personnel access to the impact areas make it virtually impossible to reach any of the NRC regulatory limits on exposure to members of the public and workers. We have exposure rate measurement results for the Hawaii ranges in reports from our contractor that support this.

As you know, depleted uranium has a very low specific activity due to the 4.5-billion year half-life of its principal constituent, uranium-238. In addition, the uranium isotopes in depleted uranium decay by alpha emission accompanied by some low-energy gamma rays. Slabs of depleted uranium do produce significant surface beta dose rates due to beta decay of immediate progeny, but (1) we do not have slabs of depleted uranium and (2) we do not have prolonged surface contact.

Air sampling at the Hawaii ranges and at every other outdoor site in my experience has never detected uranium or chemically similar transuranics at air concentrations at even a significant fraction of NRC regulatory limits. We have no reason to believe that NRC regulatory limits will be exceeded in other pathways, but we will verify this once our environmental radiation monitoring programs are in place. Dates of ground survey, flyover, and air sampling reports at the Hawaii ranges include April 2008 and monthly between February 2009, and March 2010.

f. Assuring that NRC regulatory limits on release of material will be met.

The D-38 depleted uranium alloy in the M101 (92 percent depleted uranium with about 8 percent molybdenum) is relatively inert and does not oxidize as rapidly as does uranium metal. Visual inspections for M101 rounds found on the Hawaii ranges indicate that they act differently in different environments. At Schofield Barracks the rounds oxidize at a greater rate compared to rounds at PTA. At Schofield Barracks we find a lot of yellow oxidized pieces/flakes, while at PTA we find little to no oxidization and the rounds remain mostly intact with minor degradation even after 45 years of exposure to the environment. Oxidized flakes that fall off the rounds usually remain in the immediate area of the round when the ground is left undisturbed.

As we wrote in our November 2008 license application, "Migration of depleted uranium has been and continues to be extensively studied at a variety of military installations to include Aberdeen Proving Ground, Jefferson Proving Ground, Lake City Army Ammunition Plant and the Iowa Army Ammunition Plant. Available information indicates that depleted uranium metal generally remains in the immediate vicinity where initially deposited with limited migration over the periods that the materials have been present. The potential for DU to migrate depends on a number of factors to include chemical form of the uranium; chemical characteristics of soil including pH; proximity to surface water bodies; depth to groundwater; and topography/terrain. Given that migration would generally distribute uranium over a larger area thus reducing its concentration and that dose depends primarily on the average concentration, migration would tend to lower doses but to increase the potential for low level exposures."

With the above in mind, we have no reason to believe that NRC regulatory limits on release of material will be exceeded. However, we recognize that we require data from field measurement to demonstrate this to the NRC. We expect to verify this once our environmental radiation monitoring programs are NRC-approved and in place.

g. Any restrictions for use of the firing ranges.

Department of Defense prohibitions against firing high explosives munitions into depleted uranium-affected areas predate the Army's discovery of M101 depleted uranium in 2005 on the Hawaii ranges. The Army reiterated this prohibition several times since 2005, including as follows:

- January 13, 2010: Atomic Safety and Licensing Board oral argument hearing on standing and contention admissibility
- November 17, 2010, and later: weekly radiation safety situation reports
- November 18, 2010: trip report
- April 18, 2011: symposium presentation
- April 27, 2011: broadcast email to M101-affected garrison radiation safety officers
- May 4, 2011: IMCOM OPORD

Personnel access restrictions discussed above preclude all other activities, except firing of non-high explosive munitions into a M101-affected impact area, unless an NRC-approved radiation safety program is in place.

h. Evaluations to determine if DU contamination has been transported off the ranges.

The above-mentioned restrictions on personnel access and high-explosive munitions for M101-affected impact areas are active measures to prevent DU contamination from being transported off the ranges. Similarly, monitoring of personnel and equipment as they exit M101 impact areas in Hawaii are also active measures to prevent this transport. These are all "evaluations to determine if DU contamination has been transported off the ranges." Monitoring of personnel and equipment as they exit M101 impact areas is included in the Hawaii Radiation Safety Plan. The Army will apply this same plan, to be modified to be site-specific and submitted to the NRC with license amendment applications, at all the other 15 M101-affected installations.

As previously presented, dates of ground survey, flyover, and air sampling reports at the Hawaii ranges include April 2008 and monthly between February 2009, and March 2010.

In compliance with NRC requirements, we will write environmental radiation monitoring plans for each M101-affected garrison, submit these plans as they become available to the NRC, and, once NRC-approved, implement these plans. We now have funding available to employ qualified environmental experts to write these plans. IMCOM has hired the Army Corps of Engineers and the Army Public Health Command to conduct these

Greg Komp, Army Radiation Safety Officer, Office of the Director of Army Safety

6. A description of all actions performed at the Schofield Barracks installation in support of the construction of the BAX, specifically addressing when these actions were performed and who performed them.

Pre-construction activities were undertaken in 2003 to prepare for BAX construction. Schofield Barracks Archeological initiated surveys and other support efforts for the Environmental Impact Statement. In 2004, Zapata began range clearance activities in the planned BAX construction footprint. This included survey and removal of unexploded ordnance (UXO) and scrap material from the range. It was in the pile of scrap that the tail fins from the M101 were identified in July 2005. DU was found in the scrap in August 2005.

The Army made preparations for a contractor to analytically confirm presence of DU. The Army contracted Cabrera Services in October 2006 at the beginning of a new fiscal year. Cabrera conducted the scoping survey in November 2006 and confirmed that DU was on the Schofield Barracks range. The Army instituted additional operational controls for personnel entering the impact area and informed the NRC about its discovery.

In July 2007, Cabrera began a characterization survey of approximately 425 acres. This included areas identified in the scoping surveys. This was only possible at that time because this area had been cleared of UXO and the 25th Division had been deployed and was not continually training on the range.

In June 2008, Cabrera conducted an aerial survey of a portion of the previously surveyed area to confirm that an aerial survey for DU was feasible.

In August of 2008, Cabrera began surveying previously removed scrap for radioactive materials. This continued until January of 2009. They found five pieces of DU in about 17,000 cubic feet of scrap.

In September of 2008, Cabrera began radiological surveys along the BAX construction footprint and performed source term reduction in accordance with ALARA principles and procedures in Cabrera's NRC License 06-30556-01 Amendment 2.

From November 2008 to May 2009, Parsons conducted construction activities in areas 1, 5 and portions of 2 with radiological support from Cabrera and UXO Support from Zapata. Cabrera Services established an onsite gamma spectroscopy laboratory for the purpose of analyzing construction soils for DU prior to re-use on the BAX site.

In May and June 2009, Parsons conducted construction activities in areas 2, 3, and 4 with radiological support from Cabrera and UXO Support from Zapata. Parsons only worked in areas surveyed to be free of DU at the surface. All soils moved were analyzed by the onsite laboratory for DU by Cabrera. This work was suspended in June 2009 because of Chemical Weapon Material (CWM) located on the BAX.

Parsons resumed construction work on the BAX in November 2009 with UXO, radiological, and CWM support.¹¹ This work continued until November 2010, with the exception of work stoppage due to funding issues in July and August 2010.

In December 2010, Cabrera activates NRC license 06-30556-01 Amendment 3, takes control of range. Work began again in January 2011 in areas 1 through 5 with full UXO, radiological and CWM support in place.

Post-PEC IMCOM Assessment:

Parsons (www.parsons.com) performed BAX construction activities on the Schofield Barracks DU-affected range. Zapata Engineering provided UXO support and Cabrera Services provided radiological support to these activities. The radiological support included “source term reduction” that involved surveying for DU contamination using an onsite laboratory for soil sample analysis.

If the survey and soil sample analysis results indicated DU was not present, those areas and soil were available for construction activities. However, all areas remained under Cabrera’s radiological surveillance. If DU was detected, the contaminated material was collected and disposed of in accordance with the Joint Munitions Command NRC license. The Army maintained control of contaminated materials until its ultimate disposition at an NRC-licensed disposal site.

The NRC might construe some or all of these activities as analogous to decommissioning. The Army recognizes the NRC’s authority not only over possession of source material, but also over decommissioning of DU-affected areas.

Cabrera Services did not activate its NRC license before performing these activities. Cabrera’s license, had it been activated, authorized performance of these activities with NRC knowledge and approval. Cabrera did not activate its license because Cabrera’s only role was to perform radiological surveillance of the BAX construction activities.

IMCOM hired Bob Cherry in November 2009 as its Radiation Safety Staff Officer and to become the License RSO for its NRC DU license. He determined that the NRC might not have full knowledge and concurrence with previous and proposed activities. He received assurances that the NRC was aware of these activities, but no documentation existed to establish NRC awareness. When new construction activities were contracted, he required USACE Baltimore to set up a formal information meeting with the NRC to ensure that they were aware of these new activities.

¹¹ According to the US Army Garrison Hawaii RSO, between November 2009 and November 2010, Parsons’ personnel and equipment were not frisked or monitored before they left the range. The radiological support consisted of soil sampling only. However, frisking and monitoring of personnel and equipment at other times never detected radioactive contamination or exposure above background levels.

The NRC and the Army held that meeting on October 29, 2010. The NRC notified the Army at that meeting that it had not approved the previous activities. The NRC also notified the Army that it must follow certain procedures and protocols to gain NRC approval for the proposed activities. A follow-up public meeting on November 16, 2010, affirmed those notifications.

The Army then instituted a full suspension of construction activities. The NRC gave authority to continue work under Cabrera's license. Cabrera activated its license on November 15, 2006, for Schofield Barracks. Work resumed in January 2011.

In summary, the Army now recognizes that the previous activities at the Schofield Barracks BAX construction site may not have been in full compliance with NRC regulations. We emphasize that we did not believe at that time we were violating NRC regulations, and we believed that NRC had been properly informed of and was aware of our activities. Immediately upon discovery, IMCOM took active measures (that is, asking for the October 29, 2010 public meeting, and suspending work) to comply with NRC requirements.

The Army will assure that all future activities at DU-affected portions of the Schofield Barracks BAX construction site and on all other IMCOM DU-affected ranges will be in full compliance with NRC regulations and the Army will keep the NRC informed of those activities, either directly or through its radiological contractor when the contractor's license is in effect at the site.

7. A description of the areas at Schofield Barracks that the Army determined, as part of the BAX construction project, that were suitable for unrestricted use. This description should include when such determinations were made and who specifically made them.

No areas with confirmed DU residue have been identified as releasable for restricted or unrestricted use.

The questions at the PEC demonstrated that additional information is needed to explain the areas within the impact area at Schofield Barracks and to clarify where the known DU locations were and where overlap with the BAX area might occur. The confusion stems from the following factors.

First, construction began before any DU issue was known to Schofield Barracks or its contractors. In fact, the primary reason the DU was discovered was because of unexploded ordnance clearing activities in preparation for the BAX construction. Second, upon identification of the DU, it was not known where exactly the M101 rounds had been fired. It is for that reason that a restriction was put on the entire range, pending further investigation and surveys, and consultation with the NRC.

Additionally, the now known DU area only constitutes a small area of the Schofield Barracks Impact Area (SBIA). The SBIA is approximately 2,650 acres. The area surveyed for DU during the characterization survey was approximately 425 acres, based on the ASRs. This survey was done primarily for the purpose of determining what contamination and dose rate levels were present at the SBIA and to obtain information to complete the Baseline Human Health Risk

Assessment (BHHRA). None of this work was directly in support of the BAX construction project. In April 2008, the NRC was present at the public release of the Schofield BHHRA.

In June 2008, Schofield Barracks identified the need to build three targets in an area known to have DU residue. Cabrera Services was contracted to provide radiological support for construction of these three targets. In late August 2008 questions on the BAX construction project and the DU areas came up in a teleconference. The questions indicated that there may be additional DU areas affected by the BAX construction than the previously mentioned three targets. I flew to Hawaii to obtain firsthand knowledge of the situation. Once I understood the situation, I told the Schofield team, which included representatives from Schofield Barracks (safety, legal, range, environmental, and transformation), Parsons, USACE, Zapata and Cabrera, that we might have to stop the BAX project pending decommissioning of the range area.

I called the NRC Decommissioning Branch Chief and discussed the situation with her. I asked if we had to do a full decommissioning or if there was a way to proceed with construction. She said that the NRC had allowed construction activities such as these to proceed in radioactively contaminated areas without decommissioning. During this or another conversation I asked whether we could reduce control measures if we discovered that an area was not a DU impacted area. She said that removing controls was not a problem if we subsequently discovered that it should not have been included in the first place. I do not have an email or a telephone record of the conversation, but a 27 August 2008 e-mail indicates that I was in discussions with the NRC about possible ways to move forward.

After the call with the NRC, the Schofield Barracks team met again and we discussed possible ways forward. As a group we discussed how best to control ingress and egress from the range and decided that the best approach was to establish the access control area at the entry/exit point of the range. Again the range consists of a total of 2,650 acres. The areas suspected to have DU, and that were surveyed, comprise only 425 acres of the total. Parsons would phase the work in the BAX area so priorities could be established for surveying the areas for DU.

In September 2008, the area of the entire range complex was annotated as an administrative control area for the purposes of DU awareness training and monitoring. This was because it was decided, as mentioned earlier, that the access control points for the range would be the easiest to implement. To distinguish it from the UXO and chemical controlled areas, it was called the radiological controlled area (RCA). The first map was put in place on 8 September 2008 and the RCA included all of the impact areas and most of the range complex, regardless of whether or not DU was suspected to be in those areas. This was merely an attempt to define boundaries that could easily be controlled. The BAX construction areas were designated areas 1 through 6 based on construction priorities. This numbering system was independent of the presence of DU.

The correlation between the BAX construction areas and known or suspected DU areas is as follows: Areas 1 and 5 were expected to be completely free of DU. Area 2 was expected to be free of DU, except for an area of interest on the western edge identified by the radiological surveys. Area 3 was expected to be free of DU, but we had several areas of interest in Area 3. Area 4 had several areas where DU had been detected during the scoping and characterization

surveys. Area 6 (and areas near it but outside the BAX) was determined to be the primary DU impact area during the scoping and characterization surveys.

In November 2008, a new map with areas 1 and 5 and a portion of area 2 removed, was published and put into use. The presence of DU in areas 1, 5, and the portion of 2 was never expected and surveys of potential DU areas confirmed there was no DU present. In accordance with the verbal agreement with the NRC, the RCA boundary was redrawn to exclude these areas. However, the DU awareness training was still required for anyone entering the range area. In addition, an on-site lab was established to analyze soils prior to reuse in the BAX area in case subsurface DU was encountered. This monitoring continued in all BAX areas.

A 13 January 2009 e-mail to the US Army Corps of Engineers indicates that I concurred with the Cabrera recommendation to release areas 1, 5, and a portion of 2 based on the radiological survey not finding any DU and my discussions with the NRC. A few spots were above the initial flag, but on resurvey, were shown to be free from DU. This e-mail also discusses the upcoming trip with the NRC project manager.

