The University of Virginia Reactor Decommissioning Project

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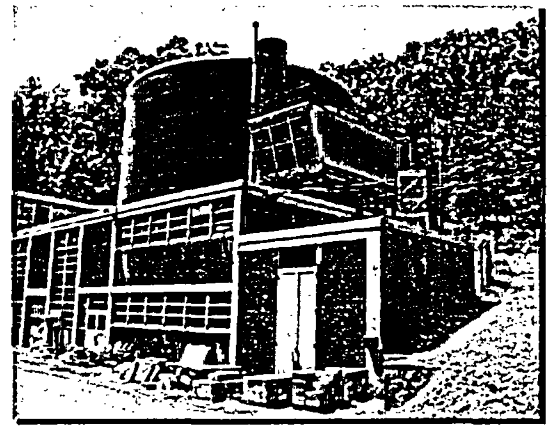

License R-66 Termination Request

Supplemental Information

-Response Letter

- Final Status Survey Report Request for Additional Information Responses

-Final Status Survey Report Revision 1

-Instrument Set 11 Revision 1

November 2004

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December 9, 2004

Docket 50-62, No. R-66

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United States Nuclear Regulatory Commission
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One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2783

Attention: Mr. Daniel E. Hughes, Project Manager
Operating Reactor Improvements Program, Mail Stop O12-G13

Subject: University of Virginia Response to Request for Additional Information Concerning the University of Virginia Final Status Survey Report, License No. R-66 (TAC NO. MB8233)

References: 1. Amendment No. 26 to Amended Facility Operating License No. R-66 for the University of Virginia Research Reactor, Docket 50-62
2. Transmittal P. E. Benneche to D. E. Hughes, "University of Virginia License Termination Request and Transmittal of the University of Virginia Decommissioning Plan Performance Summary, April 2004 and the Final Status Survey Report-- Evaluation of Radiological Results Relative to Termination of NRC License R-66, University of Virginia, Charlottesville, Virginia, May 2004" dated June 18, 2003
3. Transmittal D. E. Hughes to P. E. Benneche, "Request for Additional Information Concerning the University of Virginia Final Status Survey Report, License No. R-66 (TAC NO. MB8233) " dated September 7, 2004

Dear Mr. Hughes,

The University of Virginia is pleased to provide the responses to the Reference 3 request. The responses are provided as an attachment to this letter entitled *"Response to ORISE Comments Regarding the Final Status Survey Report for the University of Virginia Reactor Facility Decommissioning Project."* Revision 1 (November 2004) of the Final Status Survey Report text and Instrument Set 11 data sheets were produced to incorporate the Reference 3 responses.

Reviews during incorporation, resulted in a number of minor changes to the Final Status Survey Report in addition to the technical changes. To assist in your reviews, these changes are described in two additional attachments. The *"Document Change Outline for Final Status*

A020

Survey Report, University of Virginia, November 23 ,2004" and *the "Explanation of Significant Technical Changes For Final Status Survey Report, University of Virginia, Revision 1, November 2004."*

The "*Final Status Survey Report-- Evaluation of Radiological Results Relative to Termination of NRC License R-66, University of Virginia, Charlottesville, Virginia, Revision 1, November 2004"* and *"Instrument Set 11 Revision 1 November 2004."* These two documents replace the Revision 0 equivalents in their entirety.

We believe this transmittal completes the transmittals required by the University of Virginia Decommissioning Plan in order for the Commission to terminate License R-66. If you have any questions, please contact me at 434-982-5440.

I declare under penalty of perjury that the forgoing is true and correct.

Sincerely,

Paul E Benneche Date: Dec. 9, 2004

Paul E. Benneche
Acting Reactor Director / Reactor Supervisor
University of Virginia Reactor Facility

Enclosures:

1. Response to ORISE Comments Regarding the Final Status Survey Report for the University of Virginia Reactor Facility Decommissioning Project
2. Document Change Outline for Final Status Survey Report, University of Virginia, November 23, 2004
3. Explanation of Significant Technical Changes For Final Status Survey Report, University of Virginia, Revision 1, November 2004
4. Final Status Survey Report-- Evaluation of Radiological Results Relative to Termination of NRC License R-66, University of Virginia, Charlottesville, Virginia, Revision 1, November 2004
5. Instrument Set 11 Revision 1 November 2004

cc: Ralph Allen, Chair, Univ. of Va. Reactor Decommissioning Committee
Daniel Hughes, USNRC
Stephen Holmes, USNRC

