UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report No.: 50-62/96-01

Licensee: University of Virginia
Charlottesville, VA 22901

Docket No.: 50-62 License No.: R-66

Facility Name: University of Virginia Reactor (UVAR)

Inspection Conducted: May 20-21, 1996

Inspectors: A. Gooden 06/13/96
A. Gooden, Radiation Specialist Date Signed

E. Testa P.E. 06-13-96
E. Testa, Senior Radiation Specialist Date Signed

Approved by: E. J. McAlpine 6/17/96
E. J. McAlpine, Chief Date Signed
Fuel Facilities Branch
Division of Nuclear Materials Safety

SUMMARY

Scope:

This routine, announced inspection involved an onsite review of radiation protection program activities including, radiation control, environmental surveillance and monitoring, and transportation of radioactive material.

Results:

Within the areas reviewed, the licensee's radiological and environmental protection programs appeared to be maintained in accordance with regulatory requirements and license commitments. Facility contamination levels and radiation exposure to individuals were within the local administrative levels and exposures were well within federal regulatory limits. The radiation protection program was being conducted according to approved procedures and the environmental surveillances were being conducted as required.

Enclosure

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*R. Allen, Director, Environmental Health and Safety
#*P. Benneche, Reactor Supervisor
M. Cook, Health Physics Assistant
*R. Flack, Chairman, Department of Mechanical, Aerospace, and Nuclear Engineering
*D. Moody, Health Physics Technician
*R. Mulder, Director, University of Virginia Reactor Facility
*R. Piccolo, Radiation Safety Officer, University of Virginia
*D. Steva, Reactor Health Physicist

Other licensee employees contacted during this inspection included operators, technicians, and administrative personnel.

*Attended exit interview on May 21, 1996
#Participated in teleconference exit on June 12, 1996

An index of abbreviations used throughout this report will be found in the last paragraph.

2. Radiation Control (83743)

a. Organization and Staffing

TS Sections 6.1.1, 6.1.2, and 6.1.3 detail organizational structure, management responsibility, and staffing requirements for safe operation of the UVAR facility.

Based on a discussion with licensee representatives and a review of the organization chart, the inspector determined that management responsibilities for radiation protection activities at the facility had not changed since the previous NRC inspection in June 1994 (IR 50-62/94-04). The inspector determined that the MANE Department Chairman retained overall responsibility for management of the facility as specified in the TS.

The inspector reviewed, with a licensee representative, the current staffing available to conduct routine and nonroutine radiation protection activities at the facility. The licensee currently has a RHP who was assisted by a Health Physicist and technicians from the UVA OEHS, and students to perform various radiation protection activities at the facility such as the routine daily and weekly radiation and contamination level surveys required by the licensee's SOPs.

The inspector noted that the OEHS RHP was assigned responsibility and oversight of the radiological safety program at the facility. The UVA RSO also shares in this responsibility. The RHP and RSO

are assisted by UVA OEHS radiation safety technicians who have been trained in performing the monthly surveys of the reactor facility, including the environmental surveys, and provide support for nonroutine work activities and for shipping radioactive material as needed.

The inspector noted that the organization and staffing levels appeared to be adequate to conduct routine and nonroutine radiation protection activities for the facility.

b. Audits and Management Evaluations

TS 6.2 requires the RSC to review and audit reactor operations to ensure that the facility is operated in a manner consistent with public safety and within the terms of the facility license. TSs 6.2.2 and 6.2.3 detail RSC membership and qualifications, and meeting and audit frequency. The RSC is required to meet, at a minimum, semiannually, to approve untried experiments, changes to the reactor, amendments and changes to the facility license, TS and SOPs, to review reportable events and operating abnormalities, and to conduct annual audits of operational records.

10 CFR 20.1101(c) requires the licensee to periodically (at least annually) review the radiation protection program content and implementation.

The inspector reviewed the following documents:

(1) Annual Review of the Reactor Facility's Radiation Protection Program Content and Implementation dated September 27, 1994

(2) Minutes of the RSC Meeting of September 20, 1994

(3) Annual Review of Radiation Safety Program dated December 1, 1994

(4) Annual Review of the Reactor Facility's Radiation Protection Program Content and Implementation dated October 26, 1995

The inspector reviewed the composition of the RSC and determined that the composition of the RSC was as prescribed in the TS and that the members had the appropriate technical backgrounds as required.

