

July 12, 2011

Dr. Mohamad Al-Sheikhly, Director
Radiation Facilities and Nuclear Reactor
Department of Materials Science and Engineering
2309D Chemical and Nuclear Engineering Building
Building 090, Stadium Drive
The University of Maryland
College Park, MD 20742-2115

SUBJECT: UNIVERSITY OF MARYLAND - NRC NON-ROUTINE INSPECTION REPORT
NO. 50-166/2010-202 AND NOTICE OF VIOLATION

Dear Dr. Al-Sheikhly:

On November 30 to December 2, 2010, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at the Maryland University Training Reactor (Inspection Report No. 50-166/2010-202). The inspection included a review of activities authorized for your facility. The enclosed report documents the inspection results, which were discussed on December 2, 2010, with Dr. Briber, you, and members of your staff. Following the receipt of the Summary of Corrective Actions dated April 13, 2011, a final exit meeting, via a conference call, was conducted with you and members of your staff on June 16, 2011.

This inspection was an examination of activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress.

Based on the results of this inspection, the NRC has determined that a Severity Level IV violation of NRC requirements has occurred. The violation was evaluated in accordance with the NRC Enforcement Policy included on the NRC's Web site at www.nrc.gov; select **What We Do, Enforcement**, then **Enforcement Policy**. The violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. The violation is being cited in the Notice because it constitutes a failure to meet the requirements of your Technical Specifications that has more than minor safety significance and the licensee failed to identify the violation.

The NRC has concluded that information regarding the reason for the violation, the corrective actions planned and taken to correct the violation and prevent recurrence is already adequately addressed in the "Summary of Corrective Actions" which you submitted on April 13, 2011. Therefore, you are not required to respond to this letter unless the description herein does not accurately reflect your corrective actions or your position. In that case, or if you choose to provide additional information, you should follow the instructions specified in the enclosed Notice. In accordance with 10 CFR 2.390, "Public inspections, exemptions, and requests for withholding" a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public

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Document Room or from the NRC's document system (Agencywide Document Access Management System (ADAMS)). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Patrick Isaac at (301) 415-1019 or by electronic mail at Patrick.Isaac@nrc.gov.

Sincerely,

/RA/

Robert A. Nelson, Deputy Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-166
License No. R-70

Enclosures: 1. NRC Inspection Report No. 50-166/2010-202
2. Notice of Violation

cc: See next page

University of Maryland

Docket No. 50-166

cc:

Director, Dept. of Natural Resources
Power Plant Siting Program
Energy & Coastal Zone Administration
Tawes State Office Building
Annapolis, MD 21401

Mr. Roland Fletcher, Director
Center for Radiological Health
Maryland Department of Environment
201 West Preston Street
7th Floor Mail Room
Baltimore, MD 21201

Mr. Vincent G. Adams
Facility Coordinator
Chemical and Nuclear Engineering Building 090
University of Maryland
College Park, MD 20742

Maureen M. Kotlas, Director
Department of Environmental Safety
3115 Chesapeake Building 338
University of Maryland
College Park, MD 20742

Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

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OFFICE	PROB:RI	PROB:LA	PROB:BC	DPR:DD
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DATE	7/5/11	5/23/2011	7/5/11	7/12/11

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NOTICE OF VIOLATION

University of Maryland
Maryland University Training Reactor

Docket No. 50-166
License No. R-70

During a U. S. Nuclear Regulatory Commission (NRC) inspection conducted from November 30 to December 2, 2010 with an exit meeting via conference call on June 16, 2011, a violation of the Technical Specification requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Technical Specifications Section 1.3.2 defines Modified Routine Experiments as those which have not been performed previously but are similar to routine experiments in that the hazards are neither greater nor significantly different than those for the corresponding experiments.

Technical Specifications Section 6.4(2) states that Modified Routine Experiments shall be reviewed and approved in writing by the Facility Director, or designated alternate.

Contrary to the above, an experiment involving the irradiation of graphite was conducted on various occasions from April 1, 2010 to May 27, 2010, but had not been reviewed and approved in writing by the Facility Director as a Modified Routine Experiment. The experiment had not been performed previously, even though it was similar to another routine experiment and the hazards were neither greater nor significantly different than those of the corresponding experiment,

This has been determined to be a Severity Level IV violation (Supplement I).

