

UNIVERSITY OF VIRGINIA
NUCLEAR REACTOR FACILITY

U.S. MAIL ADDRESS
P.O. Box 400322
Charlottesville, VA
22904-4322

STREET ADDRESS
675 Old Reservoir Road
Charlottesville, VA 22903
Telephone: 804-982-5440
Fax: 804-982-5473

April 26, 2000

U.S. Nuclear Regulatory Commission
Mr. Alexander Adams, Jr., REXB
Mail Stop 012-D3
Washington, DC 220555

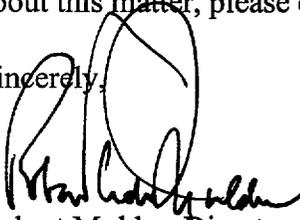
Re: Update of the U.Va. Reactor Decommissioning Plan (Docket 50-62, License R-66)

Dear Mr. Adams,

Please find enclosed an updated set of pages for the UVAR Decommissioning Plan, numbered 1-12, 1-13, 1-20, 2-23, 5-1, 6-1, A-3 and A-4. The modifications are highlighted for informational purposes in a second comparison set. The updates involve revised decommissioning cost figures and several modified characterization DCGLs which have been provided to us by U.Va.'s subcontractor, GTS Duratek.

We would be grateful if you would make this update to the UVAR Decommissioning Plan available to the NRC subcontractors who are evaluating the plan. Should you have questions about this matter, please contact me at (804)982-5440.

Sincerely,

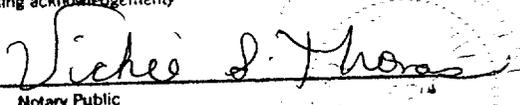

Robert Mulder, Director
Nuclear Reactor Facility

City/County of Albemarle
Commonwealth of Virginia

I hereby certify that the attached document is a true and exact copy of a letter, presented before
(type of document)

me this 26th day of April, 19 2000.

by Robert Mulder
(name of person seeking acknowledgement)


Notary Public

My commission expires 2/28, 19 2002

cc: U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, DC
Mr. Craig Bassett, Region II, Atlanta, Georgia

A00141

INFORMATION COPY ONLY

**WITH LINES IN RIGHT MARGIN INDICATING
WHERE CHANGES HAVE BEEN MADE**

1.2.1 Reactor Decommissioning Overview

Prior to implementing the decommissioning actions described herein, the UVAR will have been cleared of all extraneous fixtures, equipment and materials. Remediation will be required for the reactor and associated equipment, the reactor room, the demineralizer room, the heat exchanger room and in the buried tanks and vaults. In other areas of the facility only minor remediation requirements are anticipated. The general activities to complete the Plan objectives are:

- 1.2.1.1 Remove the reactor grid plate, the reactor support structure, equipment from the reactor pool and activated concrete from the reactor pool.
- 1.2.1.2 Perform additional decontamination and dismantlement of the structure and equipment associated with the UVAR in accordance with this plan.
- 1.2.1.3 Perform additional decontamination and dismantlement activities in outdoor areas and on equipment associated with the UVAR in accordance with this plan.
- 1.2.1.4 Prepare the decommissioning generated material for release or disposal (as appropriate) throughout the activities. Either decontaminate and release the material as non-radioactive waste, or package for transport as radioactive waste.
- 1.2.1.5 Ship all radioactive waste off-site to a licensed waste processor or disposal facility. In the event that no acceptable licensed disposal facility is available, waste may be retained onsite for interim storage.
- 1.2.1.6 Perform and document the final radiological survey(s) and submit a request to the USNRC for performance of confirmatory surveys and subsequent release of the former Reactor Facility to unrestricted use, through a termination of the reactor license.

1.2.2 ESTIMATED COST

The cost estimate is consistent with the scope of work covering D&D of the UVA Reactor. D&D of the UVAR will be accomplished without dismantlement of the building. The detailed estimated cost to decommission the UVAR licensed areas is presented in the Decommissioning Cost estimate for the UVA Reactor Facility, Charlottesville, VA (Ref. 1-3). This project is estimated to cost \$3,547,048. The decommissioning estimate was generated using Xtreme PMSM (Ref. 1-4). A cost breakdown is given in Table 1-2 below.

