THE OHIO STATE UNIVERSITY

The Ohio State University
Nuclear Reactor Laboratory

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26-Sep-2012

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SUBJECT: Annual Report for The Ohio State University Research Reactor, License R-75, Docket 50-150

Please find enclosed the annual report for The Ohio State University Research Reactor, Docket No. 50-150. This report is being submitted as required by our Technical Specifications, Section 6.6.1. If you have questions on the content of this report, please contact Mr. Andrew Kauffman, Associate Director of the Nuclear Reactor Laboratory, at 614-688-8220.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on 26-Sep-2012.

Sincerely,

Thomas E. Blue

Thomas E. Blue, Director
OSU Nuclear Reactor Lab
The Ohio State University
(License R-75, Docket 50-150)

c: David B. Williams, Dean, OSU College of Engineering
Randolph L. Moses, Associate Dean for Research, OSU College of Engineering
A. C. Kauffman, OSU Nuclear Reactor Lab

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THE OHIO STATE UNIVERSITY
RESEARCH REACTOR

ANNUAL REPORT FOR FY 2011/2012

SEPTEMBER 2012

Introduction

As stated in The Ohio State University Research Reactor (OSURR) Technical Specifications Section 6.6.1, *Operating Reports*, an annual report shall be made to the NRC by September 30 of each year. This report is to include the following seven information items:

1. A narrative summary of operating experience (including experiments performed) and of changes in facility design, performance characteristics, and operating procedures related to reactor safety occurring during the reporting period
2. A tabulation showing the energy generated by the reactor (in kilowatt hours) and the number of hours the reactor was in use
3. The results of safety related maintenance and inspections and the reasons for corrective maintenance of safety-related items
4. A table of unscheduled shutdowns and inadvertent scrams, including their reasons and the corrective actions taken
5. A summary of the safety analyses performed in connection with changes to the facility or procedures, which affect reactor safety, and performance of tests or experiments carried out under the conditions of 10 CFR 50.59
6. A summary of the nature and amount of radioactive gaseous, liquids, 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
7. A summary of radiation exposures received by facility personnel and visitors, including the dates and times of significant exposures

These seven information items are discussed below for the period July 1, 2011 through June 30, 2012, except as noted for exposure records.

1. Summary of Operating Experience and Changes

1.A. Experiments Performed

The OSURR engages in a wide range of research endeavors, including neutron activation analysis (NAA), radiation-damage studies, neutron and radiation sensitive detector development, isotope production, and biomedical experiments. Much of the NAA work performed at the OSURR is for geological and material science samples, but NAA is used for other purposes, such as industrial and biological. Most radiation-damage studies performed at the OSURR are for electronic and fiber-optic components, but studies have been performed for other materials. The OSURR has been involved in the development of a number of potential types of neutron and radiation detectors, including fiber-optic based systems, and it regularly tests fission chambers for use in commercial power reactors by characterizing their response to known neutron flux. Isotope production has typically been performed for medical research, but sources have been created for other uses, including testing of radiation-sensitive detectors. Biological sample irradiations performed at the OSURR have been for boron neutron capture therapy (BNCT) studies. In addition, other experiments are performed at the OSURR, such as reactivity worth measurements, spectrum characterizations using flux-wire activation and analysis, and physics experiments such as neutron irradiation of fullerenes.

The OSURR also provides a variety of instructional services ranging from general tours to individual and group laboratory sessions and research projects structured to student and faculty

interests. Nuclear engineering and physics classes throughout Ohio have utilized the OSURR for the following basic experiments:

a. approach to critical (using banked control rods rather than fuel loading)
b. control rod calibration by rod drop, positive period, and subcritical multiplication
c. measurement of the reactor transfer function by noise analysis
d. temperature coefficient measurements
e. radiological surveys

When the OSURR is used to introduce students, faculty or other experimenters to nuclear research, the following are typically done:

a. discuss nuclear reactions and radiological safety
b. operate the reactor at 10kW-100kW
c. have the individuals observe control room operations
d. complete a tour and demonstrate irradiation techniques

Neutron activation analysis experiments are performed for students ranging from high school to graduate school.