Attachment 1

Response to ORISE Comments Regarding the Final Status Survey Report for the University of Virginia Reactor Facility Decommissioning Project

A July 12, 2004 letter from Timothy J. Bauer (ORISE Environmental Survey and Site Assessment Program) to Daniel Hughes (Nuclear Regulatory Commission), provided comments regarding the May 2004 Final Status Survey Report for the University of Virginia Reactor Facility Decommissioning Project. The University of Virginia is submitting the following in response to those comments. In anticipation of Nuclear Regulatory Commission (NRC) concurrence with these responses, the University of Virginia has revised and is submitting Revision 1 of the Final Status Survey Report.

1. **Section 4.2.3, Page 4-8, First Paragraph (UVA 2004a) – A composite of 19 systematic soil samples from the Waste Tank Excavation was analyzed for hard-to-detect radionuclides (HTDR) and presented in Table 4-3, Page 4-9. A 19 sample composite is an extraordinarily large number of samples to form a composite. The potential exists that some HTDRs present in individual samples would be masked using this approach.**

   Response

   Based on results of characterization sampling and analyses, it was determined that the contributions of hard-to-detect radionuclides to the total dose from residual contamination in the four soil survey areas was small – the sum of the hard-to-detects typically being less than 10% of the total dose – or could be related to the contribution from a gamma emitting radionuclide, e.g., Cs-137 or Co-60. Therefore gamma emitting radionuclides were used as surrogates to demonstrate compliance with the NRC screening DCGL release criteria. Most of the characterization samples contained such low activity levels that many of the analyses for hard-to-detect radionuclides resulted in non-detects, i.e., the concentrations present were less than the measurement sensitivities of the analytical procedures. Because of the large fraction of less-than values, the FSS team felt that consistency in the ratios of hard-to-detect radionuclides could not be demonstrated, but that there was not sufficient indication of the potential presence of these radionuclides to warrant costly analyses of a large number of the final survey samples for the complete suite of hard-to-detects. It was therefore decided that, if the individual analyses for the gamma emitters demonstrated the release criteria had been met, a composite of these individual samples would be prepared and analyzed for hard-to-detect radionuclides. If these analyses did not identify positive or otherwise significant levels of non-gamma emitting radionuclides in the composite, this would provide an increase level of confidence in the approach of using the surrogate gamma-emitter to demonstrate compliance. The analyses of composites was intended to provide supplemental information only, and therefore there was no attempt to limit the number of samples in the composite as would have been appropriate if the data were to be used to demonstrate compliance.

Wording to clarify the use of the composite data will be incorporated into the report sections 4.2.2, 4.2.3, 4.4.2, 4.4.3, 4.6.2, 4.6.3, 4.8.2 and 4.8.3.

2. **Section 4.5.3, Page 4-33, First Paragraph (UVA 2004a) – Activity determined in Room M008 where Ni-63 is the contaminant is noted as ranging up to 34,982 dpm/100 cm^2. Section 7.6 of the Master Final Status Survey Plan (UVA 2004b) notes that Tc-99 is used for instrument calibration, except for facilities contaminated with Ni-63; however, the calibration source to be used is not noted. Appendix B of the Final Status Survey Report provides final survey data worksheets. For Room M008 (survey units 7 and 38), the efficiency for the 43-68 gas flow proportional (GFP) detector is 0.065. Final survey data worksheets for other areas of the facility, which are calibrated to Tc-99, show efficiencies of approximately 0.10, which is a typical efficiency for a GFP detector with a 0.8 mg/cm^2 window. It is ESSAP's opinion that the stated efficiency of 0.065 may be an overestimate of an expected Ni-63 calibration, with a 0.8 mg/cm^2 window. ESSAP recommends UVA provide information pertaining to the calibration source used for the Ni-63 contaminated Room M008 and also include the window, thickness used for the GFP detectors.**