The NRC has concluded that information regarding the reason for the violation, the corrective actions taken to correct the violation and prevent recurrence, and the date when full compliance will be achieved is already adequately addressed on the docket in the "Summary of Corrective Actions" which you submitted on April 13, 2011. However, you are required to submit a written statement or explanation pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 2.201 if the description therein does not accurately reflect your corrective actions or your position. In that case, or if you choose to respond, clearly mark your response as a "Reply to a Notice of Violation," include the violation number, and send it to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to the Director, Office of Nuclear Reactor Regulation within 30 days of the date of the letter transmitting this Notice of Violation (Notice).

If you choose to respond, your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. Therefore, to the extent possible, the response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days.

Dated this 12 day of July, 2011.

U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No: 50-166

License No: R-70

Report No: 50-166/2010-202

Licensee: University of Maryland

Facility: Maryland University Training Reactor

Location: College Park, Maryland

Dates: November 30 to December 2, 2010

Inspectors: Patrick J. Isaac
Craig Bassett

Approved by: Johnny H. Eads, Jr., Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

University of Maryland
Maryland University Training Reactor Facility
NRC Inspection Report No. 50-166/2010-202

The primary focus of this non-routine, announced inspection was the onsite review of selected aspects of the University of Maryland (the licensee's) Class II research reactor facility safety program including procedures, experiments, health physics, committees, and audit and reviews. The licensee's program was acceptably directed toward the protection of public health and safety. One violation was identified.

Contamination Event

- The inspectors reviewed the licensee's proposed corrective actions related to the incident and found them to be acceptable.

Experiments

- One violation was identified for failure to document the review and approval of a Modified Routine Experiment as required by TS Section 6.4(2). This violation has been determined to be a Severity Level IV Violation.

REPORT DETAILS

Summary of Facility Status

The Maryland University Training Reactor (MUTR), licensed to operate at a maximum steady-state thermal power of 250 kilowatts, continued to be operated in support of academic classes, educational demonstrations, operator training, surveillance, and experiments. During the inspection, the inspectors observed the reactor being operated for training.

1. Contamination Event

a. Inspection Scope (Inspection Procedure [IP] 69001)

The inspectors reviewed the following concerning a contamination event that occurred on June 3, 2010, at the MUTR:

- Reactor Console Logbook covering the period from April 9, 2009, to the present
- Reactor Safety Committee (RSC) meeting minutes dated June 15, 2010
- MUTR Operating Procedure (OP) 105, "Installation of Experiments," Revision (Rev.) 12, RSC approval dated March 27, 2000
- Corrected Annual Report for the Maryland University Training Reactor covering the period from July 1, 2008 through June 30, 2009, submitted June 2, 2010
- Annual Report for the Maryland University Training Reactor covering the period from July 1, 2009 through June 30, 2010, submitted September 29, 2010
- Sample Irradiation Form, Attachment OP 105-1, form last updated February 29, 2000, for the graphite experiments conducted during 2010
- Written statement given by the Senior Reactor Operator present during the event; statement dated June 9, 2010
- Written statement given by the Health Physicist present during the event; statement not dated
- Written statement given by the Graduate Student present during the event; statement dated June 6, 2010
- Liquid Scintillation Counter (LSC) results of nasal smears from the three individuals involved; smears counted June 3, 2010
- LSC results of second set of nasal smears from the three individuals involved; smears counted June 3, 2010
- LSC results of floor smears, skin decontamination, and urine bioassays; counted June 3, 2010
- LSC results of urine samples from the three individuals involved; counted June 4, 2010
- Gamma Spectroscopy (Spec) analysis results of wipes; counted June 4, 2010
- LSC results of wipes from the Reactor Bridge; counted June 7, 2010
- LSC results of recount of the nasal smears from the three individuals involved; counted June 7, 2010
- LSC results of urine samples from the three individuals involved; counted June 8, 2010

