July 10, 2008

MEMORANDUM TO: John D. Kinneman, Director
Division of Nuclear Materials Safety, Region I

FROM: Patrice Bubar, Deputy Director**/RA/**
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

SUBJECT: RESPONSE TO TECHNICAL ASSISTANCE REQUEST DATED APRIL 22, 2008, FOR NAVAL SURFACE WARFARE CENTER DAHLGREN DIVISION

Region I submitted a Technical Assistance Request, dated April 22, 2008, requesting review of derived concentration guideline levels (DCGLs) for Building 200, Bay 4 Indoor Test Range at the Naval Surface Warfare Center Dahlgren Laboratory. The purpose of our review was to determine if use of the Navy's proposed DCGLs as screening values during remediation will ensure the site will be able to meet the dose criteria for unrestricted release specified in 10 CFR Part 20, Subpart E and permit termination of the license. The Performance Assessment Branch has completed its review of the Navy's proposed DCGLs and has provided a Technical Evaluation Report (enclosed). Based upon our review, staff finds that the DCGLs calculated for the Dahlgren Laboratory site are acceptable provided the following condition is met.

The calculated DCGLs are only acceptable if the residual radioactivity found on the building surfaces at the site is surficial as provided in NUREG-1757, Volume 2, Revision 1. Background documents submitted with the TAR do not specifically address this issue, but do indicate that some DU rounds became embedded in the building surfaces. In response to this question being raised by NRC staff, the licensee partially addressed the issue via e-mail on 6/30/2008 indicating this condition will be met based on visual inspections and surveys conducted during previous site survey efforts. In a phone call on July 9, 2008 NRC staff informed Orysia Masnyk-Bailey of Region I that the licensee needs to specifically address how far the DU rounds or fragments of rounds penetrated the building surfaces.

If you have questions regarding this review, please contact Allen Gross of my staff. He can be reached at 301-415-8138.

Docket No.: 030-29462

Enclosure: Technical Evaluation Report

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Department of the Navy
Surface Warfare Center
Dahlgren Laboratory
Building 200, Bay 4 Indoor Test Range

Prepared by: Allen Gross, Project Manager

License: 45-23645-01NA Docket: 030-29462 Control No.: 142222

Background

Region I submitted a Technical Assistance Request, dated April 22, 2008, requesting review of derived concentration guideline levels (DCGLs) for Building 200, Bay 4 Indoor Test Range at the Naval Surface Warfare Center Dahlgren Laboratory. The purpose of our review was to determine if use of the Navy's proposed DCGLs as screening values during remediation will ensure the site will be able to meet the dose criteria for unrestricted release specified in 10 CFR Part 20, Subpart E and permit termination of the license. The Performance Assessment Branch has completed its review of the Navy's proposed DCGLs. Based upon our review, staff finds that the DCGLs calculated for the Dahlgren Laboratory site are acceptable provided the following condition is met.

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Source Term

Residual contamination consisting of depleted uranium (DU) is expected on the floor, walls, and ceiling areas of Building 200, Bay 4. The licensee provided the following weight fraction for DU 99.7% U-238, 0.25% U-235, and .005% U-234. As a fraction of total activity this equates to 51.35% U-238, 0.81% U-235, and 47.84% U-234.

In accordance with 10 CFR 20.1402, the residual radioactivity that is distinguishable from background remaining at the site at the time of license termination cannot result in a total effective dose equivalent (TEDE) to an average member of the critical group that will exceed 0.25 mSv/y (25 mrem/y).

Licensee Analysis

The Department of the Navy calculated a DCGL for depleted uranium (DU) on building surfaces of 1150 disintegrations per minute gross alpha activity per 100 square-centimeters area (dpm/100 cm^2). The DU DCGL was calculated using the formula for gross activity DCGL found

Enclosure

in MARSSIM Equation 4-4, and the DandD code Version 2.1 with its default building occupancy scenario. This resulted in a DCGL for DU of 81 dpm/100 cm^2 (42 dpm/100 cm^2 of U-238 + 39 dpm/100 cm^2 of U-234). The contribution of U-235 to the DU DCGL is less than 1 dpm/100 cm^2. The Navy then calculated an adjustment factor of 14.2 for the resuspension factor by comparing the recommended value of 1×10^{-6} found in draft NUREG-1720 "Re-evaluation of the Indoor Resuspension Factor for the Screening Analysis of the Building Occupancy Scenario for NRC's License Termination Rule" to the 1.42×10^{-5} value used in DandD Version 2.1. The DCGL of 81 dpm/100 cm^2 was multiplied by the adjustment factor to arrive at an adjusted gross alpha DCGL of 1150 dpm/100 cm^2. The proper way to utilize the revised resuspension factor is to enter the parameter directly in the DandD code and then run it with the revised factor.

