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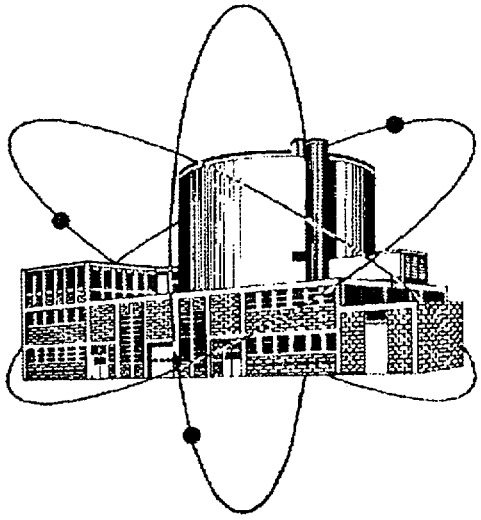
OF
VIRGINIA

REACTOR FACILITY



2001
ANNUAL REPORT

UNIVERSITY
OF
VIRGINIA

REACTOR FACILITY

2001
ANNUAL REPORT

This report was compiled by the following personnel:

Section V, Health Physics	-	Deborah Steva, Reactor Health Physicist
All other sections	-	Paul Benneche, Reactor Supervisor

and reviewed by Robert Mulder, Reactor Director on March 29, 2001

2001 ANNUAL REPORT
UNIVERSITY OF VIRGINIA REACTOR FACILITY

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2001 ANNUAL REPORT
University of Virginia Reactor Facility

I. REACTOR FACILITY ACTIVITIES AND REACTOR STAFF

A. Reactor Facility Reporting Requirements

1. Reporting Period

This report on Reactor Facility activities conducted during 2001 covers the period January 1, 2001 through December 31, 2001.

2. Basis for Reporting

An annual report of reactor operations is required by the UVAR Technical Specifications, Section 6.7.2.

B. Reactor Facility Utilization

The University of Virginia Research Reactor (UVAR) was operated from June 1960 through June 1998 under license R-66 at a maximum power of two megawatts. The Administration of the University of Virginia School of Engineering and Applied Science, with the approval of the University's Board of Visitors, decided in early 1998 to permanently cease reactor operations as of July 1, 1998 and to begin the process of decommissioning the Reactor Facility. During its 38 years of operation the reactor was operated for 40,901 hours and 61,411 megawatt-hours. In preparation for decommissioning, all reactor fuel elements, both used and unused, were shipped from the facility between 1998 and 2000. During 2001, major efforts were made dispose of unneeded equipment and supplies in the building. A number of offices and laboratories are now vacant.

The second reactor at the University of Virginia, the Cooperatively Assembled Virginia Low Intensity Experimental Reactor (CAVALIER) first went into operation in October 1974, under license R-123, at a licensed maximum power of 100 watts. Reactor operations were terminated in 1988 and the reactor was unfueled after operating for a total of 1,212 hours and 3,581 watt-hours. A decommissioning plan for this reactor was submitted to the NRC in early in 1990. An order to decommission was issued by the NRC on February 3, 1992. The CAVALIER now is scheduled to be decommissioned concurrently with the UVAR.

Since both reactors are currently defueled they cannot, and will not, again be operated. The only utilization of the reactor facility building in 2001 was for staff and faculty offices, a couple non-reactor related research projects, continuing surveillance and health physics activities monitoring the shutdown facility and activities to prepare the facility for final decommissioning work.

C. Reactor Staff and University Staff Assigned to Decommissioning Activities

1. Reactor Staff

A NRC approved Reactor Facility organization chart is shown in Figure 1. Personnel on the reactor staff as of the end of 2001 were:

Robert U. Mulder . . Reactor Director
Paul E. Benneche . . . Reactor Supervisor

Mr. Mulder has been University of Virginia Reactor Director since 1984. He also works as an Associate Professor of Materials Science and Engineering. He holds a PhD in Nuclear Engineering from the University of Virginia. He has oversight responsible for all activities at the reactor, including the decommissioning work.

