August 8, 2007

TO: Brian Holian, Director
Division of Nuclear Materials Safety
Region 1

FROM: Andy Campbell, Acting Deputy Director **/RA/**
Environmental Protection & Performance
Assessment Directorate
Division of Waste Management
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SUBJECT: RESPONSE TO TECHNICAL ASSISTANCE REQUEST FOR THE DEPARTMENT OF THE ARMY, US ARMY RDEC/ARDEC (PICATINNY ARSENAL)

Introduction

Region I submitted a Technical Assistance Request (TAR) to review the site-specific Derived Concentration Guideline Level (DCGL) for depleted uranium, using the information provided in "Derivation of a Site Specific DCGL for the Remediation of TACOM-ARDEC Picatinny Arsenal Building 318 and Evaluation of Final Survey Results, October 2004," (DCGL report), dated March 26, 2007, for the unrestricted release of Building 318 at the Picatinny Arsenal site.

According to the DCGL report, Building 318 is part of the U.S. Army Armament Research, Development and Engineering Center (ARDEC) located at the Picatinny Arsenal in Dover, New Jersey. The building was used to store manufacturing equipment from other facilities. Much of the equipment was found to be contaminated with depleted uranium. The equipment stored in Building 318 was either free released for potential re-use and moved to other buildings or disposed of as radioactive waste.

As stated in the TAR, the licensee developed a depleted uranium DCGL for Building 318 and performed final status surveys without obtaining NRC approval. The licensee determined that it was acceptable to use this DCGL based on a similar site-specific DCGL which was approved by the U.S. Nuclear Regulatory Commission (NRC) for a different building on the site. Region I became aware of these actions in October 2002 when the licensee submitted a request to release Building 318 for unrestricted use. Thereafter, Region I voided the action and requested that the licensee submit the information needed to evaluate a site-specific DCGL for Building 318 for approval. With the support of a contractor, the Picatinny Arsenal staff provided the requested information in the aforementioned DCGL report.

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Source Term

Depleted uranium, consisting of uranium-235, uranium-234, and uranium-238, is the radionuclide of concern for Building 318. The licensee assumed an initial input concentration of 1000 pCi/m^2 of depleted uranium. As stated in the DCGL report, the relative fractions of the uranium isotopes, in terms of concentrations, in depleted uranium used at the site are the following:

Uranium Isotopes	Relative Fractions
U-234	0.305
U-235	0.013
U-238	0.682

It should be noted that the relative fractions of the uranium isotopes in depleted uranium assumed by the licensee are conservative, according to the DCGL report.

Scenario Selection and Exposure Pathways

The licensee proposes unrestricted release of Building 318 in compliance with the requirements of 10 CFR 20.1402. Thus, the residual radioactivity that is distinguishable from background must not cause the total effective dose equivalent (TEDE) to an average member of the critical group to exceed 25 mrem/yr. Residual radioactivity must also be reduced to levels that are as low as reasonably achievable (ALARA). The critical group is a relatively small group of individuals, due to their habits, actions, and characteristics, who could receive among the highest potential dose at some time in the future. By using the hypothetical critical group as the dose receptor, it is unlikely that any individual would actually receive doses in excess of that calculated for the average member of the critical group.

The building occupancy scenario is used to evaluate potential exposure to fixed and removable surface radioactivity within structures that will be left in Building 318. It is assumed that a light industrial worker occupies the structure in a passive manner without deliberately disturbing the residual radioactivity on building surfaces. A light industrial worker, which is assumed to be an adult, is used to represent an average member of the hypothetical critical group. The worker is assumed to be exposed to penetrating radiation from surface sources, inhalation of resuspended surface contamination, and inadvertent ingestion of surface contamination.