The inspector determined that the licensee had met the requirements of 10 CFR 20.1101 (c) for the year 1994; however, the 1995 radiation protection program content and implementation audit notes had not been formalized and transmitted to cognizant personnel. This was identified to the licensee as a potential violation. The responsible reviewer committed to formalize his notes and transmit them by May 23, 1996. On June 12, 1996, the

inspector informed a licensee contact that the Regional Staff further review of the audit program requirements disclosed there was no time commitment for report issuance. The only requirement was that the audit be performed annually. Therefore, no violation occurred. However, the licensee's timeliness in compiling and issuance of audit results will be reviewed during a future inspection.

c. Training

10 CFR 19.12 requires the licensee to instruct all individuals working in or frequenting any portion of the restricted area in HP protection problems associated with exposure to radioactive material or radiation, in precautions or procedures to minimize exposure, in the purposes and functions of protective devices employed; also, to instruct them to observe the applicable provisions of Commission regulations, to instruct them in their responsibility to report problems, in the appropriate response to warnings in the event of problems and in the availability of radiation exposure reports which workers may request pursuant to 10 CFR 19.13.

The inspector reviewed the training provided to personnel frequenting the UVAR facility. It was noted that, excluding visitors touring the facility, persons spending any appreciable amount of time in the restricted area included reactor operators, experimenters, students, and UVA OEHS personnel. Also, only those persons who had received the appropriate training provided by the licensee and who had been badged and received a dosimeter were allowed unescorted access to restricted areas of the facility. Personnel who handled radioactive material within the facility were provided training by UVA OEHS personnel.

The inspector reviewed the training hand-out and copy of a recent exam that was administered to those persons who were given unescorted access to the facility. The training was given and/or renewed annually and consisted of security, emergency, implementing procedures, and HP subjects pertinent to the facility. The training appeared to be adequate and covered the subjects outlined in 10 CFR 19.12.

d. Posting of Notices

10 CFR 19.11 requires each licensee to conspicuously post current copies of: 1) 10 CFR Parts 19 and 20, 2) the license, 3) operating procedures, and 4) Form NRC-3, in sufficient places to permit individuals engaged in licensed activities to observe them on the way to and from any licensed activity location. If posting of the documents specified is not practicable, the licensee may post a notice which describes the documents and states where they may be examined.

During tours of the facility, the inspector noted that the applicable documents and/or references to their location were posted at the entrance to the reactor control room. The posted documentation indicated that copies of regulations and procedures were maintained in the Reactor Supervisor's office. Copies of Form NRC-3 were also posted at various locations throughout the facility on bulletins boards and in study areas.

e. Area Posting and Radioactive Material Labeling

10 CFR 20.1902 specifies the requirements for posting radiation areas, high radiation areas, and storage areas, and for labeling containers of radioactive materials.

10 CFR 20.1301 (a)(2) specifies the requirements that the dose in any unrestricted area from external sources not exceed 0.002 rem (0.02 mSv) in any one hour.

Posting of entrances into restricted areas and the labeling of radioactive material containers within the restricted area were observed during tours of the facility. All postings of areas appeared to be adequate. Labeling of radioactive material appeared adequate and in compliance with applicable regulations.

The inspector during a facilities tour on May 20, 1996, at approximately 9:15 a.m., found a gate to the parking lot that was posted as a radiation area unlocked with the security lock. The lock was incorrectly secured on the fence and was intended to prevent unauthorized access into a radiation area. The inspector, with the licensee present, performed a survey of the area and found that at a reactor operational level of approximately 1.7 Mw(t), about 85% of license limit, the maximum dose rate was approximately 0.005 rem/hr at waist level. The licensee had posted this area as 10 mrem/hr at an entrance door to this area. This was identified as a potential violation for failure to control access to a radiation area. The licensee who was conducting the facilities tour immediately opened the lock and correctly secured and positioned the lock to provide security and access control to the area. The Reactor Supervisor was contacted on June 12, 1996, to obtain additional details associated with the status of reactor operations during the period May 15-20, 1996. Based on the reactor operations details, posting requirements in 10 CFR 20, and the status of posting at the time of the discovery, Region II Staff determined a violation had not occurred. The area of the discovery was properly posted as a radiation area rather than an unrestricted area. Further, 10 CFR 20 does not require that entry ways to radiation areas be maintained locked. Therefore, the licensee's combination of posting and physical control of the area met the requirements for access control.

f. Control of Access to High Radiation Areas

10 CFR 20.1601 requires the licensee to ensure that each entrance or access point to a HRA has one or more of following features: 1) a control device that, upon entry into the HRA, causes the level of radiation to be reduced below that level at which an individual might receive a deep-dose equivalent of 100 mrem in one hour, 2) a control device that energizes a conspicuous visible or audible alarm signal, or 3) entry ways that are locked, except during periods when access to the areas is required, with positive control over each entry.