Mr. Benneche has been employed by the University since 1977 and has served at the Reactor as Reactor Operator, Senior Reactor Operator, Research Engineer, Services Supervisor and has been Reactor Operations Supervisor since 1985. He completed both his undergraduate and master's degrees in Nuclear Engineering at UVA. He is responsible for the day-to-day operations at the facility, including decommissioning activities.

2. Health Physics Staff

Deborah P. Steva . . . Reactor Health Physicist

Ms. Steva has been assigned as the UVA Reactor Health Physicist since 1989. She completed an undergraduate degree in Biology with an emphasis in Health Physics at Virginia Tech and has held several health physics related positions since graduation.

Other personnel from the UVA Office of Environmental Health and Safety assisted with work at the Reactor on an as needed basis.

3. Reactor Safety Committee

The Reactor Safety Committee (ReSC) was composed of University faculty and staff with background and training in nuclear engineering and radiation safety. The final meeting of this committee was October 27, 2000. As per UVAR and CAVALIER Technical Specification amendments, many of the responsibilities of the ReSC were at this time assumed by the Reactor Decommissioning Committee.

4. Reactor Decommissioning Committee

The Reactor Decommissioning Committee was composed of the following individuals (as of the end of 2001):

Ralph O. Allen	Director of UVA Office of Environmental Health and Safety & Professor of Chemistry (Chair)
Robert U. Mulder . .	Reactor Director & Assoc. Professor of Materials Science and Engineering
Richard G. Piccolo .	University Radiation Safety Officer
David J. Hudson . .	Associate Vice President for Research & Public Service,

Ex-Officio

Paul E. Benneche . .	UVA Reactor Supervisor
Deborah P. [illegible] . .	Radiation Safety Specialist, UVA Office of Environmental Health and Safety

