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

:EPLY TO
ATTENTION OF\

Safety Office

February 09, 2011

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

Dear Mr. McConnell:

At our November 16, 2010, public meeting with US Nuclear Regulatory Commission (NRC) personnel in Rockville, we were briefed that, "Routine Army activities that would occur within the radiation control area of any of the Davey [*sic*] Crockett DU sites ... require the operation of a radiation safety program approved by the NRC via a license."

The Army requests that you not enforce what was briefed due to the undue burden (hardship) that would be placed on the Army due to the consequent possible significant adverse impact on Army readiness, national defense, and security. We ask for your expedited review of this request.

As an initial measure, we provide supporting information for our ranges in Hawaii, where our most immediate need for relief is, as follows.

- We believe that the Army fired no more that 714 Davy Crockett M101 spotting rounds on the Schofield Barracks and Pohakuloa Training Area (PTA) ranges combined. Each M101 spotting round contains about 206 grams (g) of 92 percent depleted uranium (DU), 8 percent molybdenum alloy, which is equivalent to about 190 g of DU. Thus, the total mass of DU on our two Hawaii ranges together is about 135 kilograms.

- We enclose a proposed Radiation Safety Plan that we will follow until you issue a source material license to us to possess the DU on the Hawaii ranges. The plan shows where we believe the M101 DU is. We are designating these locations as Radiation Controlled Areas (RCAs). The plan also lists the routine activities we wish to perform in the RCAs.

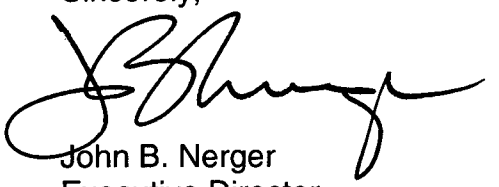
- We have no alternatives to these RCAs that are reasonably available in Hawaii. Due to the limited space on our Hawaii installations, many of our ranges have multiple overlapping uses; for example, PTA Range 11T is used as a convoy live fire range, Stryker mobile gun system range, and an aerial gunnery range. If we are not allowed to enter the RCA to conduct necessary range maintenance and training support, our training capabilities will be significantly degraded. This likely would result in an adverse impact on the readiness of our Soldiers who are preparing for potential combat in Iraq and Afghanistan.

The Army is submitting the information for our Hawaii ranges at this time because the information is readily available and can be quickly submitted for your review. Concurrently with this request, the Army is also gathering the information needed from other DU-affected Army ranges and is expediting a follow-on submission to the NRC requesting similar undue burden requests for those installations. While this undue burden request is imperative for the Army's immediate national security and training needs, from a long-term perspective, we are also gathering the information on each DU-affected installation so that we may submit an amendment application for each site.

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 (Provisional) (MCHB-TS-OHP), 5158 Blackhawk Road, Aberdeen Proving Ground, Maryland 21010-5403; Director, 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 my point of contact for this correspondence, Dr. Robert Cherry, by telephone at (210) 424-8547 or by email at robert.cherry@us.army.mil.

Sincerely,



John B. Nerger
Executive Director

Enclosure

Radiation Safety Plan for US Army Garrison Hawaii Ranges Affected by Depleted Uranium in M101 Davy Crockett Spotting Rounds

9 February 2010

Contents

Abbreviations and Acronyms

^{234}U	uranium-234
^{235}U	uranium-235
^{238}U	uranium-238
ADCL	administrative dose control level
ALARA	as low as reasonably achievable
ASR	Archive Search Report
CFR	Code of Federal Regulations
cm	centimeter
dpm	disintegration per minute
DPW	declared pregnant worker
DU	depleted uranium
EOD	explosive ordnance disposal
h	hour
IMCOM	US Army Installation Management Command
m	meter
MDC	minimum detectable concentration
mrem	millirem
NRC	US Nuclear Regulatory Commission
PPE	personal protective equipment
RCA	Radiation Controlled Area
RSO	Radiation Safety Officer
RSP	Radiation Safety Plan
TEDE	total effective dose equivalent
UXO	unexploded ordnance

1 Introduction

The US Nuclear Regulatory Commission (NRC) has approved (*pending*) this Radiation Safety Plan (RSP). Among other things, it is intended for use when personnel enter, work in, and leave areas on US Army Garrison Hawaii ranges that may have been affected by Davy Crockett M101 spotting rounds (see figure in section 23). The M101 spotting round contains depleted uranium (DU). The affected areas are controlled for radiation safety purposes and are radiation controlled areas (RCAs).

The License Radiation Safety Officer (RSO) will review this RSP annually and update it as necessary. If any updates to this RSP represent a significant change in approach to radiation safety, then the License RSO will inform the US Nuclear Regulatory Commission of the update.

1.1 Background

Depleted uranium is a byproduct of uranium enrichment, part of the process of manufacturing fuel for nuclear power plants. When uranium is enriched in the uranium-235 (^{235}U) isotope, the leftover uranium is depleted in ^{235}U. DU is useful in certain commercial and military applications because of its high density, which is about twice the density of lead. It is slightly radioactive, but it poses some chemical toxicity danger to the kidneys if ingested, either through inhaling dust or drinking contaminated water, for example.

A number of Army installations across the United States have residual DU contamination resulting from the testing of the M101 spotting round. The M101 spotting round was a 20-millimeter low-speed projectile, weighing approximately a pound that the Army used with the Davy Crockett recoilless rifle system from 1960 to 1968.

The Davy Crockett weapons system, including the M101 spotting round, was classified to some extent in the 1960s, and records of its use were guarded. In 2005 the Army discovered tail assemblies from the M101 Spotting Round during a range clearance exercise at the Army's Schofield Barracks target impact area in Hawaii. The Army then began investigating various sites where the M101 Spotting Round may have been used, and characterization studies have determined that NRC-licensable quantities of DU in the form of M101 fragments exist at several sites.

Since the Army does not currently possess a source material license, as required by NRC regulations, the US Army Installation Management Command has submitted a license application for the possession of DU to the NRC. The NRC has stated, "Routine Army activities that would occur within the radiation control area of any of the Davey [*sic*] Crockett DU sites ... require the operation of a radiation safety program approved by the NRC via a license." This RSP is intended to meet the requirement for an NRC-approved radiation safety program.

1.2 Purpose

The purpose of this RSP is to address radiation safety issues that may be encountered during performance of routine range activities in RCAs and of any other activities

involving M101 spotting round DU on US Army Garrison Hawaii ranges. The goals are to protect the health and safety of Army personnel and the general public; protect the site environment; and meet all applicable Federal, Department of Defense, and Army regulations.

1.3 Scope

This RSP describes the RCA, defines the roles and responsibilities of supporting radiation safety staff, and explains the radiation safety controls to be used during performance of routine range activities in RCAs and of any other activities involving M101 spotting round DU on US Army Garrison Hawaii ranges.

1.4 Applicability

The requirements of this plan are applicable to all personnel, including the general public, who enter an RCA.

Requirements of this plan are in addition to, not in lieu of, any and all other safety requirements, especially those related to unexploded ordnance in or around RCAs.

1.5 The Unexpected and the Unanticipated

While all radiation safety contingencies are intended to be addressed by this plan, something unexpected or unanticipated may arise. If this occurs, the US Army Garrison Hawaii RSO (Garrison RSO) will promptly establish appropriate procedures and then inform the License RSO. These procedures will be documented by including them in this plan or as an addendum to it.

2 Radiation Safety Organization and Responsibilities

2.1 US Army Installation Management Command (IMCOM) Commander

Regarding M101 spotting round DU on all IMCOM ranges, the Commanding General, IMCOM is responsible for:

- Radiation safety for, security of, and control of M101 spotting round DU
- Completeness and accuracy of the radiation safety records and all information provided to the NRC
- Knowledge about the contents of the license and application
- Compliance with current NRC regulations and the licensee's operating and emergency procedures
- Commitment to provide adequate resources (including space, equipment, personnel, time, and, if needed, contractors) to the radiation safety program to ensure that the public and personnel that enter an RCA are protected from radiation hazards and meticulous compliance with regulations is maintained
- Selection and assignment of a qualified individual to serve as the License RSO with responsibility for the overall radiation safety program
- Prohibition against discrimination of employees engaged in protected activities
- Commitment to provide information to employees regarding the NRC's employee protection and deliberate misconduct provisions
- Obtaining NRC's prior written consent before transferring control of the license

2.2 US Army Garrison Hawaii Commander

Regarding M101 spotting round DU on installation ranges, the US Army Garrison Hawaii Commander is responsible to the IMCOM Commander for assuring compliance with requirements of NRC regulations and license conditions (including this RSP) in RCAs on his or her installation.

The Garrison Commander will select and assign a qualified individual to serve as the Garrison RSO with responsibility to the License RSO for Garrison compliance with NRC regulations and license conditions regarding M101 spotting round DU on installation ranges.

2.3 License Radiation Safety Officer

The License RSO is responsible to the IMCOM Commander for the development, implementation, and overall administration of this RSP. He is also responsible to both the IMCOM Commander and the NRC for assuring and monitoring compliance with NRC regulations and license conditions for M101 spotting round DU on US Army Garrison Hawaii ranges.