Response

The Ludlum 43-68 gas proportional detector, Ser. No. 160700, used for the survey of Room M008, was fitted with a 0.4 mg/cm^2 window and calibrated for Ni-63 by the detector manufacturer. Results of the calibration were included in Appendix B with the information for Instrument Set #11. The detector calibration value was 0.26. Because the surfaces were generally clean, smooth, and free of cover material that might adversely affect measurements, it was decided to use a source efficiency factor of 0.25. The combination of these factors yielded the overall efficiency of 0.065. The documentation regarding the 0.4 mg/cm^2 window was not included in the package and will be added to Appendix B. In addition, Section 3.4.3 of the FSS report will be revised to indicate that the 43-68 detectors were outfitted with 0.8 mg/cm^2 windows, except where Ni-63 was the radionuclide of concern, in which case a 0.4 mg/cm^2 window was used.

3. **Section 4.6.3, Page 4-38, Fifth Paragraph (UVA 2004a) – Table 4-6, Page 4-41, provides the results of concentrations of HTDRs in a composite soil sample from the exterior soil area. Based on these results, the last sentence of this paragraph states: "These results confirm that significant concentrations of hard-to-detect radionuclides of facility origin are not present in site soils." First, the result for Sr-90 was 0.72 pCi/g, compared with the screening $DCGL_w$ of 1.7 pCi/g – 42% of the guideline does seem significant. Second, while not explicitly stated, it is implied from the text that the 17 samples summarized in Table 4-15, Page 4-40, were used in the one composite sample analyzed for HTDRs. This practice is of concern because a 17 sample composite is an extraordinarily large number of samples to form a composite. In addition, it is possible that a small number of the 17 samples could have concentrations of Sr-90 exceeding the screening $DCGL_w$. ESSAP recommends that UVA justify the composite sampling approach and ensure that Sr-90 concentrations are not a concern.**

Response

The author concurs that the positive concentration of Sr-90 in the composite raises questions as to whether there might be areas of exterior soil with levels of Sr-90 in excess of the screening DCGL or sufficient to cause the unity rule to be exceeded for individual locations. The individual samples were still available and analysis of each of these samples for Sr-90 was performed. Concentrations of Sr-90 in all samples were less than the screening DCGL of 1.7 pCi/g and the sum of fractions values for gamma emitters and SR-90 were less than 1.0. Section 4.6.3 will be revised to include these additional analyses and evaluations.

4. **Section 4.8.3, Page 4-63, First Paragraph (UVA 2004a) – Gross gamma levels of interior surface soils were elevated with an ambient level as high as 40,000 counts per minute (cpm). The report notes that the sensitivity of the 2" x 2" NaI detector is adequate to meet the DCGLs of 3.8 pCi/g for Co-60 and 11 pCi/g for Cs-137. The sensitivities of this detector are adequate in a nominal background field, for example 10,000 cpm; however, as the background increases, the sensitivity will decrease. It is possible that in the high background field the sensitivity could be calculated to be higher than the DCGLs, especially for Co-60. ESSAP recommends UVA re-evaluate the sensitivity of the 2" x 2" NaI detector used in the high background field.**

Response

Other than the Mezzanine floor, the exposed surfaces of the "special soil" were sub-floor and were small in area. In most locations accessible soil surfaces were less than 1 m^2 and scans were performed by either holding the detector in the hand and passing it over the surface or "dangling" the detector through a hole in the concrete surface and moving it slowly over the soil surface below. Because of these restrictions, scan speeds were slower than the "walkover" scan of open land surfaces, which typically leads to a dwell time of 1 second or less. The dwell time for these surface scans in the vicinity of a hypothetical 28 cm diameter area of contamination was therefore at least several seconds. If a conservatively low dwell time of 2 seconds is assumed, the resulting scan sensitivities are obtained:

Ambient Level (cpm)	Cs-137 MDC (pCi/g)	Co-60 MDC (pCi/g)
10,000	4.5	2.3
20,000	6.4	3.3
30,000	7.9	4.0
40,000	9.1	4.6

The sensitivity of the scan for Cs-137 is adequate to detect DCGL levels of Cs-137 contamination (11 pCi/g) in surface soil in the presence of ambient radiation levels present in the special soils areas. However, as can be noted from this table, the scan cannot detect the DCGL level of Co-60 (3.8 pCi/g) at ambient background levels above approximately 26,000 cpm.