Table 1-2 Decommissioning Cost Summary - UVA Reactor

D&D Operation	Labor Plus Travel & Living \$1000's	Waste Processing & Transport \$1000's	Equipment Contracts & Supplies \$1000's	Waste Shipping & Disposal \$1000's	Total Cost \$1000's
Reactor Confinement Structure	\$141	\$37	\$36	\$64	\$228
Reactor, Pool & Pool Contents	\$123		\$61	\$328	\$511
Old Labs & Structure	\$324	\$50	\$80	\$138	\$593
Newer Labs & Structure	\$101	\$13	\$22	\$2	\$140
Underground Tanks and Vaults	\$47	\$2	\$43	\$332	\$424
Outdoor Areas, Drains & Sewers	\$128	\$20	\$29	\$17	\$195
Decommissioning Planning	\$23				\$23
Characterization Surveys	\$56		\$7		\$63
Final Surveys	\$225		\$29		\$254
Planning, Training & Mobilization	\$19				\$19
Contractor Project Oversight	\$167				\$167
Owner Oversight & Licensing	\$154				\$154
NRC Verification Survey					\$20
Total	\$1,507	\$123	\$307	\$882	\$2,838
25 % CONTINGENCY					\$709
GRAND TOTAL					\$3,547

* The estimate for LLW disposal is based upon the assumption that the activated waste will be buried at the Barnwell, South Carolina site and all other radioactive waste will be buried at the Envirocare of Utah site.

1.2.3 Availability of Funds

An estimate of the costs to decommission the UVA USNRC licensed facility is provided above. The University of Virginia is committed to providing the funding for decommissioning of the University of Virginia Reactor.

Audit Reports

Reports of the results of each audit shall be prepared. These reports shall include a description of the area audited, identification of the individual responsible for implementation of the audited provisions and for performance of the audit, and identification of discrepant areas. The audit report shall be distributed to the appropriate level of management and to those individuals responsible for implementation of audited provisions.

Audit Corrective Action

Measures shall be established to ensure that discrepancies identified by audits are resolved. These measures shall include notification of the manager responsible for the discrepancy and verification of satisfactory resolution. Discrepancies shall be resolved by the manager responsible for the discrepancy. Higher levels of management shall resolve disputed discrepancies.

Follow-up action, including re-audit of deficient areas, shall be taken as indicated.

REFERENCES FOR SECTION 1

- 1-1 NUREG- 1537 Rev. 0, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors".
- 1-2 Amendment No. 25 to Facility License No. R-66 (UVA Reactor) — University of Virginia, Anticipated Issue in early year 2000 by the USNRC, (UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999.)
- 1-3 The University of Virginia, *Decommissioning Cost Estimate UVA Reactor Facility, Charlottesville, Virginia*, Revision 0, April 2000, prepared by GTS Duratek.
- 1-4 Xtreme PMSM, Integrated Project Management System, GTS Duratek and Merrimac.
- 1-5 10 CFR 20.1402 *Radiological Criteria for Unrestricted Use*.
- 1-6 NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*.
- 1-7 Draft Regulatory Guide DG-4006, *Demonstrating Compliance with the Radiological Criteria for License Termination*, August 1998.

DECOMMISSIONING ALTERNATIVE AND ACTIVITIES

¹ Screening levels are based on the assumption that the fraction of removable surface contamination is equal to 0.1.

² Units are disintegrations per minute per 100 square centimeters (dpm/100 cm²). 1 dpm is equivalent to 0.0167 becquerel (Bq). The screening values represent surface concentrations of individual radionuclides that would be deemed in compliance with the 0.25 mSv/yr (25 mrem/yr) unrestricted release dose limit in 10 CFR 20.1402. For radionuclides in a mixture, the "sum of fractions" rule applies; see 10 CFR Part 20, Appendix B, Note 4. NRC Draft Guidance DG-4006 for provides further information on application of the values in this table.

