U.S. NUCLEAR REGULATORY COMMISSION
DOCKET NUMBER 040-07354
January 20, 2006

SAFETY EVALUATION REPORT
Related to Amendment Request to Revise Authority to Dispose of Two M2A2 Bradley Fighting Vehicles Containing Depleted Uranium Material Pursuant to 10 CFR 20.2002
Materials License No. SUB-834
Issued to U.S. Department of the Army

1.0 BACKGROUND

On September 13, 2005, Aberdeen Test Center (ATC) requested a license approval to transfer and dispose of two M2A2 Bradley Fighting Vehicles at the US Ecology, Idaho, facility, a Subtitle C Resources Conservation and Recovery Act (RCRA) hazardous waste disposal facility. The request for approval is submitted pursuant to Section 20.2002 of Title 10 of the Code of Federal Regulations (10 CFR) 20.2002, "Method of Obtaining Approval of Proposed Disposal Procedures."

Two U.S. Army M2A2 Bradley Fighting Vehicles were damaged under battle conditions in Iraq. One is a nearly intact Bradley Vehicle with a burnt out interior, and the other is a partially melted Bradley Vehicle. Both vehicles had depleted uranium (DU) munitions on board at the time of the damage. Aberdeen Proving Grounds has performed decontamination activities on the vehicles but according to ATC: "...relatively small residual amounts of DU remain in a dispersed and spotty fashion throughout the Bradley Vehicles."

In concept, this request is similar to a previous license amendment request by the U.S. Air Force that disposed of four M-47 tanks that were contaminated with depleted uranium by use as targets at the Nellis Air Force Base. The U.S. Air Force license amendment was approved on August, 5 2005 (ML052170209). It is important to note that the U.S. Air Force amendment request involved more vehicles, and higher inventories per vehicle than the current U.S. Army request.

2.0 TECHNICAL EVALUATION

The U.S. Nuclear Regulatory Commission (NRC) staff evaluated the licensee's analyses of disposal to a Subtitle C RCRA hazardous waste disposal facility to demonstrate compliance with 10 CFR 20.2002(d) using the general guidance for dose modeling in the NUREG-1757, Volume 2, Section 5.2, supplemented by the decommissioning-specific guidance of the license termination rule.

2.1 SOURCE TERM

The M2A2 tanks were contaminated with DU in their munitions. The DU in the munitions is a metallic uranium. During the fire in the vehicles, some of the munitions discharged and thus, resulted in solid DU metal or oxide contamination throughout the interior of the vehicle. As the

aluminum matrix of the vehicle melted, DU may have been entrained into the matrix. The nearly intact M2A2 contains approximately 5.9 microcuries of DU, and when averaged over the remaining mass of the M2A2 (21 tons), the source material is far less than one-twentieth of 1 percent (0.05 percent) of the mixture. The fully destroyed M2A2 contains less than 800 microcuries, and when averaged over the remaining mass (~8 tons), the source material is far less than one-twentieth of 1 percent (0.05 percent) of the mixture. The staff considers these assumptions to lead to a conservative source term and considers this a valid approach for conducting a bounding analysis.

2.2 EXPOSURE SCENARIOS

The licensee requested that the disposal take place at US Ecology, Idaho, a Subtitle C RCRA hazardous waste disposal facility. The licensee analyzed three distinct exposure scenarios: (1) dose to a transport driver, (2) dose to the disposal facility worker, and (3) long-term impacts to a residence. While the licensee did not analyze the groundwater impacts from the disposal, NRC staff reviewed previous analyses in support of NUREG-1640, which indicated that the groundwater pathway is not a controlling factor for DU, when compared to other scenarios, such as, the disposal workers or intrusion events. Uranium does not rapidly move to the aquifer under the generic conditions assumed in the previous analyses in support of NUREG-1640. The U.S. Ecology, Idaho, site has conditions, specifically, lower precipitation rates and the groundwater is deeper at U.S. Ecology, Idaho, that would decrease the impact on groundwater from the generic analyses. NRC staff considers the three scenarios, analyzed by the licensee, appropriate for the request.

