



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
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May 10, 2001

Steve Umbrell
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

SUBJECT: REVIEW OF THE PROPOSED DERIVED CONCENTRATION GUIDELINE
LEVEL REPORT FOR THE GSA PROPERTY, WATERTOWN,
MASSACHUSETTS

Dear Mr. Umbrell:

We have reviewed the subject report dated January 31, 2001, submitted by your contractor, Harding ESE. The report evaluates various scenarios in determining a site-specific derived concentration guideline level (DCGL) for the radiological remediation of the GSA Watertown, Massachusetts property and adjoining parcel of land designated as Property 20.

Our review and dose modeling analyses for the site was performed using the guidelines identified in Section 5.2 of NUREG-1727, NMSS Decommissioning Standard Review Plan, Rev. 0, dated September 15, 2000. For sites considering unrestricted release site-specific dose modeling information should include the following:

- Source term information including nuclides of interest, configuration of the source, areal variability of the source, etc;
- Description of the exposure scenario including a description of the critical group;
- Description of the conceptual model of the site including the source term, physical features important to modeling the transport pathways, and the critical group;
- Identification, description and justification of the mathematical model used (e.g., hand calculations, DandD Screen v1.0, RESRAD v6.0, etc.);
- Description of the parameters used in the analysis;
- A discussion about the effect of uncertainty on the results; and
- Input and output files or printouts, if a computer program was used."

The submittal contained all of the information necessary to meet the above guidelines and allow the NRC to complete the technical evaluation (enclosed). We conclude that the dose modeling for the proposed action is reasonable and appropriate for the exposure scenario under consideration. Based upon the proposed derived concentration guideline level of 12.6 Bq/g (340 pCi/g) total uranium for the depleted uranium, we determine that the dose estimate provides reasonable assurance that the dose to the average member of the critical group is not likely to exceed the 0.25 mSv (25 mrem) annual dose criterion in 10 CFR 20.1402.

S. Umbrell
U.S. Army Corps of Engineers

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Thank you for your cooperation.

Enclosure: As Stated

Sincerely,

Original signed by Craig Z. Gordon

Craig Z. Gordon
Senior Health Physicist
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety

cc: w/enclosure
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TECHNICAL EVALUATION

The Harding ESE dose analysis is site-specific. The Nuclear Material Safety and Safeguards (NMSS) Decommissioning Standard Review Plan's Chapter 5.2 states that responsible party's dose modeling for unrestricted release using site-specific information should include the following:

- Source term information including nuclides of interest, configuration of the source, areal variability of the source, etc;
- Description of the exposure scenario including a description of the critical group;
- Description of the conceptual model of the site including the source term, physical features important to modeling the transport pathways, and the critical group;
- Identification, description and justification of the mathematical model used (e.g., hand calculations, DandD Screen v1.0, RESRAD v6.0, etc.);
- Description of the parameters used in the analysis;
- A discussion about the effect of uncertainty on the results; and
- Input and output files or printouts, if a computer program was used.

The submittal contained all of the necessary information for the review to be completed as noted below:

Source Term

The nuclides of interest are U-234, U-235, and U-238, with the majority contribution of both the activity and mass from U-238. The main contamination is present in the surface soil spread non-homogeneously across the site, with most of the activity in the northern section around the burn-pit. Conservatively, the site was conceptualized as being uniformly contaminated. The source term's configuration of contaminated surface soil is consistent with both the site data and the conceptual model used in RESRAD Version 6.0.

Harding ESE presented biosphere dose conversion factors (i.e., dose per unit activity in soil) for four limiting exposure scenarios. Inherent in the use of biosphere dose conversion factors to calculate the DCGL is an assumption that the radionuclide concentration is almost homogeneous across the contaminated area. Use of DCGLs for remediation requires proof that spatial variability is assumed to be homogeneous and should be demonstrated as part of the final survey.

The default chemical form (uranium oxide) in RESRAD was used resulting in a more conservative value compared with the uncertainty in the actual chemical form. The staff finds the source term evaluation acceptable.