Review of the survey data indicates that the scan values for soil surfaces in the Mezzanine ranged from 18,000 to 23,000 cpm; scan levels above this listed in FSS Report Table 4-19 were associated with the wall surfaces adjacent to the reactor room wall – likely resulting primarily from the elevated naturally occurring radionuclides in the fill. The gamma scan of the demineralizer excavation ranged to 24,700 cpm; the value of 26,525 cpm in report Table 4-19 is the integrated gamma count after sampling. Neither of these survey areas therefore is of concern regarding an adequate scan sensitivity. Corrections will be made to the report.

The scan range for the areas below the reactor room floor ranged up to 30,000 cpm with two of the fifteen scanned areas exceeding 26,000 cpm; theses were location V (maximum of 28,400 cpm) and location B (30,000 cpm). Further scans in the vicinity of locations M and B below the reactor room floor ranged up to 30,937 cpm with eight of the seventeen locations being above 26,000 cpm.

The scan range for the areas below the reactor pool ranged up to 40,495 cpm with three of the twelve scanned locations exceeding 26,000 cpm. Thus 13 of the 34 locations had ambient gamma levels such that the scan sensitivity for Co-60 in surface soil was above the DCGL. A one-year decay of Co-60 results in a reduction in to 0.875 of the original level. Thus, in the slightly greater than a year that has passed since these scans were performed, if Co-60 had been present at its detectable concentration at that time, as of 8/31/04 it would be reduced to 3.5 pCi/g (4.0 x 0.875) beneath the reactor room floor and to 4.0 pCi/g (4.6 x 0.875) beneath the reactor pool. In addition, these soils beneath the reactor room floor and the reactor pool are not surface soils and, any residual activity on their surface would undergo dilution by mixing with the other fill soil, which this report has demonstrated to contain residual activity well below the DCGLs. The results and conclusions sections (4.8.3 and 4.8.4) of the report will be modified accordingly.

5. **Section 4.8.3 (UVA 2004a) – This section provides the results and conclusions for the Special Soils Areas. In general, the assessment approach used in this section is not consistent with the MARSSIM or with Section 4.6 that assessed the exterior soil areas. All soil results were compared to the Co-60 $DCGL_{surrogate}$ of 3.4 pCi/g. This modifiedCo-60 $DCGL_w$ was developed based on a single sample from the Underground Waste Tank Excavation Addendum 001 (UVA 2004c). The mixture used to develop this DCGL did not have any detectable Cs-137. However, a Cs-137 level of 7.10 pCi/g (Table 4-22, Page 6-64) was identified at sample location 3 from the remediated soil areas beneath the reactor pool. This result shows that the Co-60 $DCGL_{surrogate}$ of 3.4 pCi/g is not applicable to this soil area. ESSAP recommends that UVA re-evaluate the application of the Co-60 surrogate $DCGL_w$ and employ the unity rule as was done in Section 4.6.3.**

Response

The text of Section 4.8.3 will be revised to include an evaluation of the applicability of Co-60 as a surrogate, based on the sample results. Tables 4-20 through 4-25 will be revised to include a sum of fractions evaluation, similar to the one provided in Table 4-15.

Attachment 2

Document Change Outline
for
Final Status Survey Report
University of Virginia
November 23, 2004

Page No.	Section No.	Reason for Change
Cover Page		Inserted "Revision 1" to reflect correct revision and correct date (May 04 to November 04)
ii		Inserted "Revision 1" to reflect correct revision and correct date (May 04 to November 04)
iii		Inserted "Revision 1" to reflect correct revision and correct date (May 04 to November 04)
v	Table of Contents	Page numbers changed
vi	Table of Contents	Table 4-15 Title Revised and page numbering changed Figure 2-2 Change in title of figure
vii	Table of Contents	Page numbers changed Appendix A change in title
1-1	1-1	Formatting page number
2-1	2-1	1st sentence of 1st paragraph – deleted "western" and inserted "northern" and formatted page number
2-2 thru 2-6	2-1	Formatted page number
3-2 thru 3-6	3-1	Formatted page number
3-6	Table 3-3	Made change in Screening Value for Plutonium 241 and formatted page number.
3-7 thru 3-8	3.3	Formatted page number.
3-9	3.4.3	Inserted additional technical information in 1st paragraph. Formatted page number.
3-10	3.5	Formatted page number
3-11	3.7	Deleted some technical information and inserted a new sentence in the last paragraph.
4-1	4.1	Formatted page number.
4-2	4.1.2	Revised Figure 4-1 and formatted page number.
4-2	4.1.2	Made grammatical change in last paragraph. Formatted page number.
4-4	4.2.1	Deleted text. Formatted page number.
4-6	4.2.2	Formatted page number.
4-7	4.2.2	Last two paragraphs before Section 4.2.3 – deleted some text and added last paragraph with technical information.
4-8	4.2.3	Added paragraph of technical information before Table 4-2. Revised page number
4-9	4.2.3	Made minor changes in Table 4-3
4-9	4.2.4	Inserted new text "in this survey area" (2nd sentence).

