UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 5, 2007

MEMORANDUM TO: Brian Holian, Director
Division of Nuclear Materials Safety, RI

FROM: Scott C. Flanders, Deputy Director
Environmental & Performance
Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

SUBJECT: RESPONSE TO TECHNICAL ASSISTANCE REQUEST DATED NOVEMBER 02, 2007, FOR HOMER LAUGHLIN CHINA COMPANY

Region I submitted a Technical Assistance Request, dated November 02, 2007, requesting review of a dose assessment for source material waste that meets the exemption criteria in 10.CFR 40.13 from Homer Laughlin China Company (Homer Laughlin). The purpose of our review was to determine if transport and disposal of the waste would satisfy the Commission's policy of 0.25 mSv/y (25 mrem/y), as well as, the dose criteria for unrestricted release specified in 10 CFR 20.1402 upon site closure. The Performance Assessment Branch has completed its review of the Homer Laughlin dose assessment and has provided a Technical Evaluation Report (enclosed). Based upon our review, staff finds that the dose from exposure to residual radioactive materials during transport and disposal of the material and site closure would be significantly below the Commission's policy of 0.25 mSv/y (25 mrem/y) and below the criteria for unrestricted release specified in 10 CFR Part 20.1402.

If you have questions regarding this review, please contact Shamica Walker of my staff. She can be reached at 301-415-5142.

Enclosure: Technical Evaluation Report

cc: John Nicholson

Homer Laughlin China Company
Technical Evaluation Report
Prepared by: Shamica Walker, Systems Performance Analyst

Background

Homer Laughlin China Company (Homer Laughlin) intends to transfer uranium contaminated waste materials from previous decommissioning activities to the WCS facility in Andrews, TX for treatment and ultimate disposal. Homer Laughlin analyzed the potential doses from transportation and landfill disposal of the waste as well as, the future release of the landfill that will contain these materials. In conducting their analysis, Homer Laughlin assessed the doses to a transport worker, workers at the WCS facility, the offsite population, a future onsite resident, and an intruder. For the onsite resident and intruder scenarios, the licensee performed a dose assessment for unrestricted use upon closure of the WCS landfill. To verify the licensee's doses to the transport truck driver and WCS facility workers, the NRC staff performed an independent analysis.

Source Term

The source term for disposal consists of various materials which include wood blocks, concrete blocks and debris and various steel components with an average radionuclide concentration of 3340 Bq/kg (90.3 pCi/g) of U-238, 1490 Bq/kg (40.4 pCi/g) U-234 and 63 Bq/kg (1.7 pCi/g) of U-235. The material is currently located in drums and will be shipped within the drums. The material will later be removed from the drums for disposal in the WCS landfill. According to 10 CFR 40.13 (a), persons are exempt from the regulations if the source material is by weight less than 0.05 percent of the mixture, compound, solution, or alloy. In this case, the 0.05 percent by weight limit is equivalent to 12500 Bq/kg (339 pCi/g) for natural uranium.

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). Per Commission policy, disposal of such exempt materials should not exceed this dose criterion.

Scenarios, Modeling and Results

As mentioned above, the licensee evaluated the following exposure scenarios: (1) A transport truck driver, (2) workers at the WCS facility, (3) an offsite resident during WCS operations, (4) an onsite resident after site closure, and (5) an intruder. The licensee used the TSD-DOSE computer program to assess the dose to WCS workers from transport, receipt, processing and disposal of source material. TSD-DOSE was also used to assess the dose to an offsite resident. The licensee found the dose to a transport truck driver, WCS workers and the offsite population to be 3.6×10^{-4} mSv (0.036 mrem), 4.4×10^{-4} mSv (0.044 mrem) and 0.12 person- mSv (0.0032 person-rem) respectively.

For its analysis of an onsite resident after site closure, the licensee used RESRAD, Version 6.3. The HELP model was used to estimate infiltration through the disposal cell cover. The licensee assumed that the resident would receive exposure from all the pathways within the RESRAD code, which includes the following: direct radiation exposure, inhalation of dust particles, radon release, plant ingestion, ingestion of animal meat and milk products, soil ingestion, and groundwater ingestion. The RESRAD analysis for an onsite resident resulted in a dose of zero mSv.

In addition to an onsite resident, the licensee performed an analysis of an intruder scenario after site closure. It was assumed that an intruder would build a house on or near the landfill and drill a well for drinking water. The source of exposure would be from exposure to waste during the drilling period. The licensee used a unit concentration equation to calculate the intruder dose. For the equation parameter values, the licensee used NUREG/CR-4370, NUREG/CR-3585, Federal Guidance Document No. 12, as well as, site specific information. The resulting dose from the intruder scenario was 4.0×10^{-7} mSv (4.0×10^{-5} mrem). For conservatism, the licensee assigned this dose to the onsite resident scenario.

NRC staff found the licensee scenarios to be acceptable. Given that there is no residential area within a 5 mile radius of the WCS facility, the staff believes that the onsite resident scenario is conservative. The NRC staff also found the use of RESRAD, the HELP model and a unit concentration equation to be acceptable. The staff noticed that a different source concentration value was used in RESRAD than was reported by the licensee. Through discussion with the licensee, the staff determined that the licensee used a more conservative source concentration in its RESRAD analysis, which was based upon the 0.05 percent by weight limit. Staff also found the licensee's parameter values to be acceptable.

The licensee's analysis mentions that the WCS workers are classified as radiation workers. However, staff evaluated the WCS workers as members of the public, because the WCS facility is a non-licensed facility. The staff performed and independent evaluation of the transport truck driver and WCS worker scenarios (as described below) to verify the dose calculated from TSD-DOSE.