The License RSO will:

- Coordinate with appropriate personnel as necessary to assure that routine range activities in RCAs comply the requirements of this RSP
- Provide recommendations to the Garrison RSO and other appropriate personnel for the control and, if possible, elimination of existing and potential radiological hazards
- Assist in the review and interpretation of analytical results for radiological samples
- Maintain documentation that demonstrates that the dose to individual members of the public does not exceed the limit specified in 10 CFR 20.1301
- Ensure security of radioactive material
- Ensure proper posting of documents required by 10 CFR Part 19, § 19.11 and by 10 CFR Part 21, § 21.6
- Ensure that radiation exposures are as low as reasonably achievable (ALARA)
- Oversee all activities involving DU, including monitoring and surveys
- Act as liaison with NRC and other regulatory authorities
- Provide necessary information on all aspects of radiation safety to personnel at all levels of responsibility, pursuant to 10 CFR Parts 19 and 20, and any other applicable regulations
- Determine the need for personnel monitoring, distribute and collect personnel radiation monitoring devices, evaluate bioassays, monitor personnel radiation exposure and bioassay records for trends and high exposures, notify individuals and their supervisors of radiation exposures approaching the limits, and recommend appropriate remedial action
- Conduct training programs and otherwise instruct personnel in the proper procedures
- Supervise and coordinate the radioactive waste disposal program, including recordkeeping on waste storage and disposal records.
- Oversee the storage of radioactive waste
- Maintain an inventory of all radioisotopes possessed under the license
- Immediately terminate any unsafe condition or activity that is found to be a threat to public health and safety or property
- Maintain other records not specifically designated above, for example, records of receipts, transfers, and surveys as required by 10 CFR 20, Subpart L, "Records"
- Hold periodic meetings with, and provide reports to, licensee management
- Perform periodic audits of the radiation safety program to ensure that the licensee is complying with all applicable NRC regulations and the terms and conditions of the license, the content and implementation of the radiation safety program to achieve occupational doses and doses to members of the public that are ALARA in accordance with 10 CFR 20.1101 and required records are maintained.
- Ensure that the results of audits, identification of deficiencies, and recommendations for change are documented (and maintained for at least 3

years) and provided to management for review; ensure that prompt action is taken to correct deficiencies
- Ensure that the audit results and corrective actions are communicated to all affected personnel
- Ensure that all incidents, accidents, and personnel exposure to radiation in excess of ALARA or Part 20 limits are investigated and reported to NRC and other appropriate authorities, if required, within the required time limits
- Maintain understanding of and up-to-date copies of NRC regulations, the license, revised licensee procedures, and ensure that the license is amended whenever there are changes in licensed activities, responsible individuals, or information or commitments provided to NRC during the licensing process.

2.4 US Army Garrison Hawaii RSO

The Garrison RSO represents both the Garrison Commander and the License RSO in the day-to-day radiation safety operations and oversight during routine range activities. The Garrison RSO will maintain records of radiation safety activities in the RCAs for review by the License RSO and by NRC inspectors.

The Garrison RSO shall have completed a formal course of instruction addressing the following topics:

- Basic radiation interactions
- Radioactivity
- Terms and units
- Biological effects
- Radiation detection and measurement
- Radiation and contamination control
- Radiation dosimetry

Acceptable courses for garrison RSOs are offered by the US Army Chemical School, US Army Medical Command, the National Guard Bureau, and US Army Materiel Command licensees.

In addition, the Garrison RSO shall receive specific training on his or her duties and responsibilities related to M101 spotting rounds on his or her installation.

The Garrison RSO, as necessary, will:

- On behalf of the Garrison Commander and License RSO, assure implementation of and compliance with this RSP and applicable NRC regulations and license conditions
- Discuss deviations from routine range activities that affect radiation safety with appropriate personnel and the License RSO
- Maintain a detailed log of routine range activities in RCAs as they occur

- Routinely report on radiation safety activities in RCAs at Garrison Radiation Safety Committee meetings (with appropriate documentation in the minutes of these meetings)
- Perform audits as necessary to verify compliance with provisions of this RSP and of NRC regulations and license conditions
- Advise personnel as they carry out their radiation safety responsibilities
- Stop work if conditions indicate that a potential exists for an unanticipated or excessive radiation exposure to range personnel or the general public, or if an individual violates the radiation safety rules, regulations, or procedures in a manner that may adversely affect personnel at the RCA or the general public
- Train personnel in the proper use of radiological instruments for monitoring personnel and equipment leaving the RCA
- Implement, audit and validate instrument calibrations and the appropriateness of calibration sources, methods, records and procedures
- Ensure that radiation exposures are maintained ALARA
- Implement and maintain records of radiological surveys and evaluations
- Ensure appropriate radiation safety training is provided to all personnel who enter an RCA and maintain documentation of this training
- Arrange maintenance and calibration service and maintain associated records for radiation survey instruments used at the RCA
- Ensure that all required radiation monitoring is performed at the RCA
- Review planned RCA activities and implement radiation safety procedures to ensure safe performance and completion of work

The Garrison RSO has authority to:

- Verify that all operations are in compliance with the requirements of this RSP and halt any activity that poses a potential hazard to personnel, property, or the environment
- Temporarily suspend individuals from field activities for infractions against the RSP pending consideration by the Garrison Commander and License RSO

2.5 Personnel in the RCA

Generally, personnel entering the RCA are not considered to be occupationally exposed to ionizing radiation. However, they will receive radiation safety and DU awareness training (essentially on provisions of this RSP applicable to them) from the Garrison RSO at a level commensurate with their activities in the RCA as the Garrison RSO determines and documents.

Each person who enters the RCA is responsible for demonstrating familiarity with the provisions of this RSP applicable to them, for strict adherence to radiation safety rules and regulations, and for minimizing radiation exposure to the maximum extent practical.

Responsibilities of personnel who enter the RCA include:

- Understanding and abiding by the policies and procedures specified in this RSP and in other applicable safety policies, and clarifying those areas where understanding is incomplete
- Providing feedback to health and safety management relating to errors, deficiencies or omissions and modifications in the RSP or in other safety policies

The health and safety authority of each employee assigned to the RCA includes the following:

- The right to refuse to work and/or stop work authority when the employee feels that the work conditions are unsafe (including subcontractors or team contractors), or where specified safety precautions are not adequate or fully understood
- The right to refuse to work on any task or operation where the safety procedures specified in this RSP or other safety policies are not being followed
- The right to contact the Garrison Commander, the Garrison RSO, the License RSO, or the NRC at any time to discuss potential concerns

2.6 Visitors

All visitors to the RCA are required to comply with the requirements of this RSP. Depending on the areas to be accessed and the nature of the visit, the Garrison RSO or his or her designee will escort visitors in order to assure safe radiation safety practices as necessary.

The Garrison RSO or his or her designee will brief authorized visitors requiring entry to the RCA on the presence of DU in the RCA. Visitors will be escorted at all times in the RCA and will be responsible for compliance with health and safety policies.

Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within the RCA.

3 Radiation Controlled Areas

The St. Louis District of the US Army Corps of Engineers performed the Archive Search Report (ASR) Project from 2006 to 2011. The result was a report with annexes for specific installations that described Army efforts to identify Army ranges where the M101 Davy Crockett spotting rounds were fired. The typical Davy Crockett range impact area is a rectangle, 400 meters (m) × 500 m = 200,000 m^2.

For the purposes of this plan and as a starting point, RCAs are M101 spotting round impact areas (and any similarly affected areas) identified in ASR annexes. The License RSO may add to ASR-identified areas in coordination with the Garrison RSO using information that was not available to or used by the ASR authors.

Figures in Section 23 show a typical Davy Crockett range impact area and the locations of actual M101 spotting round impact areas as determined by the ASR Project.

The Garrison RSO and License RSO will be notified if and when M101 spotting round debris (or any other heretofore unknown radioactive material) is found on US Army Garrison Hawaii ranges. The sizes and locations of the RCAs will be adjusted accordingly. The License RSO will notify the NRC of any changes to the size, number, and locations of RCAs.

4 Routine Range Activities Authorized in RCAs

The IMCOM license application to the NRC is for possession only of the DU from the M101 spotting rounds on US Army Garrison Hawaii ranges. Therefore, the NRC has strictly limited the types of activities that may be performed in the RCAs. Whenever any of the authorized range activities are performed in an RCA, the provisions of this RSP apply to those activities within the RCA in addition to any other safety or environmental requirements.

4.1 High explosives in RCAs

High-explosive munitions will not be fired into an RCA. The Garrison RSO will assure that this prohibition is well-known to range operators and trainers.

Department of Defense Directive Number 4715.11 (certified current as of 24 April 2007), paragraph 5.4.9.2 states, "... high-explosive munitions shall not be fired into the same area as DU." The NRC has reinforced this rule in some of its formal communications to IMCOM.

This ban on firing high-explosive munitions into RCAs does not apply for other types of non-high-explosive munitions such as small-arms fire.

4.2 Unexploded ordnance (UXO) in RCAs

If unexploded ordnance (UXO) is encountered in an RCA, explosive ordnance disposal (EOD) personnel will determine the appropriate disposition in accordance with EOD policies and procedures.

If EOD personnel decide to remove the UXO (if safe), then it will be checked for DU contamination before it leaves the RCA.

If EOD personnel decide to blow the UXO in place, then:

- Prior knowledge and approval of the Garrison RSO and the License RSO is required
- The immediate area (blast zone) will be checked for and cleared (to the maximum reasonable extent possible) of DU using appropriate radiological instrumentation under the joint supervision of the Garrison RSO and EOD personnel

4.3 Authorized range activities

Range activities in RCAs not listed below in this section are not authorized and may not be performed unless and until authorization is received from the License RSO. Upon request, the License RSO will forward requests for additional range activities to the NRC for approval. Upon NRC approval, the License RSO will add those NRC-approved activities to the list.

The following routine range activities in RCAs are authorized. Records of these activities will be recorded in appropriate range logs that will be accessible to NRC

inspectors as necessary. Range personnel should provide copies of these records to the Garrison RSO to facilitate NRC inspections.