The inspector noted that the licensee had various areas designated as HRAs. These areas were maintained locked by the licensee except when access to the HRAs was required. The locks and their integrity were observed and physically checked by the inspector during tours of the facility. All access points to HRAs were maintained locked, and the locks were secured as required.

g. Surveys

10 CFR 20.1501 requires the licensee to make or cause to be made surveys that:

(1) may be necessary for the licensee to comply with the regulations and,

(2) are reasonable under the circumstances to evaluate:

(a) the extent of radiation levels,
(b) concentrations or quantities of radioactive material, and
(c) the potential radiological hazards that could be present.

During a review of selected daily, weekly, and monthly survey maps that had been completed for the RCAs and the uncontrolled areas of the facility, the inspector determined that required surveys were completed during the period January 1994 through June 1994 and July 1995 through December 1995. The survey results had been reviewed by a member of the UVAR staff and the RHP as required. The inspector performed several independent surveys of drain traps of laboratory sinks. No radiation level above background was observed. The inspector also surveyed the demineralizer tank and found the radiation levels on the tank as posted by the licensee.

h. External Exposure Review

(1) Annual Exposure for 1994 and 1995

10 CFR 20.1201(a) requires each licensee to control the occupational dose to individual adults, except for planned

special exposures under 10 CFR 20.1206, to the following dose limits:

(a) An annual limit, which is more limiting of: (i) the TEDE being equal to 5 rems; or (ii) the sum of the deep-dose equivalent and the committed dose equivalent to any organ or tissue other than the lens of the eye being equal to 50 rems.

(b) The annual limits to the lens of the eye, to the skin, and to the extremities, which are: (i) an eye dose equivalent of 15 rems; and (ii) a shallow-dose equivalent of 50 rems to the skin or to any extremity.

10 CFR 20.1502(a) requires each licensee to monitor occupational exposure to radiation and to supply and require the use of individual monitoring devices for adults likely to receive an annual dose in excess of 10% of the limits in 10 CFR 20.1201(a).

The inspector reviewed and discussed with the licensee the exposure records of persons working in the UVAR restricted area during 1994, 1995, and from January 1 through March 31, 1996. Personnel exposure measurements were made using film badges provided by a vendor. Vendor specifications reported a detection limit of 10 millirem (mrem) for the dosimetry provided. The highest cumulative whole body exposure reported for 1994 was 250 mrem and 1995 was 330 mrem. During 1996 through the end of March (the latest data available), the highest cumulative exposure was approximately 60 mrem to the whole body, 60 mrem to the lens of the eye, and 60 mrem to the skin. The exposures were attributed to the Reactor Supervisor's involvement with unloading the mineral irradiation facility and in preparing Iridium-192 seeds for shipment. The remaining cumulative exposures through March 1996 for the other UVAR operations personnel and staff totaled less than 10 mrem.

During 1994 and 1995, the licensee provided neutron dosimetry in addition to the whole body film badges for all personnel working with the neutron beam ports. The licensee reported that the dosimeters have a minimum reporting dose of 20 mrem. During 1994, 12 individuals were monitored, and in 1995, sixteen neutron badges were issued. In 1994 as in 1995, the highest exposure was 20-30 mrem. The remaining exposures were less than 20 mrem.

The inspector also reviewed the licensee extremity monitoring program and the monitoring results. The highest cumulative extremity exposure was 770 mrem for 1994 and 1160 mrem for 1995. Through March 1996, the highest cumulative extremity exposure was 260 mrem. The referenced

exposures were assigned to the Reactor Supervisor. The majority of the remaining cumulative extremity exposures for the other UVAR operations personnel and staff totaled less than 20 mrem each.