REFERENCES FOR SECTION 2

- 2-1 Amendment No. 25 to Facility License No. R-66 (UVA Reactor) — University of Virginia, Anticipated Issue in early year 2000 by the USNRC, (UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999.)
- 2-2 *The Health Physics and Radiological Health Handbook*, Revised Edition 1992, Editor by B. Shleien.
- 2-3 Xtreme PMSM, Integrated Project Management System, GTS Duratek and Merrimac.
- 2-4 10 CFR 20 Subpart H, *Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas*.
- 2-5 Regulatory Guide 8.15, *Acceptable Programs for Respiratory Protection*; Revision 1, October, 1999
- 2-6 NUREG 0041, *Manual of Respiratory Protection Against Airborne Radioactive Materials*
- 2-7 29 CFR 1910.134, *Respiratory Protection*
- 2-8 UVAR Characterization Survey Report
- 2-9 10 CFR 20 Subpart E, *Radiological Criteria for License Termination*
- 2-10 10 CFR 20.1402 *Radiological Criteria for Unrestricted Use*
- 2-11 *Supplemental Information on the Implementation of the Final Rule on Radiological Criteria for Licence Termination*, the Federal Register (63 FR 64132, 11/18/98)
- 2-12 Draft Regulatory Guide DG-4006, *Demonstrating Compliance with the Radiological Criteria for License Termination*, August 1998

5.0 TECHNICAL SPECIFICATIONS

It is anticipated that for decommissioning the applicable Technical Specifications for the UVA Reactor will be set forth in Amendment No. 25 to Facility License No. R-66, University of Virginia Reactor, Docket No. 50-62, issued by the USNRC in early year 2000, as per UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999 (Ref. 5-1).

As decommissioning progresses, further requests for changes to the Technical Specifications may be submitted in an application for amendment to the license pursuant to 10 CFR 50.59.

REFERENCES FOR SECTION 5

- 5-1 Amendment No. 25 to Facility License No. R-66 (UVA Reactor) — University of Virginia, Anticipated Issue in early year 2000 by the USNRC, as per UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999.

6.0 PHYSICAL SECURITY PLAN

All UVA radiation restricted areas are secured from unauthorized entry. During non-working hours, all nuclear facility sensitive areas are locked. UVA maintains routine, periodic police surveillance of the reactor site.

Existing physical security and material control and accounting plans approved by the Nuclear Regulatory Commission, as may be amended, will continue to be implemented.

These existing plans meet the requirements in NUREG-1537 Chapter 17 *Decommissioning and Possession-Only Amendments*, and will be maintained as required by the UVA Possession Only Amendment (Ref. 6-1).

REFERENCES FOR SECTION 6

- 6-1 Amendment No. 25 to Facility License No. R-66 (UVA Reactor) — University of Virginia, Anticipated Issue in early year 2000 by the USNRC, as per UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999.

collected and sent offsite for analysis of potential hazardous material constituents. The purpose of the hazardous material assessment was to recognize hazardous materials that may be present for the D&D phase of the work, and to meet the Waste Acceptance Criteria for waste shipments to Envirocare of Utah.

Survey package instructions were developed and measurements performed for background surface, structure and environs reference areas. Direct beta background values were determined for naturally occurring radioactive materials (NORM) in asphalt, brick, ceramic tile, cinder block and concrete. These background values were applied to the direct beta measurements collected at the UVAR facility surfaces and structures to determine the net beta activity results per 100 cm² from the measured activity results. Also, survey measurements and samples collected from sediment and water of the environs were used to determine background values for NORM and from weapons testing. These values are included in the characterization report (Ref. A-1) but were not applied to UVAR survey results.

One resin sample from the UVAR poolwater clean-up system and one pond sediment sample (taken where the facility drains enter the pond) were collected and sent offsite for 10 CFR Part 61 radionuclide analysis. These sample results and the other onsite characterization results were used to develop UVAR site-specific DCGL's for site clean-up and release for unrestricted use.

The UVAR facility and site, for the most part, are below the radiological characterization DCGL and are mostly free from hazardous material concerns. However, some areas and locations at the UVAR facility and site will require decontamination before the site is suitable for NRC license termination. Of the 2,655 total samples and measurements collected and performed for the survey, 1,142 of them were direct measurements collected for the radiological characterization. Twelve (12) direct beta measurement results were greater than the MDA goal (50 % of the 5,000 dpm/100 cm² characterization DCGL) and five (5) of these direct beta measurements were greater than the characterization DCGL (9,250 dpm/100 cm²). Of the 198 samples collected for gamma spectrum analysis, 18 sample results were greater than the characterization soil concentration DCGL's (1.91 pCi/g for Co-60 and/or 0.95 pCi/g for Cs-137). Details of these surveys and complete results are provided in the UVAR Characterization Survey Report (Ref. A-1).