- Standard marksmanship and weapons familiarization training
- Down-range movement throughout the expanse of the range by mounted and dismounted personnel
- Installation, programming, operation, preventive maintenance, and repairs on Army Standard Integrated Target Systems
- Diagnosis and inspection of all electronics and computerized integrated target systems
- Installation and wiring of range equipment
- Installation and replacement of targets and target mechanisms
- Testing of target systems after the completion of repairs
- Control of vegetation by mowing and use of weed eaters
- Maintenance and repair of support facilities, range towers and buildings
- Inspection and monitoring of training
- Monitoring of threatened and endangered species
- Controlled burning
- Cleaning of solar panels and adjustment of charge controllers
- Maintenance of batteries
- Maintenance of signage (for example, painting, alignment, and replacement)
- Maintenance of berms
- Maintenance of trail roads
- Removal and disposal of items that cannot be repaired (for example, batteries, solar panels, signage, targets, and targetry)
- Range Division and OIC Range-Walk to ensure range is ready for training activity
- On-site repair and recovery of vehicles, as necessary
- Police calls (for example, for brass and litter)
- Walk/drive-through for range clearance at end of training activities

5 Radiation Safety Principles

The following are general radiation safety principles that guide radiation safety policies in the RCA.

5.1 Justification

No one will be occupationally exposed to ionizing radiation needlessly. This means that only essential personnel will be in the RCA at any time.

5.2 Optimization

All personnel radiation exposure will be kept ALARA, taking technological and socioeconomic factors into account.

The ALARA program will be implemented through the use of the following:

- Administrative Dose Control Levels (ADCLs) (see Section 6.1) that are well below the regulatory limits in Title 10, Code of Federal Regulations (CFR), Part 20
- Training of personnel in appropriate radiation safety practices and work procedures
- Good housekeeping practices
- Engineering controls
- Use of personal protective equipment (PPE) as necessary

5.3 Individual dose and risk limits

No one will be allowed to exceed regulatory dose limits. This will be achieved through the implementation of the ALARA program and contamination control within NRC limits (Table 6-1).

6 Radiation Safety Standards

Title 10 CFR, Part 20, Subpart C contains the NRC occupational dose limits, which will not be exceeded under any circumstances.

6.1 Administrative Dose Control Levels

ADCLs typically are set to ten percent of the NRC occupational dose limits. However, most, if not all, range personnel are not routinely occupationally exposed to ionizing radiation. Therefore, the ADCLs will be set to one percent of the NRC occupational dose limits, to assure that NRC radiation dose limits for individual members of the public in Title 10 CFR, Subpart D are not exceeded.

According to the Department of Energy's *Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities* (DOE-STD-1136-2009, July 2009), "Gamma radiation from uranium is normally not the controlling challenge to radiation safety. For example, the contact beta radiation field from depleted uranium is approximately 240 mrem/h, while the contact gamma radiation field is less than 10 mrem/h."[1]

"Contact gamma radiation field" in the previous paragraph means the contact gamma dose equivalent rate for a large slab of depleted uranium. Only small pieces of depleted uranium and flakes of depleted uranium in soil have been found to a measurable extent on US Army Garrison Hawaii ranges. Therefore, contact gamma radiation dose equivalent rates to large portions of the body due to DU on US Army Garrison Hawaii ranges are highly unlikely. Gamma radiation dose equivalent rates at waist level for this DU in or on the ground, which is the most likely mode of external exposure to DU on US Army Garrison Hawaii ranges, are much less 1 mrem/h.

6.1.1 Annual Whole Body ADCL

The whole body annual ADCL (combined external deep dose and internal committed effective dose equivalent) is 50 millirems (mrem) total effective dose equivalent (TEDE).

The annual ADCL for the sum of the deep dose equivalent and the internal committed dose equivalent to any individual organ or tissue, other than the lens of the eye, is 500 mrem.

6.1.2 Annual Skin and Extremities ADCL

The annual ADCL for the skin or any extremity is 500 mrem shallow dose equivalent.

6.1.3 Annual Lens of the Eye ADCL

The annual ADCL for the lens of the eye is 150 mrem.

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[1] mrem = millirem; h = hour

6.2 Surface Contamination

The NRC acceptable surface contamination levels are given in NRC Regulatory Guide 1.86. Table 6-1 is the extract relevant for DU. Decontamination will always be to levels below those in Table 6-1 and to levels that are ALARA.

Table 6-1 Acceptable surface contamination levels

NUCLIDE [a]	*AVERAGE* [bcf]	*MAXIMUM* [bdf]	*REMOVABLE* [bcef]
U-natural, ^{235}U, ^{238}U, and associated decay products	5,000 dpm alpha/100 cm^2	15,000 dpm alpha/100 cm^2	1,000 dpm alpha/100 cm^2

[a] Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently.
[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
[c] Measurements of average contamination level should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.
[d] The maximum contamination level applies to an area of not more than 100 square centimeters (cm^2).
[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
[f] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 millirad per hour at 1 centimeter and 1.0 millirad per hour at 1 centimeter, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

6.3 Declared Pregnant Worker

Because of the radiosensitivity of the embryo/fetus, the NRC has set the dose limit to the embryo/fetus of a declared pregnant worker (DPW) at 500 mrem TEDE for the period of gestation. It has determined that this limit provides an adequate margin of safety for the embryo/fetus. Upon a written declaration of pregnancy by a DPW, the Garrison RSO will:

Perform a retrospective review of the dose received by the DPW to date during the period of gestation. Exposure limits for the remaining balance of the dose will be set at that time.

Counsel the DPW regarding the fetal risks for radiation exposure and the options to limit the radiation dose to the fetus for the balance of the pregnancy period as described in NRC Regulatory Guide 8.13. The Garrison RSO will provide a copy of NRC Regulatory Guide 8.13 to the DPW.

A fetal dosimeter is not required.

Provide increased radiation safety surveillance of the DPW to ensure that radiation exposure is maintained ALARA and that it does not exceed the prescribed ADCL.

7 Dosimetry

Dosimetry is not required for entry into the RCA.

8 Bioassay

Bioassay is not normally required for entry into or following exit from the RCA. The Garrison RSO will consult with the License RSO if it is believed an uptake of DU may have occurred (see section 22.1).

9 Protective Personnel Equipment

Normal work clothing provides adequate protection for radiation safety purposes from M101 spotting round DU on US Army Garrison Hawaii ranges for authorized routine range activities (section 4.3).

Wear disposable gloves at all times when handling DU.

Should RCA exit monitoring detect DU contamination on personnel or equipment, the Garrison RSO shall notify the License RSO for reconsideration of this policy.

10 Respiratory Protection

Respiratory protection is not required for entry into the RCA.

11 Contamination Surveys

11.1 Instrument Scanning

When necessary, the Garrison RSO will establish access control points ("hot-lines") for entry and exit to the RCA. The Garrison RSO will assure that appropriate instruments and supplies (for example, soap and water for decontamination, if necessary) are available at the hot-lines. The Garrison RSO or his or her designee will perform instrument scanning on personnel, vehicles and equipment at the hot-line as they exit the RCA.

11.1.1 Personnel Monitoring

All personnel exiting an RCA will be monitored for contamination as they leave the RCA. If DU contamination is detected, they will be completely decontaminated if possible. Usually, washing with soap and water will achieve complete DU decontamination. The Garrison RSO will consult with the License RSO if other decontamination measures become necessary.

See section 17 for instrumentation requirements.

11.1.2 Equipment and Vehicle Monitoring

All equipment and vehicles will be monitored for contamination as they leave the RCA. If DU contamination is detected, the equipment item or vehicle will be decontaminated to meet the requirements in Table 6-1 (which includes the requirement to decontaminate to levels ALARA). Usually, washing with soap and water will achieve complete DU decontamination. The Garrison RSO will consult with the License RSO if other decontamination measures become necessary.

11.2 Documentation

All occurrences of personnel, equipment, and vehicle contamination will be thoroughly documented to include:

- Description of instrument used, along with its calibration date and calibration due date
- Identification of contaminated person, equipment item, or vehicle
- Location of contamination
- Initial contamination found in units of dpm/100 cm^2 or dpm over smaller area
- Decontamination method(s) used
- If initial decontamination efforts are not fully successful, interim contamination in units of dpm/100 cm^2 or dpm over smaller area
- Final contamination status
- Name and signature of person performing monitoring

See section 17 for instrumentation requirements.

11.3 Swipe Tests

Swipe tests generally are not necessary. However, if instrument scanning detects contamination, the Garrison RSO or his or her designee may take swipe tests to verify that decontamination efforts were adequate. The Garrison will consult with the License RSO on proper procedures for taking swipes, counting them, and documenting the results, as necessary.

11.4 Reporting Results to Workers

The Garrison RSO will provide results of swipe tests and scanning to any RCA personnel who ask for them, as is a right of workers to know the potential hazards to which they are exposed.

12 Environmental Monitoring

Environmental monitoring requirements are provided in a separate RCA-specific environmental radiation monitoring plan. [NRC-approved environmental monitoring plans are not yet available.]

13 Inventory

The Garrison RSO will inventory and control all check sources associated with instrumentation used at the RCA. No other radioactive sources, other than M101 spotting round DU itself, are expected to be at the RCA. (Also, see section 18.)

The Garrison RSO will maintain a log of all M101 spotting round DU found on the installation. The log will show the location of each find, an estimate of the amount of DU (for example, two mostly intact rounds, three fragments, evidence of soil contamination, and so on) and whether the DU was left in place or removed for proper disposal.

14 Posting Requirements

The Garrison RSO will post areas and containers so that potential hazards are clearly indicated to all personnel and to meet NRC regulatory requirements.

14.1 Radiation Controlled Area

A radiation controlled area (RCA) is an area controlled for the purpose of radiation safety. The Garrison RSO, in coordination with range personnel, will establish each M101 spotting round DU impact area on the installation as an RCA.

Casual visits within an RCA are not authorized.

Eating, drinking, smoking, and applying of cosmetics are not allowed in the RCA.

Plates in section 23 show the M101 spotting round DU impact areas on the installation. The Garrison RSO will assure that all range operations personnel are aware of the RCAs.

Should M101 spotting round DU be discovered outside of known RCAs, it will be reported immediately to the Garrison RSO and then to the License RSO. The Garrison RSO will establish a new or extended RCA to address this discovery. The Garrison RSO will forward information about the discovery and the location of the new or extended RCA to the License RSO. The License RSO will notify the NRC about the new or extended RCA and arrange for the preparation of revisions that add the new RCA to the existing set of M101 spotting round DU impact area figures and documents.