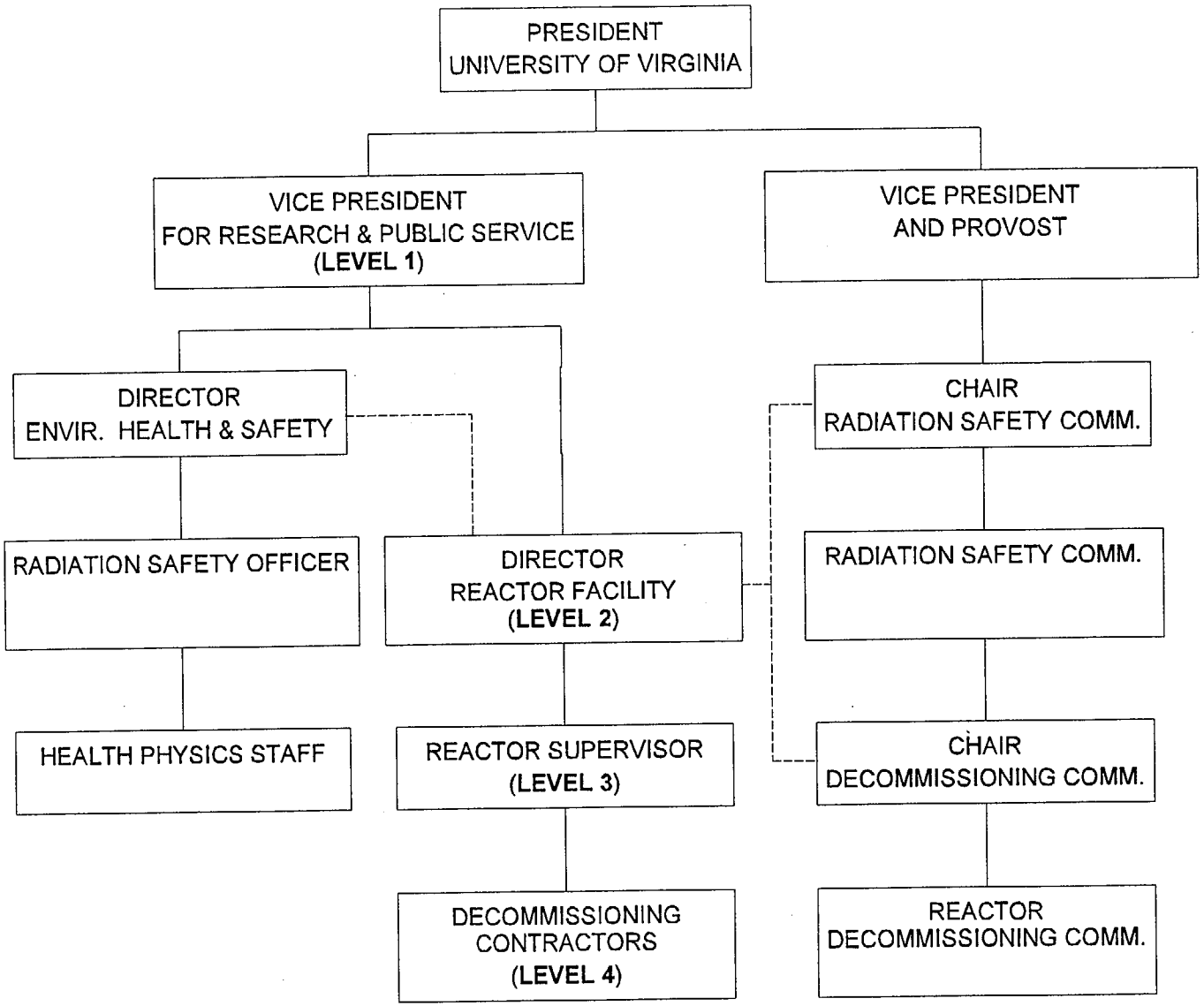

FIGURE 1
ORGANIZATIONAL CHART
UNIV. OF VIRGINIA NUCLEAR REACTOR FACILITY
(AFTER SHIPMENT OF ALL FUEL ELEMENTS OFF-SITE)

II. NON-DECOMMISSIONING RELATED ACTIVITIES

A. Standard Operating Procedures (SOP)

During 2001, one set of changes was made to Chapter 10, Radiation Protection, of the UVAR standard operating procedures. The Reactor Safety Committee reviewed and approved these changes.

B. Surveillance Requirements

The following surveillance items were completed during 2001 as required by Section 4.0 of the Technical Specifications:

1. Tests and Calibrations

Data on these tests and calibrations are on file at the Facility.

a. Monthly

Health physics surveys of the reactor building are completed monthly.

b. Quarterly

There should be quarterly checks of the contents of the emergency equipment lockers and other emergency equipment. These checks were not completed in 2000 as noted in NRC Inspection Report No. 50-62/2001-201 and Notice of Violation, dated January 25, 2001. These checks were completed in 2001 as committed to in UVA's Reply to Notice of Violation, dated February 23, 2001.

c. Semi-Annually

Criticality monitoring instrumentation outside the fuel storage room continues to be used and calibrated.

d. Annually

Instrumentation used in conjunction with health physics measurements are calibrated annually. This includes portable instrumentation, hand and foot monitor, alpha-beta low background counters and portable air samplers.

e. Reactor Pool Water Quality

The Technical Specifications requiring a certain level of pool water quality were deleted when all reactor fuel was removed from the pool and shipped off-site. The pool water quality is still being maintained at a high degree of purity but there are no specific quality standards or measurement requirements.

f. Communication Checks

The security system and emergency communications with the University Police and Charlottesville-Albemarle Fire Department were checked on a weekly basis throughout the year. These checks confirmed the availability of systems and communication equipment.

C. Maintenance

No corrective maintenance or repairs of any significant consequence was performed on any UVAR system during the calendar year 2001.

D. Pool Water Make-up

During the year, the daily makeup of water to the reactor pool averaged 800 gallons for a total of 211,900 gallons during the year. The makeup replaced water evaporated at the pool surface and leaked from the pool. Since the reactor ceased operations the estimated leak rate has increased, from about 200 to 800 gallons per day. However, the activity in the pool water is very low and continues to be reduced. The only isotope above MDA is tritium, and its concentration is a couple of orders of magnitude below the release limit.

E. Personnel Training and Instruction

At the end of 2001 the reactor staff consisted of two individuals, the Reactor Director and the Reactor Supervisor.

No licensed activities were conducted, nor could be conducted, during the year since the reactor was permanently shutdown and all used reactor fuel had been shipped off-site. Consequently, requalification training normally required for licensed individuals was not necessary or conducted. Required training and re-training was conducted in the subject areas of health physics, emergency procedures and security procedures.