From 17 to 20 March 2009 the NRC project manager conducted a site visit. This included a visit to Makua, Schofield Barracks and Pohakuloa Training Area. We visited the range complex, identified the water and sediment sampling sites identified in the environmental radiation monitoring plan and visited the on-site soils analysis lab. The ongoing field work was discussed. At this time, the construction was occurring in areas 1 and 5. Cabrera was also conducting surveys in areas 2, 3 and 4. They were also collecting DU when found in areas 3 and 4 in order to reduce the source term and ensure the health and safety of anyone who might enter the range (none was found in area 2). We discussed the protocols that were in place at the time and reviewed the area map. We asked if he would like to have copies of the work plans. His response was no; that they should be available on-site for the NRC inspector to review. Until this time, we were under the impression that we were expected to provide the Field Sampling and Analysis Plan (FSAP) and the Schofield Barracks Site Radiological Health and Safety Plan for Range Construction and Maintenance Activities (RHSAP) to the NRC for review and approval during his visit.

On 1 April 2009 the remainder of area 2 was confirmed not to have DU, even though some parts of it had been identified as possible DU areas. There are survey points in which the Z-score exceeded 3.5, which is the alert level for additional screening. These areas were re-surveyed and no DU was found. Work was allowed in this area with sampling of soil piles that had been removed. A procedure was established to limit the pile size and the depth of work allowed. Any depth greater than 18 to 24 inches required clearance by both the unexploded ordinance team and the radiation survey team. The protocols for conducting spoils sampling was refined and put into effect.

In May 2009 construction was allowed to resume in areas 3 and 4. It was stopped again in June 2009 because of a concern unrelated to DU. Cabrera had completed surveys and removed DU when found. Areas were resurveyed and no DU was detected. This was done in accordance with the work plans we offered to the NRC in March. Construction resumed with DU protocols in place and with Cabrera providing radiation safety support. These protocols include the DU

awareness training, surveying equipment and personnel leaving the area, and sampling of spoils piles. To date DU has not been identified in any of the surveys or sampling. The map in effect at this time limited the RCA to area 6, the only construction zone known to have significant DU residue, and the other portions of the impact area where there is the potential for DU residue. This map was presented to the NRC during the August 2009 Category 1 meeting.

Bob Cherry, IMCOM Radiation Safety Staff Officer:

8. A description, including dates, of the manner in which the Army has suspended personnel entry into areas at the identified ranges known or believed to be contaminated with DU. If the Army has not suspended entry into areas known or believed to be contaminated with DU, the Army should be prepared to discuss its reasons for not doing so.

Within a few days of our meeting with the NRC on October 29, 2010, the Hawaii garrison commander placed a pause on BAX construction activities within M101-affected areas in Hawaii. Work resumed on November 24, 2010. We ordered other garrisons to suspend personnel entry into areas known or believed to be contaminated with depleted uranium in the following fashions:

- April 18, 2011, symposium presentation
- April 27, 2011, broadcast email to M101-affected garrison radiation safety officers
- May 4, 2011 IMCOM OPORD 11-397

Personnel at M101-affected IMCOM Regions and garrisons are engaging me almost continuously with their interest and concerns about maintaining compliance with the NRC restrictions promulgated in the OPORD, which is a direct order from the IMCOM Commanding General, Lieutenant General Lynch.

Closing Remarks

The Army's position is that the NRC should not hold it in violation of NRC regulations and licensing requirements. For the reasons stated earlier, the requirement for the Army to possess a license for DU was created upon the NRC's 2007 decision to require one after the Army reported the existence of DU on its Schofield Barracks range in 2006. The Army has worked closely with the NRC since that time and has attempted to comply with the requirement, including filing a license application in 2008. In addition, the Army conducted a diligent and thorough search of archival and historical records all over the country in an attempt to discover any possible location that DU may exist at other Army installations – and reported those findings to the NRC. Additionally, the Army believes that activities on Schofield Barracks were sanctioned by the NRC staff and that no areas were released for restricted or unrestricted access.

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		3. License No.
1. Name	Department of the Army	SUB-459
2. Address	Washington, D. C.	4. Expiration Date
		October 31, 1964
		5. Docket No.
		40-6639
6. Source Material	7. Maximum quantity of source material which licensee may possess at any one time under this license	
Uranium	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 *2/19/61* _____

For the U. S. ATOMIC ENERGY COMMISSION

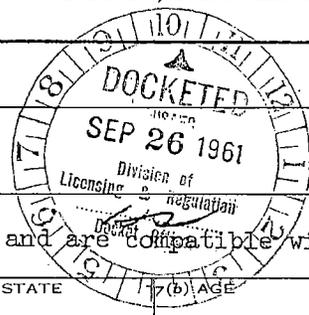
Date of issuance NOV 1 1961

40-6639
July

UNITED STATES ATOMIC ENERGY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.



1. (Check one) <input checked="" type="checkbox"/> (a) New license <input type="checkbox"/> (b) Amendment to License No. _____ <input type="checkbox"/> (c) Renewal of License No. _____ <input type="checkbox"/> (d) Previous License No. _____		2. NAME OF APPLICANT Department of Army	
		3. PRINCIPAL BUSINESS ADDRESS Washington 25, D. C.	
4. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED At such sites as are in the best interest of national defense and are compatible with the need to protect public health and safety.			
5. BUSINESS OR OCCUPATION Defense of the United States		6. (a) IF APPLICANT IS AN INDIVIDUAL, STATE CITIZENSHIP (b) AGE	
7. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED Depleted uranium will be used in projectile casings for ammunition and in other military applications where its physical and chemical properties will provide unique capabilities for national defense. Depleted uranium will not be used as a source of U-235 or Pu-239.			
8. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE			
(a) TYPE	(b) CHEMICAL FORM	(c) PHYSICAL FORM (Including % U or Th.)	(d) MAXIMUM AMOUNT AT ANY ONE TIME (in pounds)
NORMAL URANIUM	-	-	-
URANIUM DEPLETED IN THE U-235 ISOTOPE	Green salt or uranium metal	As required by specific military application	Unlimited
THORIUM	-	-	-
(e) MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME (in pounds) Unlimited			
9. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL HAZARDS ASSOCIATED WITH EACH STEP OF THOSE OPERATIONS. Depleted uranium will be fabricated into military supply items, and these items will then be stored, distributed to subordinate military units, and utilized or expended in training or combat.			
10. DESCRIBE THE MINIMUM TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE THAT WILL BE REQUIRED OF APPLICANT'S SUPERVISORY PERSONNEL INCLUDING PERSON RESPONSIBLE FOR RADIATION SAFETY PROGRAM (OR OF APPLICANT IF APPLICANT IS AN INDIVIDUAL). (For sources of data on specific procedures, controls and safety precautions covered by items 9 through 13, see attached supplemental sheets.)			
11. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9; INCLUDE: (a) RADIATION DETECTION AND RELATED INSTRUMENTS (including film badges, dosimeters, counters, air-monitoring and other survey equipment as appropriate. The description of radiation detection instruments should include the type of radiation detected and the range(s) of each instrument.) (b) METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED IN (a) ABOVE (for film badges, specify method of calibrating and processing, or name supplier.)			

11 (c). VENTILATION EQUIPMENT WHICH WILL BE USED IN OPERATIONS WHICH PRODUCE DUST, FUMES, MISTS, GASES, ETC.

12. DESCRIBE PROPOSED PROCEDURES TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE AND PROPERTY AND RELATE THESE PROCEDURES TO THE OPERATIONS LISTED IN ITEM 9; INCLUDE:
(a) PROCEDURES FOR USE OF NUCLEAR MATERIALS AND SAFETY FEATURES AND PROCEDURES TO AVOID NONNUCLEAR ACCIDENTS, SUCH AS FIRE, EXPLOSION, ETC., IN SOURCE MATERIAL STORAGE AND PROCESSING AREAS.

(b) EMERGENCY PROCEDURES IN THE EVENT OF ACCIDENTS WHICH MIGHT INVOLVE SOURCE MATERIAL.

(c) DETAILED DESCRIPTION OF RADIATION SURVEY PROGRAM AND PROCEDURES.

13. WASTE PRODUCTS: *If none will be generated, state "None" opposite (a); below. If waste products will be generated, check here and explain on a supplemental sheet:*

- (a) Quantity and type of radioactive waste that will be generated.
- (b) Detailed procedures for waste disposal.

14. IF PRODUCTS FOR DISTRIBUTION TO THE GENERAL PUBLIC UNDER AN EXEMPTION CONTAINED IN 10 CFR 40 ARE TO BE MANUFACTURED, USE A SUPPLEMENTAL SHEET TO FURNISH A DETAILED DESCRIPTION OF THE PRODUCT, INCLUDING:

- (a) PERCENT SOURCE MATERIAL IN THE PRODUCT AND ITS LOCATION IN THE PRODUCT.
- (b) PHYSICAL DESCRIPTION OF THE PRODUCT INCLUDING CHARACTERISTICS, IF ANY, THAT WILL PREVENT INHALATION OR INGESTION OF SOURCE MATERIAL THAT MIGHT BE SEPARATED FROM THE PRODUCT.
- (c) BETA AND BETA PLUS GAMMA RADIATION LEVELS (*Specify instrument used, date of calibration and calibration technique used*) AT THE SURFACE OF THE PRODUCT AND AT 12 INCHES.
- (d) METHOD OF ASSURING THAT SOURCE MATERIAL CANNOT BE DISASSOCIATED FROM THE MANUFACTURED PRODUCT.

CERTIFICATE

(This item must be completed by applicant)

15. The applicant, and any official executing this certificate on behalf of the applicant named in Item 1, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 40, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

Department of Army

(Applicant named in Item 2)

SEP 19 1961

Dated

BY

PAUL E. IGNATIUS

Assistant Secretary of the Army for Installations and Logistics

(Title of certifying official authorized to act on behalf of the applicant)

SEP 25 1961

WARNING: 18 U.S.C. Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

40-60000
file copy

man

Ordnance Corps Application for AEC General License

- A. Material for which license is requested: Depleted uranium.
- B. Scope of license: It is required that the Ordnance Corps be permitted to procure, possess, fabricate, use, transfer and export depleted uranium or items fabricated from this material.
- C. Quantity of material to be covered by license: 216,157 pounds.
- D. Utilization of material: Production of XM101 20mm spotting round for Davy Crockett weapon system.



- E. Production procedure: The green salt is shipped from Oak Ridge to Mallinckrodt Chemical, St. Louis, Mo., where it is reduced to the metal under AEC contract with funds provided by the Ordnance Corps. The dingo is shipped to National Lead, Albany, N. Y., where it is alloyed with 8% molybdenum and fabricated into barstock. The barstock is shipped to Lake City Arsenal, Independence, Mo., where it is machined to final configuration. There also, various components of the spotting round are assembled and subsequently issued to The Army Field Forces through the Ordnance supply channels. The industrial contracts may change depending upon subsequent bids received, however, the procedure will be as outlined:
 - F. Health hazards: During all of the handling operations within Ordnance Corps facilities the pertinent Army regulations are adhered to. Wipe tests of the final item show negligible rub-off. The hazard from ionizing radiation also appears negligible.
- No
change

Incl 1

TRAINING AND EXPERIENCE AT LAKE CITY ARSENAL

- A. Before commencing operation of D38 and prior to receipt of the material a considerable number of key employees, contractor and Ordnance, both in safety, technical and operating departments, made visits to appropriate locations for consultation and training in various phases of safety and health.
- (1) Instructions given at Lake City by J. Murphy Watertown Arsenal Health Physicist on safety and health aspects pertaining to D38.
 - (2) Contractor operator medical supervisor, safety supervisor, production engineer, control superintendent and others, including Ordnance representative, visited Fernald Plant JKAEC-National Lead (to consult on safety and health measures).
 - (3) Safety Engineers, contractors and Ordnance, visited Bendix-AEC plant for consultation.
 - (4) Chief Chemist, contractor operator, and numerous Ordnance Engineers (LCA-IED) visited Watertown Arsenal on consultation on air pollution and radiological controls. One member of Ordnance was a Physicist (Masters) whose background and education include knowledge and experience in basic course of atomic and nuclear physics and principles of ionizing radiation.
 - (5) Safety Engineer, Contractor Operation, took two weeks course in radiological monitoring (Radiological School, OCEM).
 - (6) Chief Process Engineer, Contractor Operation, visited Fernald Plant, Argonne National Laboratory, AEC-Albuquerque and Watertown Arsenal.
 - (7) Chief Supervisor in equipment and Chief Supervisor, Production Contractor, made visit to Watertown Arsenal to consult and study preparations prior to startup at LCA.



IN REPLY REFER TO
MEDPS-PO

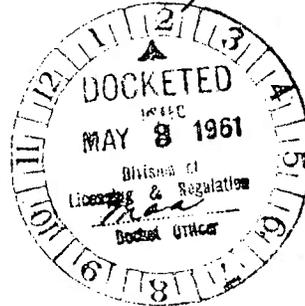
HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE SURGEON GENERAL
WASHINGTON 25, D. C.

REPORT NO. 40-6476

file

1 May 1961

Licensing Branch
Division of Licensing and Regulation
U. S. Atomic Energy Commission
Washington 25, D. C.



40-6639
info only

Gentlemen:

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 proposed end use of the item.

Sincerely,

Charles W. Kraul

1 Incl
Application for
License (in trip)

CHARLES W. KRAUL
Lt Colonel, MC
Preventive Medicine Division

A/1



HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ORDNANCE
WASHINGTON 25, D. C. Mr. Thorkildsen/ymp/79004

40-6476

IN REPLY REFER TO:

ORDTN

2 June 1961

U. S. Atomic Energy Commission
Licensing & Regulation Division
Germantown, Maryland
ATTN: Mr. Lyall Johnson

40-6639
Improvement
man

Dear Sir:

Reference is made to AEC letter dated 26 May 1961, file L&R: DH-40-6476 to Hdq. DA, ATTN: Lt. Col. Kraul. The following information is provided to support the Ordnance Corps request for a license to procure, possess, fabricate, use, transfer and export depleted uranium or items fabricated from this material.

Each XM101 spotting round contains .414 pounds of depleted uranium. The shell bodies are machined on turret lathes. During machining operations, the cutting tool and spotting round body are continuously wet down by a coolant. The building housing the machining operation has controlled ventilation. Hoods over potentially hazardous machining operations collect and pass the air through electrostatic precipitators.

To date, there has been no incidents of uranium fire. However, the fireman have been trained on actions to be taken in the event of a fire in the area where the depleted uranium is being machined.

It is estimated that from a 20 pound piece of barstock, 14 pounds is waste material. This waste material will be disposed of through Army channels by the Chemical Corps.

With respect to the burning operation described in the "Heavy Metals Manual", a burning ground is used for conventional materials. No depleted uranium has been burned, nor is there any intent to dispose of the depleted waste material in this manner.

Visitors passing through the machining building are required to wear paper aprons, or smocks to insure that their clothing does not pick up any depleted uranium dust. These paper garments are disposed of by burning.

A/2

Inclosed herewith is a statement of the advanced training provided not only to safety department personnel, both contractor and Ordnance, but to engineering and production personnel, as applicable.

The last ABC inspection at Lake City Arsenal by the Albuquerque Operations Office Safety Office reported that controls were good and training adequate. No discrepancies were reported.