Parameter Selection and Calculations

The licensee selected RESRAD-BUILD, Version 3.22 to calculate the DCGL for depleted uranium. The licensee used RESRAD-BUILD default parameter values to develop the DCGL value with the following exceptions:

- removable fraction of surface contamination was set to 0.1
- selection of area source as source type
- evaluation times of 0, 1, 2, 5, 10, 100, and 1000 years were selected

The removable fraction parameter value selected by the licensee is consistent with the NRC guidance provided in NUREG/CR-6755. The source type and evaluation times selected are appropriate for modeling Building 318. In this case, the default parameter values used which are sensitive to dose were conservative parameter values. Therefore, these parameter values are acceptable.

According to the DCGL report, Building 318 is a single story, brick, high-bay structure that is approximately 30 ft wide by 130 ft long. The building is partitioned at one end to provide an office space of about 30 ft wide by 30 ft long. The remaining 3,000 square feet was used as storage space. However, the licensee used the default parameters for the area of the building (36 m^2) as well as the source area (36 m^2) to model the building. The licensee used the default parameter values for the source and receptor location in which the contamination is assumed to be in the corner area of the room with the receptor at 1 m distance from the area of contamination. In addition, the licensee used an input concentration of 1,000 pCi/m^2 for depleted uranium. The dose results from RESRAD-BUILD in units of mrem per 1,000 pCi/m^2 were scaled to the 25 mrem (0.25 mSv) TEDE limit and converted to dpm/100 cm^2 to determine an acceptable depleted uranium DCGL value. Staff made confirmatory runs using RESRAD-BUILD, Version 3.22 implementing the licensee's parameter values. The staff was able to verify the licensee's depleted uranium DCGL result of 2413 dpm/100 cm^2 for building surfaces. With an input concentration of 1,000 pCi/m^2, the maximum dose in the first year of exposure resulted in 0.23 mrem.

Staff performed independent analyses to evaluate the dose effects of increasing the modeled room size from the default value of 36 m^2 (6 ft by 6 ft) to 144 m^2 (12 ft by 12 ft) using the parameter selection guidance provided in NUREG/CR-6755. The source area was similarly increased from 36 m^2 to144 m^2. The receptor was assumed to be at the center of the floor at a height of 1 m. The surfaces of the walls, ceiling, and floor were assumed to be contaminated. For consistency, an input concentration of 1,000 pCi/m^2 of depleted uranium was used. The results of the analysis demonstrates that the DCGL value increases approximately by a factor of 2. The maximum dose resulted in less than 0.15 mrem in the first year of exposure for an assumed depleted uranium concentration of 1,000 pCi/m^2. If only the floor (12 ft by 12 ft) was assumed to be contaminated, the DCGL value derived by staff is consistent with the DCGL value derived by the licensee. Because the parameter values selected by the licensee are conservative in modeling Building 318, the DCGL value for depleted uranium derived by the licensee is determined to be acceptable.

Conclusion

The staff finds that the source term, scenario, and exposure pathways used in the assessment were appropriate. Although most of the input parameters used by the licensee were default parameter values, the licensee's derived DCGL value for depleted uranium is conservative when compared to staff's independent analyses. The staff concludes that the site-specific depleted uranium DCGL of 2413 dpm/100 cm^2 for Building 318 is acceptable and meets the dose criterion in 10 CFR 20.1402 for unrestricted release.

References

Duratek, “Derivation of a Site Specific DCGL for the Remediation of TACOM-ARDEC Picatinny Arsenal Building 318 and Evaluation of Final Survey Results,” October 2004.

U.S. NRC, “Technical Basis for Calculating Radiation Doses for the Building Occupancy Scenario Using the Probabilistic RESRAD-BUILD 3.0 Code,” NUREG/CR-6755, February 2002.

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Duratek, “Derivation of a Site Specific DCGL for the Remediation of TACOM-ARDEC Picatinny Arsenal Building 318 and Evaluation of Final Survey Results,” October 2004.

U.S. NRC, “Technical Basis for Calculating Radiation Doses for the Building Occupancy Scenario Using the Probabilistic RESRAD-BUILD 3.0 Code,” NUREG/CR-6755, February 2002.

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