The areas that will require remediation or further investigation and evaluation are presented in the discussions that follow. The location of the elevated measurements are depicted in Figures A-1 to A-4 by number on each figure.

1. Figure A-1, *Reactor Facility First Floor Level*, Location No. 1, one confinement room elevated measurement result of 12,593 dpm/100 cm² was obtained on the East wall. However, this result may have been influenced by elevated background radiation levels due to radioactive materials stored in the area. The radioactive materials stored in the reactor confinement room during this survey period will be removed prior to, or as a part

- of, the facility decommissioning. Measurement results from the three floor drains in the confinement room showed contamination levels up to 6,398 dpm/100 cm² in floor drain number 2 on the east side of the reactor pool.
2. Figure A-1, *Reactor Facility First Floor Level*, Location No. 2, the reactor pool will require remediation based upon the operational history, radioactive materials known to be present in the pool and activation products from reactor operations in the concrete walls and floor.
 3. Figure A-1, *Reactor Facility First Floor Level*, Location No. 3, a composite sediment sample, collected from the exhaust of the confinement building stack during the building exterior surfaces survey, measured 0.8 pCi/g of Co-60 and 2.8 pCi/g of Cs-137.
 4. Figure A-2, *Reactor Facility Mezzanine Level*, Location No. 4, in room M008 one elevated direct measurement result of 26,365 dpm/100 cm² total beta activity was obtained from the laboratory sink. The contaminant was suspected to be Nickel-63 based on research experiment history and the low-energy of the measured activity.
 5. Figure A-2, *Reactor Facility Mezzanine Level*, Location No. 5, in room M021A one elevated direct measurement result of 8,318 dpm/100 cm² total beta activity was obtained from the equipment surface of the reactor pool water clean-up system. However, this surface contamination measurement result may have been influenced by elevated background radiation levels from the water clean-up system internal contamination. The water clean-up system tanks, pumps and piping and the prototype water clean-up system tank and piping located in the adjacent room M021 will be removed as a part of the facility decommissioning.
 6. Figure A-3, *Reactor Facility Ground Level*, Location No. 6, the measurement results from the survey indicate that room G007 excluding any CAVALIER Reactor, supporting systems, the sub-critical reactor assembly and pit for the most part was radiologically clean. Measurements performed on the sub-critical reactor assembly and pit were inconclusive due to elevated natural radon activity. An NRC approved decommissioning plan and decommissioning order is in place for the CAVALIER Reactor, supporting systems. The sub-critical reactor assembly located in room G007 is scheduled for shipment back to Oak Ridge (DOE). The CAVALIER Reactor, and supporting systems and the sub-critical reactor assembly will be decommissioned in accordance with the approved plan.
 7. Figure A-3, *Reactor Facility Ground Level*, Location No. 7, the Hot Cell rooms G026 and G027 each had one elevated direct measurement result greater than 9,250 dpm/100 cm² total beta activity. Results of measurements collected ranged up to 63,661 dpm/100 cm² on the floor in room G026 and up to 19,268 dpm/100 cm² on the floor in room G027.

1.2.1 Reactor Decommissioning Overview

Prior to implementing the decommissioning actions described herein, the UVAR will have been cleared of all extraneous fixtures, equipment and materials. Remediation will be required for the reactor and associated equipment, the reactor room, the demineralizer room, the heat exchanger room and in the buried tanks and vaults. In other areas of the facility only minor remediation requirements are anticipated. The general activities to complete the Plan objectives are:

- 1.2.1.1 Remove the reactor grid plate, the reactor support structure, equipment from the reactor pool and activated concrete from the reactor pool.
- 1.2.1.2 Perform additional decontamination and dismantlement of the structure and equipment associated with the UVAR in accordance with this plan.
- 1.2.1.3 Perform additional decontamination and dismantlement activities in outdoor areas and on equipment associated with the UVAR in accordance with this plan.
- 1.2.1.4 Prepare the decommissioning generated material for release or disposal (as appropriate) throughout the activities. Either decontaminate and release the material as non-radioactive waste, or package for transport as radioactive waste.
- 1.2.1.5 Ship all radioactive waste off-site to a licensed waste processor or disposal facility. In the event that no acceptable licensed disposal facility is available, waste may be retained onsite for interim storage.
- 1.2.1.6 Perform and document the final radiological survey(s) and submit a request to the USNRC for performance of confirmatory surveys and subsequent release of the former Reactor Facility to unrestricted use, through a termination of the reactor license.