The ranges are operational and essential for Army training and readiness. Access to the ranges and, hence, the RCAs, is otherwise controlled for reasons of security, operations, and/or UXO. Therefore, fencing and signage around the RCAs generally is not feasible and is unnecessary. However, the Garrison RSO will assure that all appropriate local range safety, range training, and range operations regulations, SOPs, and other documents contain information about the RCAs that is required to properly inform personnel about the restrictions placed on the RCAs by the NRC and by this RSP.

14.2 Radioactive Materials

"Radioactive Materials" signage is generally not feasible at the ranges, as discussed in the previous section.

Deliberate searches for and removal of DU from an RCA is not authorized. However, unintended discovery of M101 spotting round DU debris and its location will be reported immediately to the Garrison RSO. The Garrison RSO, in consultation with the EOD personnel and the License RSO, will determine whether it is more reasonable to pick up the DU and hold it for appropriate disposal than it is to leave it in place.

Containers of DU being held for disposal as radioactive waste will be appropriately labeled with "Radioactive Material" labels.

14.3 Radiation Area

A radiation area is an area, accessible to personnel, in which radiation levels could result in which an individual could be exposed to five milliroentgens in one hour at thirty centimeters from the source or from any surface through which the radiation penetrates.

M101 spotting round DU on US Army Garrison Hawaii ranges is not in sufficient quantity or form to produce a radiation area.

14.4 NRC-Required Postings

Documents, notices, or forms posted under this section shall appear in a sufficient number of places to permit individuals engaged in NRC-licensed or regulated activities to observe them on the way to or from any particular licensed or regulated activity location to which the document applies, shall be conspicuous, and shall be replaced if defaced or altered.

At a minimum, the Garrison RSO will post these documents, notices, and forms in control towers for DU-affected ranges, in his or her office, and with documents that are required reading for range personnel.

14.4.1 NRC Form 3, "Notice to Employees"

Current copies of NRC Forms 3 will appear in a sufficient number of places to permit personnel to observe them on the way to or from any particular work location to which the document applies; will be conspicuous; and will be replaced if defaced or altered.

14.4.2 Other Notices to Workers

The Garrison RSO shall post or make available current copies of

- Title 10 CFR, Part 19, "Notices, Instructions and Reports To Workers: Inspection And Investigations"
- Title 10 CFR, Part 20, "Standards for Protection against Radiation"
- Title 10 CFR, Part 21, "Reporting of Defects and Noncompliance" [Under provisions of 10 CFR Part 21, § 21.7, IMCOM is asking for exemption from this requirement]
- The license, license conditions, and documents incorporated into the license by reference, and amendments thereto [IMCOM has applied for the license; the NRC has not yet issued it]
- The operating procedures applicable to licensed activities (specifically, this RSP and the environmental radiation monitoring plan)

If posting of any of these documents specified in this sub-section is not practicable, the Garrison RSO instead may post a notice which describes the document and states where it may be examined.

14.4.3 Notices of Violation

The Garrison RSO shall post or make available current copies of any notice of violation involving radiological working conditions, proposed imposition of civil penalty, or order from the NRC and any IMCOM response.

15 Access Control

Personnel access to an RCA is not authorized except with the knowledge and approval of the Garrison RSO. This is because the Garrison RSO must make appropriate arrangements to assure compliance with NRC regulations and license conditions as promulgated in this RSP. The Garrison RSO will assure that all appropriate range operators and trainers are aware of this requirement. This requirement is in addition to and not in lieu of any other approvals for access that may be required.

Whenever personnel access to the RCA is required, the Garrison RSO will establish a minimum number of access control points on the RCA's perimeter for entry and exit (except in an emergency), known as the "hot-line."

Other than official visitors, no one may enter the RCA unless he or she meets all radiation safety training requirements (section 20). The Garrison RSO will maintain documentation to show that these requirements have been met.

Official visitors will be escorted by personnel otherwise qualified to enter the RCA.

The Garrison RSO will control access to the RCA in accordance with the above instructions and with the "Physical Security Plan for US Army Garrison Hawaii Ranges Affected by Depleted Uranium in M101 Davy Crockett Spotting Rounds." He or she will refer to the License RSO for additional guidance as necessary.

16 Markings on Containers and Equipment

Title 10 CFR Part 20, § 20.1904 requires that all containers that contain more than 100 microcuries of ^{238}U or of natural uranium[2] be properly labeled with a "CAUTION—RADIOACTIVE MATERIALS" sign or label. The label will also provide information, such as the radionuclides present (DU), an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, and kinds of materials, to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

The specific activity of DU is about 0.4 microcurie per gram, so 100 microcuries of DU has a mass of about 40 grams or 3 ounces.

The only containers of M101 spotting round DU on the installations should be containers of DU being held for disposal as radioactive waste (section 14.1 and section 14.2).

[2] The activity in DU is mostly due to ^{238}U. The activity in natural uranium is mostly due to ^{234}U and ^{238}U in equilibrium with each other. Table C in Appendix C to 10 CFR Part 20 does not list DU explicitly, but the inference is taken that the labeling requirement for an activity of more than 100 microcuries should also apply for DU.

17 Instrumentation

Section 24 shows examples of commercial instruments. Instruments such as these, including those in RADIAC Set AN/PDR-77, are suitable for use in support of this RSP.

The Garrison RSO, in consultation with the License RSO, as necessary, will assure that appropriate calibrated instruments are available for use by appropriately trained personnel before allowing personnel access to the RCA.

17.1 Instrument Calibration and Maintenance

All instruments will be calibrated by a qualified calibration/repair facility at least annually in accordance with manufacturers' instructions. The Garrison RSO will retain calibration records for each instrument.

Each instrument shall be checked before first use each day with check sources to verify that its response is within ± 20 percent of the value established by the calibration laboratory for that instrument/check source/geometry combination.

Each item of survey equipment shall meet function response requirements before, during, and at the end of the workday. If survey equipment requires repair during a workday, it shall be repaired and its proper function verified before it is returned to use.

17.2 Minimum Detectable Concentrations

The following sections describe how minimum detectable concentrations (MDCs) will be determined for field equipment. The MDC will be calculated and documented for each field instrument put into use. The Garrison RSO will maintain this documentation and make it available to the License RSO and NRC personnel upon request.

After completing background measurements outside of but nearby the RCA, MDCs will be calculated using RCA-specific variables (reference activity/instrument efficiencies) to verify that all MDCs are significantly below the regulatory limits that correspond to the instruments' uses.

17.2.1 Static Minimum Detectable Concentrations

According to the *Multi-Agency Radiation Survey and Site Investigation Manual* (*MARSSIM*), the *critical level* (L_C) is the level, in counts, at which there is a 5 percent statistical probability of incorrectly identifying a measurement system background value as greater than background. Any response above this level is considered to be greater than background. The *detection limit* (L_D) is an *a priori* estimate of the detection capability of a measurement system and is also reported in units of counts. The minimum detectable concentration (MDC) is the detection limit (counts) multiplied by an appropriate conversion factor to give units consistent with a site guideline, such as dpm/100 cm^2. In other words, the MDC is the *a priori* net activity level above the critical level that an instrument can be expected to detect 95 percent of the time,

MARSSIM explains how to calculate L_C, L_D, and MDC and arrives at the following result (*MARSSIM* Equation 6-7) for the static MDC:

$$\text{Static MDC} = C\left(3 + 4.65\sqrt{B}\right).$$

C represents total detection and efficiency and other constants or factors needed to put the static MDC into appropriate units and *B* is the number of background counts that are expected to occur while performing an actual measurement. All static counts will be taken in 1 minute.

For the present purposes,

$$C = \frac{1}{A\varepsilon_i\varepsilon_s} \times \frac{100\,\text{cm}^2}{100\,\text{cm}^2}.$$

A is the effective area of the probe, ε_i is the instrument or detector efficiency, $\varepsilon_s = 0.5$ is the efficiency of the contamination source, and the final factor, which equals 1, helps put the units of scan MDC into dpm/100 cm^2.

17.2.2 Scan Minimum Detectable Concentrations

The minimum detectable concentration of a scan survey (scan MDC) depends on the intrinsic characteristics of the detector (such as efficiency and physical probe area), the nature (type, abundance, and energy) of emissions, the relative distribution of the potential contamination (point versus distributed source and depth of contamination), scan rate, and personal characteristics of the surveyor. *MARSSIM* Section 6.7.2.1 discusses the basis for estimating scanning MDCs and arrives at the following equation for scan MDC:

$$\text{Scan MDC} = \frac{\text{MDCR}}{\sqrt{p}A\varepsilon_i\varepsilon_s} \times \frac{100\,\text{cm}^2}{100\,\text{cm}^2}.$$

MDCR is the minimum detectable count rate (interpolated from MARSSIM Table 6.6), *p* is surveyor efficiency (assumed to be 0.5) and other parameters are shown above. The final factor, which equals 1, helps put the units of scan MDC into dpm/100 cm^2.

18 Radioactive Waste

The Garrison RSO, in coordination with EOD personnel, will double-bag in plastic bags all M101 spotting round DU that is picked up and removed from the RCA (see section 14.2). Anyone handling DU will use tools or gloved hands to handle it. The bags then will be stored in sturdy containers with appropriate markings (see section 14.2).

The Garrison RSO will secure these containers in a locked storage facility with access limited to personnel appropriately trained in radiation safety and security.

The Garrison RSO, in coordination with the License RSO, will contact Chief, Army Low-Level Radioactive Waste Disposal Division, US Army Joint Munitions Command, ATTN: AMSJM–SF, Rock Island Arsenal, Rock Island, IL 61299–6500, who will arrange for appropriate disposal of the DU.

19 Program Audits

The Garrison RSO or his or her designee will continuously monitor activities in an RCA when personnel are in the RCA and maintain appropriate documentation of those activities. This documentation will be provided periodically to the License RSO for his or her license files.

