April 6, 2001

MEMORANDUM TO: Scott W. Moore, Chief
Special Projects Section
Decommissioning Branch

FROM: Sandra Wastler, Chief **/RA/**
Performance Assessment and
Integration Section
Environmental and Performance
Assessment Branch

SUBJECT: REVIEW OF DOSE MODELING SUPPORTING THE ABERDEEN PROVING GROUND'S FORMER TRANSONIC RANGE DECOMMISSIONING PLAN

The Department of the Army is decommissioning an area used for testing depleted uranium munitions at the Aberdeen Proving Ground's former Transonic Range. The 5 ha (12 acre) site has general soil contamination with hot spots up to 13.3 kBq/g (360,000 pCi/g). The Army has proposed a derived concentration guideline limit of 8.5 Bq/g (230 pCi/g) total uranium.

On December 15, 1999, the Army provided an Argonne National Laboratory dose analysis, which utilized RESRAD Version 5.82 to develop acceptable concentrations. The analysis considered two scenarios, which appear similar to the resident farmer and the industrial worker default scenarios, from NUREG-1549. On February 1, 2001, the licensee provided new analyses in response to questions raised by the U.S. Nuclear Regulatory Commission (NRC) in its letter dated August 11, 2000. This analysis used the same scenarios but utilized the RESRAD Version 6.0 code. The staff review focused on the resident farmer scenario as it was the limiting scenario (30 Bq/g (810 pCi/g) for the industrial worker and 8.5 Bq/g (230 pCi/g) for the resident farmer).

The staff has reviewed the dose modeling analyses for the former Transonic Range as part of the review of the Aberdeen Proving Ground's decommissioning plan using Standard Review Plan 5.2 (NUREG-1727: NMSS Decommissioning Standard Review Plan).

The staff concludes that the dose modeling completed for the proposed action is reasonable and is appropriate for the exposure scenario under consideration. In addition, 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. This conclusion is based on the modeling effort performed by the licensee and the independent analysis performed by the staff.

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In determining the dose, the licensee has a combination of the conceptual model, exposure scenario, mathematical model and input parameters to calculate a reasonable estimate of dose. The licensee has adequately considered the uncertainties inherent in the modeling analysis.

Docket No.: 40-6394

Attachment: Technical Evaluation Report

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Docket No.: 40-6394

Attachment: Technical Evaluation Report

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DOCUMENT NAME: Review of Dose Modeling Supporting the Aberdeen Proving Ground's former Transonic Range Decommissioning Plan

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April 6, 2001

TECHNICAL EVALUATION REPORT

DOCKET NO. 40-6394 LICENSE NO. SMB-141

LICENSEE: Department of the Army

FACILITY: Aberdeen Proving Ground's former Transonic Range

PROJECT MANAGER: John R. McGrath, Region I

TECHNICAL REVIEWER: Christepher McKenney

SUBJECT: REVIEW OF DOSE MODELING SUPPORTING THE DECOMMISSIONING PLAN

SUMMARY AND CONCLUSIONS

The staff has reviewed the dose modeling analyses for the former Transonic Range as part of the review of the Aberdeen Proving Ground's decommissioning plan using Standard Review Plan 5.2 (NUREG-1727: NMSS Decommissioning Standard Review Plan).

The staff concludes that the dose modeling completed for the proposed action is reasonable and is appropriate for the exposure scenario under consideration. In addition, 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. This conclusion is based on the modeling effort performed by the licensee and the independent analysis performed by the staff.

In determining the dose, the licensee has a combination of the conceptual model, exposure scenario, mathematical model and input parameters to calculate a reasonable estimate of dose. The licensee has adequately considered the uncertainties inherent in the modeling analysis.

DESCRIPTION OF LICENSEE'S AMENDMENT REQUEST

The Department of the Army is decommissioning an area used for testing depleted uranium munitions at the Aberdeen Proving Ground's former Transonic Range. The 5 ha (12 acre) site has general soil contamination with hot spots up to 13.3 kBq/g (360,000 pCi/g).