F. Reactor Tours

During the calendar year 2001, the staff guided several small groups of individuals on tours of the Facility (see Health Physics section).

III. DECOMMISSIONING RELATED ACTIVITIES

A. A decommissioning plan for the UVA Reactor Facility was submitted to the Nuclear Regulatory Commission in February 2000. Throughout 2001 the Reactor Staff maintained communications with the NRC to promote the timely completion of the NRC's review process. A second request for additional information related to the UVAR decommissioning plan was received from the NRC on April 13, 2001 and the UVA reply was sent May 4, 2001. (Note: NRC approval of the UVAR decommissioning plan was received on March 28, 2002.

B. In February 2001, after considerable discussion, analysis and negotiation, the company CH2M HILL was selected as the primary contractor to perform the decommissioning of the UVA Reactor Facility. No CH2M HILL employees were engaged on-site a support to the reactor staff during 2001. (Note: CH2M HILL employees will come on-site to begin work in April of 2002).

C. In May 2001, continued access to the Barnwell South Carolina radioactive waste burial facility through June 2002 was assured by agreement with the State of South Carolina and Chem Nuclear Corporation.

D. A request to delete the UVA Reactor Physical Security Plan as an attachment to the Technical Specifications was submitted to the NRC on September 17, 2001 and was amended on November 15, 2001. This action was taken because the amount of special nuclear material on-site had been reduced below the amount which requires an NRC approved security plan. This was also done to alleviate the reactor staff of some previously required tasks that are no longer necessary. (Note: NRC approval of Amendment No. 27 removing the requirement to maintain a security plan was issued on March 26, 2002).

E. An Environmental Assessment and Finding of No Significant Impact related to the submittal of the Decommissioning Plan was received from the NRC on November 27, 2001.

F. A chartering meeting between representatives from UVA, CH2M HILL and several proposed decommissioning subcontractors was held at UVA on November 7, 2001.

G. A meeting of representatives from UVA, NRC and CH2M HILL was held at the NRC in Rockville, Maryland on December 14, 2001.

IV. REGULATORY COMPLIANCE

A. Reactor Decommissioning Committee

1. Meetings

During 2001, the Reactor Decommissioning Committee averaged meeting more than once a month. Meetings are required at least quarterly.

2. Audits

During the year a sub-committee of the Reactor Decommissioning Committee performed an audit of the Facility records, dated June 18, 2001, which encompassed three audit subjects and/or time periods. Two audit periods of the Reactor Operations records (April 1999 through March 2000 and April 2000 through March 2001) were reviewed. A third audit covering Health Physics Procedures and Records and the Security and Emergency Plans was also conducted. A response to this audit was written by Mr. Benneche and Ms. Steva, dated July 16, 2001.

3. Approvals

During 2001, the Reactor Safety Committee approved one set of changes to standard operating procedures as well as reviewing other documents:

January 2001:	Changes to UVAR SOP 10.4.B and 10.5.B.2.c.1 Deletion of UVAR SOP 10.4.E. and 10.4.G.

B. 10 CFR 50.59 Reviews

During 2001 there were three 10CFR50.59 analyses:

01-24-2001:	Replacement of fire alarm system control box
05-17-2001:	Replacement of one hour timer on reactor pool filling system with a six hour timer
08-27-2001:	Replacement of old underground oil tank located outside fence on northeast side of building, with a new 5000 gallon tank

C. Inspections

During 2001 there was one NRC compliance inspection on January 8-10 conducted by Mr. Craig Bassett. This inspection uncovered a single violation of the Technical Specifications involving a missed (late) periodic inspection of reactor emergency equipment and supplies. Corrective actions were implemented to assure that inspections are performed as scheduled.

D. Licensing Action

A decommissioning plan for the UVAR was submitted for approval to the NRC in February 2000. A second request from the NRC for additional information concerning this submittal was received April 13, 2001 and UVA's response to this request was sent May 4, 2001. The University received final approval of this plan, as modified, on March 28, 2002 (cover letter was dated March 26, 2002).

A request to delete the UVA Reactor Physical Security Plan as an attachment to the Technical Specifications was submitted to the NRC on September 17, 2001 and was amended on November 15, 2001. This request was approved by the NRC on March 26, 2002.