During tours of the facility, the inspector noted that the licensee appeared to be providing appropriate monitoring equipment and controlling exposure to facility personnel.

i. Internal Exposure Review

10 CFR 20.1204 states that for purposes of assessing dose used to determine compliance with occupational dose equivalent limits, the licensee, when required to monitor internal exposure, shall take suitable and timely measurements of concentrations of radioactive materials in air, quantities of radionuclides in the body, quantities of radionuclides excreted from the body, or combinations of these measurements. When specific information on the behavior of the material in an individual is known, that information may be used to calculate the CEDE.

10 CFR 20.1502(b) requires each licensee to monitor the occupational intake of radioactive material by and assess the CEDE to:

(1) Adults likely to receive, in one year, an intake in excess of 10% of the applicable ALI in Table 1, Columns 1 and 2 of Appendix B to 10 CFR 20.1001-20.2401; and

2) Minors and declared pregnant women likely to receive, in one year, a CEDE in excess of 0.05 rem.

In discussing this portion of the regulation with UVA OEHS representative, the licensee contact indicated that they had not had a problem with internal exposure. A bioassay program had been developed, however, and had been implemented for use with the university's broad license program.

j. Calibration of Instruments

10 CFR 20.1501(b) requires the licensee to ensure that instruments and equipment used for quantitative radiation measurements are calibrated periodically for the radiation measured.

TS 6.3 requires radiation control procedures to be maintained and made available to all operations personnel.

SOP Section 10, Radiation Protection Procedures, requires in Part 10.6.A that portable radiation monitoring instruments required for reactor operations and surveys at the facility shall

be calibrated annually and operation checked quarterly by the RHP (or HP designee). It also requires that calibrations and quarterly operation checks be documented.

The inspector reviewed the calibration and operation check records for the Eberline Hand/Foot Monitor to confirm that periodic calibration and operational checks were performed in accordance with SOPs. These records were maintained and the calibrations were performed by UVA OEHS personnel or coordinated through the UVA OEHS office. The inspector determined that the monitor was being calibrated at the required frequency and in accordance with approved procedures. In addition to the aforementioned review, the inspector noted during facility tours that labels were affixed to portable and fixed equipment to indicate the date of last calibration and operational check, and the due date for performing the next calibration and/or operational check. Randomly selected instruments were checked at several locations (e.g. laboratory, reactor control room) and were recently calibrated and/or operationally checked in accordance with SOP 10.6.

k. Declared Pregnant Women and Dose to the Embryo/Fetus

10 CFR 20.1208(a) requires that the dose to the embryo/fetus not exceed 500 mrem during the entire pregnancy due to occupational exposure of a declared pregnant woman.

The inspector reviewed the licensee's program to maintain the dose to the embryo/fetus low. This was done by using a form for a female to make a voluntary declaration of pregnancy. Based on a review of the form, the inspector determined that the form requirements were consistent with 10 CFR Part 20 requirements and Regulatory Guide provisions. The licensee's form stipulated that declaration of pregnancy form be completed by worker and provided to the OEHS. With the declaration, the individual agreed to abide by the lower dose limits for protection of the embryo/fetus including: (1) limiting the dose during the entire pregnancy to 500 mrem, and (2) attempting to maintain a uniform exposure rate during each month of pregnancy. Further, a form entitled "Voluntary Declaration of Pregnancy - Withdrawal" was available for any declared pregnant woman to withdraw the voluntary declaration at any time and for any reason prior to the termination of the pregnancy. The licensee's declared pregnant female policy appeared to be adequate to limit the dose to the embryo/fetus. The licensee contact on this matter informed the inspector that there were no declared pregnant female workers at the time of the inspection.

No violations or deviations were identified.

3. Environmental Monitoring (80745)

a. Environmental Reports

TS 6.6.2 requires a routine annual report to be submitted by March 31 of each year covering the activities of the reactor facility during the previous calendar year. Each report is required to include a summary of the nature and amount of radioactive gaseous, liquid and solid effluents released or discharged to the environs beyond the effective control of the licensee as measured or calculated at or prior to the point of such release or discharge; environmental surveys performed outside the facility and exposures received by facility personnel and visitors; and a summary of radiation and contamination surveys performed within the facility.

The inspector verified that an annual report was prepared and issued by the licensee in accordance with applicable TS requirements. Details of the report are discussed below in subsequent sections of this paragraph.

b. Liquid Effluent Releases

(1) Liquid Releases at the Site Boundary

TS 3.4.2 requires that the activity of liquids released beyond the site boundary shall not exceed 10 CFR Part 20 limits.