The License RSO or his or her designee will review the radiation safety program content and implementation and document the results of this review at least annually to ensure the following:

- Compliance with NRC and the terms and conditions of the license
- Occupational doses and doses to members of the public are ALARA (10 CFR 20.1101)
- Records of audits and other reviews of program content are maintained for 3 years

19.1 Purpose of Annual Audit

An audit is conducted, in part, to fulfill the requirements of 10 CFR 20.1101 for an annual review of the content and implementation of the radiation safety program. It should also identify program weaknesses and allow licensees to take early corrective actions (before an NRC inspection). During an audit, the auditor needs to keep in mind not only the requirements of NRC's regulations, but also the licensee's commitments in its applications and other correspondence with NRC. The auditor should also evaluate whether the licensee is maintaining exposures to workers and the general public as low as is reasonably achievable (ALARA) and, if not, make suggestions for improvement.

19.2 Guide for Annual Audit

The form in this section will be used to document the annual audit of the radiation safety program. Guidance follows on completing each section of the form. In the "remarks" portions of the form, note any deficiencies that were identified and the corrective actions taken (or to be taken).

- Section 1, Audit History. Enter the date of the last audit, whether any deficiencies were identified, and whether actions were taken to correct the deficiencies.
- Section 2, Organization and Scope of Program. Give a brief description of the organizational structure, noting any changes in personnel. Describe the scope of licensed activities at the audited location. Check whether the Radiation Safety Officer (RSO) is the person identified in the license and fulfills the duties specified in the license.
- Section 3, Training, Retraining, and Instructions to Workers. Ensure that workers have received the training required by 10 CFR 19.12. Be sure that, before being permitted to enter an RCA, the worker has received training. Note whether refresher training is conducted annually. Ensure by interview and/or observation of selected workers that they can implement the licensee's procedures.

- Section 4, Audits. Verify that audits fulfill the requirements of 10 CFR 20.1101, are conducted in accordance with licensee commitments, and are properly documented.
- Section 5, Facilities. Verify that the licensee's facilities are as described in its license documents.
- Section 6, Radiation Surveys. Verify that the licensee has appropriate, operable and calibrated survey instruments available, that the instruments are calibrated (at the required frequency) in accordance with license conditions and in accordance with 10 CFR 20.2103. Calibration records must be retained for 3 years after the record is made. Check that radiation levels in areas adjacent to use are within regulatory limits and in accordance with 10 CFR 20.2103. Verify compliance with 10 CFR 20.1301. Records of surveys must be retained for 3 years after the record is made.
- Section 7, Transfer of Radioactive Material for Waste Disposal. Ensure that transfers are performed in accordance with 10 CFR 40.51. Records of surveys, receipt, and transfer must be maintained in accordance with 10 CFR 20.2103 and 40.51.
- Section 8, Personnel Radiation safety. Evaluate the licensee's determination that unmonitored personnel are not likely to receive more than 10 percent of the allowable limits. If any worker declared her pregnancy in writing, evaluate the licensee's compliance with 10 CFR 20.1208. Check whether records are maintained as required by 10 CFR 20.2101, 2102, 2103, 2104 and 2106.
- Section 9, Auditor's Independent Measurements (If Made). The auditor should make independent survey measurements and compare the results with those made or used by the licensee.
- Section 10, Notification and Reports. Check on the licensee's compliance with the notification and reporting requirements in 10 CFR Parts 19, 20, and 30. Ensure that the licensee is aware of the telephone number for NRC's Emergency Operations Center; (301) 816-5100.
- Section 11, Posting and Labeling. Check for compliance with the posting and labeling requirements of 10 CFR 19.11, 20.1902, 20.1904, and 21.6.
- Section 12, Recordkeeping for Decommissioning. Check to determine compliance with 10 CFR 40.36(f).
- Section 13, Bulletins and Information Notices. Check to determine if the licensee is receiving bulletins, information notices, NMSS Newsletters, and so on from the NRC. Check whether the licensee took appropriate action in response to NRC mailings.
- Section 14, Special License Conditions or Issues. Verify compliance with any special conditions on the licensee's license. If the licensee has any unusual aspect of its work, review and evaluate compliance with regulatory requirements.
- Section 15, Continuation of Report Items. This section is self-explanatory.
- Section 16, Problems or Deficiencies Noted; Recommendations. This section is self-explanatory.
- Section 17, Evaluation of Other Factors. Evaluate licensee management's involvement with the radiation safety program, whether the RSO has sufficient

time to perform his/her duties, and whether the licensee has sufficient staff to handle the workload and maintain compliance with regulatory requirements.

19.3 Sample Checklist

The following pages provide a sample checklist based on NUREG-1556, volume 7, appendix L.

Audit Report No. _____ License No. _____

Licensee's name and mailing address:

_____

_____

_____

_____

Audit of activities at (Address):

_____

_____

_____

_____

Contact at Audit Location _____ Telephone No. _____

Date of this Audit _____

Summary of Findings and Action:

[ ] No deficiencies
[ ] Deficiencies
[ ] Action on previous deficiencies

Recommendations:

Auditor: _____ Date: _____
(Signature)

1. AUDIT HISTORY [ ] N/A (N/A means "Not applicable" - Initial Audit)

A. Last audit of this location conducted _____

B. Problems/deficiencies identified during last two audits or two years, whichever is longer [ ] Y [ ] N

C. Open problems/deficiencies from previous audits:

Status Requirement	Prob./Def.	Corrective Action Taken (Y/N)	Open/Closed

D. Any previous problem/deficiency not corrected or repeated [ ] Y [ ] N [ ] N/A
Explain:

2. ORGANIZATION AND SCOPE OF PROGRAM

A. Briefly describe organizational structure

1. Structure is as described in license documents [ ] Y [ ] N
2. Multiple authorized locations of use [ ] Y [ ] N
3. Briefly describe scope of activities involving byproduct material, frequency of use, staff size, etc. [ ] Y [ ] N

B. Radiation Safety Officer [ ] Y [ ] N

1. Authorized on license [ ] Y [ ] N
2. Fulfills duties as RSO [ ] Y [ ] N

C. Use only by authorized individuals [ ] Y [ ] N

Remarks:

3. TRAINING, RETRAINING, AND INSTRUCTIONS TO WORKERS

A. Instructions to workers per [10 CFR 19.12] [ ] Y [ ] N

B. Training program required [ ] Y [ ] N

C. Training records maintained [ ] Y [ ] N

D. Evaluation of individuals' understanding of procedures and regulations based on interviews, observation of selected workers [ ] Y [ ] N

Adequate understanding of:

Current safe use procedures [ ] Y [ ] N

Emergency procedures [ ] Y [ ] N

E. Part 20

Workers cognizant of requirements for:

1. Radiation Safety Program [20.1101] [ ] Y [ ] N

2. Annual dose limits [20.1301, 20.1302] [ ] Y [ ] N

3. 10 percent monitoring threshold [20.502] [ ] Y [ ] N

4. Dose limits to embryo/fetus and declared pregnant women [20.1208] [ ] Y [ ] N

Remarks:

4. INTERNAL AUDITS, REVIEWS OR INSPECTIONS

A. Audits are conducted [ ] Y [ ] N

1. Audits conducted by _____

2. Frequency _____

B. Content and implementation of the radiation safety program reviewed annually [20.1101(c)] [ ] Y [ ] N

C. Records maintained [20.2102] [ ] Y [ ] N

5. FACILITIES

Facilities as described in license application [ ] Y [ ] N

Remarks:

6. RADIATION SURVEYS

A. Instruments and Equipment: [ ] Y [ ] N

1. Appropriate operable survey instrumentation possessed or readily available [ ] Y [ ] N

2. Calibrated as required [20.1501] [ ] Y [ ] N

3. Calibration records maintained [20.2103(a)] [ ] Y [ ] N

B. Briefly describe survey requirements [20.1501(a)]:

C. Performed as required [20.1501(a)] [ ] Y [ ] N

1. Radiation levels within regulatory limits [ ] Y [ ] N

2. Corrective action taken and documented [ ] Y [ ] N

D. Records maintained [20.2103] [ ] Y [ ] N

E. Protection of members of the public

1. Adequate surveys made to demonstrate either (a) that the TEDE to the individual likely to receive the highest dose does not exceed 100 mrem in a year, or (b) that if an individual were continuously present in an unrestricted area, the external dose would not exceed 2 mrem in any hour and 50 mrem in a year [20.1301(a)(1), 20.1302(b)] [ ] Y [ ] N

2. Unrestricted area radiation levels do not exceed 2 mrem in any one hour [20.1301(a)(2)] [ ] Y [ ] N

3. Records maintained [20.2103, 20.2107] [ ] Y [ ] N

Remarks:

7. TRANSFER OF RADIOACTIVE MATERIAL FOR WASTE DISPOSAL

A. Transfer(s) for "disposal" performed per [40.51] [ ] Y [ ] N [ ] N/A

B. Records of transfer maintained [20.2103(a), 40.51] [ ] Y [ ] N

Remarks:

8. PERSONNEL RADIATION SAFETY

A. ALARA considerations are incorporated into the Radiation Safety Program [20.1101(b)] [ ] Y [ ] N

B. Adequate documentation of determination that unmonitored individuals are not likely to receive more than 10 percent of allowable limit [20.1502(a)] [ ] Y [ ] N [ ] N/A

C. Worker declared her pregnancy in writing during inspection period (review records) [ ] Y [ ] N [ ] N/A

If yes, determine compliance with [20.1208] [ ] Y [ ] N

Check for records per [20.2106(e)] [ ] Y [ ] N

F. Records of exposures, surveys, monitoring, and evaluations maintained [20.2102, 20.2103, 20.2106, L/C] [ ] Y [ ] N

Remarks:

9. AUDITOR'S INDEPENDENT MEASUREMENTS (IF MADE)

A. Survey instrument Serial No. _____ Last calibration _____

B. Auditor's measurements compared to licensee's [ ] Y [ ] N

C. Describe the type, location, and results of measurements:

10. NOTIFICATION AND REPORTS [ ] N/A

A. Licensee in compliance with [19.13, 30.50] (reports to individuals, public and occupational, monitored to show compliance with Part 20) [ ] Y [ ] N [ ] N/A

B. Licensee in compliance with [20.2201, 40.60] (theft or loss) [ ] Y [ ] N [ ] None

C. Licensee in compliance with [20.2202, 40.60] (incidents) [ ] Y [ ] N [ ] None

D. Licensee in compliance with [20.2203, 40.60] (overexposures and high radiation levels) [ ] Y [ ] N [ ] None

E. Licensee aware of telephone number for NRC Emergency Operations Center [(301) 816-5100] [ ] Y [ ] N

11. POSTING AND LABELING

A. NRC-Form 3 "Notice to Workers" is posted [19.11] [ ] Y [ ] N

B. Parts 19, 20, 21, Section 206 of Energy Reorganization Act, procedures adopted pursuant to Part 21, and license documents are posted, or a notice indicating where documents can be examined is posted [19.11, 21.6] [ ] Y [ ] N

C. Other posting and labeling per [20.1902, 1904] and the license is not exempted by [20.1903, 1905] [ ] Y [ ] N

Remarks:

12. RECORD KEEPING FOR DECOMMISSIONING (if needed) [ ] N/A

A. Records of information important to the safe and effective decommissioning of the facility maintained in an independent and identifiable location until license termination [ ] Y [ ] N

B. Records include all information outlined in [40.36(f)] [ ] Y [ ] N

Remarks:

13. BULLETINS AND INFORMATION NOTICES

A. Receipt of NRC Bulletins, NRC Information Notices, NMSS Newsletters, and so on [ ] Y [ ] N

B. Appropriate action taken in response to Bulletins, Information Notices, etc. [ ] Y [ ] N

Remarks:

14. SPECIAL LICENSE CONDITIONS OR ISSUES [ ] N/A

A. Review special license conditions or other issues, and describe findings:

B. Problems/deficiencies identified at licensee facilities other than at audit location:

C. Evaluation of compliance:

15. CONTINUATION OF REPORT ITEMS [ ] N/A

(If more space is needed, use separate sheets and attach to report.)

16. PROBLEMS OR DEFICIENCIES NOTED; RECOMMENDATIONS [ ] N/A

Note: Briefly state (1) the requirement and (2) how and when violated. Provide recommendations for improvement.

17. EVALUATION OF OTHER FACTORS

A. Senior licensee management is appropriately involved with the radiation safety program and/or RSO oversight [ ] Y [ ] N

B. RSO has sufficient time to perform his/her radiation safety duties and is not too busy with other assignments [ ] Y [ ] N

C. Licensee has sufficient staff [ ] Y [ ] N

Remarks/recommendations:

20 Training

Before RCA entry, all personnel (except one-time visitors; see section 2.6) will receive and acknowledge training on the requirements of this RSP. The Garrison RSO or his or her designee will conduct this training.

20.1 Frequency of Training

Personnel who enter an RCA will receive radiation safety training:

- Before assuming duties that involve entry into an RCA
- Whenever there is a significant change in duties, regulations, or the terms of the license
- Annually (refresher training)

20.2 Training Topics

The Garrison RSO will tailor training to personnel wanting to enter an RCA to be commensurate with the type of work to be performed. Generally, these personnel are not occupationally exposed to radiation and, so, only require a minimum of awareness and familiarization training that will assure compliance with this RSP.

20.2.1 General Radiation Safety Topics

General Radiation RCA worker training may include the following topics:

- Fundamentals of radiation safety
- Characteristics of radiation
- Units of radiation dose (rem) and radioactivity (curie)
- Significance of radiation dose
- Radiation safety standards
- Biological effects of radiation
- Levels of radiation from sources of radiation
- Methods of controlling radiation dose
    - Time
    - Distance
    - Shielding
- Radiation safety practices, including prevention of contamination and methods of decontamination
- Discussion of internal exposure pathways
- Radiation detection instrumentation to be used
- Radiation survey instruments
    - Operation
    - Calibration
    - Maintenance
    - Limitations
- Survey techniques
- Individual monitoring devices

- Equipment to be used
- Handling equipment and remote handling tools
- Sources of radiation
- Storage, control, disposal, and transport of equipment and sources of radiation
- Requirements of pertinent federal and state regulations
- Written operating, safety, and emergency procedures
- Recordkeeping procedures

20.2.2 RCA-Specific Radiation Safety Topics

RCA-specific radiation safety training will include the following topics:

- Provisions of this RSP
- Radiological characteristics of DU and its biological effects
- Dosimetry and bioassay requirements
- Contamination control
- Hot-line procedures
- Decontamination, techniques, methods, procedures and management practices
- Worker rights and responsibilities
- Emergency procedures for events such as personnel injury, fire, RCA evacuation, lightning, and so on
- Reporting of incidents
- Stop work procedures
- Special training and rights of declared pregnant workers

20.3 Training Documentation

The Garrison RSO will establish and maintain the following training documentation:

- Attendance rosters that include each attendee's name, signature, and organization for each class
- The time, date, and location of the training for each class
- The name of the instructor for each class
- The lesson plans for the RCA-specific radiation safety training

21 Recordkeeping

21.1 Garrison Documentation

The Garrison RSO will maintain the following project documentation, which will be provided to the License RSO and, upon request, made available to the NRC:

- Records of radiation surveys, monitoring and disposal
- Evidence of attendance at 8-h Radiation Worker Training courses
- RCA-specific radiation safety training records
- Instrument inventory and calibration records
- RCA personnel entry logs
- Notification of incidents
- Reports of overexposure and excessive levels and concentrations
- Notification and reports to individuals
- Any other records generated for the purposes of radiation safety during the project

21.2 Radioactive Material License Documentation

The License RSO will maintain a copy of each of the documents listed in Section 21.1 in license files.

22 Emergency Planning

The Garrison RSO will provide radiation safety support to supporting emergency medical personnel as necessary and upon request.

22.1 Radiological Emergencies

Although unlikely if normal precautions and personal hygiene measures are followed, significant acute ingestion or inhalation of DU-contaminated dust could occur and is the only credible radiological emergency at the RCA. In such an event, the worker will be evacuated to the local supporting military medical facility for evaluation.

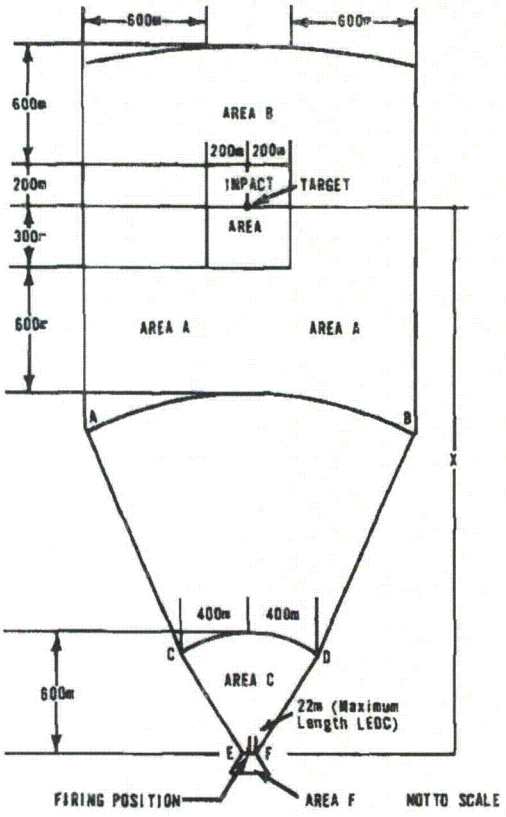
Current US Army Medical Command guidance is in OTSG/MEDCOM Policy Memo 09-038, 18 June 2009 (expires 18 June 2011), subject: Medical Management of Army Personnel Exposed to Depleted Uranium (DU).