E. Emergency Preparedness

On February 26, 2001, a practice evacuation of the building was conducted.

On February 13, 2001, the annual emergency drill for the calender year 2001 was initiated at the facility. The drill scenario involved a simulated injury to a member of the University Facilities Management staff and a fire in the building, with the hypothetical possibility of saboteurs having caused the emergency.

IV. HEALTH PHYSICS

A. Personnel Dosimetry

1. Visitor Exposure Data For 2001

During 2001, there were 303 visitors who frequented the Facility for either work or a tour. The highest dose received in any single visit was one mrem.

2. Reactor Facility Personnel Dosimetry Data For 2001

a. Monthly Whole Body Badge Data

Radiation doses received by Reactor Facility personnel were measured using Landauer film badge dosimeters. These dosimeters measured exposure from beta, X, gamma and thermal neutron radiation. In addition, those individuals authorized to use the neutron-emitting sealed sources present at the facility were issued neutron dosimeters. The neutron dosimeters used were Landauer Neutrak ER badges that allowed detection of an extended range of neutron energies. All dosimeters were changed out on a monthly basis.

The dose distribution for personnel badged at the Reactor Facility during the period January 1, 2001 through December 31, 2001 is shown in Table 1.

TABLE 1

2001 Personnel Radiation Doses Received at Reactor Facility

Measured Accumulated Deep Dose Equivalent* (mrem)	Number of Individuals in Dose Range
Less than 10 (M)	14
Greater than 10	0

Number of badged personnel: 14 persons

Collective dose for this group: <0.010 rem

* Deep dose equivalent (DDE) as measured by "whole body" film badge dosimeters. These dosimeters have a detection minimum of 10 mrem for gamma, X-rays and thermal neutrons and 40 mrem for energetic beta particles.

During 2001, no doses exceeded the UVA ALARA Investigational Level 1 of 125 mrem per quarter.

b. Neutron Exposures

Four (4) Facility personnel were issued Neutrak ER neutron badges in 2001. The neutron dose distribution for this group is shown in Table 2.

TABLE 2	
2001 Personnel Neutron Doses at the Reactor Facility	
Measured Accumulated Deep Dose Equivalent (mrem)	Number of Individuals in Dose Range
Less than 20 (M) Greater than 20	4 0
NOTE: These dosimeters have a minimum reporting dose of 20 mrem.	

c. Extremity Exposures

During 2001, four (4) Facility personnel were issued TLD ring badges in addition to their whole body badges. The following is a summary of the extremity doses received by Reactor Facility personnel who wore ring badges during the period January 1, 2001 through December 31, 2001.

TABLE 3	
2001 Personnel Extremity Doses at the Reactor Facility	
Measured Accumulated Extremity Dose (mrem)	Number of Individuals in Dose Range
Less than 30 30 - 40 41-50 Greater than 50	3 0 2 0
NOTE: These dosimeters have a minimum reporting dose of 30 mrem for X and gamma-rays and 40 mrem for energetic beta particles.	

During 2001, there were no individuals who received doses (extremity) that exceeded the UVA ALARA Investigational Level 1 of 1250 mrem/qtr.

d. Direct-reading Dosimeter Exposures

Direct-reading dosimeters (in addition to whole body film badges) are worn by UVAR personnel when they handle irradiated material that has a calculated or measured exposure rate of greater than 100 mR per hour, measured at one foot from the source. If the exposure totals more than 5 mR in one day, the exposure is recorded in an exposure log kept in the control room. This information is helpful in assessing the amount of exposure received during specific operations. There were no exposures incurred or recorded in the log book during 2001, because the reactor was not operated and no decommissioning activities were conducted.

B. Effluents Released During 2001

1. Airborne Effluents

The reactor was not operated in 2001 and no airborne radioactivity areas were created in the facility during this time. Consequently, there were no airborne releases from the Reactor Facility.