The inspector reviewed the data concerning the releases made from the facility by the licensee. From January 1, 1994, through December 31, 1994, the licensee conducted 35 releases with an average radionuclide concentration of 8.6 E-9 uCi/ml. The total volume of liquid released was 1.42 E7 gallons. Total gross beta activity released during the year was 448 uCi, excluding tritium. Total tritium activity released was 11.701 mCi and the average tritium release concentration was 2.46 E-7 uCi/ml. These concentrations were within the limits specified in 10 CFR 20, Appendix B, Table 2, Column 2.

The inspector also reviewed 1995 data concerning the releases made from the facility by the licensee. From January 1, 1995, through December 31, 1995, the licensee conducted 26 releases with an average radionuclide concentration of 9.5 E-9 uCi/ml. The total volume of liquid released was 7.7 E7 gallons. Total gross beta activity released during the year was 268 uCi, excluding tritium. Total tritium activity released was 7.3 mCi and the average tritium release concentration was 3.2 E-7 uCi/ml. These concentrations were within the limits specified in 10 CFR 20, Appendix B, Table 2, Column 2.

(2) Off-Site Air and Water Environmental Samples

TS 6.5.2 requires the licensee to retain records of off-site environmental monitoring surveys for the life of the facility.

TS 6.3 requires radiation control procedures to be maintained and made available to all operations personnel.

SOP 10.4.C, "Facility and Environmental Surveys," stipulates that samples of air and water shall be collected and analyzed on a monthly basis.

The inspector reviewed the analyses of monthly environmental water samples collected during 1994 at selected upstream and downstream locations relative to the UVAR facility release point. The analyses appeared adequate and the average gross beta concentration measured at each location was less than the applicable effluent concentration limit of 3E-8 uCi/ml.

The inspector also reviewed the analyses of monthly environmental water samples collected during 1995 at selected upstream and downstream locations relative to the UVAR facility release point. The selected analyses appeared adequate and the average gross beta concentration measured at each location was less than the applicable effluent concentration limit of 3E-8 uCi/ml.

c. Airborne Effluent Releases

Gaseous effluent released during 1994 was approximately 2.3 Ci of Ar-41. For 1994, the licensee continued to rely on a calculated estimate of the maximum concentration of Ar-41 produced during normal operations.

The inspector also reviewed the gaseous effluent released during 1995. The release was approximately 2.45 Ci of Ar-41. For 1995, the licensee continued to rely on a calculated estimate of the maximum concentration of Ar-41 produced during normal operations.

The inspector also reviewed the analyses of monthly environmental air samples collected during 1994 and 1995 at selected locations relative to the UVAR facility. The analyses appeared adequate and the average gross beta concentration measured at each location was less than the applicable regulatory limits.

No violations or deviations were identified.

4. Transportation of Radioactive Material (86740)

10 CFR 71.5 requires each licensee who transports licensed material outside the confines of its plant or other place of use to comply with the applicable requirements of the DOT in 10 CFR Parts 170 through 189.

The inspector reviewed the shipping paperwork and records for selected radioactive material shipments made in 1994 and 1995 since the last inspection. All shipment records were completed and being maintained as required.

No violations or deviations were identified.

5. Exit Interview

The inspection scope and results were summarized on May 21, 1996, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the inspection findings, including a potential Violation and NCV (Paragraph 2). However, on June 12, 1996, the Reactor Supervisor was informed via a teleconference exit that following further management review, no violations occurred. The radiation exposures to individuals were maintained well within the facility administrative levels and the federal regulatory limits. No problems were noted with shipments of radioactive materials from the facility.

The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector.

6. Index of Abbreviations Used In This Report

ALI	Annual Limit on Intake
Ar-41	Argon-41
CEDE	Committed Effective Dose Equivalent
CFR	Code of Federal Regulation
Ci	Curie
DOT	Department of Transportation
HRA	High Radiation Area
HP	Health Physics
IR	Inspection Report
MANE	Mechanical, Aerospace, and Nuclear Engineering
NCV	Non-cited Violation
NRC	Nuclear Regulatory Commission
OEHS	Office of Environmental Health and Safety
RHP	Reactor Health Physicist
RCA	Radiologically Controlled Area
RSC	Reactor Safety Committee
RSO	Radiation Safety Officer
SOP	Standard Operating Procedures
TEDE	Total Effective Dose Equivalent
TS	Technical Specification
UVA	University of Virginia
UVAR	University of Virginia Reactor
VIO	Violation