Sincerely,

1 Incl
Training &
Experience at
LCA


GERALD D. BURKE
Deputy Chief
Nuclear & Special Components Branch
NS&D Division

Copy furnished:

OCISGO

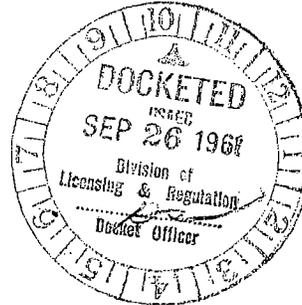
ATTN: Col. MacMurray



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D. C.

DOCKET NO. 40-6639
filed

SEP 19 1961



Mr. Harold L. Price
Director of Regulation
United States Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Price:

The purpose of this letter is to request a comprehensive source material license for the Department of Army.

As you know, depleted uranium is officially classified as a source material because it retains limited value as a source of U-235 and Pu-239, and is therefore subject to special regulation under the Atomic Energy Act of 1954. The Army is planning to use depleted uranium in applications unrelated to its potential as a source material and has encountered administrative difficulties in complying with the special regulations governing its use.

Of most immediate concern are depleted uranium projectiles for spotting rounds for the DAVY CROCKETT weapons system. Depleted uranium is ideal for this application because its great density permits unique ballistic characteristics. In developing these rounds the Chief of Ordnance, Lieutenant General Hinrichs, has found it necessary to seek and obtain a license from the Commission authorizing him to possess depleted uranium and to fabricate and test these projectiles. However, since Lieutenant General Hinrichs commands only the Ordnance Corps of the Army, the present license does not permit transfer of projectiles to the field units which will employ them, nor does it permit expenditure of rounds in practice or combat. In addition, it does not provide for other uses of depleted uranium foreseen by the Army.

I understand that the administrative problems of providing depleted uranium to the Army were discussed by the Commissioners and the members of the Military Liaison Committee at a joint meeting on 10 August 1961, and that Dr. Seaborg stated the difficulties could readily be overcome by issuing a more comprehensive license. While licensing may not be the best long-term solution, I recognize that in view of the present wording and interpretation of the Atomic Energy Act it offers the most expeditious solution to this urgent problem.

*no cy. sent to PDR or Compliance instructions
as w/holding was never cleared up*

K/B

Mr. Harold L. Price

Therefore, request that the existing license to the Chief of Ordnance be withdrawn, and that a new license be issued to the Department of Army. This license should authorize possession of depleted uranium without quantity limitation and should permit fabrication, testing, export, issue to subordinate organizations, and expenditure of this material in uses other than production of U-235 or Pu-239. Appropriate Commission application forms are forwarded with this letter.

The Army staff is of course available to provide any assistance or additional information you may desire in resolving this matter.

Sincerely yours,



A Tyler Port

Acting Assistant Secretary of the Army
(Installations and Logistics)

1 Incl (In quad)
License Application

Copy furnished
Chairman, AEC



IN REPLY REFER TO ORDTM

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ORDNANCE
WASHINGTON 25, D. C.

40-6476
re foring

26 September 1961

U. S. Atomic Energy Commission
Division of Licensing & Regulation
Germantown, Maryland
ATTN: Mr. D. Nussbaumer

COCKET NO. 40-6639
improving

Dear Sir:

Reference is made to AEC letter dated, 14 June 1961.

It is requested that the Ordnance Corps Source Material License number SUB-307 be amended to permit Frankford Arsenal, Philadelphia, Pa., to possess, fabricate, use, transfer, and test spotting rounds containing depleted uranium. To date, Frankford Arsenal has received source material on an SS accountability station.

Attachments 1, 2, and 3 contain pertinent information as to the processes the source material will under-go and the measures taken to minimize danger to life or property.

There are approximately 15 employees engaged (part time) in machining, melting, and casting of uranium. Each of these employees, in addition to those listed below, are given an in-house familiarization course on the potential hazard and the procedures which must be enforced. The following is a list of the participating personnel concerned with control and accountability of source material.

<u>Function</u>	<u>Name</u>	<u>Position</u>	<u>Ars. Group</u>
SS Accountability Rep.	F. Blocke	Admin. Officer	R&D
SS Accountability Rep. (Alt.)	A. Saia	Metallurgist	"
Health Physicist (Advisor)	S. Berk	Chemist	"
SS Responsible Rep.	R. Edelman	Metallurgist	"
SS Responsible Rep.	R. Walters	Ind. Engr.	"

A/4

OKRFB

Mr. D. Nussbaumer

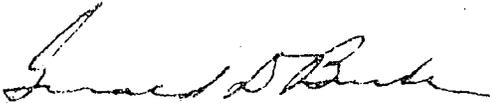
Safety	T. P. Atkinson	Safety Engr.	I.S. & S
Health	Dr. L. P. Devlin	Post Surgeon	Services
RD Control Officer	R. A. Patterson	Dep. Ch.	I.S. & S.

Mr. G. Berk has a B. S. in chemistry and has attended the Oak Ridge School. Mr. P. Bloche, in addition to taking the in-house course, has visited and conferred with personnel of Dow Chemical, Watertown Arsenal, and Rocky Flats, relative to health and safety practices.

For the past 2 years, this installation has been surveyed by the Albuquerque Operations Office, concerning health and safety procedures. The reports indicate, "the health protection programs are consistent with programs that have been successful at other installations". "They also conform to AEC guidelines and health procedures".

Waste material from this operation will be disposed of through Army channels by the Chemical Corps.

Sincerely,



GERALD B. BURKE
Deputy Chief
Nuclear & Spec Compts Br
R&D Division

3 Incls

1. Draft
2. Trip Rpt
3. Tech Ins

Copy Furnished:

The Surgeon General

ATTN: Lt. Col. MacFarlay w/o Incl

DOCUMENT NO. 40-6639

copy

SUPPLEMENT TO APPLICATION FOR SOURCE MATERIAL LICENSE

General

The most immediate Army use of depleted uranium will be in projectiles for ammunition. The following table lists the documents which collectively will constitute Army policy for control and use of depleted uranium in this application.

These or comparable documents will also govern use of depleted uranium in other future applications.

Additional documents will be published as the need arises. It is anticipated that in the near future a new Army regulation will be published consolidating policy on depleted uranium.

Copies of the listed documents will be transmitted separately to the AEC staff.

" see Negro's file "

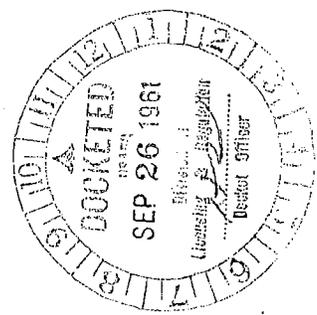
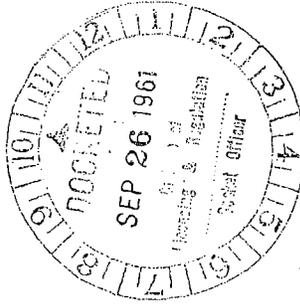


TABLE OF DOCUMENTS

see reports file

Documents	Areas of Applicability			
	<u>Fabrication</u>	<u>Storage, Distribution, or Disposal</u>	<u>Utilization</u>	
1. Field Manuals				
a. FM 9-5: Ammunition service, Ordnance		X		
2. Technical Manuals				
a. TM 9-1100: Inspection of Ordnance materiel in hands of troops		X		
b. TM 9-1903: Care, handling, preservation and destruction of ammunition		X		
c. TM 9-1904: Ammunition inspection guide		X		
3. Army Regulations				
a. AR 40-414: Noncombat personnel dosimetry	X		X	
b. AR 40-580: Control of hazards to health from radioactive materials	X		X	
c. AR 40-582: Evaluating and reporting internal exposure to radioactive materials	X		X	
d. AR 210-84: Report of loss, theft and recovery of government property	X		X	



Areas of Applicability

	<u>Documents</u>	<u>Areas of Applicability</u>		
		<u>Fabrication</u>	<u>Storage, Distribution, or Disposal</u>	<u>Utilization</u>
e.	AR 385-10: Army safety program	X	X	X
f.	AR 385-20: Administration of Army safety program	X	X	X
g.	AR 385-40: Accident reporting and records	X	X	X
h.	AR 385-60: Coordination with Armed Services Explosive Safety Board		X	X
i.	AR 385-63: Regulations for firing ammunition for training, target practice and combat			X
j.	AR 700-945: Safeguarding weapons and ammunition		X	
k.	AR 711-1300-8: Ordnance ammunition stock status report		X	
l.	AR 735-5: Property accountability, general principles and policies	X	X	
m.	AR 742-910: Ammunition inspection and lot number report		X	
n.	AR 755-380: Disposal of radioactive material	X	X	
4.	Special Regulations:			
a.	SR 210-20-20: Training areas and facilities for ground troops (ranges)			X

Areas of Applicability

Fabrication Storage, Distribution, or Disposal Utilization

Documents

5. Miscellaneous Publications

- | | | | |
|---|---|---|--|
| a. MTFB 15-VI: Shipment of explosives and other dangerous articles | X | | |
| b. MTFB 11-VIII: Proper placarding and labeling of shipments of ammunition, explosives and dangerous articles | X | | |
| c. Cir 700-8: Security of small arms and ammunition | X | | |
| d. ORD M 3-4, Vol. I and II: Ammunition control | X | | |
| e. Frankford Arsenal SOP for Machining Depleted Uranium Metal | | X | |
| f. Watertown Arsenal monograph on uranium alloys for critical Ordnance components | | X | |
| g. Lake City Arsenal heavy metals manual | | X | |

Registered Patent



HEALTH PHYSICS STUDY DURING FIRING
OF URANIUM XM101 PROJECTILE

By

J. D. MURPHY

WATERTOWN ARSENAL
WATERTOWN, MASS.

Incl #2

HEALTH PHYSICS STUDY DURING FIRING
OF URANIUM XM101 PROJECTILE

- A. Manufacture of XM101 Projectiles
- B. Tactical Use of XM101 Projectiles
 - 1. Handling and Loading of the Projectile
 - 2. Firing of the Weapon
 - 3. Post-Firing Environment and Points of Contact
 - a. Breathing Zone of Personnel Using the Weapon
 - b. Bore Cleaning
 - 4. Impact Area
 - 5. Conclusions
 - 6. Technical Addendum

Prepared by:

J. D. MURPHY
Health Physicist
Watertown Arsenal

19 February 1960

HEALTH PHYSICS STUDY DURING FIRING
OF URANIUM XM101 PROJECTILE

A. Manufacture of XM101 Projectiles

The potential hazards in the manufacturing, i.e., melting, alloying, machining, etc., of the components of the uranium XM101 have been taken care of by the existing standard operating procedures as specified by the Watertown Arsenal Health Physics Office based on the limits as delineated by the Atomic Energy Commission in the Federal Register, 10 CFR, Part 20.

These procedures have been provided to Lake City Arsenal, Aberdeen Proving Ground, and Frankford Arsenal. This cooperative effort has materially expedited the alloy development, manufacturing and application of uranium material. Briefly, health physics studies conducted during melting and machining operations during the past year at Watertown Arsenal have demonstrated that the procedures implemented have effectively controlled the potential hazards to within small fractions of the permissible tolerances.

B. Tactical Use of XM101 Projectiles

1. Handling and Loading of the Projectile

Wipe tests performed on the projectile to evaluate that which could be picked up in handling showed that only extremely minute amounts of radioactive material could be wiped off. The data fall well below the minimum permissible tolerances. Our concern, however, is not for this surface radiation, but from the possibility during handling of it becoming part of the atmosphere. The wiping tests indicate that this is not a problem. The results of these tests are in Graph I. There is no health hazard involved in the handling of the uranium components in the tactical use of the round.

2. Firing of the Weapon

The circumstances of firing are no different from any conventional weapon. Normal operating procedures observed in testing and tactical use of conventional weapons are completely satisfactory for the uranium XM101 projectile.

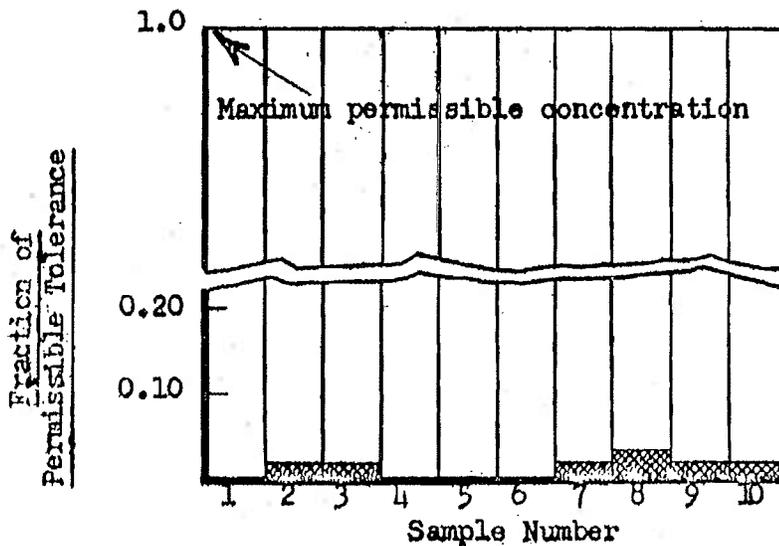
3. Post-Firing Environment and Points of Contact

a. Breathing Zone of Personnel Using the Weapon

The Watertown Arsenal Health Physics Laboratory has experimentally measured the amount of radiation resulting from particles of uranium given off during actual firing. The results as shown in Table 1 and the bar graph II

(shown below) clearly demonstrate that the amount of radiation and hence the amount of uranium particles (dust) given off is negligible. In four out of ten samples taken, no uranium dust could be measured with even the most sensitive instruments, and in all other cases was less than 0.6% (1/160) of maximum permissible tolerance.

In addition, there is no problem of cumulative concentrations in successive firing because of the extremely small amount of uranium material released to the atmosphere.(1)



GRAPH II

b. Bore Cleaning

Wipe tests were made on the bore surface of the gun barrel after firing of one round and after firing four consecutive rounds. One cleaning (wipe) removed all traces of radioactivity after firing one round, and only two cleanings (wiping passes) were required to remove all traces of radioactivity after firing four rounds. Test results are given in Table 2. The data shows that all traces of radioactivity were easily cleaned out.

No epidemiological hazard exists from cleaning the weapon, and the cleaning rags are not active enough to be considered a disposal problem.

(1) Recommended limits of exposure to airborne uranium dust as accepted by the Atomic Energy Commission and required under license in accordance with Atomic Energy Commission Regulation 10 CFR, Part 20. 70 dpm/m³ (disintegration per minute per cubic meter of air) or 50 μgr/m³ (micrograms per cubic meter of air).

The rags are below that amount which the Atomic Energy Commission would consider contaminated. The recommendations of this author would be to dispose of the rags in any waste container and use standard bore cleaning procedures.

4. Impact Area

Earth samples were taken from Lake City Arsenal and Aberdeen Proving Ground where testing of the uranium XM101 was performed. The earth samples were leached of their uranium with nitric acid solution and evaluated fluorometrically. 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 has been suggested that the permissible concentration level for soil might safely be set at 100 times the value for water.⁽²⁾ This suggestion was given by the Health and Safety Laboratory, Atomic Energy Commission, New York Operations Office. It is worth noting that no limit for ground contamination is given in Atomic Energy Commission Regulation 19 CFR, Part 20. 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 above-mentioned Atomic Energy Laboratory.