Critical Group, Scenarios and Pathway Identification, and Selection

The contractor indicates that scenarios related to farming (suburban or urban), residential use, and commercial agricultural use were not plausible for the site because of the shallow groundwater, its location in the floodplain of the local river and future development plans by the Commonwealth of Massachusetts. Both Mass. Department of Environmental Protection and Mass. Department of Public Health staff have agreed that the most likely potential uses of the site involved some form of public or recreational use. The NRC staff review agrees with these possible scenarios. After remediation ownership of the land will revert to the Commonwealth of

Massachusetts, which has a long-range plan for development of the site into a recreational facility for public use.

The contractor evaluated four main scenarios, based on public use of the grounds:

- Construction Worker;
- Workers exposed while working at the site's recreational facilities;
- Users of the recreational facility; and
- Urban community gardeners.

We have determined these scenarios are appropriate and reasonable for the site conditions.

Conceptual Model

Conceptual models for each credible scenario were developed which detail the pathways modeled and important exposure factors. The conceptual models are consistent with the site, the scenarios, and the models used to calculate dose.

The selected conceptual models adequately describe the pathways involved in the exposure scenarios.

Calculations and Input Parameters

RESRAD 6.0 was used for all the scenarios, detailing the parameters used and the reasons why non-default data were considered. In addition, print-outs of output files from the RESRAD 6.0 code runs were provided. External dose was the controlling pathway for all of scenarios, and a number of parameters were modified to model each scenario. Behavioral parameters were supported by information by the Commonwealth of Massachusetts.

An underlying consideration of input parameters was the gamma-shielding factor. The default gamma-shielding factor for unknown radionuclides is 0.2, thereby reducing the gamma dose rate by 80 percent. The MicroShield code and minimal design requirements were used for recreational buildings for the site conditions. With the weak gamma rays of depleted uranium and the concrete slabs required by the site for minimal foundations, the gamma-shielding factor was reduced to 0.05 (95 percent gamma dose rate reduction). An adequate sensitivity analyses on the gamma-shielding factor assumptions was performed.

The NRC staff review finds these analyses and parameters appropriate for the situation.

Evaluated Scenarios

Computer results for each of the scenarios is shown below for the RESRAD 6.0 code evaluations (MADPH dose limit of 10 mrem/yr), and results of the MADEP spreadsheet calculations.

SCENARIO	MADPH- 0.1 mSv/y (10 mrem/y limit)	MADEP- 1×10^{-5} Lifetime Risk
Construction Worker	560 pCi/g Total U	1330 pCi/g Total U
Occupational Worker	2150 pCi/g Total U	340 pCi/g Total U
Recreational Visitor	3350 pCi/g Total U	725 pCi/g Total U
Community Gardener	5175 pCi/g Total U	635 pCi/g Total U
Urban Resident	1010 pCi/g Total U	

The DCGL for the urban resident scenario was evaluated and is based on the NRC dose limit of 0.25 mSv/y (25 mrem/y).

The Occupational Worker DCGL of 12.6 Bq/g (340 pCi/g) Total U (assuming depleted uranium ratios) was selected. Using RESRAD 6.0, this results in a dose estimate of approximately 0.01 mSv/y (1 mrem/y), within the dose limit of 10 CFR 20.1402.

Uncertainty Analysis

An acceptable uncertainty analysis was performed on the Occupation Worker scenario using a depleted uranium concentration of 12.6 Bq/g (340 pCi/g). The resulting dose distribution ranged from 0.0045 to 0.019 mSv/y (0.45 to 1.9 mrem/y) with a mean dose of 0.0115 ± 0.0027 mSv/y (1.15 ± 0.27 mrem/y).

The individual parameters that contributed most significantly to dose and thus to the uncertainty are:

- External gamma shielding factor (see above);
- Thickness of the contaminated zone;
- Indoor & Outdoor time fractions; and
- Depth of soil mixing layer.