Attachment 3

Explanation of Significant Technical Changes
For
Final Status Survey Report
University of Virginia
Revision 1
November 2004

The following additions/modifications have been incorporated into the May 2004 version of the UVAR FSS Report to resolve comments provided by the NRC and ORISE in their Request for Additional Information (RAI) and telephone conferences.

Section 3.4.3 Described special setup of Model 43-68 gas proportional instrument for surveys of locations with potential Ni-63 contamination.

Section 4.2.2 Clarified the use of gamma analysis results for demonstrating compliance with criteria. Described the use of hard-to-detect analyses of composite samples as for supplemental information, only, to confirm the absence of non gamma emitters identified by the characterization as potential contaminants and to thereby further justify the approach of using gamma analysis for demonstrating compliance. Explained that the number of samples for a composite was not limited by design, as would have been the case, if the results were to have been used to demonstrate compliance.

Section 4.2.3 Described the results of hard-to-detect analyses of the composite sample for those radionuclides identified during the characterization as potential contaminants. Stated that results of composite analyis confirms approach of using gamma analysis for demonstrating compliance.

Section 4.4.2 Clarified the use of gamma analysis results for demonstrating compliance with criteria. Described the use of hard-to-detect analyses of composite samples as for supplemental information, only, to confirm the absence of non gamma emitters identified by the characterization as potential contaminants and to thereby further justify the approach of using gamma analysis for demonstrating compliance.

Section 4.4.3 Indicated that the results of hard-to-detect analyses of composite samples from characterization confirms approach of using gamma analysis for demonstrating compliance and that further hard-to-detect analyses were not justified.

Section 4.6.2 Clarified the use of gamma analysis results for demonstrating compliance with criteria. Described the use of hard-to-detect analyses of composite samples as for supplemental information, only, to confirm the absence of non gamma emitters identified by the characterization as potential contaminants and to thereby further justify the approach of using gamma

analysis for demonstrating compliance. Explained that the number of samples for a composite was not limited by design, as would have been the case if the results were to have been used to demonstrate compliance.

Section 4.6.3 Described the identification of a positive Sr-90 concentration activity in the composite and the follow-up analyses of individual samples for Sr-90. Presented the results of this additional analysis and incorporated sum-of-fractions calculations for gamma emitters and Sr-90 into the data evaluation analysis for demonstrating compliance.

Section 4.8.2 Clarified the use of gamma analysis results for demonstrating compliance with criteria. Described the use of hard-to-detect analyses of composite samples as for supplemental information only to confirm the absence of non gamma emitters identified by the characterization as potential contaminants and to thereby further justify the approach of using gamma analysis for demonstrating compliance. Explained that the number of samples for a composite was not limited by design, as would have been the case if the results were to have been used to demonstrate compliance.

Section 4.8.3 Provided expanded discussion of gamma scan process and the impact of elevated ambient levels on the scan sensitivity. Justified scan survey as being adequate to identify areas of elevated activity. Described the results of hard-to-detect analyses of the composite samples for those radionuclides identified during the characterization as potential contaminants. Stated that results of composite analyis confirms approach of using gamma analysis for demonstrating compliance. Described findings of Cs-137/Co-60 ratios, which are not consistent with design assumptions and therefore do not support the use of Co-60 as a surrogate for certain survey units. Revised the data evaluations based on the calculation of sum-of-fractions and incorporated results into data tables and text.

Jim Berger
11/23/04