December 12, 2003

Mr. Paul E. Benneche, Acting Director
Nuclear Reactor Facility
University of Virginia
P.O. Box 400322
Charlottesville, VA 22904-4322

SUBJECT: UNIVERSITY OF VIRGINIA - MASTER FINAL STATUS SURVEY PLAN AND ADDENDA 001-008 (TAC NO. MB8233)

Dear Mr. Benneche:

We are reviewing your Master Final Status Survey Plan (FSSP) and Addenda 001-008 for Facility Operating Licenses No. R-66 and R-123 for the University of Virginia Reactors. The FSSP was submitted on April 4, 2003, and addenda were submitted on June 18, 2003. During our review of your FSSP, questions have arisen for which we require additional information and clarification. Please provide responses to the enclosed request for additional information within 30 days of the date of this letter. In accordance with 10 CFR 50.30(b), your response must be executed in a signed original under oath or affirmation. Following receipt of the additional information, we will continue our evaluation of your FSSP.

If you have any questions regarding this review, please contact me at 301-415-1631.

Sincerely,

/RA/

Daniel E. Hughes, Project Manager
Research and Test Reactors Section
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-62

Enclosure: As stated

cc w/enclosure: Please see next page

cc:

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REQUEST FOR ADDITIONAL INFORMATION
UNIVERSITY OF VIRGINIA RESEARCH REACTOR
DOCKET NO. 50-62

1. Section 5, Page 5-1, 2nd Paragraph (UVA 2003a)—The text references Table 3-1 as providing the screening values for total surface contamination. This appears to be a typographical error as the correct reference is likely Table 5-1.

2. Sections 7.10.1 and 7.10.2 (UVA 2003a)—Scan coverage is listed as 25% for Class 2 and 10% for Class 3 survey units for both beta and gamma surface scans. However, Section 4.4.3 of the UVA decommissioning plan (UVA 2000) states that beta and gamma scans coverage will be 100% for Class 2 and 25% for Class 3. What is the reason for the reduced scan coverage?

3. Appendix A, Section A (UVA 2003a)—This section describes the method for determining the mix of radionuclide contaminants. In particular, steps 4 through 6 appear to be incorrect. Once steps 1 through 3 are complete, the total activity in each sample should be calculated. Then the fraction for each radionuclide should be calculated by dividing the radionuclide's concentration in the sample by the total activity in the sample, rather than dividing by the derived concentration guideline level ($DCGL_w$) as stated in step 6. Provide clarification of this issue.

4. Appendix A, Section B (UVA 2003a)—This section describes the approach for establishing a gross beta surface activity guideline of a mixture. The methodology, as presented, appears to miscalculate an adjusted gross $DCGL_{adjgross}$ value when non-detectable (hard-to-detect) radionuclides are present. As written, step B.1 uses the fractions calculated from the preceding Section A. First, these fractions appear to be incorrectly calculated (see Comment 3). Second, the equation given in step B.1 does not describe that the f_1 through f_n values need to be normalized to only include the contributions of detectable radionuclides.

   For example, assume the following mixture of radionuclides and their fractions: Co-60, f=0.3; Cs-137, f=0.5; and, H-3, f=0.2. The fractions stated are based on the total activity. The $DCGL_{gross}$ from step B.1 should be calculated as:

$$DCGL_{gross} = \frac{1}{\frac{f_{Co-60}/F}{DCGL_{Co-60}} + \frac{f_{Cs-137}/F}{DCGL_{Cs-137}}},$$

   where F is the total fraction of detectable radionuclides. In this example, F would equal 0.3 + 0.5 = 0.8.

   The equation presented in step B.2 to calculate the $DCGL_{adjgross}$ that accounts for non-detectable radionuclides is correct. However, clarify by providing additional text describing how to calculate the value R. To continue the example, RH-3 would equal 0.2 / F = 0.25.

Addenda 001 through 008 shows that a conservative approach of applying the lowest $DCGL_w$ of the identified contaminants in most cases was used, rather than deriving a $DCGL_{adjgross}$ as discussed above. Provide clarification to the master final status survey plan in the event that this DCGL modification process is used in the future.