22.2 Non-Radiological Emergencies

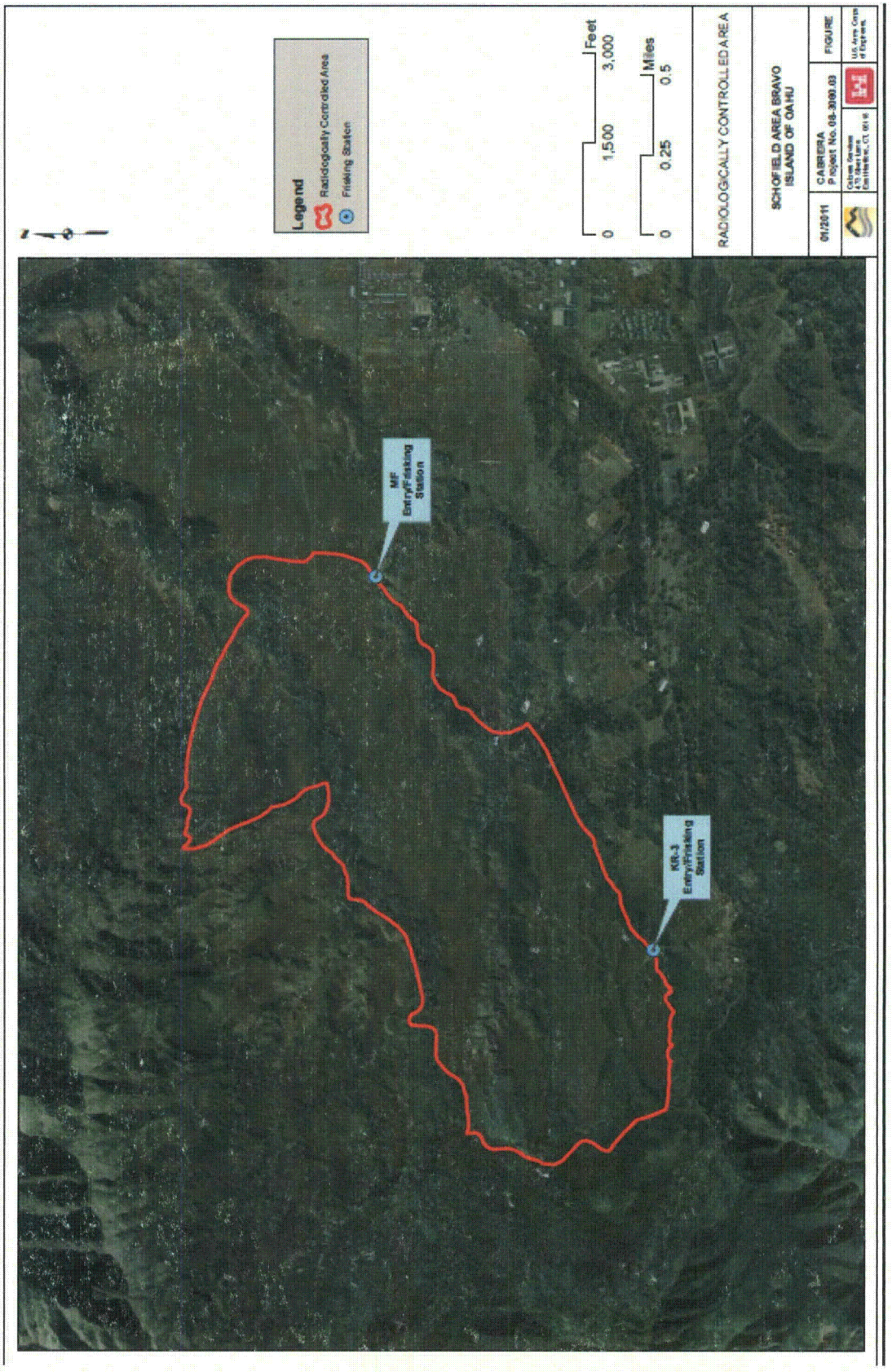
All life-saving and limb-saving emergencies always take priority over radiation safety concerns, including decontamination. (Note that removal of outer clothing will remove most surface contamination.)

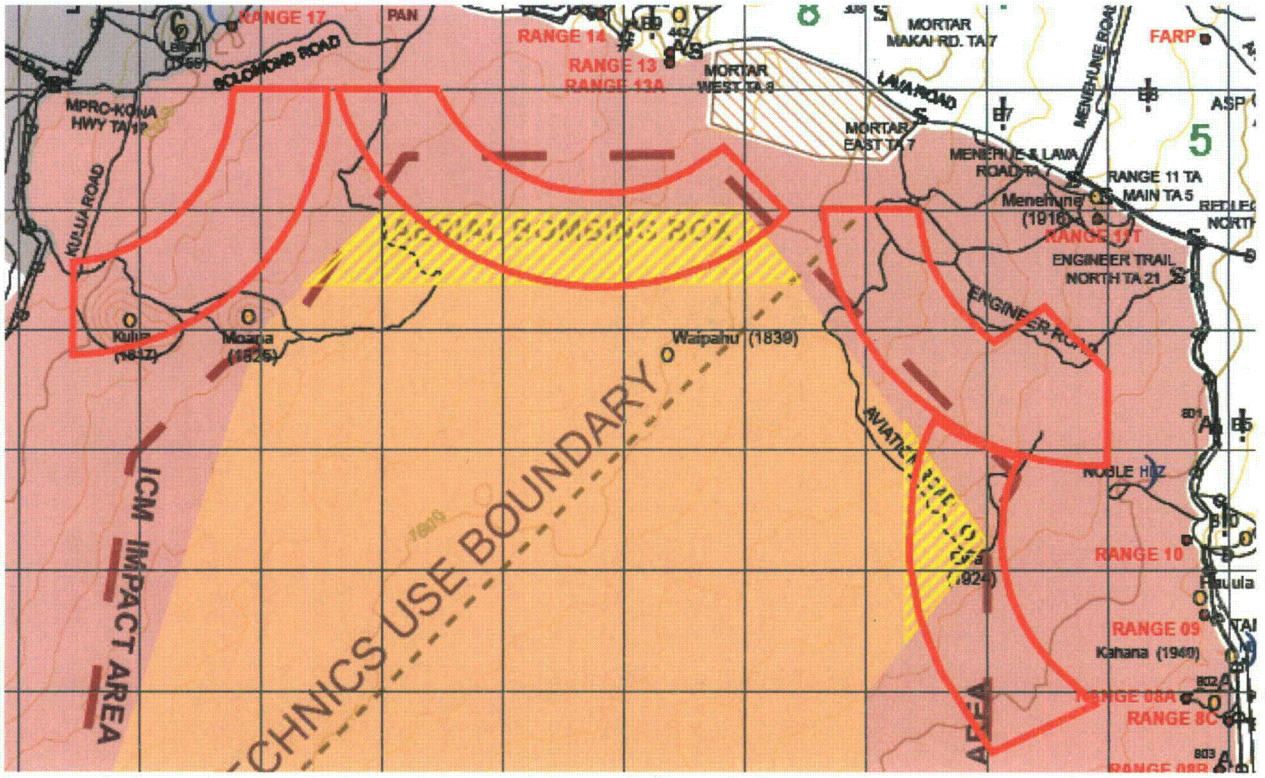
23 Figures

M101 spotting round



Davy Crockett surface danger area diagram


Legend
Radiologically Controlled Area
Firing Station
Feet
0
1,500
3,000
Miles
0
0.25
0.5
RADIOLOGICALLY CONTROLLED AREA
SCHOFIELD AREA BRAVO
ISLAND OF OAHU
01/2011
CABRERA
Project No. 08-3060.03
FIGURE
MF
Entry/Firing
Station
KR-3
Entry/Firing
Station



RCAs at Pohakuloa Training Area, Island of Hawaii

24 Example Instrumentation

Ludlum Model 12 Ratemeter

COMPATIBLE DETECTORS: G-M, proportional, scintillation
METER DIAL: 0 - 500 cpm, 0 - 2.5 kV, BAT TEST (*others available*)
MULTIPLIERS: × 1, × 10, × 100, × 1000
LINEARITY: Reading within plus or minus 10 percent of true value with detector connected
CONNECTOR: Series "C" (*others available*)
AUDIO: Built in unimorph speaker with ON/OFF switch (*greater than 60 dB at 2 feet*)
CALIBRATION CONTROLS: Accessible from front of instrument (*protective cover provided)*
HIGH VOLTAGE: Adjustable from 200 – 2500 volts (*can be read on meter*)
DISCRIMINATOR: Adjustable from 2 – 60 mV
RESPONSE: Toggle switch for FAST (4 s) or SLOW (22 s) from 10 percent to 90 percent of final reading
RESET: Push-button to zero meter
POWER: 2 each D cell batteries (*housed in sealed compartment that is externally accessible*)
BATTERY LIFE: Typically 600 hours with alkaline batteries (*battery condition can be checked on meter*)
METER: 2.5" (6.4 cm) arc, 1 mA analog type
CONSTRUCTION: Cast and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 6.5 inches (16.5 cm) height × 3.5 inches (8.9 cm) width × 8.5 inches (21.6 cm) length
WEIGHT: 3.5 lbs (1.6 kg) including batteries

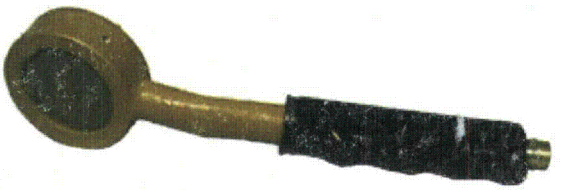
Ludlum Model 19A MicroR Meter

WORKING ENVIRONMENT: Splash proof shields for outdoor use
INDICATED USE: Low level gamma survey
DETECTOR: 1-inch × 1-inch sodium iodide NaI(Tl) scintillator
SENSITIVITY: Typically 175 cpm $(\mu R\ h^{-1})^{-1}$ (^{137}Cs gamma)
ENERGY RESPONSE: Energy dependent
METER DIAL:0 – 500 $\mu R\ h^{-1}$ dual colored logarithmic scale, BAT TEST
ALARM: Indicated by red lamp and audible tone (Alarm audio overrides the audio ON/OFF switch)
LIGHT: Push-button to activate
LINEARITY: Reading within ± 10 percent of true value
AUDIO: Built in unimorph speaker with ON/OFF switch (greater than 60 dB at 2 feet)
CALIBRATION CONTROLS: All calibration controls are internal
RESPONSE: Dependent on number of counts present (typically not greater than 7 seconds from 10 percent to 90 percent of final reading)
RESET: Push-button to zero meter
POWER: 2 each "D" cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: Typically 600 h with alkaline batteries (battery condition can be checked on meter)
METER: 2.5 inches (6.4 cm) arc, 1 mA analog type
CONSTRUCTION: Cast and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 7.8 inches (19.8 cm) height × 3.5 inches (8.9 cm) width × 8.5 inches (21.6 cm) length
WEIGHT: 4.5 pounds (2.1 kg) including batteries