2. Liquid Effluents

Liquid radioactive waste generated at the UVAR is disposed of by one of two means. Liquid waste generated in the research laboratories is poured into approved containers that are collected and disposed of by the Office of Environmental Health and Safety. Large volume liquid wastes (e.g. from regeneration of the UVAR demineralizer system) is collected in three 2,250 gallon tanks on the ground floor of the Facility. The liquid waste collected in these tanks is released to the sanitary sewer in accordance with 10CFR20 requirements. There were no demineralizer regenerations in 2001. Currently, the system is inoperable and no further use of the system is planned before it is decommissioned.

In certain situations, (e.g. draining of the reactor pool, pool leaks, sink drain disposal), the on-site pond may receive radioactive liquid discharges from the facility. The major sources of water in the pond are surface runoff and a creek that flows into it from the west end. Water is periodically released from the pond in a controlled manner via a spillway. A small amount of pond water routinely leaks through the pond spillway to the release standpipe at an average rate of 4.0 gallons per minute.

In May of 2001 the procedure for release of pond water was changed. Over the two year time period since UVAR shutdown, radioactivity levels in the sampled pond water have been well below required release limits. Without the operating reactor as a potential source term and no work with radioactivity performed in facility labs, the prior level of sampling and release control practiced during reactor operation became unnecessary. Water from the pond is currently allowed to flow over the spillway in a continuous release. This release water is sampled and analyzed for radioactivity on a quarterly basis. During the first quarter of 2001, before the procedural change was instituted, there were four controlled releases of pond water. Prior to, and during all of these releases, water samples were collected and analyzed for radioactivity content. The average concentration of radioactive material (as measured by gross beta particle activity analysis) released in effluent from the UVAR pond was 0.5 x 10-8 uCi/ml. This concentration was 15% of the UVAR administrative release limit and was the same as the average concentration of radioactive material measured in the water upstream of the pond (0.5 x 10-8 uCi/ml). There was no measurable tritium activity in the pond water released. The total volume of liquid released off-site during the 4 releases was 5,600,000 liters (1,474,000 gallons).

There were no releases made to the sanitary sewer in 2001.

TABLE 4	
Liquid Effluent Releases Sampling Results	
Release No.	Pond Water *Avg. Gross Beta Particle Activity (excluding Tritium) ($x10^{-8}$ µCi/ml ± 2 s.d.)
1	0.4 ± 0.1
2	0.4 ± 0.4
3	0.4 ± 0.2
4	0.6 ± 0.2
Ave. ± 2 s.d.	**0.45 ± 0.2**
* Three samples are collected during the release. Number reported is the average (or mean) of the three samples and ± 2 s.d. of this mean. A priori LLD: 0.3 x 10^{-8} µCi/ml	

3. Solid Waste Shipments

There were no shipments of low level radioactive waste made from the reactor facility in 2001.

4. Other Shipments of Radioactive Material

One shipment of limited quantity radioactive material was made from the Reactor Facility during 2001. This shipment was made in accordance with all applicable DOT requirements.

C. Environmental Surveillance

1. Water Samples

Environmental water samples were collected on a monthly basis from the locations indicated in Table 5. Gross beta particle activity analysis was performed on all water samples collected. The results of the analyses are provided in Table 5. The average gross beta particle activity measured at each location was well below the UVAR Administrative Effluent Concentration Release Limit of 3 x 10^{-8} µCi/ml.

TABLE 5			
Environmental Water Sampling Results Gross Beta Particle Activity (x 10^{-8} µCi/ml ± 2 sigma)			
	Upstream of on-site pond	Water filtration plant 0.26 mi. southeast	Meadow Creek near Barracks Road, 1.8 mi northeast (2 samples collected short distance apart on creek, results are averaged)
January	0.1 ± 0.2	< LLD	0.1 ± 0.2
February	0.2 ± 0.2	0.1 ± 0.1	0.3 ± 0.3
March	0.6 ± 0.2	0.1 ± 0.1	0.5 ± 0.7
April	0.3 ± 0.2	0.1 ± 0.2	0.3 ± 0.2
May	1.0 ± 0.2	0.9 ± 0.2	0.4 ± 0.2
June	0.7 ± 0.2	0.1 ± 0.2	0.5 ± 0.2
July	0.9 ± 0.2	0.2 ± 0.2	0.5 ± 0.6
August	0.4 ± 0.2	0.1 ± 0.2	0.3 ± 0.3
September	0.1 ± 0.2	0.1 ± 0.2	0.6 ± 0.1
October	1.0 ± 0.3	0.3 ± 0.2	0.5 ± 0.4
November	0.7 ± 0.3	< LLD	0.3 ± 0.1
December	0.1 ± 0.2	< LLD	0.2 ± 0.9
Avg±2 s.d.	**0.5 ± 0.4**	**0.2 ± 0.2**	**0.4 ± 0.1**
A priori LLD: 0.3 x 10^{-8} µCi/ml			