1.2.2 ESTIMATED COST

The cost estimate is consistent with the scope of work covering D&D of the UVA Reactor. D&D of the UVAR will be accomplished without dismantlement of the building. The detailed estimated cost to decommission the UVAR licensed areas is presented in the Decommissioning Cost estimate for the UVA Reactor Facility, Charlottesville, VA (Ref. 1-3). This project is estimated to cost \$3,547,048. The decommissioning estimate was generated using Xtreme PMSM (Ref. 1-4). A cost breakdown is given in Table 1-2 below.

Table 1-2 Decommissioning Cost Summary - UVA Reactor

D&D Operation	Labor Plus Travel & Living \$1000's	Waste Processing & Transport \$1000's	Equipment Contracts & Supplies \$1000's	Waste Shipping & Disposal \$1000's	Total Cost \$1000's
Reactor Confinement Structure	\$141	\$37	\$36	\$64	\$228
Reactor, Pool & Pool Contents	\$123		\$61	\$328	\$511
Old Labs & Structure	\$324	\$50	\$80	\$138	\$593
Newer Labs & Structure	\$101	\$13	\$22	\$2	\$140
Underground Tanks and Vaults	\$47	\$2	\$43	\$332	\$424
Outdoor Areas, Drains & Sewers	\$128	\$20	\$29	\$17	\$195
Decommissioning Planning	\$23				\$23
Characterization Surveys	\$56		\$7		\$63
Final Surveys	\$225		\$29		\$254
Planning, Training & Mobilization	\$19				\$19
Contractor Project Oversight	\$167				\$167
Owner Oversight & Licensing	\$154				\$154
NRC Verification Survey					\$20
Total	\$1,507	\$123	\$307	\$882	\$2,838
25 % CONTINGENCY					\$709
GRAND TOTAL					\$3,547

* The estimate for LLW disposal is based upon the assumption that the activated waste will be buried at the Barnwell, South Carolina site and all other radioactive waste will be buried at the Envirocare of Utah site.

1.2.3 Availability of Funds

An estimate of the costs to decommission the UVA USNRC licensed facility is provided above. The University of Virginia is committed to providing the funding for decommissioning of the University of Virginia Reactor.

Audit Reports

Reports of the results of each audit shall be prepared. These reports shall include a description of the area audited, identification of the individual responsible for implementation of the audited provisions and for performance of the audit, and identification of discrepant areas. The audit report shall be distributed to the appropriate level of management and to those individuals responsible for implementation of audited provisions.

Audit Corrective Action

Measures shall be established to ensure that discrepancies identified by audits are resolved. These measures shall include notification of the manager responsible for the discrepancy and verification of satisfactory resolution. Discrepancies shall be resolved by the manager responsible for the discrepancy. Higher levels of management shall resolve disputed discrepancies.

Follow-up action, including re-audit of deficient areas, shall be taken as indicated.

REFERENCES FOR SECTION 1

- 1-1 NUREG- 1537 Rev. 0, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors".
- 1-2 Amendment No. 25 to Facility License No. R-66 (UVA Reactor) — University of Virginia, Anticipated Issue in early year 2000 by the USNRC, (UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999.)
- 1-3 The University of Virginia, *Decommissioning Cost Estimate UVA Reactor Facility, Charlottesville, Virginia*, Revision 0, April 2000, prepared by GTS Duratek.
- 1-4 Xtreme PMSM, Integrated Project Management System, GTS Duratek and Merrimac.
- 1-5 10 CFR 20.1402 *Radiological Criteria for Unrestricted Use*.
- 1-6 NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*.
- 1-7 Draft Regulatory Guide DG-4006, *Demonstrating Compliance with the Radiological Criteria for License Termination*, August 1998.

DECOMMISSIONING ALTERNATIVE AND ACTIVITIES

¹ Screening levels are based on the assumption that the fraction of removable surface contamination is equal to 0.1.