5. Conclusions

The results of the evaluated test data demonstrate that the use of the uranium in the XM101 is not an epidemiological health hazard. The standard operating procedures as exercised in the use of any conventional weapon will be adequate.

6. Technical Addendum

Sampling and Counting Techniques: All air samples were taken, using breathing zone, constant volume air samplers designed by Watertown Arsenal's Health Physics Laboratory. Samples were evaluated with an internal proportional counter on a 2π basis using an argon and methane gas mixture. In order to improve upon the reliability of the measurements extremely long counting times had to be resorted to because of the very low level of radiation encountered in these tests.

Field monitors included geiger counters with anton tubes which incorporate thin-walled geiger tubes which use a halogen quencher. Eberline gas flow, alpha survey meters were also used.

(2) 1040 micrograms of uranium per gram of soil (parts per million, ppm).

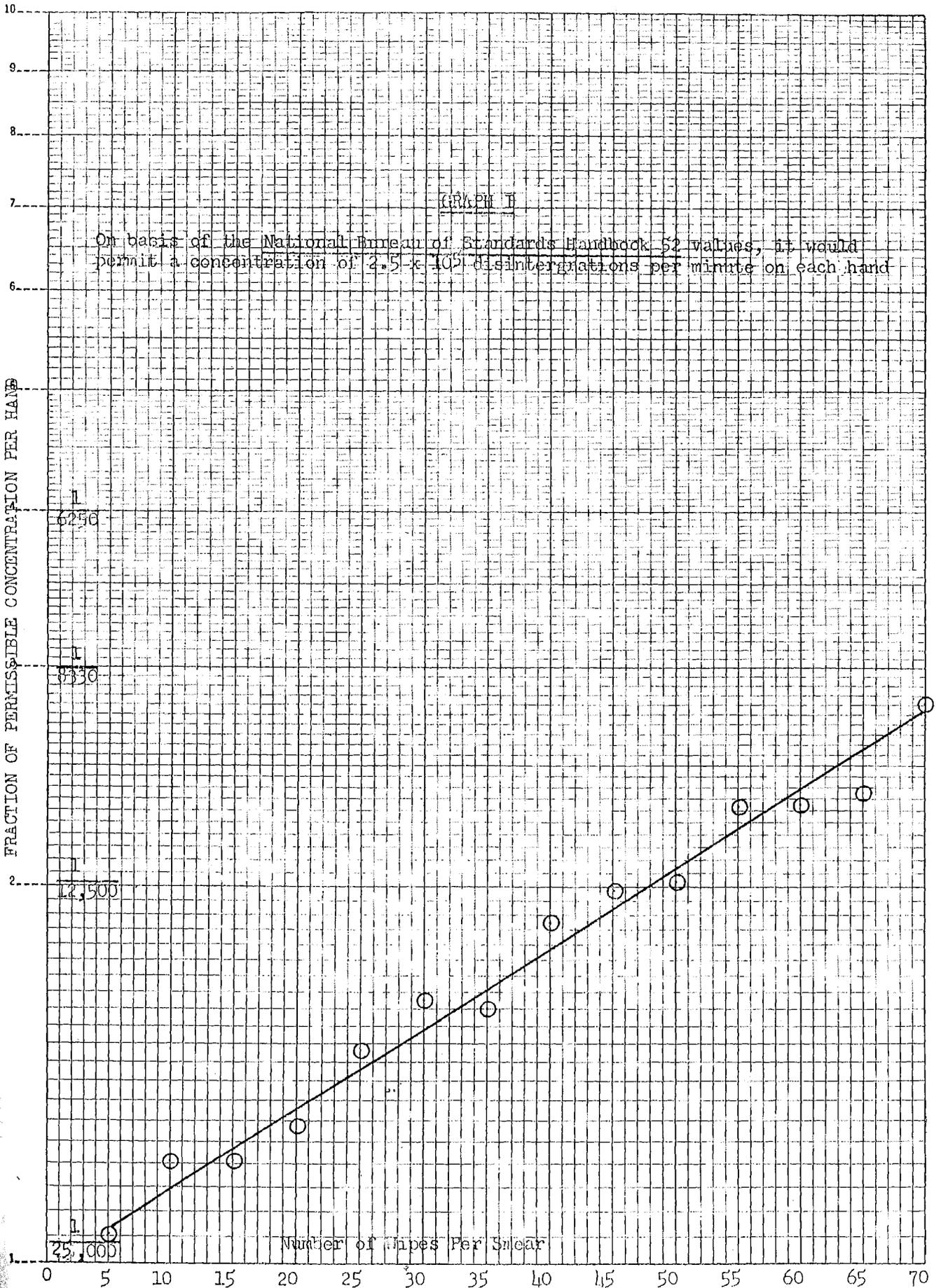


TABLE 1

DATA TAKEN PER ROUND AT BREATHING ZONE OF OPERATOR WHILE TEST
FIRING URANIUM XM101 AT LAKE CITY ARSENAL, 5 FEBRUARY 1960

<u>Sample No.</u>	<u>Location</u>	<u>dpm/m³ (above bkgrd)*</u>	<u>Fraction of Permissible Tolerance</u>
1	Breathing Zone	0	0
2	" "	0.4 ± 0.01	0.0057
3	" "	0	0
4	" "	0.2 ± 0.02	0.0029
5	" "	0	0
6	" "	0	0
7	" "	0.2 ± 0.02	0.0029
8	" "	0.4 ± 0.01	0.0057
9	" "	0.2 ± 0.02	0.0029
10	" "	0.4 ± 0.01	0.0057

* dpm/m³ disintegration per minute per cubic meter. Background, self-absorption, standard correction, and geometry were all considered in the calculation.

TABLE 2

WIPE TEST PERFORMED ON THE INNER SURFACE OF THE GUN BARREL
AFTER FIRING THE URANIUM XM101

<u>No. of Rounds Fired</u>	<u>Total d/m*</u>
1 (one) - 1st wipe	6.7 ± 0.03
2nd wipe	0
4 (four) - 1st wipe	48.8 ± 0.02
2nd wipe	9.1 ± 0.04
3rd wipe	0

* d/m (disintegrations per minute). Background, self-absorption, standard correction, and geometry were all considered in the calculation.



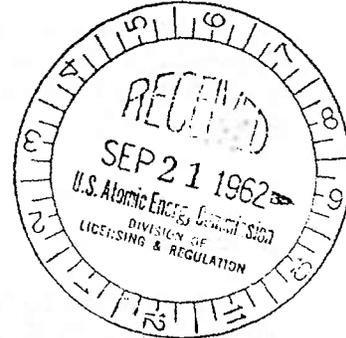
DOCKET NO. 40-6639

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR LOGISTICS
WASHINGTON 25, D. C.

L&R File Copy

SEP 20 1962

Mr. Donald A. Nussbaumer
Chief, Source and Special Nuclear Materials Branch
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, D. C.



Dear Mr. Nussbaumer:

Reference is made to your request of 20 August 1962 for additional information in connection with the Army request of 26 July 1962, to amend Source Material License SUB-459. The required information is submitted as follows:

a. The drawings of the artillery round which will contain source material is attached as inclosure 1. Their fabrication and use, including field use, can be performed at the locations and in accordance with the procedures and conditions specified in Item 8 of License SUB-459.

b. Inclosure 2 includes the procedures followed during fabrication and use of the uranium. These procedures are set forth in greater detail in the draft of a TM on fabrication and handling of depleted uranium which was furnished to your office for comment about two months ago.

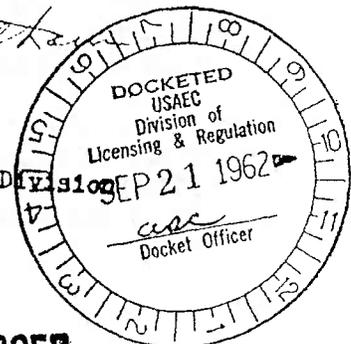
c. Based on the Report of Radiological Hygiene Special Study No. 3993R21-62, Part I and Part II, dated 27 December 1961, there are no radiological health hazards associated with the artillery ammunition (see inclosure 3).

19

Sincerely yours,

Jesse R. Cheatham

JESSE R. CHEATHAM
Colonel, GS
Chief, Industrial Division



- 3 Incl
1. Pic. & Draw. of Art. Rnd.
2. Ltr to CG, OrdWpnsCmd
3. Ltr to SurGen frm AEHA
dtd 27 Dec 61 w/stdy

ACKNOWLEDGED

9172

Ordnance Corps Application for AEC General License

- A. Material for which license is requested: Depleted uranium.
- B. Scope of license: It is requested that the Ordnance Corps be permitted to procure, possess, fabricate, use, transfer and export depleted uranium or items fabricated from this material.
- C. Quantity of material to be covered by license: 216,157 pounds.
- D. Utilization of material: Production of M101 20mm spotting round for Navy Crockett weapon system.
- E. Production procedure: The green salt is shipped from Oak Ridge to Mallinckrodt Chemical, St. Louis, Mo., where it is reduced to the metal under AEC contract with funds provided by the Ordnance Corps. The ingot is shipped to National Lead, Albany, E. V., where it is alloyed with 8% molybdenum and fabricated into barstock. The barstock is shipped to Lake City Arsenal, Independence, Mo., where it is machined to final configuration. There also, various components of the spotting round are assembled and subsequently issued to The Army Field Forces through the Ordnance supply channels. The industrial contracts may change depending upon subsequent bids received, however, the procedure will be as outlined.
- F. Health hazards: During all of the handling operations within Ordnance Corps facilities the pertinent Army regulations are adhered to. Wipe tests of the final item show negligible rub-off. The hazard from ionizing radiation also appears negligible.

Incl 1

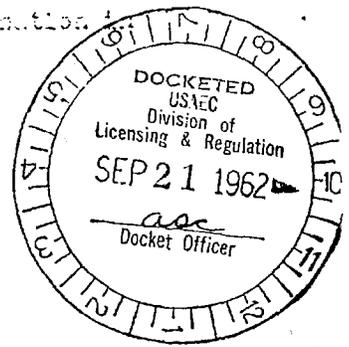
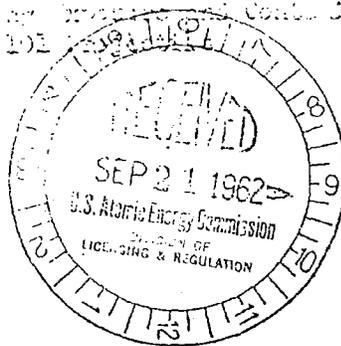
L&R File Copy

JAF:rol/edf/42204

40-6639-2

SUBJECT: Test Proposal for Potential for Personnel Contamination
Connection with the W-101

TO: Commanding General
Ordnance Weapons Center
Islet Island, Illinois
ATTN: Col R. J. Santorini



1. Development and Proof Services Center will address all the questions concerning the potential secondary contamination resulting from the handling and firing of W-101 projectiles have not been inadequately resolved. It is felt that only by the availability of empirical test results with all the present and prospective users of the W-101 projectiles will all the present and prospective users of the W-101 projectiles be completely satisfied. Just as with any other features of a weapon system, theoretical answers alone are insufficient.

2. Since W-101 is faced with the requirement to fire a large number of W-101 projectiles in the near future, it appears that these firing tests will provide an excellent opportunity to make a study to determine the exposure and contamination associated with the handling and firing of the projectiles. The incident test proposal has been prepared for your consideration. It will be noted that except for the static demonstration of W-101 projectiles, all data will be derived from firings paid for by other test programs planned for the W-101 projectiles. Thus, the cost for the incident test proposal is relatively low, only \$300. Although the cost of the test is covered with the usual amount of exposure and contamination, it is nevertheless desirable to conduct another necessary test program designed to prove the weapon system. The information obtained should be of interest to USAEC, especially as it relates to training activities, to the Ordnance General, and to Ordnance installations involved in firing the projectiles.

3. Present W-101 practices as related to the W-101 cables for testing, training activities to protect personnel against radiation exposure, handling of W-101 in dust, and the tracking of contamination are of the following nature: (a) personnel handling projectiles carry full protective gear, personnel entering the impact area either wear foot coverings or are suitcases off impact, handling time of projectiles is limited, and firing is not permitted when there is a possibility that the wind will blow dust from a detonation upon personnel. Our philosophy is based upon three tenets: (a) all unnecessary exposure to ionizing radiation should be avoided, (b) exposure records of personnel should be

Inclosure 2 to R/S
7/29/61 - dtd -

DOCKET NO. 46 6639

L&R File Copy

HEADQUARTERS
U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY
UNITED STATES ARMY MEDICAL SERVICE

CLASS II ACTIVITY
OF
THE SURGEON GENERAL

ARMY CHEMICAL CENTER
MARYLAND

27 DEC 1961

IN REPLY REFER TO:

EA-108

SUBJECT: Report of Radiological Hygiene Special Study No. 3993R21-62, Part I

TO: The Surgeon General
ATTN: MDEPS-PO
Department of the Army
Washington 25, D. C.

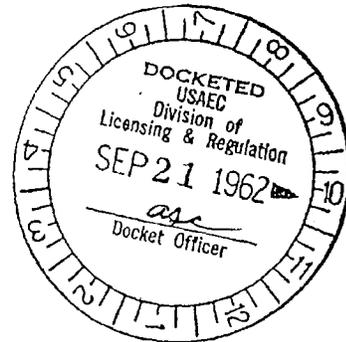
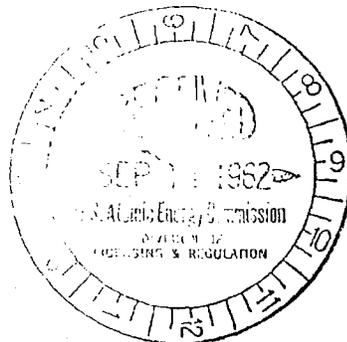
1. Enclosed is Report of Radiological Hygiene Special Study, Part I, MFL01 Spotting Round, conducted at Lake City Arsenal, Independence, Missouri, on 25-27 October 1961, by Lt Colonel Ralph S. Penner, MC, Chief, Radiological Hygiene Division, and Major Ralph J. Walsh, MSC, Assistant Director, Processing Services, of this Agency. This report includes findings of the study, conclusions based on these findings, and recommendations of this Agency with respect to certain of these findings.

2. Part II of this report covering Industrial Hygiene will be forthcoming in the near future.

Charles W. Kraul
CHARLES W. KRAUL
Lt Colonel MC
Command

1 Encl
Rpt of Rad Hyg Spec Study
(MFL01 Spotting Round)

18



3 to file
log/81- d/c

9172

HEADQUARTERS
U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY
UNITED STATES ARMY MEDICAL SERVICE

CLASSIFICATION
OF
THE SURGEON GENERAL
USAEHA-MR

ARMY CHEMICAL CENTER
MARYLAND

27 DEC 1961

REPORT OF RADIOLOGICAL HYGIENE SPECIAL STUDY NO. 3993R21-62
PART I
XM-101 SPOTTING ROUND
26-27 OCTOBER 1961

1. AUTHORITY.

a. AR 40-557, par 13.

b. Letter, ORDRS, Office of the Chief of Ordnance, 15 September 1961, subject: "Health Hazards Associated with the XM101 Projectile", thru The Surgeon General, to this Agency.