Because the licensee's scoping surveys revealed that it was much more efficient to measure beta radiation than alpha radiation, the Navy calculated a gross beta DCGL. The licensee determined that two beta particles are emitted for every disintegration of uranium-238, considering the uranium-238 decay chain down to uranium-234. The licensee stated that because uranium-235, uranium-234 and their progeny are removed to negligible amounts during the enrichment process, uranium-234 and its progeny can be ignored in the calculation of beta particles produced. Therefore the gross beta DCGL was calculated by multiplying the U-238 gross alpha DCGL of 42 dpm/100 cm^2 by 14.2 to adjust for the revised resuspension factor from NUREG-1720 and then multiplying that by 2 to account for the number of beta particles produced during decay. The result is a gross beta DCGL of 1192 dpm/100 cm^2.

The licensee's statement that uranium-234 is removed to a negligible amount is not entirely correct because even though it only makes up .005% of the fraction by weight, it accounts for 47.84% of the total activity. However, since uranium-234 does not emit a beta particle, their method for calculating the gross beta DCGL is acceptable.

NRC Analysis

NRC staff conducted its review in accordance with guidance provided in NUREG-1757, Vol. 2, Rev. 1. The guidance states that DCGLs developed using DandD Version 2 computer code will be acceptable provided the following conditions are met:

1. The residual activity on building surfaces is surficial and non-volumetric [e.g. ≤ 10 mm (0.39 in) of penetration].

2. If the residual radioactivity is greater than 10% of the respective screening DCGLs, (from Table H.1 of NUREG-1757, Vol. 2, Rev. 1, Appendix H), the removable fraction is 10% or less at license termination, or the removable fraction has been adjusted as explained in footnote a in Table H.1.

3. If more than one radionuclide is involved, there is reasonable assurance that the sum of fractions is no greater than 1.

4. Other than entering the unit concentrations, only default parameters within the code are used in the analysis.

5. The licensee used the 90^{th} percentile of the dose distribution to derive the concentrations.

The licensee adequately addressed criteria 2, 3, and 4. Individual radionuclide DCGL values were developed through the use of DandD Version 2.1 by entering the draft NUREG-1720 resuspension factor directly in the DandD code, entering unit concentrations for the radionuclides, and using the default values for all other parameters. The 90th percentile value of the dose distribution from the DandD runs for each of the 3 radionuclides, in units of mrem per dpm/100 cm^2, were scaled to the 25 mrem TEDE limit to determine the individual radionuclide DCGL values.

The individual radionuclide DCGL values and their respective fractions of the total activity of DU found at the site were entered in MARSSIM Equation 4-4 to calculate the gross alpha DCGL for the site. The result was a gross alpha DCGL of 1329 dpm/100 cm^2 compared to the 1150 dpm/100 cm^2 DCGL the Department of the Navy calculated.

The gross beta DCGL was calculated by multiplying the gross alpha DCGL of 1328 dpm/100 cm^2 by 0.5135, which is the fraction of total activity that comes from U-238, and then multiplying that by 2 for each beta particle produced during decay as described above. The result was a gross beta DCGL of 1365 dpm/100 cm^2 compared to that calculated by the Navy of 1192 dpm/100 cm^2.

The Navy's DCGLs are lower because it appears they used the values of the upper bound of the 95th confidence interval for the 90th percentile values of the dose distributions in their calculations rather than the 90th percentile values. Also, their DCGLs would be slightly different due to rounding errors in their method of applying the draft NUREG-1720 resuspension factor.

Conclusions

Since the DCGLs calculated by the Navy are more conservative than those calculated by the NRC, they are acceptable provided that the residual radioactivity found on the building surfaces at the site is surficial as outlined in NUREG-1757, Vol. 2, Rev. 1, Appendix H. Background documents submitted with the TAR do not specifically address this issue, but do indicate that some DU rounds became embedded in the building surfaces. In response to this question being raised by NRC staff, the licensee partially addressed the issue via e-mail on 6/30/2008 indicating this condition will be met based on visual inspections and surveys conducted during previous site survey efforts. In a phone call on July 9, 2008 NRC staff informed Orysia Masnyk-Bailey of Region I that the licensee needs to specifically address how far the DU rounds or fragments of rounds penetrated the building surfaces.

The use of resuspension factors from draft NUREG-1720 for calculation of DCGLs using the DandD code is an acceptable approach. The Regions can approve of its use without requesting approval from the Performance Assessment Branch.

If you have any questions on this action, please contact Allen Gross, of my staff at (301) 415-8138. If you have any questions on whether a technical assistance request is necessary for a site, contact the Performance Assessment Branch Chief, Andrea Kock, at (301) 415-7183.

cc: Marie Miller, Region 1
Orysia Masnyk-Bailey, Region 1
Dominick Orlando, DURLD