² Units are disintegrations per minute per 100 square centimeters (dpm/100 cm²). 1 dpm is equivalent to 0.0167 becquerel (Bq). The screening values represent surface concentrations of individual radionuclides that would be deemed in compliance with the 0.25 mSv/yr (25 mrem/yr) unrestricted release dose limit in 10 CFR 20.1402. For radionuclides in a mixture, the "sum of fractions" rule applies; see 10 CFR Part 20, Appendix B, Note 4. NRC Draft Guidance DG-4006 for provides further information on application of the values in this table.

REFERENCES FOR SECTION 2

- 2-1 Amendment No. 25 to Facility License No. R-66 (UVA Reactor) — University of Virginia, Anticipated Issue in early year 2000 by the USNRC, (UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999.)
- 2-2 *The Health Physics and Radiological Health Handbook*, Revised Edition 1992, Editor by B. Shleien.
- 2-3 Xtreme PMSM, Integrated Project Management System, GTS Duratek and Merrimac.
- 2-4 10 CFR 20 Subpart H, *Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas*.
- 2-5 Regulatory Guide 8.15, *Acceptable Programs for Respiratory Protection*; Revision 1, October, 1999
- 2-6 NUREG 0041, *Manual of Respiratory Protection Against Airborne Radioactive Materials*
- 2-7 29 CFR 1910.134, *Respiratory Protection*
- 2-8 UVAR Characterization Survey Report
- 2-9 10 CFR 20 Subpart E, *Radiological Criteria for License Termination*
- 2-10 10 CFR 20.1402 *Radiological Criteria for Unrestricted Use*
- 2-11 *Supplemental Information on the Implementation of the Final Rule on Radiological Criteria for Licence Termination*, the Federal Register (63 FR 64132, 11/18/98)
- 2-12 Draft Regulatory Guide DG-4006, *Demonstrating Compliance with the Radiological Criteria for License Termination*, August 1998

5.0 TECHNICAL SPECIFICATIONS

It is anticipated that for decommissioning the applicable Technical Specifications for the UVA Reactor will be set forth in Amendment No. 25 to Facility License No. R-66, University of Virginia Reactor, Docket No. 50-62, issued by the USNRC in early year 2000, as per UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999 (Ref. 5-1).

As decommissioning progresses, further requests for changes to the Technical Specifications may be submitted in an application for amendment to the license pursuant to 10 CFR 50.59.

REFERENCES FOR SECTION 5

- 5-1 Amendment No. 25 to Facility License No. R-66 (UVA Reactor) — University of Virginia, Anticipated Issue in early year 2000 by the USNRC, as per UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999.

6.0 PHYSICAL SECURITY PLAN

All UVA radiation restricted areas are secured from unauthorized entry. During non-working hours, all nuclear facility sensitive areas are locked. UVA maintains routine, periodic police surveillance of the reactor site.

Existing physical security and material control and accounting plans approved by the Nuclear Regulatory Commission, as may be amended, will continue to be implemented.

These existing plans meet the requirements in NUREG-1537 Chapter 17 *Decommissioning and Possession-Only Amendments*, and will be maintained as required by the UVAR Possession Only Amendment (Ref. 6-1).

REFERENCES FOR SECTION 6

- 6-1 Amendment No. 25 to Facility License No. R-66 (UVA Reactor) — University of Virginia, Anticipated Issue in early year 2000 by the USNRC, as per UVA request dated September 29, 1998, as supplemented on January 20, August 16, and November 23, 1999.

collected and sent offsite for analysis of potential hazardous material constituents. The purpose of the hazardous material assessment was to recognize hazardous materials that may be present for the D&D phase of the work, and to meet the Waste Acceptance Criteria for waste shipments to Envirocare of Utah.

Survey package instructions were developed and measurements performed for background surface, structure and environs reference areas. Direct beta background values were determined for naturally occurring radioactive materials (NORM) in asphalt, brick, ceramic tile, cinder block and concrete. These background values were applied to the direct beta measurements collected at the UVAR facility surfaces and structures to determine the net beta activity results per 100 cm² from the measured activity results. Also, survey measurements and samples collected from sediment and water of the environs were used to determine background values for NORM and from weapons testing. These values are included in the characterization report (Ref. A-1) but were not applied to UVAR survey results.