Independent Analyses

The NRC staff used the guidance provided in NUREG-1640, "Radiological Assessments for Clearance of Materials from Nuclear Facilities," Vol. 3, Appendix I to estimate the potential dose to individual members of the critical group who would likely be exposed to the residual radioactivity from the transport and disposal of scrap steel, steel dust, and concrete rubble. The scenarios evaluated included a transport truck driver and an onsite worker. As discussed in NUREG-1640, the radiological assessment of the impact from the release of building material from NRC-licensed facilities compares the radiation exposures to various groups using 115 radionuclides and their progenies in 30 exposure scenarios. Using Monte Carlo uncertainty analyses, the effective dose equivalent (EDE) from one year of exposure is calculated and normalized to an initial unit activity concentration of each separated radionuclide in the given media (i.e. scrap metal, concrete rubble etc.) at the time of release. The results are reported as both mass-based (in units of μSv/yr per Bq/g) and surficial (in units of μSv/yr per Bq/cm^2) normalized doses.

The NRC staff evaluated the dose from transport and disposal of scrap steel, steel dust and concrete rubble. The radioactivity was assumed to be 3340 Bq/kg (90.3 pCi/g) for U-238, 1490 Bq/kg (40.4 pCi/g) for U-234 and 62.9 Bq/kg (1.7 pCi/g) for U-235 based upon the source material data provided by the licensee. Because concrete provides the largest dose, for conservatism, NRC chose to assess dose based upon transport and disposal of concrete rubble. The NRC did not determine the dose from wood materials because NUREG-1640 does not supply values for wood. However, wood materials are only contained in 13 of the 69 drums. In addition, the concentration of uranium in the wood materials represents the low range of concentration values, representing 6% of the total concentration, and six of the wood contained drums have a concentration as low as 37 Bq/kg (1pCi/g). Because wood materials constitute a smaller fraction of material and smaller radioactivity, and because the licensee's assessment showed that the dose from transport and disposal of the material is minimal, the staff believes that using concrete as the source material for analysis is justified. The mean dose was determined to be 0.03 mSv/y (3.0 mrem/y) for transport of concrete rubble and 0.025 mSv/y (2.5 mrem/y) for the dose to a site worker during disposal of concrete rubble.

Staff also determined the dose from the radionuclides at the 0.05 percent by weight limit. The concentration at the 0.05 percent by weight limit is 6180 Bq/kg (167 pCi/g), 6180 Bq/kg (167 pCi/g), and 296 Bq/kg (8 pCi/g) for U-238, U-234 and U-235 respectively based upon the mass abundance of these radionuclides. The resulting mean dose was determined to be 0.08 mSv/yr (8.0 mrem/y) for transport of concrete rubble and 0.06 mSv/yr (6.0 mrem/y) for the dose to a site worker from disposal of concrete rubble.

The NUREG-1640 analysis provided a much higher dose (i.e. 3.6×10^{-4} mSv/y versus 0.03 mSv/y) than that determined by the licensee. However, the NUREG-1640 values are based upon transport and disposal of concrete material from nuclear power plants that range from 140,000 to 230,000 tons of contaminated concrete. Homer Laughlin plans to dispose approximately 30 tons of material. This significant difference in the amount of material disposed likely results in a longer exposure time and provides for a conservative assessment when using NUREG-1640. Staff also found that the dose to a WCS worker would bound the dose to the offsite population, so the offsite population was not analyzed.

The staff also completed an independent analysis of the dose to a future onsite resident and intruder after facility closure using RESRAD. The staff verified the licensee's results.

Conclusion

The NRC staff has reviewed the dose assessments by Homer Laughlin that evaluated the disposal of source material exempt from 10 CFR 40.13 "Unimportant Quantities of Source Material" to assess whether the disposal would meet the dose criteria specified in 10 CFR 20.1402, per Commission policy. The staff concluded that the dose modeling completed for the transfer and disposal of waste material from the Homer Laughlin site is adequate. The dose to a future onsite resident and intruder was determined by the licensee to be 4.0×10^{-7} mSv/y (4.0×10^{-5} mrem/y). The dose to workers from transport and receipt and processing, based upon NUREG-1640, was conservatively determined to be 0.03 mSv/y (3.0 mrem/y) and 0.025 mSv/y (2.5 mrem/y) respectively. These dose values are considerably less than the Commission's policy of 0.25 mSv/y (25 mrem/y) and the unrestricted use limit in 10 CFR 20.1402 of 0.25 mSv/y (25 mrem/y). Even in

assuming a source concentration based upon the 0.05 percent weight limit, the dose criteria are not exceeded. The dose to an offsite resident during operations was bounded by the worker dose. These conclusions are based on the modeling effort performed by the licensee and the independent analysis performed by the NRC staff.

References

Homer Laughlin China Co., 2007. "Dose Assessment for Transfer and Disposal of Source Material at WCS Andrews Facility." August, 2007.

Homer Laughlin China Co., 2007. "Update on Waste Characterization Activities." ML072430077. August, 2007.

NRC, 2006. "Consolidated NMSS Decommissioning Guidance." NUREG-1757, Volume 2. Office of Nuclear Material Safety and Safeguards. Washington, DC. September 2006.

NRC, 2003. "Radiological Assessments for Clearance of Materials from Nuclear Facilities." NUREG-1640. Office of Nuclear Regulatory Research. Washington, DC. June 2003.