2. PURPOSE. The purpose of this study was to accomplish the following objectives:

a. To evaluate the radiation exposure to personnel processing and packing XM-101 projectiles and rounds.

b. To evaluate radiation levels in areas of storage of bar stock, scrap, and projectiles.

c. To evaluate the fate of the round during firing and radiation levels of the impact area.

3. STANDARDS.

a. Title 10, Part 20, Code of Federal Regulations, "Standards for Protection Against Radiation".

b. Handbook 42, "Safe Handling of Radioactive Isotopes", dated September 1956.

c. TB MED 254, "Permissible Dose from External Sources of Ionizing Radiation", dated 6 May 1957.

d. AR 40-414, "Noncombat Personnel Dosimetry", dated 26 November 1957.

4. INSTRUMENTATION. The following radiation detection instruments were used.

a. Eberline 112 Beta Gamma Survey Meter.

b. Nuclear Chicago Scaler with Alpha Scintillation Crystal.

5. FINDINGS.

a. Storage of Bar Stock and Scrap from Machining. Bar stock was stored in crates outside Bldg A-3. Plastic covering protected the crates from weather. Four packages were brought into the building at a time. These were stored just inside Bldg A-3 until processing. Measurements of gamma radiation on bar stock crates were as follows:

Center of top surface of crates	1.5 mr/hr
Sides and ends of crates	0.8 mr/hr

Scrap was stored in old powder containers. The scrap was placed in these metal cans, and the cans were filled with water. A large number of these cans of scrap were currently stored in a tin storage shed behind Bldg A-3. Prior to shipment the water was removed and the case was filled with oil. This case was sealed within a 55-gallon drum for shipment. Measurements of gamma radiation on scrap containers were as follows:

Tops of containers	0.5 mr/hr
Sides of exterior row of containers	0.8 mr/hr
Sides between rows of containers	1.2 mr/hr

Rejected bar stock was also stored behind Bldg A-3. These rods were lying in open containers and covered an area 5 x 10 feet. The highest reading of gamma radiation was at surface contact in the center of this area. Here a reading of 4 mr/hr was obtained. This decreased as the probe tube was moved toward the edges or away from the surface. A few old rounds that had not turned black from oxidation were wiped to determine if oxidation caused radioactive material to be released from the surface. See Appendix, Sample 2, for alpha count wipes.

b. Processing Area, Bldg A-3.

(1) The first step of processing was to cut bar stock into the proper length. The cut pieces were placed in wire racks containing 100 pieces each. A cartload of these cut pieces gave the highest levels of radiation found in the processing area. Radiation levels of the loaded cart were as follows:

Center of cart, contact with sections	4.0 mr/hr
Edge of cart	1.0 mr/hr
Location of person pushing cart	0.5 mr/hr

USAEHA-MR Rept of Rad Hyg Spec Stdy #3993R21-62, Part I (XM-101 Spotting Round) dtd 26-27 Oct 61

Missiles, during processing movement, were handled in wire baskets containing 100 missiles. In this manner they were moved from one station to the next. After the projectiles were shaped, readings remained rather constant in intensity. Gamma radiation levels of loaded wire basket with 100 projectiles were as follows:

Central portion, top	1.8 mr/hr
Edges, location of hands in handling	1.1 mr/hr
Measurement of beta and gamma radiation to body from a carried rack	6.0 mr/hr
Measurement of beta and gamma radiation to hands	20.0 mr/hr

(2) Measurements of radiation as received by a person operating a processing machine were negligible.

c. Loading of the Projectile into the 20-mm Case and Packaging of the Round, Bldg 65.

(1) The processed rounds gave slightly lower readings than the projectiles during processing because of the partial shielding provided by the steel shell case and the increased distance between rounds. Rounds were stored, 100 per box, in open cardboard boxes until packaged for storage and shipment.

(2) Gamma radiation levels per box were 1 to 1.2 mr/hr.

(3) Dose to person pushing cart of projectiles, beta and gamma, was 2 mr/hr.

d. Storage.

(1) Finished and boxed XM-101 rounds were stored in large steel ammunition chests containing 80 rounds per chest packaged in cardboard boxes of five rounds each. Thirteen boxes were stacked in an aggregate. Reading of gamma radiation at the surface of the containers was 0.7 mr/hr. When the probe was placed between four chests, a reading of 1 to 1.2 mr/hr was obtained. There was no beta radiation outside the chest.

(2) The multiple point sources of the rounds did not behave as a plane source and there was no significant buildup as the number of rounds increased.

e. Evaluation of the 1600-yd Impact Area, Lake City Ordnance Range.

(1) The ground in this area, which measures approximately 250 ft square, is of clay, scraped free of sod. About 1000 rounds had been fired into the area from a fixed mount weapon. Very little dispersion occurs with this type of firing. A number of recent craters were present in the area.

(2) Radiation measurements of the area with the instrument at waist level were not above background. Measurements of recent craters indicated general levels at ground surface to be from 0.05 to 0.1 mr/hr. When a fragment was lying on the surface, readings slightly above 0.2 mr/hr occurred. Radiation measurements indicated that the fragments were well confined within a two-foot radius. The majority were within the fragmented ground which was about one square foot. Occasional pieces blew free from the crater area. The fuse and anterior body were buried to an average depth of six inches. The tail section and fragments were about three inches or less below the surface. There was no indication of burning or oxidation of the recovered fragments.

(3) Old craters were measured for activity. This was 0.05 mr/hr or less at the surface. No exploration was conducted since one could not determine if the round was a dud. The fresh craters had been marked where duds had impacted.

(4) Observations would indicate that there is no hazard to personnel from the fired rounds. Since no burning occurs and radiation is localized, (see appendix, samples 3 and 4) recovery of the fragments, if desired, would not be difficult since 30 to 40 percent of the round remains with the nose and tail sections and could be recovered with a minimum of dirt. Location of rounds can be made with a beta gamma survey instrument. However, the hazard to personnel from unexploded ordnance would make decontamination undesirable.

f. Personnel Processing XM-101 Rounds. Those personnel who handled or processed depleted uranium were on a film badge-monitoring system supplied by Lexington Signal Depot. All visitors coming into the area were also monitored by film badges. Bioassays of urine for uranium were made on employees every six months. Film badge reports were reviewed on ten workers. Four were inspectors; the remainder worked at one of the processing stations. The inspectors received the highest dosage, since they had permitted rounds to accumulate before the extent of the exposure was discovered.

USAEHA-MR Rept of Rad Hyg Spec Stdy #3993R21-62, Part I (XM-101 Spotting Round) dtd 26-27 Oct 61

<u>Inspector</u>	<u>Time</u>	<u>Beta</u>	<u>Gamma</u>
A	6 mos	340 mr	82 mr
B	6 mos	602 mr	85 mr
C	6 mos	498 mr	58 mr
D	6 mos	252 mr	28 mr
<u>Workers</u>	<u>Time</u>	<u>Beta</u>	<u>Gamma</u>
A	20 mos	50 mr	84 mr
B	14 mos	332 mr	72 mr
C	14 mos	160 mr	112 mr
D	14 mos	0 mr	17 mr
E	14 mos	20 mr	66 mr
F	14 mos	85 mr	50 mr

Assays on urine ranged from .000 mg per liter to .003 mg per liter. These were done by the New York district of the AEC every six months. Since there was no area in the process or storage area that reached 2 mr/hr of gamma radiation, there was, in effect, no radiation area. In view of the low film badge readings, the film badge service was not indicated since it is impossible to exceed the maximum permissible levels of whole body gamma radiation.

6. CONCLUSIONS.

- a. There was no hazard to personnel from external radiation from any number of XM-101 rounds or component parts.
- b. There was no apparent hazard to personnel from firing the XM-101 nor was there a radiation hazard to personnel in the impact area.
- c. Oxidation from aging of the XM-101 projectile did not cause removable radioactivity.

7. RECOMMENDATIONS.

- a. Lake City Arsenal should be relieved of the requirement of maintaining a film badge monitoring service.

USAEHA-MR Rept of Rad Hyg Spec Stdy #3993R21-62, Part I (XM-101 Spotting
Round) dtd 26-27 Oct 61

b. Area monitoring and bioassay procedures should be continued
for evaluation of the possible internal hazard during processing procedures.

APPENDIX

BETA - ALPHA ACTIVITY ANALYSES

Scintillation (Beta Crystal)

Background = 27.8 cpm

Standard $\text{Sr}^{90} \rightleftharpoons 12 \times 10^3$ cpm

Efficiency = $\frac{1025}{12 \times 10^3} = 8.5\%$

<u>Sample</u>	<u>Gross Count 10/min</u>	<u>cpm</u>	<u>-Bg</u>	<u>Net cpm</u>
1 (Prec wipe)	955	95.5	27.8	67.7
2 (Round wipe)	480	48.0	27.8	20.2
3 (Range wipe of missile from range)	366	36.6	27.8	8.8
4 (Range dirt sample)	10947	1094.7	27.8	1066.9

Scintillation (Alpha Crystal)

Standard $\text{U}^{238} \rightleftharpoons 2400$ cpm

Efficiency = $\frac{853}{2400} = 35\%$

<u>Sample</u>	<u>Gross Count 10/min</u>	<u>cpm</u>	<u>-Bg</u>	<u>Net cpm</u>
1 (Prec wipe)	166	16.8	-0	16.8
2 (Round wipe)	70	7.0	-0	7.0
3 (Range wipe of missile from range)	33	3.3	-0	3.3
4 (Range dirt sample)	32	3.2	-0	3.2

USAEHA-MR Rept of Rad Hyg Spec Stdy #3993R21-62, Part I (XM-101 Spotting
Round) dtd 26-27 Oct 61

Ralph S. Fenner

RALPH S. FENNER
Lt Colonel, MC
Chief, Radiological Hygiene Division

Ralph J. Walsh

RALPH J. WALSH
Major, MSE
Assistant Director, Engineering Services

APPROVED:

Charles W. Kraul

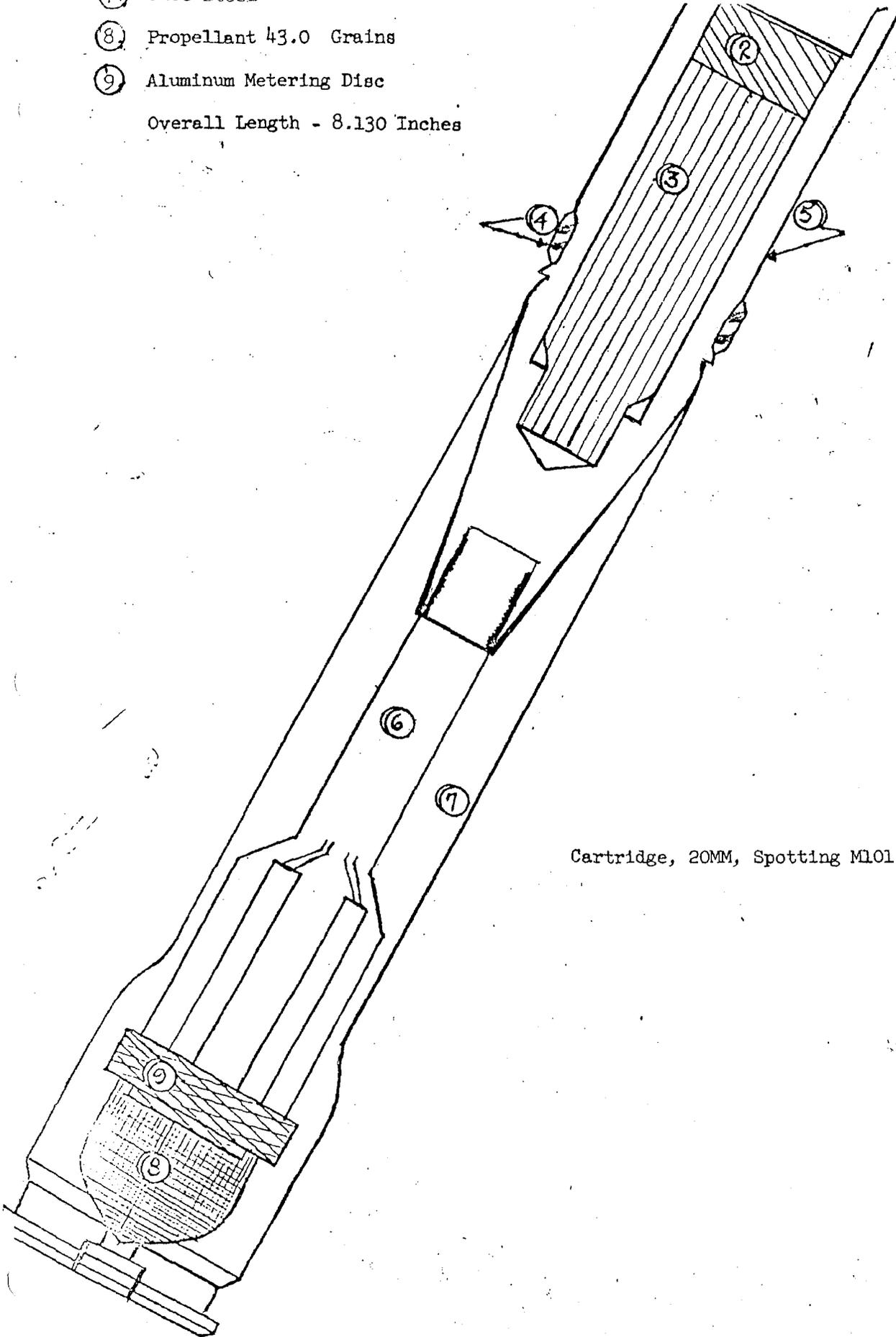
CHARLES W. KRAUL
Lt Colonel, MC
Commanding