Ludlum Model 43-89 Alpha/Beta Scintillator

INDICATED USE: Alpha-beta survey
SCINTILLATOR: ZnS(Ag) adhered to 0.010-inch thick plastic scintillation material
WINDOW: Typically 1.2 mg cm^{-2} aluminized Mylar
WINDOW AREA: Active – 125 cm^2; Open – 100 cm^2
EFFICIENCY (4π geometry): Typically 16 percent – ^{239}Pu; 5 percent – ^{99}Tc; 16 percent – $^{90}S/^{90}Y$
BACKGROUND: Alpha - Less than 3 cpm; Beta - Typically 300 cpm or less (10 μR h^{-1} field)
NON-UNIFORMITY: Less than 10 percent
CROSS TALK: Alpha to Beta - Less than 10 percent; Beta to Alpha - Less than 1 percent
COMPATIBLE INSTRUMENTS: Model 2224, 2360, 2929
TUBE: 1.5 inches (3.8cm) diameter magnetically shielded photomultiplier
OPERATING VOLTAGE: Typically 500 - 1200 volts
DYNODE STRING RESISTANCE: 100 megohms
CONNECTOR: Series C (others available)
CONSTRUCTION: Aluminum housing with beige polyurethane enamel paint
TEMPERATURE RANGE: -4° F(-20° C) to 122° F(50° C)
SIZE: 5.5 inches (13.9 cm) height × 4 inches (10.2 cm) width × 12.3 inches (33 cm) length
WEIGHT: 1.5 lb (0.7kg)

Ludlum Model 44-9 Pancake G-M Detector

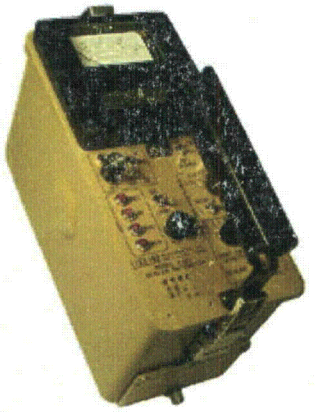


INDICATED USE: Alpha beta gamma survey; Frisking
DETECTOR: Pancake type halogen quenched G-M
WINDOW: 1.7 ± 0.3 mg cm^{-2} mica
WINDOW AREA: Active – 15 cm^2; Open – 12 cm^2
EFFICIENCY (4π geometry): Typically 5 percent – ^{14}C; 22 percent – $^{90}Sr/^{90}Y$; 19 percent – ^{99}Tc; 32 percent – ^{32}P; 15 percent – ^{239}Pu
SENSITIVITY: Typically 3300 cpm $(mR\ h^{-1})^{-1}$ (^{137}Cs gamma)
ENERGY RESPONSE: Energy dependent
DEAD TIME: Typically 80 μs
COMPATIBLE INSTRUMENTS: General purpose survey meters, ratemeters, and scalers
OPERATING VOLTAGE: 900 volts
CONNECTOR: Series C (*others available*)
CONSTRUCTION: Aluminum housing with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 1.8 inches (4.6 cm) height × 2.7 inches (6.9 cm) width × 10.7 inches (27.2 cm) length
WEIGHT: 1 lb (0.5kg)

Ludlum Model 44-10 Gamma Scintillator

INDICATED USE: High energy gamma detection
SCINTILLATOR: 2-inch (5.1-cm) diameter × 2-inch (5.1-cm) thick NaI(Tl) scintillator
SENSITIVITY: Typically 900 cpm $(\mu R\ h^{-1})^{-1}$ (^{137}Cs)
ENERGY RESPONSE: Energy dependent
COMPATIBLE INSTRUMENTS: General purpose survey meters, ratemeters, and scalers
TUBE: 2-inch (5.1cm) diameter magnetically shielded photomultiplier
OPERATING VOLTAGE: Typically 500 – 1200 volts
DYNODE STRING RESISTANCE: 60 megohms
CONNECTOR: Series C (others available)
CONSTRUCTION: Aluminum housing with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 2.6 inches (6.6 cm) diameter × 11 inches (27.9 cm)length
WEIGHT: 2.3 pounds (1.1kg)

Ludlum Model 2221, Scaler/Ratemeter Single Channel Analyzer



INDICATED USE: Field analysis
COMPATIBLE DETECTORS: G-M, proportional, scintillation
CONNECTOR: Series "C" (others available)
AUDIO: Built in unimorph speaker with volume control (greater than 60 dB at 2 feet, full volume)
AUDIO DIVIDE: Thumb switch for 1, 10, or 100 events-per-click
AUDIO JACK: For optional headset
METER DIAL: 0 - 500 cpm; 50 - 500k cpm logarithmic scale (others available)
MULTIPLIERS: × 1, × 10, × 100, × 1k, and LOG for logarithmic scale
LINEARITY: Reading within ± 10% of true value with detector connected
DIGITAL DISPLAY: 6-digit LCD display with 0.5" (1.3 cm) digits
LCD BACKLIGHT: Activated by LAMP switch
DIGITAL RATEMETER: Provides a digital display of count rate when selector switch is in Dig. Rate position
SCALER: Used in conjunction with timer to allow for gross counting with range from 0 - 999999 counts when
selector switch is in Scaler position (controlled by COUNT and HOLD buttons)
TIMER: Switch selectable divisions of 0.1, 0.5, 1, 2, 5, 10 minutes or CONT (continuous) for manual timing
CALIBRATION CONTROLS: Accessible from front of instrument (protective cover provided)
HIGH VOLTAGE: Adjustable from 200 - 2400 volts (can be checked on display)
THRESHOLD: Adjustable from 100 - 1000 (can be checked on display)
WINDOW: Adjustable from 0 - 1000 above threshold setting (can be turned on or off)
GAIN: Adjustable from 1.5 - 100 mV at threshold setting of 100
OVERLOAD: Senses detector saturation. Indicated by "------" on LCD display and meter going to full scale (adjustable depending on detector selected)
RESPONSE: Toggle switch for FAST (4 seconds) or SLOW (22 seconds) from 10% to 90% of final reading
RESET: Push-button to zero meter
POWER: 4 each "D" cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: Typically 250 hours with alkaline batteries (battery condition can be checked on digital display)
METER: 2.5" (6.4 cm) arc, 1 mA analog type
CONSTRUCTION: Milled and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: -4° F (-20° C) to 122° F (50° C)
May be certified for operation from -40° F (-40° C) to 150° F (65° C)
SIZE: 9" (22.9 cm) height × 4.3" (10.9 cm) width × 10" (25cm) length including handle
WEIGHT: 5.5 lbs (2.5kg) including batteries

Ludlum Model 2224 Alpha/Beta Scaler/Ratemeter

INDICATED USE: Simultaneous alpha, beta counting and discrimination
COMPATIBLE DETECTORS: Proportional and dual phosphor scintillation detectors
CONNECTOR: Series C (others available)
AUDIO: Built in unimorph speaker with volume control (greater than 60 dB at 2 feet, full volume)
AUDIO DIVIDE: Selectable dual or individual click-per-event for alpha and beta counts and divisions of 1, 10, 100, or 1000 events-per-click (beta counts only)
METER: 2.5 inches (6.4 cm) arc, 1 mA analog type
METER DIAL: 0 – 500 cpm, 0 – 2 kV, BAT OK, OL(overload)
MULTIPLIERS: × 1, × 10, × 100, × 1000
LINEARITY: Reading within ± 10 percent of true value with detector connected
SCALER: 6 digit LCD display with 0.25-inch (0.64-cm) digits, overflow arrow, and colons to indicate when a count is in process
COUNT: Push-button to initiate scaler count
COUNT TIME: Internally selected times of 0.1, 0.5, 1, or 2 minutes
SELECTOR SWITCH: Toggle switch to select alpha and beta, alpha only, or beta only
HIGH VOLTAGE: Adjustable from 200 – 2000 volts (can be read on meter)
HIGH VOLTAGE ADJUST: Accessible from front of instrument (protective cover provided)
THRESHOLD: Internal control allows adjustment from 2 mV – 15 mV for beta, and 40 mV – 700 mV for alpha
WINDOW (Beta only): Internal control allows adjustment from beta threshold up to the alpha threshold setting
OVERLOAD: Senses detector saturation. Indicated by red lamp on meter and meter going to full scale (adjustable
depending on detector selected)
RESPONSE: Will vary according to number of counts present. Typically 2 s – 11 s from 10 percent to 90 percent of final reading
POWER: 2 each D cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: Greater than 350 hours with alkaline batteries (battery condition can be checked on meter)
CONSTRUCTION: Cast and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 6.5 inches (16.5 cm)height × 3.5 inches (8.9 cm) width × 8.5 inches (21.6 cm) length
WEIGHT: 3.5 lbs(1.6 kg) including batteries

Ludlum Model 2241 Digital Survey Meter

INDICATED USE: General purpose survey, gross counting
COMPATIBLE DETECTORS: G-M, proportional, scintillation
CONNECTOR: Series C (others available on request)
AUDIO: Built in unimorph speaker with ON/OFF switch (greater than 60 dB at 2 feet)
ALERT/ALARM: Indicated by enunciator on display and audible tone
DISPLAY: 4 digit LCD display with 0.5-inch (1.3-cm) high digits, separate enunciators for display units, alert, alarm, low battery, detector overload, counting overflow, and scaler counting
BACKLIGHT: Push-button to activate
RATEMETER: Can display in R/hr, Sv/hr, cpm, or cps when control switch is in RATEMETER position
DISPLAY RANGE: Auto ranging from 0.0 μR h^{-1} – 9999 R h^{-1}; 0.000 μSv h^{-1} – 9999 Sv t^{-1}; 0 cpm – 999k cpm;
or 0 cps – 100 kcps
LINEARITY: Reading within ± 10 percent of true value with detector connected
SCALER: Activated by push-button in handle (count time adjustable from 1 to 9999 s in 1-s intervals)
CALIBRATION CONTROLS: Accessible from front of instrument (protective cover provided)
HIGH VOLTAGE: Adjustable from 200 volts – 2500 volts
DISCRIMINATOR: Adjustable from 2 mV – 100 mV
OVERLOAD: Indicated by OVERLOAD on display (adjustable depending on detector selected)
RESET: Push-button to zero display, acknowledge and/or reset alarm
POWER: 2 each D cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: Typically 200 h with alkaline batteries (low battery indicated on display)
CONSTRUCTION: Cast and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 6.5 inches (16.5cm) height × 3.5 inches (8.9cm) width × 8.5 inches (21.6cm) length
WEIGHT: 3.5 lbs (1.6kg) including batteries