One resin sample from the UVAR poolwater clean-up system and one pond sediment sample (taken where the facility drains enter the pond) were collected and sent offsite for 10 CFR Part 61 radionuclide analysis. These sample results and the other onsite characterization results were used to develop UVAR site-specific DCGL's for site clean-up and release for unrestricted use.

The UVAR facility and site, for the most part, are below the radiological characterization DCGL and are mostly free from hazardous material concerns. However, some areas and locations at the UVAR facility and site will require decontamination before the site is suitable for NRC license termination. Of the 2,655 total samples and measurements collected and performed for the survey, 1,142 of them were direct measurements collected for the radiological characterization. Twelve (12) direct beta measurement results were greater than the MDA goal (50 % of the 5,000 dpm/100 cm² characterization DCGL) and five (5) of these direct beta measurements were greater than the characterization DCGL (9,250 dpm/100 cm²). Of the 198 samples collected for gamma spectrum analysis, 18 sample results were greater than the characterization soil concentration DCGL's (1.91 pCi/g for Co-60 and/or 0.95 pCi/g for Cs-137). Details of these surveys and complete results are provided in the UVAR Characterization Survey Report (Ref. A-1).

The areas that will require remediation or further investigation and evaluation are presented in the discussions that follow. The location of the elevated measurements are depicted in Figures A-1 to A-4 by number on each figure.

1. Figure A-1, *Reactor Facility First Floor Level*, Location No. 1, one confinement room elevated measurement result of 12,593 dpm/100 cm² was obtained on the East wall. However, this result may have been influenced by elevated background radiation levels due to radioactive materials stored in the area. The radioactive materials stored in the reactor confinement room during this survey period will be removed prior to, or as a part

of, the facility decommissioning. Measurement results from the three floor drains in the confinement room showed contamination levels up to 6,398 dpm/100 cm² in floor drain number 2 on the east side of the reactor pool.

2. Figure A-1, *Reactor Facility First Floor Level*, Location No. 2, the reactor pool will require remediation based upon the operational history, radioactive materials known to be present in the pool and activation products from reactor operations in the concrete walls and floor.
3. Figure A-1, *Reactor Facility First Floor Level*, Location No. 3, a composite sediment sample, collected from the exhaust of the confinement building stack during the building exterior surfaces survey, measured 0.8 pCi/g of Co-60 and 2.8 pCi/g of Cs-137.
4. Figure A-2, *Reactor Facility Mezzanine Level*, Location No. 4, in room M008 one elevated direct measurement result of 26,365 dpm/100 cm² total beta activity was obtained from the laboratory sink. The contaminant was suspected to be Nickel-63 based on research experiment history and the low-energy of the measured activity.
5. Figure A-2, *Reactor Facility Mezzanine Level*, Location No. 5, in room M021A one elevated direct measurement result of 8,318 dpm/100 cm² total beta activity was obtained from the equipment surface of the reactor pool water clean-up system. However, this surface contamination measurement result may have been influenced by elevated background radiation levels from the water clean-up system internal contamination. The water clean-up system tanks, pumps and piping and the prototype water clean-up system tank and piping located in the adjacent room M021 will be removed as a part of the facility decommissioning.
6. Figure A-3, *Reactor Facility Ground Level*, Location No. 6, the measurement results from the survey indicate that room G007 excluding any CAVALIER Reactor, supporting systems, the sub-critical reactor assembly and pit for the most part was radiologically clean. Measurements performed on the sub-critical reactor assembly and pit were inconclusive due to elevated natural radon activity. An NRC approved decommissioning plan and decommissioning order is in place for the CAVALIER Reactor, supporting systems. The sub-critical reactor assembly located in room G007 is scheduled for shipment back to Oak Ridge (DOE). The CAVALIER Reactor, and supporting systems and the sub-critical reactor assembly will be decommissioned in accordance with the approved plan.
7. Figure A-3, *Reactor Facility Ground Level*, Location No. 7, the Hot Cell rooms G026 and G027 each had one elevated direct measurement result greater than 9,250 dpm/100 cm² total beta activity. Results of measurements collected ranged up to 63,661 dpm/100 cm² on the floor in room G026 and up to 19,268 dpm/100 cm² on the floor in room G027.