- Air Sample Analysis Report of the analysis of air samples taken in the Reactor Building; counted June 4, 2010
- Gamma Spec analysis results of wipes; counted June 7, 2010
- RSO Inc. High Purity Germanium (HPGe) Gamma Spectroscopy analysis results of maslin wipes; counted June 8, 2010
- VARSKIN MOD 3 Skin Dose Report of the reactor operator skin dose that was received June 3, 2010
- Gamma Spec analysis results of wipes; counted June 4, 2010
- RSO Inc. LSC Analysis Results of wipes and Urine Analysis Verification Summary Statement; dated/counted June 9, 2010
- HVAC Filter Survey results; counted June 9, 2010
- LSC results of surveys conducted in the Rabbit Laboratory, on the Reactor Bridge, and on the area floors following decontamination efforts; counted June 10, 2010
- LSC results of surveys conducted on the Reactor Bridge and in the Control Room following decontamination efforts; counted June 11, 2010
- LSC results of surveys conducted in the Rabbit Laboratory and on the Reactor Bridge following decontamination efforts; counted June 14, 2010
- RSO Inc. HPGe Gamma Spec analysis results of cable ties used in the graphite experiment; counted June 14, 2010
- LSC results of wipes taken following removal of the AVAC Filter; counted June 15, 2010
- LSC results of wipes taken in/on/around the pneumatic tube; counted June 16, 2010
- LSC results of wipes taken following decontamination of the pneumatic tube; counted June 18, 2010
- RSO Inc. HPGe Gamma Spec analysis results of wire ties used in the graphite experiment; counted June 22, 2010
- RSO Inc. Urinalysis Report dated June 22, 2010
- LSC results of wipes taken following the Final Release Survey of the Reactor Bay and Adjacent Areas; counted June 23, 2010
- RSO Inc. Decay Analysis Report identifying Antimony-124 (Sb-124) as the primary contaminant following the contamination event of June 3, 2010; report dated July 15, 2010
- Occupational Radiation Exposure Reports for those involved in the contamination event of June 3, 2010; report dated August 6, 2010
- Naval Dosimetry Center Whole Body Count Report indicating no uptake or intake of radioactivity following the June 3, 2010 event, report dated July 13, 2010
- Executive Summary – Radioactive Material Spill June 3, 2010, dated September 28, 2010

b. Observations and Findings

1) Sequence of Event

The sequence of events below is based on interviews with licensee staff and all the data accumulated by the licensee and the U. S. Nuclear Regulatory Commission (NRC) staff.

On June 3, 2010, a spill involving a radioactive material occurred on the bridge of the MUTR reactor. At the time of the spill, the reactor was not operating. The spill occurred as graphite samples were being removed from a heater apparatus following irradiation in the MUTR pneumatic transfer system. As the heater was being opened to remove the graphite samples, a polyethylene tie broke causing a small quantity of gray powder to become airborne. The tie was being used to hold together wires, tubing, and two aluminum "wings" connected to the heater. The potential for degradation of the polyethylene tie and the presence of the powder was not anticipated by the individuals involved.

The individuals handling the samples immediately vacated the facility and incident response actions were initiated.

2) Licensee Investigation of Event

Initial surveys indicated that one individual had skin contamination on the arm and back of the head. Decontamination was successful and the shallow dose to the individual was estimated by four different methods to be 3 mrad. Surveys of two other individuals present at the time of the spill showed no personal contamination. Internal doses were assessed and urine bioassays showed no detectable radioactivity above background. All personnel exposures resulting from this incident were determined to be below the NRC annual limits for occupational exposure.

Inspection of the heater apparatus revealed that the wiring harness that attached the heater to the control unit on the reactor bridge became brittle through exposure to heat and radiation. The insulation of the wires showed significant deterioration and several pieces had broken off, exposing bare copper wire. The wire consisted of 41 strands of 30 gauge tinned copper.

Gamma spectroscopy of the gray powder present at the time of the contamination indicated the primary activation product involved in this spill to be Antimony (Sb-124). Antimony is often used as a constituent of solders, and it was inferred that it is present in the "tinning" of the wire. The licensee concluded that the powder was from the heater power wire that degraded during the irradiation in the reactor.

3) Licensee Response to the Event Including Corrective Actions

On April 13, 2011, the licensee submitted to the NRC a summary of corrective actions relative to the radioactive contamination incident of June 3, 2010 (ML11104A048). The corrective actions fall into three categories including: 1) modifications to future graphite experiments, 2) personnel training, and 3) review/approval of experiments. The licensee committed to having these corrective actions implemented before any additional graphite experiments are conducted. For a description of the corrective actions associated with the violation, see the discussion below in Section 2, Experiments.

c. Conclusion

The inspectors reviewed the licensee's proposed corrective actions related to the incident and found them to be acceptable.

2. Experiments

a. Inspection Scope (IP 69001)

To verify compliance with licensee's procedures, technical specifications (TS) Section 3.5, Limitations on Experiments, TS 6.4, Experiment Review and Approval, and Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59, the inspector reviewed selected aspects of:

- Reactor Console Logbook covering the period from April 9, 2009, to the present
- Reactor Console Logbook covering the period from December 8, 1993, to February 26, 1996
- Reactor Console Logbook covering the period from September 21, 1992, to December 2, 1993
- Reactor Safety Committee (RSC) meeting minutes dated June 10, 1993
- Reactor Safety Committee (RSC) meeting minutes dated November 1, 1994
- Electronic-Mail from W. Chappas, former Reactor Director, to M. Al-Sheikhly, current Reactor Director
- MUTR Operating Procedure (OP) 105, "Installation of Experiments," Revision (Rev.) 12, RSC approval dated March 27, 2000
- Sample Irradiation Form, Attachment OP 105-1, form last updated February 29, 2000, for the graphite experiments conducted during 2010
- Corrected Annual Report for the Maryland University Training Reactor covering the period from July 1, 2008 through June 30, 2009, submitted June 2, 2010
- Annual Report for the Maryland University Training Reactor covering the period from July 1, 2009 through June 30, 2010, submitted September 29, 2010

b. Observations and Findings

Due to the contamination event that occurred on June 3, 2010, at the MUTR, the inspectors focused their attention on the experiment that was being conducted at the time of the event. Graphite irradiation experiments contained in an electric resistance heated container were being irradiated in the reactor pneumatic transfer system starting in January 2010. The heater apparatus was similar to one that had been used in a 1997 experiment. They were similar but not the same. There were many important differences between the new experiment and the 1997 one. A polyethylene tube for purge gas was added to the current heater apparatus. The purge gas was intended to be used in later experiments, but not used in the current experiment. The heater apparatus used for this experiment had been rewired using 14 gauge tinned copper wire with white PVC insulation. The new experiment was exposed to radiation for longer times with the heater set at much higher temperatures than in 1997.

In their Summary of Corrective Actions, dated April 13, 2011, the licensee explained their classification of the new experiment as follows:

The experiment was considered to be a Routine Experiment since a similar experiment had been performed previously. As a Routine Experiment, it did not require review and approval by the Reactor director. However, after a more detailed (post-incident) analysis, we recognize that there were sufficient differences between the experiments such that it should have been treated as a Modified Routine Experiment.

MUTR TS 1.3.2 defines Modified Routine Experiments are those which have not been performed previously but are similar to routine experiments in that the hazards are neither greater nor significantly different than those for the corresponding routine experiments.

MUTR TS 6.4(2) stipulates that Modified routine experiments shall be reviewed and approved in writing by the Facility Director, or designated alternate. TS 6.4(3) adds the review of modified routine experiments shall consider its effect on reactor operation and the possibility and consequences of its failure, including, where significant, consideration of chemical reactions, physical integrity, design life, proper cooling, interaction with core components, and reactivity effects.

The licensee did not have access to the documents for the review of the experiment conducted in 1997 and relied on the recollection of a staff member who was at the MUTR when the experiment was conducted. For the new experiment of January 2010, the licensee was unable to provide to the inspectors a copy of the documentation for its review and approval.

The licensee was informed that the failure to document the review and approval of the new experiment was an apparent violation the MUTR TS 6.4(2). (VIO 50-166/2010-202-01)

c. Conclusion

One violation was identified for failure to document the review and approval of a Modified Routine Experiment as required by TS Section 6.4(2). This violation has been determined to be a Severity Level IV violation.

3. Exit Interview

The inspectors presented the inspection results to licensee management at the conclusion of the inspection on June 1, 2010. Following the receipt of the Summary of Corrective Actions, dated April 13, 2011, for the contamination event of June 3, 2010, a final exit meeting, via a conference call, was conducted with the Facility Director on June 16, 2011. The inspectors described the areas inspected and discussed the inspection observations. The licensee acknowledged the observations presented and no dissenting comments were received.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

V. Adams	Facility Coordinator and Senior Reactor Operator
M. Al-Sheikhly	Director, Radiation Facilities and Nuclear Reactor
M. Dorman	Assistant Director of Environmental Safety
B. Zidek	Health Physicist

INSPECTION PROCEDURES USED

IP 69001 Class II Non-Power Reactors

ITEMS OPENED, CLOSED

OPENED:

VIO 50-166/2010-202-01 A Severity Level IV VIO for failure to document the review and approval of a Modified Routine Experiment as required by TS Section 6.4(2).

CLOSED:

VIO 50-166/2010-202-01 A Severity Level IV VIO for failure to document the review and approval of a Modified Routine Experiment as required by TS Section 6.4(2).

PARTIAL LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Document Access and Management System
ALARA	As Low As Reasonably Achievable
EP	Emergency Procedure
FC	Facility Coordinator
FD	Facility Director
IP	Inspection Procedure
MUTR	Maryland University Training Reactor
NRC	U. S. Nuclear Regulatory Commission
OP	Operating Procedure
RO	Reactor Operator
RSC	Reactor Safety Committee
RSO	Radiation Safety Officer
SP	Surveillance Procedure
SRO	Senior Reactor Operator
TS	Technical Specifications
UMD	University of Maryland
URI	Unresolved Item
VIO	Violation