5. Section 3, Page 3-1, 1st Paragraph (UVA 2003b)—The text in this paragraph notes that contaminated soil was identified at the base of the demineralizer regeneration waste tank blockhouse. Soil samples collected down to a depth of three meters in the area were analyzed by gamma spectroscopy and identified Co-60 and Cs-137. A sample of waste tank sludge was also collected and identified Co-60 and Cs-137. The paragraph concludes to say that based on the sample results and history of reactor operations, that the radionuclides of concern are only Co-60 and Cs-137. Provide clarification on what was or is to be done to rule out the presence of hard-to-detect radionuclides (e.g., additional analyses).

6. Section 4.8, Page 4-3 (UVA 2003b)—The reviewer interprets the discussion in this section to mean that the results of a single composite sample will be used to calculate modified DCGLs to account for hard-to-detect radionuclides. One composite sample may misrepresent the hard-to-detect radionuclide concentrations by averaging the ratios without providing the spatial variability in the survey unit. In other words, it appears an analysis of the ratios was not done to determine if a consistent relationship exists. Describe what was or is to be done to ensure the spatial variability of the hard-to-detect radionuclide concentrations throughout the survey unit are consistent with the survey design input (e.g., analysis of a portion of the final status survey samples for hard-to-detect radionuclides).

7. Appendix A, Section C (UVA 2003a)—Equations are not provided in step 2 for adjusting DGCLs for surrogate measurements. Provide clarification on the specific calculational approach, including reference to guidance documents as appropriate.

8. Section 4.5 (UVA 2003c)—This section discusses the sample size calculation for the reactor facility piping. The value for σ is noted as 2300, "based on the MDA for the least sensitive measurement technique." The MDA is not used to determine the variability in the survey unit. In addition, the master final status survey plan (UVA 2003a), Section 7.8 provides guidance to assume a σ of 25% of the DCGL when empirical data is not available. Provide clarification of this approach. This approach is also taken and should be clarified in the other addenda where surface activity measurements are described.

9. Attachment A, Page A-3 (UVA 2003c)—The calculation of MDA_{scan} appears to be incorrect. The observation interval of 2.1 sec was not included under the radical. The correct calculation is shown below.

$$MDA_{scan} = \frac{1.38\sqrt{36.1 \cdot \frac{2.1}{60} \cdot \frac{60}{2.1}}}{\sqrt{0.5} \cdot 0.0135} = 4{,}643 \text{dpm}/100\text{cm}^2$$

References:

1. University of Virginia (UVA). University of Virginia Reactor Decommissioning Plan. Charlottesville, VA; February 2000.

2. University of Virginia. Master Final Status Survey Plan, UVA-FS-002. Charlottesville, VA; Revision 0, March 2003a.

3. University of Virginia. Final Status Survey Plan, Addendum 001: Underground Waste Tank Excavation. Charlottesville, VA; Revision 0, June 2003b.

4. University of Virginia. Final Status Survey Plan, Addendum 002: Reactor Facility Piping. Charlottesville, VA; Revision 0, June 2003c.

5. University of Virginia. Final Status Survey Plan, Addendum 003: Pond Sediments. Charlottesville, VA; Revision 0, June 2003d.

6. University of Virginia. Final Status Survey Plan, Addendum 004: Interior Structure Surfaces. Charlottesville, VA; Revision 0, June 2003e.

7. University of Virginia. Final Status Survey Plan, Addendum 005: Exterior Soil and Paved Surfaces. Charlottesville, VA; Revision 0, June 2003f.

8. University of Virginia. Final Status Survey Plan, Addendum 006: Exterior Surface Structures. Charlottesville, VA; Revision 0, June 2003g.

9. University of Virginia. Final Status Survey Plan, Addendum 007: Special Soil Areas. Charlottesville, VA; Revision 0, June 2003h.

10. University of Virginia. Final Status Survey Plan, Addendum 008: Ventilation Systems. Charlottesville, VA; Revision 0, June 2003i.

11. U.S. Nuclear Regulatory Commission (NRC). Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Washington, DC; NUREG-1575; Revision 1, August 2000.