① Case Steel

⑧ Propellant 43.0 Grains

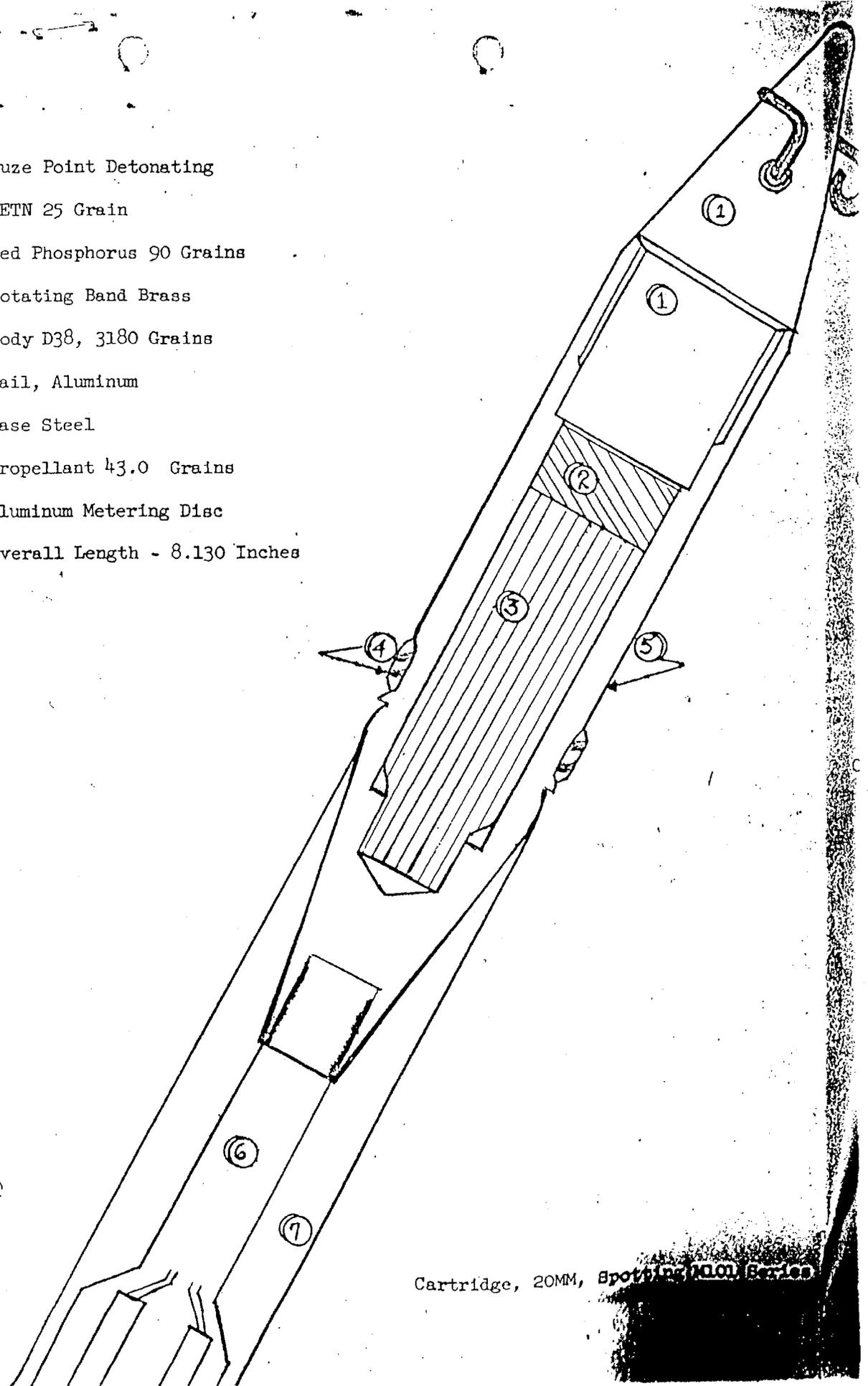
⑨ Aluminum Metering Disc

Overall Length - 8.130 Inches



Cartridge, 20MM, Spotting M101 Series

- ① Fuze Point Detonating
 - ② PETN 25 Grain
 - ③ Red Phosphorus 90 Grains
 - ④ Rotating Band Brass
 - ⑤ Body D38, 3180 Grains
 - ⑥ Tail, Aluminum
 - ⑦ Case Steel
 - ⑧ Propellant 43.0 Grains
 - ⑨ Aluminum Metering Disc
- Overall Length - 8.130 Inches



Cartridge, 20MM, Spotting (M10) Series

COMPLIANCE INSPECTION REPORT

1. Name and address of licensee Department of the Army Washington 25, D. C. (Lake City Arsenal, Independence, Missouri)	2. Date of inspection November 20 and 21, 1963
	3. Type of inspection Assist
	4. 10 CFR Part(s) applicable 20 and 40

5. License number(s), issue and expiration dates, scope and conditions (including amendments)

SUB-459 8-26-63 10-31-64
(Docket No. 40-6639)

6. Inspection findings (and items of noncompliance)

7. Date of last previous inspection ---	8. Is "Company Confidential" information contained in this report? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (Specify page(s) and paragraph(s))
--	--

DISTRIBUTION:

eeh
.....**Charles E. Norelius**.....
(Inspector)

Approved by: *FD*

November 20 and 21, 1963

D E T A I L S

GENERAL INFORMATION

9. This initial inspection of this licensed program at Lake City Arsenal was conducted on an unannounced basis on November 20 and 21, 1963.
10. Mr. Kenneth Miller of the State of Missouri Public Health Department was notified by telephone on November 13, 1963 of this scheduled inspection. Mr. Miller indicated at that time that he would be unable to accompany the AEC representative during the inspection.
11. At the time of this inspection, the following persons were interviewed and provided information given in this report:

Wayne A. O'Neil - Property Administrator, Army
Ordnance
M. R. Rudolph - Property Disposal Officer, Army
Ordnance
R. Elsea - Senior Clerk Aid in Planning and Scheduling, Remington
E. W. Hill - Supervisor of Production, Remington
R. E. Belser - Chief Chemist, Remington

The inspection purpose and results were discussed with J. F. Callahan, Program Manager, Army Ordnance in the presence of Mr. H. Zacha, Army Security Control Officer.

PROGRAM

12. Lake City Arsenal, Independence, Missouri has been involved in the manufacture of 20 millimeter spotting rounds in which the basic part of the projectile is constructed of depleted uranium. (This has been called the D-38 Program.) fuse located inside of the uranium cylinder is designed to explode on impact so that a visual siting of the impact location could be made and used for guidance of the artillery rounds. Uranium is used because of its weight.
13. This program began during 1960. At that time, the title to the uranium used at Lake City Arsenal (Ordnance plant) was apparently held by the Atomic Energy Commission with the ordnance plant being an SS Accountability Station which used the material under contract. On June 14, 1961 License No. SUB-307 was issued to the Department of the Army, Ordnance Corps authorizing use of depleted uranium at the Lake City Arsenal. License No. SUB-459 was issued on November 1, 1961. This was amended on August 26, 1963 and it is this license under which the work has been conducted. On December 21, 1961, Lake City Arsenal ceased to be an SS Accountability Station for AEC and apparently received title for the uranium on hand which totaled 77,674.3 pounds. (See Exhibit A)
14. The Remington Arms Company, Inc. receives and fabricates the uranium for the Army at Lake City Arsenal. The depleted uranium is purchased from Oak Ridge National Laboratory in the form of a green salt. After transformation into uranium metal, it is sent to National Lead Company, Nuclear Metals Division, Albany, New York where it is alloyed with 8 per cent molybdenum. Originally the alloyed material was shipped to Lake City Arsenal in the form of bar stock. It was machined into slugs weighing about 1.19 pounds each before being made into spotting rounds. Eventually, National Lead also machined the bar stock and Lake City Arsenal received all uranium in the form of slugs. These slugs

November 20 and 21, 1963

14. (continued)

were then machined into projectiles which had a weight of 2,888.93 grains (approximately .376 pounds) of uranium each. Remington completed the production of spotting rounds using uranium during September 1963.

15. At the time of this inspection, Remington possessed about 328 pounds of uranium in the form of slugs, 8,307 finished projectiles (about 3123 pounds) and 64,623 pounds of alloyed uranium in the form of chips and scrap. The later was being held pending shipment to the Army Chemical Corps.

ORGANIZATION

16. License No. SUB-459 has been issued to the Department of the Army for use at Frankfort Arsenal, Picatenny Arsenal and Lake City Ordnance Plant. Lake City Ordnance Plant is part of the Ammunition Procurement and Supply Agency with headquarters at Joliet, Illinois and reports through that group to the U. S. Army Munitions Command. The Lake City Ordnance plant is Government owned but operated under contract by Remington Arms Company, Inc.
17. The Commanding Officer at Lake City Arsenal is Lt. Col. Bruce Pierce. J. F. Callahan is the Program Manager and is the highest civilian in a management position. Mr. O'Neil, Property Administrator, reports to H. F. Slusher, Contract Administrator. Mr. Slusher reports to J. F. Callahan. Mr. M. R. Rudolph, Property Disposal Officer, has been responsible for handling all waste in the D-38 Program. Mr. Rudolph also reports to Mr. Callahan.
18. Mr. E. Sparre is the Plant Manager for Remington Arms Company, Inc. at Lake City Arsenal. C. F. Henderson is the Superintendent of the Planning and Scheduling Department and Mr. M. R. Elsea is the Senior Clerk Aid in that Department. Mr. D. W. Hill is the Chief Supervisor of Production who had the responsibility for producing the projectiles from the slugs. Mr. R. E. Belser, Chief Chemist had the responsibility for making evaluations of the hazards involved in receiving and handling the uranium. Dr. M. R. Bay, Director of the Medical Department, had the responsibility of the personnel monitoring program.
19. The Heavy Metals Subcommittee of Remington has had the responsibility of seeing that the depleted uranium would be handled safely. The committee members are:

R. E. Belser, Chief Chemist - Chairman
M. R. Bay, MD, Medical Director
E. L. Head, Safety Department
E. W. Hill, Supervisor of Production
C. F. Henderson, Superintendent of
Planning and Scheduling
H. Phillips, Fire Department

This committee established the personnel monitoring and survey procedures with the help of AEC personnel from the Albuquerque Operations Office and Bendix Corporation in Kansas City. This committee reviewed the program periodically to reduce exposures and better evaluate the hazards. This subcommittee reported to an Army Safety Committee.

20. Mr. R. Elsea stated that in this program the Department of the Army orders ammunition rounds of certain specifications. The Process Engineering Department of Remington determines what material must be purchased in order to fill the specifications. The Planning and Scheduling Department then originates a requisition for this material through the Purchasing Department. All purchase

November 20 and 21, 1963

20. (continued)

orders must be approved by Ordnance personnel. Once purchased, the material is handled in the Production Department. In general the program is operated by Remington but controlled by Army Ordnance.

RADIOLOGICAL SAFETY PROCEDURES

21. At the time of the inspection, Mr. O'Neil was the only individual who maintained a copy of License No. SUB-459. He was the only one observed to have a copy of the written procedures involving handling uranium which were incorporated in a manual entitled "Heavy Metals Manual". A copy of these procedures were submitted with the application for License No. SUB-307 dated June 2, 1961.
22. Mr. Belser and Dr. Bay both possessed copies of Part 10 CFR 20 which had been rewritten with specific parts having written comment on them.

FACILITIES

23. The Lake City Arsenal is located approximately 5 miles east of Independence, Missouri. All depleted uranium was received, used and stored in Section D-38 of Building 3A. This area was divided into 6 separate bays. In each bay a separate operation was being accomplished. There were machines used for the original cutting of the bar stock, milling machines, grinders and tapping machines. Each machine was equipped with exhaust system such that most of the dust generated in the process should be drawn through an electrostatic precipitator. Mr. Hill explained that during operations each machining process was water cooled with the exception of the tapping operation. This entire D-38 area was restricted by the licensee by locking and posting all entrances to the area.
24. Scrap metal from this operation was placed in 55 gallon drums on the back loading dock of Building 3A. When the drums were full they were covered and sealed and moved to a storage area along side of the railroad tracks near Building 3A. At the time of this inspection, the licensee still had some materials in storage and it was observed that these 55 gallon drums were piled together inside of a chained and posted area.
25. At the time of this inspection, the area and all machines which had been used in manufacturing the spotting rounds had been decontaminated. (The water used for decontamination went to the licensee's industrial waste holding pond.) The machines had all been oiled for storage. On the date of this inspection sealer was being applied to the floors of the D-38 facility.

EQUIPMENT

26. Instrumentation possessed by the licensee included a Hurricane high volume air sampler, a Gelman low volume air sampler, an Eberline E-1128-1 meter using a GM probe (this instrument had ranges of 0 to 20 mr per hour with 1, 0.1 and 0.01 scale factors), an Eberline SAC-2 alpha scintillation counter and an Eberline Model PAC-3 alpha gas flow counter.

PERSONNEL MONITORING AND EXPOSURE DETERMINATION

27. Each individual who was permanently assigned to do work within the D-38 area was issued a film badge on a 4 week basis. The issuing of badges has been handled through the Remington Medical Department. These badges had been ana-

November 20 and 21, 1963

27. (continued)

lyzed by the Lexington Signal Depot. Records of film badge results were available for each individual who had worked during the period from December 4, 1960 through November 4, 1963. Because the licensee had used a 4 week exposure period, it was not possible to determine 13 week totals. A separate record has been kept for each individual. The numbers on this record were transcribed from the Lexington Signal Depot's report. On these reports a separate reading was given for beta exposure and gamma exposure in most cases. However, there were some times when there would be a number given without specification as to beta or gamma exposure. In general, the film badge records showed that during 1961 exposures were higher than they have been in the past year and a half. In some cases, the badges showed for a 4 week period, an exposure of 500 to 600 mr beta exposure. However, in many cases a note was also made in the record showing that the badge had spot contamination on it which would show the high exposure to the badge and would not necessarily reflect exposure to the individual. Mr. Belser of the Chemistry Department explained that after 1961 when exposure readings were higher than the subcommittee thought they should be, corrective action was taken by placing Lucite shields on some machines to eliminate much of the beta exposure. He stated that they developed a polyethylene cover which could be placed over the badge. He said that the thickness of this material was such that the reduction in beta transmission would only be about 10% according to their investigations. Film badge records showed that the problem of spot contamination on the badges was eliminated with the use of these covers for the badges. The review of the film badge records showed that in general, if any exposure was shown at all, that the gamma exposures were less than 25 mr and that the beta exposures ranged from 50 to 100 mr per 4 week period.

28. At the beginning of work in this area and at each 6 months thereafter, urinalyses were performed for each employee. The urine samples were analyzed by USAEC Health and Safety Division of the New York Operations Office. The maximum reading obtained from urinalysis was for Mr. William Moss on 12/28/61. The results of this test showed 0.015 milligrams uranium per liter. All other results ranged from 0.001 to 0.007 milligrams per liter.

RADIATION SURVEYS AND/OR EVALUATIONS

29. When the D-38 project was in operation, surveys were conducted by personnel from the Chemistry Department every 2 weeks. These surveys included a check on the air flow rates at each machine and at the face of each exhaust hood for that particular machine, a physical radiation survey to determine radiation levels in terms of mr per hour, and an analysis of removable and fixed alpha and beta gamma contamination.
30. Physical radiation surveys were conducted on each incoming shipment of depleted uranium to assure that there was no leakage from the containers and also that the shipment contained only depleted uranium. A physical radiation survey was also conducted as the shipments were being unpackaged. After this, surveys were conducted every two weeks at the various locations of use and the results of these surveys were recorded in terms of mr per hour.
31. Wipe tests were taken and analyzed by use of an alpha scintillation counter. An alpha gas flow counter was used to determine the fixed and removable contamination in each area. Areas checked included floors, working surfaces, surfaces of parts being worked upon and the electrostatic precipitator in the exhaust system. The results of these surveys were recorded in terms of counts per minute. The electrostatic precipitator was found to contain measurable quantities

November 20 and 21, 1963

31. (continued)

of radioactive materials. A system was set up whereby the filters in the system were cleaned every 3 months. It was required that they set up a maintenance log on these units to assure that the filters were cleaned at the prescribed schedule.