The transport driver scenario considers the dose to the truck driver who is responsible for hauling the vehicles to the disposal facility. The licensee used the computer code, Microshield, to calculate the external exposure from the residual radioactivity. The analysis conservatively neglected any benefits as a result of shielding from the cab or tank armor, and maximized the concentration by assuming it was all contained in a 1 square meter area closest to the transportation worker or driver. The licensee assumed the driver transported all the vehicles on a 5-day long transportation haul with continuous occupancy of the cab. The total dose calculated for this conservative estimate, based on a dose rate of $2x10^{-5}$ mSv/hr ($2x10^{-3}$ mrem/hr) was 0.0024 mSv (0.24 mrem). NRC staff agrees that the only applicable exposure pathway for this scenario is direct radiation from the vehicles, and the assumptions used are adequate.

The disposal facility worker scenario considers the potential dose to the worker responsible for loading, unloading, and burying the vehicles. The calculation was based on an exposure time of two hours per vehicle. The only relevant exposure pathway is external because the tanks will be sealed prior to shipment. Since the tanks are sealed there would be no removable contamination on the exterior of the tanks. While no removable contamination is assumed, the scenario remains conservative based on the assumption that all the activity is in close proximity to the exposed worker. This scenario resulted in a conservative dose estimate of 0.0003 mSv (0.028 milirem). NRC staff continues to agree that the only applicable exposure pathway for this scenario is direct radiation from the two vehicles, and the assumptions used are adequate.

The third scenario analyzed by the licensee was the long-term impacts from the tanks. The licensee assumed a soil concentration of 100 pCi/g of DU, approximately the concentration that would exist if the mass of DU was mixed instantly with a volume of soil in the cell equivalent to

the displacement volume of the fully demolished vehicle. However, this resulting concentration was assumed to exist throughout the entire disposal cell, a gross over estimation of the inventory. The analysis assumed there was a cover present and assumed that a house was built over the disposal area. The pathways of exposure were external, inhalation, and radon. External exposure is the dominant pathway based on the DU. The result of this unlikely scenario was a peak annual dose of $7x10^{-26}$ mSv ($7x10^{-24}$ mrem). This is mainly due to the performance and existence of the cover. The staff also reviewed the safety analysis report performed for the U.S. Air Force's similar disposal request (ML052170209). The U.S. Air Force request is for similar material, at a higher concentration, and discounted the existence of a cover. Their estimate of the long-term dose was still a small fraction of a mrem. NRC staff agrees that this scenario; however unlikely, is conservative and reasonably appropriate for long-term exposure assessment.

Each of the analyses conservatively estimated the exposure as less than 1 mrem total dose per year. The proposed action will not significantly increase the probability or consequences of accidents and there is no significant increase in occupational or public radiation exposures.

3.0 SUMMARY AND CONCLUSIONS

Based upon the above analyses, the licensee has demonstrated, and NRC staff has confirmed that the proposed 10 CFR 20.2002 disposal is expected to result in minimal risk to workers and the public. For the analysis, the licensee assumed that the remaining DU in the tanks was concentrated in the worst possible configuration for the appropriate scenario. The licensee analyzed the dose to the transport driver, disposal facility worker, and long-term impacts to a residence. While the licensee did not analyze the groundwater impacts from the disposal, NRC staff reviewed previous analyses in support of NUREG-1640, which indicate that the groundwater pathway is not a controlling factor for DU. The licensee's scenarios relied upon conservative bounding analyses. Each of the scenarios evaluated resulted in dose estimates of less than 0.01 mSv (1 mrem) total dose. Therefore, NRC staff recommends approval of this modification to the licensee's authority to dispose of waste in accordance with 10 CFR 20.2002.

Further, in accordance with the provisions of 10 CFR 40.14, "the Commission may, upon application by an interested person or upon its own initiative, grant such exemptions from the requirements of the regulations...as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest." Based on the above analyses, this material authorized for disposal poses no danger to public health and safety, does not involve information or activities that could potentially impact the common defense and security of the United States, and it is in the public interest to dispose of wastes in a controlled environment, such as that provided by a Subtitle C RCRA hazardous waste disposal facility. Therefore, to the extent that this material authorized for disposal in this 20.2002 authorization is otherwise licensable, the staff concludes that the site authorized for disposal is exempt from further Atomic Energy Act and NRC licensing requirements.