On December 15, 1999, the Army provided an Argonne National Laboratory dose analysis, which utilized RESRAD Version 5.82 to develop acceptable concentrations. The analysis considered two scenarios, which appear similar to the resident farmer and the industrial worker default scenarios, from NUREG-1549. On February 1, 2001, the licensee provided new

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analyses in response to questions raised by the U.S. Nuclear Regulatory Commission (NRC) in its letter dated August 11, 2000. This analysis used the same scenarios but utilized the RESRAD Version 6.0 code. The staff review focused on the resident farmer scenario as it was the limiting scenario (30 Bq/g (810 pCi/g) for the industrial worker and 8.5 Bq/g (230 pCi/g) for the resident farmer).

TECHNICAL EVALUATION

The Argonne dose analysis is a site-specific analysis and the Nuclear Material Safety and Safeguards (NMSS) Decommissioning Standard Review Plan's Chapter 5.2 states that the NRC will review the following information provided by the licensee:

"The licensee's or 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 February 1, 2001, submittal contained all of the necessary information for the review to be completed.

Source Term

The nuclides of interest are Uranium-234, U-235, and U-238, with U-238 being the majority of both the activity and the mass. The main contamination is present in the surface soil of the site, mainly in the first 7.5 cm (3 inches). The site has 12 self-identified hotspots (areas with uranium concentrations greater than two standard deviations from the site mean). 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.

Argonne created biosphere dose conversion factors (i.e., dose per unit activity in soil) for its two scenarios. Inherent in the use of biosphere dose conversion factor to calculate the DCGL is an assumption that the radionuclide concentration is fairly homogeneous across the contaminated area. Because the licensee is suggesting the use of DCGLs for remediation, proof that the spatial variability in fact can be assumed to be homogeneous is required as part of the final survey.

The RESRAD code uses uranium oxide as a default chemical form, which would be appropriate for the situation. The licensee used the default chemical form because it resulted in a more conservative value given the uncertainty in the actual chemical form.

Critical Group, Scenarios and Pathway Identification and Selection

The licensee has selected two exposure scenarios: (1) a resident farmer scenario, and (2) an industrial worker scenario. The resident farmer scenario is an unlikely future use of the land because of the presence of unexploded ordinance. Both scenarios are appropriate and reasonable, although the resident farmer does bound the analysis. Both scenarios contain all of the applicable pathways inherent in these scenarios (see NUREG-1549). The critical group is similar to the critical group described in NUREG-1549 and the licensee has used the RESRAD 6.0 default values for behavioral parameters. Therefore, the staff finds no fault with the scenarios or critical group.

Conceptual Model

The conceptual model of the site is compatible with the RESRAD 6.0 conceptual model. The residual radioactivity is present in the top 15 cm (6 in) of the soil. The conceptual model adequately describes the pathways involved in the exposure scenario.

Calculations and Input Parameters

The licensee used the deterministic mode of the RESRAD 6.0 computer model to perform the calculations. The licensee primarily used default data but changed only a few hydrologic parameters based on site-specific information and the source term characteristics.

The staff reviewed the input and output files for not only the compliance calculation but the supporting calculations for alternate source terms (i.e., different U-234/U-235/U-238 ratios). Changing the hydrologic parameters back to defaults resulted in no change to the proposed DCGLs. The doses are controlled by the inhalation and ingestion pathways for U-234 and the external pathway for U-235 and U-238.

The resulting DCGLs equal to 0.25 mSv/y (25 mrem/y) for each single radionuclide are:

- 640 pCi/g (24 Bq/g) for U-234,
- 54 pCi/g (2 Bq/g) for U-235, and
- 230 pCi/g (8.5 Bq/g) for U-238.

Using the activity ratios of the depleted uranium, the total amount of uranium equal to 0.25 mSv/y (25 mrem/y) is 230 pCi/g (8.5 Bq/g). Based on this DCGL for total uranium, if U-238 was measured as an indicator radionuclide for DU, the soil concentration limit would be 190 pCi/g (7 Bq/g) U-238.

Uncertainty Analysis

According to the licensee, the peak dose occurred in the first year after license termination. The main pathways of concern for the resident farmer are external exposure, plant ingestion, and inhalation of dust. The licensee has used default data for all three pathways, which is a conservative approach and bounds the uncertainty in the dose.

As part of the Argonne analysis, calculations of the external dose using measurements of the actual external dose rate were compared to the results of the RESRAD calculation. The external pathway accounted for 60% of the dose. The calculated dose for the actual measurements was approximately 25 times lower than the RESRAD calculation [0.37 mSv/y (37 mrem/y) vs. 10 mSv/y (1,000 mrem/y)].