The reactor utilization for July 1, 2011 through June 30, 2012 is summarized in the following reports. Please note that the utilization hours listed below only reflect actual reactor operating time. The list does not include hours spent on tasks supporting this reactor utilization.

The Ohio State University Nuclear Reactor Lab Reactor Utilization Report: July 1 - December 31, 2011

User (Affiliation)	Description	Hours[1]
AFIT	Radiation effects on materials and electronics	25.8
D. Schaefer (Air Force)	Buckyballs	2.4
Edison Welding Inst.	SiC joining techniques	6.7
GE Reuter-Stokes	Testing fission chambers	54.9
Luna Innovations	Radiation effects on fiber-based sensors	55.5
K. Lepper (NDSU)	NAA of geological samples	1.4
Hatch (NRL)	Scandium irradiation	4.7
NRL	Calibrations, requal, etc.	23.0
A. Zelaski (OSU NE)	SiC irradiation	0.0 [2]
R. Cao (OSU NE)	BP#2 facility testing	4.0
Bardsley (OSU Physics)	Radiation effects on GMR materials	3.5
U. of Cincinnati	Neutron spectrum in BP#1	0.8
S. Glover (UC)	Irradiation of silica discs	4.5
C. Barklay (UDRI)	Irradiation of tantalum alloys	7.8
Various	Tours (Kenyon College, Ohio DPS / EMA, OSU IS555, OSU NE505, OSU NROTC, OSU Energy & Env., OSU Women in Eng., Wilberforce University)	21.6
	Total:	**216.6**

Notes:

1. The utilization hours listed above reflect actual reactor operating time. The list does not include hours spent on tasks supporting this reactor utilization (pre-start and post-shutdown checkout, experiment setup, etc.).
2. Does not include reactor utilization time when run as a secondary user concurrent with a primary user

The Ohio State University Nuclear Reactor Lab Reactor Utilization Report: January 1 - June 30, 2012

User (Affiliation)	Description	Hours[1]
R. McMahon (AFIT)	Radiation effects on electronic devices	5.2
D. Schaefer (Air Force)	Buckyballs	1.5
GE Reuter-Stokes	Testing fission chambers	61.8
Lambda Instruments	Radiation effects on fiber-based sensors	0.9 [2]
Luna Innovations	Radiation effects on fiber-based sensors	144.0
K. Lepper (NDSU)	NAA of geological samples	1.1
Hatch (NRL)	Scandium irradiation	1.6
D. Hawn (OSU NE)	Radiation effects on optical fiber	42.8
R. Cao (OSU NE)	BP#2 facility testing	4.0
R. Cao (OSU NE)	Radiation effects on GaN	0.0 [2]
OSU NE 742 & 744	Laboratory classes	19.5
S. Glover (UC)	Irradiation of silica disks	3.2 [2]
Various	Tours (AFIT, Bluffton H.S., Columbus Police & Fire, Marburn Academy, OEMA, Ohio Energy Project, OSU FST, OSU Intl. Studies, NE 505, OSU Nuc. Med., OSU Physics, Westerville South H.S.)	35.6
	Total:	**335.9**

Notes:

1. The utilization hours listed above reflect actual reactor operating time. The list does not include hours spent on tasks supporting this reactor utilization (pre-start and post-shutdown checkout, experiment setup, etc.).
2. Does not include reactor utilization time when run as a secondary user concurrent with a primary user

1.B. Changes in Facility Design

There were no facility design changes that required a change to the Technical Specifications. 10CFR50.59 changes are described in Section 5.A of this report.

1.C. Changes in Performance Characteristics

There have been no changes in performance characteristics related to reactor safety in the last year.

1.D. Changes in Operating Procedures

There were no changes in operating procedures related to reactor safety in the last year. 10CFR50.59 changes are described in Section 5.B of this report.

2. Energy Generated and Hours of Use

Kilowatt-Hours of Operation: 101690.4 kW-hr

Hours of Utilization: 552.5 hr

3. Safety Related Maintenance

None.

4. Unscheduled Shutdowns

From July 1, 2011 to June 30, 2012 there were 4 unplanned shutdowns. These are summarized below.