32. Each survey in the D-38 area included a check of the air flow at the machining location and at the vent to the exhaust system. The exhaust system was set up such that a higher air flow would be drawn from an area which would generate the most dust such as the grinding operation. A review of these records showed that the air flow at each machine ranged from 100 to 600 linear feet per minute while the velocities at the hood openings usually located within one foot of the machining location ranged from 1000 to 2300 feet per minute.
33. Air samples were taken by the licensee using high volume and low volume air samplers. These were taken in general areas to determine background, in areas next to the machines and in breathing zones. The air samples were counted and converted to micrograms per cubic meter of air. The counting times and conversion to micrograms was based on a paper entitled "Determination of Uranium and Air Dust Samples by Alpha Counting Methods" by J. H. Harley and E. Jetter of the Health and Safety Division of the New York Operations Office. A review of this paper indicated that the counting times were based on a 20% error at the 90% confidence level. The highest report ever shown as a result of this air sampling program was 150 micrograms per cubic meter. If it is assumed that all this activity was due to U-238 the airborne concentration would be approximately 5×10^{-11} microcuries per milliliter which is still within the permissible levels for continuous airborne concentration in a restricted area. Mr. Belser explained that this high reading was due to a leak in the exhaust system and records indicated that as soon as this leak was corrected the air samples became less than 50 micrograms per cubic meter. Mr. Belser also explained that they made air surveys during the most extreme conditions such as during grinding operations. He pointed out that these grinding operations would usually last only from 2 to 3 hours a day and that grinding would not be done everyday so their assumption was that if they were within the limits during the most hazardous operation this would put them well below the maximum permissible limits on an average basis.
34. The licensee has conducted periodic surveys of the industrial waste holding pond and the creek into which this water is released. All water which had been used in processing and cleaning of the D-38 area went to this waste holding pond. The records of the analysis of the 200 milliliter samples which were collected showed less than 1 count per minute of alpha contamination from the holding pond while the creek showed up to 2.6 counts per minute maximum. In general, creek samples were higher than holding pond samples in all cases. Both were low and insignificant.

POSTING AND LABELING

35. Although there was no work being done in the D-38 area the doors to this area were still all posted with the radiation caution symbol and the words "Caution Radiation Area - Restricted Area - Authorized Personnel Only".
36. On the loading dock in back of Building 3A there were waste barrels located each of which were labeled with a sign and the colors of magenta on yellow bearing the words "Contaminated Waste". When the barrels were full they were removed to a storage area beside the railroad track. This area was in the open with a chain around it which had signs hanging from it in the colors of magenta on yellow bearing the radiation caution symbol and the words "Caution Radioactive Material".

November 20 and 21, 1963

WASTE DISPOSAL

37. The waste from this process has been scraps and chips coming from the machining processes. The procedure used for disposal has been that whenever Remington has a load of material for disposition, they would inform Mr. M. R. Rudolph, Property Disposal Officer of the Army, who would arrange for the disposal and give authority and instructions for disposition. Records maintained by Mr. Rudolph showed that the first shipment containing 3,948.83 pounds of chips and turnings was made on 9/26/61 to the Army Chemical Corps, U. S. Army Center, Maryland for disposal. A second shipment containing 8,503.4 pounds was made to the same organization on 5/1/62. Another shipment containing 64,623 pounds was sold by the Defense Surplus Sales Office at Fort Leavenworth, Kansas to S. W. Shattuck Chemical Company, 1805 South Bannock Street, Denver 23, Colorado. Mr. Rudolph stated that the contract officer at Fort Leavenworth would have the information concerning that recipient's license number. At the time of this inspection, the licensee possessed 24,061.3 pounds of scrap pending shipment to the Chemical Corps.
38. The uranium which had been machined into projectile parts had been shipped to various Army installations within the United States and abroad. These were to be used as spotting rounds. The dispersion of isotopes in this manner is authorized by this license.

REPORTS OF THEFT AND LOSS

39. Those interviewed stated that no depleted uranium had been lost or stolen.

INCIDENTS OR UNUSUAL OCCURENCES

40. Those interviewed stated that there were no incidents or unusual occurrences with regard to the use of this material.

RECORDS

41. Mr. Elsea, Senior Clerk Aid in the Planning and Scheduling Department had records showing dates and amounts of receipt of all depleted uranium. He also maintained all information showing the amount of material on hand at the time of this inspection. Mr. Rudolph maintained records showing the depleted uranium which had been shipped as waste.

LICENSE CONDITIONS

42. The following shows the status of compliance with the conditions of this license.

Condition 8 - "Authorized Use"

This inspection was limited to the use of uranium at the Lake City Ordnance Plant, one of 3 locations which are authorized in this license. At the time of this inspection, they were doing no actual fabrication of spotting rounds using the depleted uranium. Discussion with the persons who had been involved in this program and observation of the facility which had been used indicated that the licensee had been manufacturing these spotting rounds in accordance with procedures which had been submitted by the Ordnance Corps in previous license applications. The artillery rounds which had been manufactured had been distributed to various field units of the Army to be used for the spotting of impact areas. The use appears to be in accordance with the specifications of this license.

Continuation Sheet #7
Army, Department of the
Independence, Missouri

November 20 and 21, 1963

MANAGEMENT DISCUSSION

43. The purpose of this inspection and the results were discussed with Mr. J. F. Callahan. Mr. Callahan was informed that the program regarding use of depleted uranium appears to have been conducted with due regard for radiation safety and that no item of noncompliance was noted. Mr. Callahan was informed that he would receive no written comment on this inspection directly from Region III but rather that correspondence from the AEC would be directed to Department of the Army, Washington, D. C.

Enclosure:
Exhibit A

WESTERN UNION TELEGRAM
WESTERN UNION TELEGRAM
WESTERN UNION TELEGRAM
WESTERN UNION TELEGRAM

WUZ113 WUF217 SA313

5 MI. PD WAX O BROOK ILL 20

JACK ROEDER DIVISION OF COMPLIANCE U S ATOMIC ENERGY COMMISS
376 HUDSON ST NYK

PLS FORWARD LICENSE NO SUB-495 DOCKET NO 40-6639 ISSUED TO
DEPARTMENT OF THE ARMY WASHINGTON, D.C. WHICH AUTHORIZES USE
AT PICATINNEY ARSENAL, FRANKFORT ARSENAL, AND LAKE CITY ARSE
AT INDEPENDENCE, MISSOURI ALSO FORWARD BACKUP MATERIAL, PART
LETTERS DATED SEPTEMBER 26, 1961, SEPTEMBER 20, 1962 AND AL
13, 1963 INCLUDING ANY ATTACHMENTS. WE MADE INSPECTION AT LA
CITY ARSENAL, SINCE WE HAVE LICENSE NO SUB-307, DOCKET NO 40
ISSUED TO DEPARTMENT OF THE ARMY, WASHINGTON D.C. , WHICH
AU HORIZES USE AT LAKE CITY ARSENAL. HOWEVER, LICENSEE REPR
ADVISED NEVER HAD COPY OF SUB-307 LICENSE BUT DOES
HAVE COPY OF SUB-495 UNDER WHICH INSPECTION THEREFORE MADE.
~~IT WOULD APPEAR THAT SUB-495 SUPERSEDES SUB-307 . WE WOULD~~

LIKE FILE WAS SOON AS POSSIBLE SINCE INSPECTOR IS

ANXIOUS

TO PREPARE ASSIST REPORT

JAMES M. ALIAN, REGION 111

SUB-495 40-6639 26 1961 20 1962 13 1963 SUB-307 40-6476 SUB.
SUB-495 SUB-49 SUB-307
(or).

941A EST DEC 11 63

PLS ACK

R WUZ113 HGA TNX

APR 11 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:
→ Socket file
DR Reading file
Division Reading file
Branch Reading file
J. A. McBride, DML
H. Shapar, OGC
H. L. Price, DR
Secretary (2)

21

J. A. McBride 4/10/69

OFFICE ▶	DML	DML	OGC	DR		
SURNAME ▶	Nussbaumer/mad	J. A. McBride	W. H. Price	HLPrice		
DATE ▶	4/8/69	4/11/69	4/9/69			



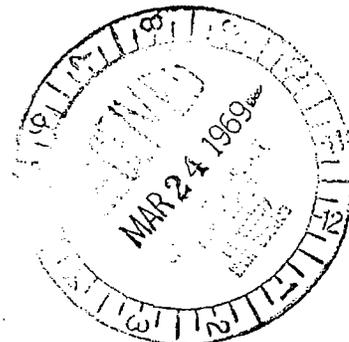
DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY MATERIEL COMMAND
WASHINGTON, D.C. 20315

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



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.

1009

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-ISB w/Incl
CG, MUCOM, ATTN: AMSMU-SS-SD w/o Incl



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

To: John Manfre
(703) 617-5469

August 18, 2003

Docket No. 040-08702
License No. SUB-01339 (Terminated)

Mark Hankin, President
Hankin Management Company
P. O. Box 26767
Elkins Park, PA 19027

SUBJECT: FORMER NRC LICENSED FACILITY AT BRIDGE AND
TACONY STREETS, PHILADELPHIA, PENNSYLVANIA

Dear Mr. Hankin:

This refers to the former Frankford Arsenal facility in Philadelphia, Pennsylvania. The U. S. Army was licensed primarily for the use of depleted uranium (DU) at the Frankford Arsenal by the U. S. Atomic Energy Commission (AEC), the predecessor of the U. S. Nuclear Regulatory Commission (NRC). License No. SUB-00459 authorized the possession and use of unlimited quantities of DU, for fabrication and testing of military ordnance, and thorium, for thin coatings on optical lenses, from 1961 to about 1978. Other isotopes used in research activities on site included Hydrogen-3 (tritium), Promethium-147, Thallium-204, and Krypton-85. In 1976, the facility was declared excess to the Army's needs and Frankford Arsenal was closed on September 30, 1977. License No. SUB-00459 was superceded by License No. SUB-01339, which was issued in 1978 for the decontamination of the Frankford Arsenal. Remediation activities were conducted in 1980-1981 and License No. SUB-01339 expired in 1983.

NRC records for these licenses were reviewed as part of an NRC program to ensure that facilities, where activities authorized by the AEC or NRC licenses that have been terminated, were suitable for release for unrestricted use in accordance with current NRC guidelines. As part of this program, our contractor, Oak Ridge National Laboratory (ORNL), reviewed each terminated license file and scored it according to a system designed to identify facilities which require additional review by NRC staff. In general, files that indicate that licensed material may have been used at particular facilities, but that did not include adequate final survey records for these facilities, were identified for additional review. The review by ORNL identified License No. SUB-01339 as a file describing a site which required additional surveys to ensure that buildings and property were properly decontaminated and any residual radioactive contamination of NRC licensed material was less than the limits for release for unrestricted use.

M. Hankin
Hankin Management Company

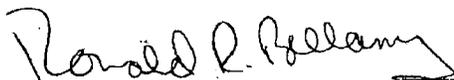
2

In July, 2000, the U. S. Army Materiel Command formally transferred responsibility for site assessment to the Formerly Used Defense Sites (FUDS) Program and assigned the U. S. Army Corps of Engineers (USACE), Baltimore District, to conduct activities to ensure proper site closure. The USACE, Baltimore District, contracted Cabrera Services, Inc., to complete a site historical review and radiological surveys to identify residual radioactive contamination remaining on the property. On July 28, 2003, a final report, "Radiological Scoping Survey Report for the Former Frankford Arsenal, Philadelphia, PA." was submitted.

We have completed our review of this report and confirmed that exposure rate and contamination survey results of the former Frankford Arsenal facility meet the NRC dose based release criteria for unrestricted use. NRC will not require any additional decommissioning in response to future NRC criteria or standards, unless additional radioactive contamination is found indicating that there is a threat to public health and safety. This completes our review of the activities at this site and we plan no further action.

No reply to this letter is required. Your cooperation with us is appreciated.

Sincerely,



Ronald R. Bellamy, Chief
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety

cc:
Robert J. Williams, Jr., Army Corp of Engineers, Baltimore District
Michael J. Borlisky, Army Materiel Command
Dustin Armstrong, PADEP

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.

Picatunny Arsenal

Picatunny 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.

Reviewed by: _____ **Date** _____

Approved by: _____ **Date** _____

Attachment 1 for ORNL Sites - Summary
License No. SUB-00459

? Frankford Arsenal

Building 23: In the 1940's, radium used for some of the original watch work was stored here. The basement was remodelled and used as the NCO club. Contamination may have been covered during the remodelling.

Building 44: (1977) Used for receiving DU. The DU was then sent to a holding area near Building 44.

Building 45: Used for threading the DU rounds.

Building 55 and 58 Balcony: (1977) DU machining area (finish grinding).

Building 64: Major laboratory work was conducted here. The second floor was used for corrosion studies.

Building 108: Tritium devices were assembled and stored on the third and fourth (location of major work effort) floor and basement (for storage). An inspector recommended a survey for tritium in these areas. In 1977, there was a large optical shop on the first and second floors. Grinding of lenses and lens assembly was conducted. Representatives of Frankford Arsenal stated that thorium was not used in this area; however, an NRC inspector considered the area suspect and recommended surveys.

new Building 112: Fire Control Instruments containing tritium gas sources were packaged.

Building 116: Tritium devices were packaged and stored. An inspector recommended a survey for tritium in the entire building.

Building 123: (1977) Special Projects Building. Used for assembling DU components.

Building 149: (Pitman-Dunn Laboratory) Melting and casting of uranium was conducted. This was the main processing building.

Building 150: The watch shop was moved here from Building 202 in 1958 or 1960. In 1968, the watch testing laboratory in Room 222 was identified as possibly contaminated with radium. Watch parts were identified as having radium contamination with levels as high as 1×10^6 cpm $\alpha/100$ cm². In 1970, the watch shop was moved to Building 519. Starting in about 1960, this was the main DU machining building; the refractory shop was located in the northeast corner. DU rounds might have been fired in a range in this building.

Building 201: Tritium gas sources were used on the first and second floors. Irradiated material authorized by License No. 37-01091-08 was used.

Building 201-1: Thorium-fluoride was used for thin film coatings on optical components.

Building 202: This was the location of the watch shop (radium used) from 1942-1958 or 1960. The watch shop was moved to Building 150 in 1958 or 1960. Sometime after the watch shop moved, tritium gas sources were stored in a vault area.

Building 210: DU machining was conducted on the third floor. The area was remediated between 1965-1970.

Building 210-3: Manufacture of the (ALPHA) Body Slug in the Special Ammunition Unit area. Machining of DU was conducted.

Building 215-2: Laundry room for contaminated clothing.

Building 227B: (1977) Major DU storage area.

Building 230: In 1976, this was the environmental testing laboratory. This was at least partly used for the testing of watches. Tritium and possibly radium was used.

Building 307: (1977) DU storage and shipping area.

Building 312: (1971-1972) #28 and #126 transportainers filled with DU were stored. (1977) Du storage area.

Radioisotope Laboratory. In the early years of the Frankford Arsenal, this building (mainly the second floor and the radioisotopes laboratory) was used for work with Co-60, Zn-65, Ag-110, Po-210, and Ra-226. Ventilation ducts, hoods, and sewers were suspected of being contaminated. In 1977, an inspector recommended that the sewers, sumps, and hoods be surveyed.

Building 316: Two laboratories (labs C & F) were used for DU operations. Lab C was used for the firing of DU projectiles. The DU firing range was surveyed in about 1977 (probably after remediation). The highest measurement from the survey was 1239 dpm/100 cm². At the time, there was a recommendation to survey the roof vent of the ventilation system and the blacktop pavement located outside of the building and to the side of the range (also a ventilation exhaust location).

