



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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May 23, 2018

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SUBJECT: REVIEW OF FINAL STATUS SURVEY DATA AND EVALUATION OF SITE
WR111, HILL AIR FORCE BASE, UTAH

Dear Dr. Bhat,

By Memorandum dated March 1, 2018 (Agencywide Documents Access Management System [ADAMS] Accession No. ML18060A451), you submitted a technical memorandum to the U.S. Nuclear Regulatory Commission (NRC) entitled, "Summary of Final Status Survey Data and Evaluation to Achieve Clean-up Goals at Site WR111 (Magnesium-Thorium Disposal Trench), Little Mountain Test Facility, Hill Air Force Base, Utah." This technical report was developed by your contractor EA Engineering, Science, and Technology, Inc. (EA).

EA found two locations at the site that contained residual radioactivity in soil above the cleanup criteria. To demonstrate compliance with the release requirements of 10 CFR Part 20, Subpart E, the contractor calculated area factors and used an adapted version of Equation 8-2 from NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), which was modified to include multiple radionuclides.

In response to your submittal, Region IV staff consulted with the NRC program office. The consultation included a technical review of the equation used by the contractor as well as the proposed area factors. The staff concluded that the area factors were acceptable. The staff also determined that the contractor's modified MARSSIM equation was acceptable for use; however, the NRC concluded that you did not incorporate the terms for both elevated areas together with the term associated with the survey unit, consistent with MARSSIM guidance. The staff revised the equation accordingly, and confirmed that the WR111 site meets the criteria for unrestricted release per regulatory requirements.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access Management System (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

R. Bhat

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Should you have any questions concerning this letter, please contact Rachel Browder, Senior Health Physicist, at 817-200-1452, or the undersigned at 817-200-1191.

Sincerely,

/RA by LEBrookhart Acting for/

Ray L. Kellar, P.E., Chief
Fuel Cycle and Decommissioning Branch
Division of Nuclear Materials Safety

Docket: 030-28641

License: 42-23539-01AF

Enclosure:

Staff review of Site WR111 Final Status
Survey Data and Evaluation

cc:

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STAFF REVIEW OF SITE WR111 FINAL STATUS SURVEY DATA AND EVALUATION

The Department of the Air Force submitted a summary of final status survey data and evaluation performed by the contractor EA Engineering, Science, and Technology, Inc. (EA) for the WR111 magnesium-thorium disposal trench at Hill Air Force Base (AFB), Utah, to the U.S. Nuclear Regulatory Commission (NRC) by Memorandum dated March 1, 2018 (ADAMS Accession No. ML18060A451). During an evaluation of data collected from the WR111 site, it was found that two locations on the site, SU02 (60 square meters, or m²) and SU04 (339 m²), contained residual radioactivity in soil above the cleanup criteria. To demonstrate compliance of the WR111 site with the unrestricted release requirements specified in 10 CFR Part 20, Subpart E, the contractor, under contract with the Air Force Civil Engineer Center (AFCEC), used area factors and sum-of-ratios (SOR) calculation in accordance with NUREG-1575, Revision 1, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The licensee's calculation was based on Equation 8-2 from MARSSIM, adapted by the licensee to include multiple radionuclides.

The NRC staff approved site-specific derived concentration guideline levels (DCGL_{Ws}) for the three radionuclides of concern (Ra-226, Th-230, and Th-232) at the WR111 site in a technical evaluation report dated October 19, 2015 (ADAMS Accession No. ML15299A164). Using these site-specific parameters, EA calculated elevated measurement comparison DCGLs (DCGL_{EMCS}) for areas with elevated contamination levels of various sizes. The DCGL_{EMCS} in turn were used to derive area factors for each radionuclide of concern. The staff's review concluded that the DCGL_{EMCS} and corresponding area factors were acceptable. The staff also noted that the licensee's analysis used area factors of 75 m² and 500 m² for the two hot spots (SU02 and SU04) which are larger and therefore more conservative than the actual size of these areas (60 m² and 339 m², respectively).

The NRC staff also reviewed the modified MARSSIM Equation 8-2, which employed a SOR method in lieu of concentrations and DCGLs due to the presence of multiple radionuclides of concern. NUREG-1575 gives Equation 8-2 as a method to demonstrate that the total dose is within the release criterion, when residual radioactivity is found in an isolated area of elevated activity. The contractor adapted the equation to conservatively account for multiple radionuclides:

- The smallest area factor is used for the radionuclides of concern for each hot spot;
- An average SOR is used for the systematic sample results in each survey unit, in place of the estimated average residual radioactivity;
- An average SOR is used for elevated area sample results in place of the average concentration in each elevated area; and
- An SOR of 1.0 is used in place of the DCGL_W.

The staff reviewed EA's modified equation and determined that it was acceptable for use in demonstrating compliance with release criteria. The values used for area factor and DCGL_W are appropriately conservative. The equation as used by the licensee demonstrated that the sum of ratios was less than 1.0 for each elevated area. However, per Section 8.5.2 of NUREG-1575, "[i]f there is more than one elevated area, a separate term should be included for each." Therefore the staff revised the modified equation to include both terms:

$$\frac{\delta}{1} + \frac{(Average\ SOR\ in\ SU02 - \delta)}{SU02\ Area\ Factor} + \frac{(Average\ SOR\ in\ SU04 - \delta)}{SU04\ Area\ Factor} < 1$$

As in the equation used by the contractor, δ here represents the average SOR in a survey unit, and the area factor is the smallest area factor calculated for the radionuclides of concern in each elevated area. The first term in the modified equation evaluates the average SOR for the entire survey unit, including both elevated areas. The second and third terms evaluate the contributions from elevated areas SU02 and SU04, respectively. In accordance with NUREG-1575, the overall SOR, the sum of all 3 terms, would need to be less than 1 in order to meet the regulatory release criteria

Using the updated equation, the staff calculated an overall sum of 0.98 for the survey unit and both elevated areas together. Furthermore, the staff calculated site-specific area factors for SU02 and SU04, using their actual sizes and not the conservatively large areas assumed by the licensee. When these are applied to the updated equation, the overall SOR equals 0.92.

In conclusion, the staff has determined that the area factors calculated by the licensee are acceptable. In addition, the staff found that the licensee's modified MARSSIM Equation 8-2 was generally appropriate for use; however, the survey unit and both elevated areas should be incorporated into one equation consistent with NUREG-1575. Using the updated version of the proposed equation that includes both elevated areas, the staff confirms that the area meets the regulatory release criteria for the site.

REVIEW OF FINAL STATUS SURVEY DATA AND EVALUATION OF SITE WR111, HILL AIR FORCE BASE - DOCKET NO. 030-28641 – DATED MAY 23, 2018

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