Reason		Corrective Action
Safety system continuity scram	(3)	Failed relay in continuity circuitry identified and replaced
Operator error; wrong button pushed by SRO	(1)	None required

5. Changes in Facility and Procedures in Accordance with 10CFR50.59

5.A. Facility Modifications

During the period July 1, 2011 to June 30, 2012, four OSURR Modification Requests were completed:

1) Cooling system upgrade (addition of compressor-based chiller to cooling system)
2) Beam Port 2 external beam facility installation
3) Control console manual scram pushbutton switch replacement
4) Startup channel ratemeter replacement

5.B. Procedure changes

The following is a list of procedure changes made under 10-CFR-50.59 from July 1, 2011 to June 30, 2012 in accordance with Administrative Procedure AP-05, *Format for Writing, Revising, and Approving Procedures.*

Procedure Number	Procedure Title	Revision Date
AP-02	General Rules	9/11/11
EP-04	Emergency Equipment Inventory	9/7/11
IM-12	Reactor Instrumentation Calibration	9/23/11
OM-03	Experimental Facilities	8/23/11
RS-15	Radiation Safety Instruction	9/7/11

6. Radioactive Effluents

6.A. Gaseous Effluent

The only gaseous effluent measured is the release of Ar-41. For the period July 1 - Dec. 31, 2011, Ar-41 releases measured 1.18% of the annual average concentration limit. From Jan. 1 - June 30, 2010, releases measured 2.20% of the annual average concentration limit. In accordance with the requirements of 10CFR20.1101(d), the COMPLY code was run using the total Ar-41 release for the period July 1, 2011 - June 30, 2012 of 269.5 mCi. Using level 2 in the code, the effective dose equivalent rate at the facility fence was computed to be 0.2 mrem/yr. This is well below the 10 mrem/yr constraint specified in the regulation.

6.B. Liquid Releases

Hot sink releases are recorded and reported through the OSU Office of Radiation Safety. One release was made to the sanitary sewer system during the period July 1, 2010 to June 30, 2011, and it contained: 0.0034 μCi Co-60, 0.00074 μCi Mo-99, 0.059 μCi Cs-137, and 0.00067 μCi Hg-203.

6.C. Solid Releases

No releases of solid radioactive material were made to the uncontrolled environment.

7. Radiation Exposures

Since the firm that maintains records for The Ohio State University keeps a year-to-date record, it is simpler to report radiation exposure records by the nearest completed calendar year. Therefore dosimetry badge exposures in this report are for the period January 1, 2011 to December 31, 2011. Nine individuals were monitored as radiation workers during this period, and the measured dose equivalent values are tabulated below in mrem.

Individual	Dose Equivalent (mrem)			
	DDE	LDE	SDE, WB	SDE, ME
Visitors	0	0	0	N/A
Staff member #1	133	210	383	808
Staff member #2	41	42	42	289
Staff member #3	175	186	207	586
Staff member #4	170	174	179	626
Staff member #5	85	92	92	400
Staff member #6	11	14	14	36
Staff member #7	19	22	22	-
Student #1	19	19	19	214
Student #2	7	7	7	36
Student #3	3	3	3	21

Student #4	49	49	52	-
Student #5	8	9	11	130
Student #6	3	3	3	1
Student #7	7	7	7	26

40 CFR Part 61
National Emission Standards
for Hazardous Air Pollutants

REPORT ON COMPLIANCE WITH

THE CLEAN AIR ACT LIMITS FOR RADIONUCLIDE EMISSIONS

FROM THE COMPLY CODE - V1.6.

Prepared by:

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Prepared for:

U.S. Environmental Protection Agency
Office of Radiation and Indoor Air
Washington, DC 20460

NRL_2012

SCREENING LEVEL 2

DATA ENTERED:

Nuclide	Release Rate (curies/YEAR)
AR-41	2.695E-01

Release height 10 meters.

Building height 11 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 15 meters.

Building width 25 meters.

Default mean wind speed used (2.0 m/sec).

NOTES:

Input parameters outside the "normal" range:

None.

RESULTS:

Effective dose equivalent: 0.2 mrem/yr.

*** Comply at level 2.

This facility is in COMPLIANCE.

It may or may not be EXEMPT from reporting to the EPA.

You may contact your regional EPA office for more information.

********** END OF COMPLIANCE REPORT **********