Building 439: Incinerator for combustible contaminated waste such as contaminated paper products.

Building 507: DU storage area.

Building 508: Holding area for uranium scrap.

Building 512: (1977) DU storage area. The building was removed.

Attachment 1: License No. SUB-00459 3

Building 513: Used to swedge DU wire.

Building 519: The watch shop was moved here from Building 150 in about 1970. Only tritium was used in the basement. Radium was possibly used.

Building 521: A small amount of DU was fired on Range 16 in 1965.

Attachment 2 for ORNL Sites - Summary
License No. SUB-00459

Building 3-A: All DU was used and stored in Section D-38; Bays 1, 3, 4, 5, 7, and 9. The six bays housed milling, grinding, and tapping machines. Each machine had an independent exhaust system. The machining processes were water cooled. There was a DU storage area for 55 gallon drums located along the railroad tracks near this building. Scrap DU was stored in cans filled with water and placed in a tin shed behind Building 3-A. Building 3-A was remediated prior to 1963. The water from the remediation activities discharged to the industrial waste holding pond. The machines were oiled and placed in storage. All other waste was disposed off-site. The DU machining area floor was coated with a sealer.

Building 6: Used for receiving DU.

Building 42-A: Used for the storage of DU projectiles.

Building 65: Used for assembly and packaging DU.

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 FIELD
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 ---



Encl 2-1

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. $\text{Score}=\text{score}\times 1.0$

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.

9. FIRST SITE: Some likelihood that meaningful outdoor contamination could have occurred at site. $\text{Score}=\text{score}\times 1.0$
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. $\text{Score}=\text{score}\times 1.1$
14. FIRST SITE: There was significant generation of waste material in routine cleanup of facility. $\text{Score}=\text{score}\times 1.5$
15. FIRST SITE: Possible inappropriate disposal or abandonment of contaminated material from cleanup. $\text{Score}=\text{score}\times 1.2$
16. FIRST SITE: There was adequate documentation of the disposition of materials. $\text{Score}=\text{score}\times 0.7$
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. $\text{Score}=1.2\times\text{score}$
20. SECOND SITE: Some likelihood that building onsite could have been left with contamination. $\text{Score}=\text{score}\times 1.0$

--- 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

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

File

SLR:RH
40-6639

MAR 23 1965

Commanding Officer
United States Army
Frankford Arsenal
Philadelphia 37, Pennsylvania

Attention: SMUFA-0720

Dear Sir:

In reply to your letter of January 27, 1965 to Mr. Robert W. Kirkman, Director of the AEC's Regional Compliance Office in New York City, your proposal regarding the retention of receipt and disposal records is acceptable to the Commission. Such records showing the receipt and disposal of source material possessed and used pursuant to AEC License No. SUB-459 need not be retained for more than two years after that license expires.

Very truly yours,

bcc: Compliance Div., HQ
Compliance Div., I
OGC
DANussbaumer, DML:S&SNMB

"Signed" Eber R. Price

Eber R. Price, Director
Division of State and
Licensee Relations

cc: Department of the Army
Office of the Surgeon General
Washington, D. C.
Attention: Lt. Col. Roswell G. Daniels, MC
Code: MEDPS-PO

Handwritten note: The work up on this is being handled by...

OFFICE ▶	SLR:EB RH: LHM: ROP	OGC G. F. Hsd/ate	DML:S&SNMB DANussbaumer	SLR EB Price		
SURNAME ▶	<i>[Handwritten]</i>	<i>[Handwritten]</i>	<i>[Handwritten]</i>	<i>[Handwritten]</i>		
DATE ▶	3-11-65					

Table — Estimated Number of M101 Spotting Rounds Fired on IMCOM Ranges

Location (IMCOM Locations in BOLD)	M101 Spotting Rounds		Date of First Use (Possession)/Last Use	Date DU Presence Determined (Investigation) ^b
	Confirmed Shipped	Estimated Fired ^a		
<i>Identified at November 16, 2010 Public Meeting</i>				
Fort Benning, Georgia	9,700	— ^c	1962/1968	March 2008
Fort Campbell, Kentucky	681	— ^c	1962/1968	June 2008
Fort Carson, Colorado	NA	1,404 ^a	1962/1968	April 2008
Fort Dix, New Jersey; Frankford Arsenal, Pennsylvania	50	— ^c	1961/1962	April 2009
Fort Gordon, Georgia	NA	273 ^a	1962/1968	July 2009
Fort Greely, Alaska	NA	50 ^a	1961/1962	October 2008
Fort Hood, Texas	4,038	— ^c	1962/1968	January 2008
Fort Hunter Liggett, California	NA	100 ^a	1962/1968	July 2009
Fort Jackson, South Carolina	NA	234 ^a	1962/1968	June 2009
Fort Knox, Kentucky	3,956	— ^c	1962/1968	June 2008
Fort Lewis, Washington	1,756	— ^c	1962/1966	July 2008
Fort Polk, Louisiana	NA	1,923 ^a	1962/1968	November 2008
Fort Riley, Kansas	105	— ^c	1962/1968	August 2008
Fort Sill, Oklahoma	NA	585 ^a	1963/1968	July 2009
Schofield Barracks and Pohakuloa Training Area, Hawaii	714	— ^c	1962/1965	May 2007
Yakima Training Center, Washington	NA	100 ^a	1962/1966	July 2008
Yuma Proving Ground, Arizona; Nevada National Security Site	50	— ^c	1961	January 2009
<i>Identified after November 16, 2010 Public Meeting</i>				
Fort Bragg, North Carolina	NA	4,212 ^{a, d}	1962/1968	May 2008
Springfield Armory, Massachusetts	1,234	— ^c	1960/1961	May 2011
Watervliet Arsenal, New York	NA	50 ^e	1960/1961	June 2011 ^d
<i>Net total</i>	22,284	8,931^c		
<i>Grand total (not including overseas rounds)</i>	31,215^c			

Notes:

NA = not available

^a Estimate of Maximum Potentially Fired based on Table of Allowances No. 23-100-6, February 1966, *Ammunition, Rockets, and Missiles for Unit Training – Active Army and Reserve Components*. The Davy Crockett ammunition allowances for the Cartridge, 20mm Spotting M101 for training in a fiscal year was 22 rounds per Gunner and 17 rounds per Assistant Gunner. Calculation made based on number of authorized units (infantry battalions), number of authorized M28 squads (firing team), number of allocated rounds per year, and duration units were at the installation. This calculation is modified for R&D and Test facilities.

^b Date of Archive Search Report (ASR) investigation

^c The estimated maximum number of rounds is not listed when shipping records are available. The shipping records are deemed to be more authoritative. The sum (31,215) of the shipping record column and the estimated maximum number column is close to the number of rounds not turned in (about 75,000 manufactured; about 44,000 demilitarized; leaving about 31,000 available for firing) but does not include rounds shipped to Army units overseas (12,760). Clearly, the estimated maximum number of rounds is an overestimate and totals in the “M101 Spotting Rounds” column are uncertain.

^d In that the 82nd Airborne Division garrisoned at Fort Bragg was airmobile, estimate of maximum potential rounds fired assumes two Light Weapons M28 per Section.

^e Research and inspection of Watervliet Arsenal ongoing as of May 23, 2011. Actual use of M101 spotting round has not been confirmed. Estimate for maximum potential rounds fired has not been verified.

UNCLASSIFIED

Copy ___ of ___ Copies
U.S. Army Installation Management Command
San Antonio, TX
(DTG)

**OPERATIONS ORDER 11-397: US Nuclear Regulatory Commission (NRC)
Restrictions on Ranges Affected by Davy Crockett Depleted Uranium (DU) (U)**

Refs: (a) (U) Title 10, Code of Federal Regulations (CFR), Part 10, Standards for
Protection Against Radiation
(b) (U) Title 10, CFR, Part 40, Domestic Licensing of Source Material
(c) (U) DOD Directive 4715.11, 10 May 04, Environmental and Explosives Safety
Management on Operational Ranges Within the United States

(U) Time Zone Used Throughout the Order: Zulu.

1. (U) SITUATION.

1.A. (U) In 2005 contractors working on a Schofield Barracks training range discovered residual DU due to firing of M101 spotting rounds in the 1960s. The M101 spotting round was part of the Davy Crockett recoilless rifle weapon system and contained a small quantity of DU.

1.B. (U) Subsequently, HQDA funded US Army Corps of Engineers St. Louis District to perform an archive search that revealed M101 spotting rounds were fired at 16 Army installations (listed in Annex A) in the 1960s that are now IMCOM responsibility. NRC regulations in 10 CFR 20 and 10 CFR 40 require IMCOM to have a source materials license to possess this DU that includes an NRC-approved radiation safety program.

1.C. (U) In a meeting between Army and NRC personnel held on 16 Nov 10, the NRC staff communicated to IMCOM that routine maintenance activities within the radiation control area (RCA) of any of the installations believed to be contaminated with depleted uranium would require the operation of a radiation safety program approved by the NRC. IMCOM does not possess an NRC-approved radiation safety program at any of our DU-affected ranges. Gaining that approval is part of IMCOM's license application process with the NRC that is underway.

1.D. (U) Both the DoD (DoD Directive 4715.11, paragraph 5.4.9.2) and the NRC forbid firing of high explosive munitions into a DU radiation controlled area (RCA).

2. (U) MISSION. Immediately upon receipt of this order, HQ, IMCOM and IMCOM subordinate commands will maintain compliance with NRC restrictions, per reference (c), on Davy Crockett M101 spotting round impact areas on affected IMCOM ranges.

UNCLASSIFIED

UNCLASSIFIED

**OPERATIONS ORDER 11-397: US Nuclear Regulatory Commission (NRC)
Restrictions on Ranges Affected by Davy Crockett Depleted Uranium (DU) (U)**

3. (U) EXECUTION.

3.A. (U) Commander's Intent. My intent is for IMCOM Regions and Garrisons listed in Annex A, AEC, and HQ, IMCOM staff elements to comply with all NRC regulations and restrictions associated with the NRC source material license issued to me. This mission directly supports Installation Management Campaign Plan Line of Effort Five, Safety. I consider this mission complete when IMCOM is in compliance with all applicable NRC, DoD, and Army regulations and directives.

3.B. (U) Concept of Operations.

3. B.1. (U) All personnel must stay out those areas on each IMCOM range known or suspected to contain M101 DU until IMCOM has an NRC-approved radiation safety program for the DU impact areas on that range. However, firing of non-high explosive munitions into a DU Radiation Controlled Area (RCA) is permitted. IMCOM may request relief from the NRC for this requirement on a case-by-case basis; contact the IMCOM Radiation Staff Safety Officer (RSSO) if such relief is required.

3.B.2. (U) Both the DOD (DOD Directive 4715.11, paragraph 5.4.9.2) and the NRC forbid firing of high explosive munitions into a DU RCA.

3.C. (U) Tasks to Subordinate Units.

3.C.1. (U) IMCOM Region Directors. (SE, WE, PA)

3.C.1.A. (U) Upon request and within capabilities and resources, provide assistance, responses, and information to the License Radiation Safety Officer (RSO) relevant to the restrictions the NRC has placed on use of and activities in DU RCAs on IMCOM ranges.

3.C.1.B. (U) Assure compliance with all NRC requirements pursuant to M101 spotting round DU on IMCOM ranges.

3.C.2. (U) U.S. Army Garrisons. (Benning, Bragg, Campbell, Gordon, Jackson, Knox, Polk, JBLM, Carson, Hood, Hunter Liggett, Riley, Sill, Yakima, Greely, Hawaii)

3.C.2.A (U) Do not permit personnel entry into Radiation Safety Plan impact areas known or suspected of being contaminated with DU until an NRC-approved RSP is in effect. Once the RSP is in effect, installation organizations and tenant units will comply with its provisions.

3.C.2.B (U) Do not fire high explosive munitions into a DU RCA.

UNCLASSIFIED

UNCLASSIFIED

**OPERATIONS ORDER 11-397: US Nuclear Regulatory Commission (NRC)
Restrictions on Ranges Affected by Davy Crockett Depleted Uranium (DU) (U)**

3.C.2.C (U) As necessary, coordinate with the License RSO for a request to the NRC for relief from the restrictions on personnel entry into an RCA before an NRC-approved RSP is in effect.

3.C.2.D. (U) Upon request and within capabilities and resources, provide assistance, responses, and information to the License RSO relevant to the restrictions the NRC has placed on use of and activities in DU RCAs on IMCOM ranges.

3.C.2.E. (U) Assure compliance with all NRC requirements pursuant to M101 spotting round DU on IMCOM ranges.

3.D. (U) Coordinating Instructions.

3.D.1. (U) This order is effective upon receipt and will remain in effect for the duration of the NRC license.

3.D.2. (U) At the direction of HQ, IMCOM Safety Office (License RSO) participate in or take action in support of activities, meetings, and/or conferences required to successfully execute this order. Any requests for suspense extensions may be granted by HQ, IMCOM Safety Office (License RSO) on a case-by-case basis.

3.D.3. (U) Installations experiencing potential impacts to training mission accomplishment will report concerns through their respective IMCOM Region, to the IMCOM G7 Sustainable Range Program Manager, once analysis and assessments are complete.

4. (U) SUSTAINMENT. None

5. (U) COMMAND AND CONTROL.

5.A. (U) Command. HQ, IMCOM Safety (radiation safety) is the lead element for this action and all others are supporting.

5.B. (U) Control. None

5.C. (U) Signal.

5.C.1. (U) The IMCOM Safety Office Action Officer is the License RSO, Dr. Robert Cherry, COMM: 210-424-8547, e-mail: robert.cherry@us.army.mil

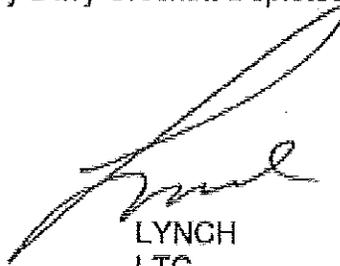
5.C.2. (U) Acknowledge receipt of this order to the HQ, IMCOM Safety Office POC at COMM: 210-424-8547, e-mail: robert.cherry@us.army.mil

UNCLASSIFIED

UNCLASSIFIED

OPERATIONS ORDER 11-397: US Nuclear Regulatory Commission (NRC)
Restrictions on Ranges Affected by Davy Crockett Depleted Uranium (DU) (U)

ACKNOWLEDGE:



LYNCH
LTG
Commanding

OFFICIAL:

WEAVER
COL
G3/5/7

ANNEXES:

A – (U) List of M101 Spotting Round DU-Affected IMCOM Garrisons

DISTRIBUTION:

DCG, IMCOM
ED, IMCOM
COS, IMCOM
CSM, IMCOM
IMCOM Region Directors (SE, WE, PA)
USAGs

Fort Benning
Fort Bragg
Fort Campbell
Fort Carson
Fort Gordon
Fort Greely
Fort Hood
Fort Hunter-Liggett
Fort Jackson
Fort Knox
Fort Polk
Fort Riley
Fort Sill

DISTRIBUTION (CONT):

Hawaii
Joint Base Lewis McChord
Yakima Training Center

UNCLASSIFIED