2. Air Samples

During 2001, there were no work activities which generated airborne radioactivity, thus, air samples were not required to be collected in the facility or the environment surrounding the facility. Air sampling equipment does, however, continue to be calibrated and maintained in operating condition for use on an as needed or emergency basis.

3. Environmental Dosimetry Network

Luxel Aluminum Oxide dosimeters are mounted at eight fixed field sites in the vicinity of the UVAR. All of the sites are outside the UVAR facility but within the area surrounding the facility that is bounded by the exclusion fence. The dosimeters are changed out and read on a quarterly basis. Table 6 shows the doses recorded by the dosimeters. The annual total dose measured at each location was less than the annual dose limit of 100 mrem.

TABLE 6						
2001 Environmental Surveillance - Outside Area Dosimetry Network Deep Dose Equivalent (mrem) For Periods Shown Below						
Location	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total	Annual Net *
280	7	8	10	10	35	35
281	13	16	17	19	65	65
282	12	13	13	15	53	53
283	8	9	12	19	48	48
284	10	15	14	17	56	56
285	2	5	7	5	19	19
286	2	1	1	M	4	4
287	3	7	7	9	26	26
Control	M	M	M	M	M	Control
Control	M	M	M	M	M	Control
M minimum detection limits: For DOSIMETRY: 1 mrem for gamma and x-rays * Annual Net = Annual Total = Average Control Annual Total						

D. UVAR Facility Radiation and Contamination Surveys

Monthly surveys were performed throughout the Facility to monitor radiation and contamination levels. All required area radiation and contamination surveys were performed during 2001.

In 2001, there was very little activity that involved work with radioactive material. The levels of contamination detected in the Facility during 2001 were generally very low (typically less than 50 dpm/100 cm^2). In keeping with the ALARA policy, most areas are decontaminated if found to have greater than 50 dpm/100 cm^2. The area radiation level surveys revealed no overall increase in background or systems-related radiation levels.

E. Other Health Physics/Decommissioning Related Activities

As the facility staff continued to prepare for decommissioning, there were many activities requiring HP review, survey, etc. The HP program scope and content was reassessed on several occasions to facilitate transition from a program supporting reactor operations to one supporting decommissioning activities.

Health Physics personnel were involved in the review of decommissioning proposals and final selection of the decommissioning contractor. Quality Health Physics personnel and procedures will be key in the performance of characterization and final surveys during the decommissioning process.

During the report period, the reactor HP worked with DOE to arrange for transfer and shipment of the Facility's remaining HEU to a secure DOE facility. This will facilitate termination of the facility SNM license and security plan.

In preparation for decommissioning, many items (equipment, furniture, etc.) were surplused. As reasonable, the majority of the items were surveyed to ensure that contaminated items were not inadvertently surplused. Radioactive items and waste were consolidated into a

controlled area to be disposed of during decommissioning. All radioactive sources were inventoried and identified for disposal or retention.

Two additional groundwater monitoring wells were installed during the reporting period. Water samples were collected from the wells and analyzed for radioactivity.

F. Summary

During 2001, no State or Federal limits for exposure to personnel or the general public were exceeded.

VII. FINANCES

A. Expenditures

Expenditures for 2001 were as follows:

	State and University Support
Salaries + Fringe benefits:	$145,996
Other Than Personnel Service:	105,673
Total Expenditures:	$251,669

B. Income

There was no income from outside sources in 2001.

C. Decommissioning Funding

The Reactor Facility continues to receive funding from the University of Virginia to pay the salaries of the remaining staff and for expenditures related to preparations for decommissioning. The actual decommissioning expenditures, which are estimated to be about three million dollars, will be paid by funds currently available to the University of Virginia. These expenditures will commence in 2002.