



**College of
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October 20, 2008

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Transmittal of Annual Facility Operating Report for 2007

Dear Madam/Sir:

Enclosed please find a copy of the Annual Operating Report for the Idaho State University AGN-201M Reactor, License No. R-110, Docket No. 50-284, for calendar year 2007. Submission of this report satisfies the requirements of AGN Technical Specification 6.9.1.

If you have any questions concerning the report, please call me at (208) 282-3351.

Sincerely,

John S. Bennion
Reactor Manager/Supervisor

Cc: Mr. Daniel E. Hughes, Project Manager
Non-Power Reactors and Decommissioning Project Directorate
Operating Reactor Improvements Program
Office of Nuclear Reactor Regulation

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NRR

**Idaho State University
AGN-201M Reactor Facility
License R-110, Docket No. 50-284
Annual Operating Report for 2007**

1. Narrative Summary

A. Changes in Facility Design, Performance Characteristics, and Operating Procedures:

There were no changes in facility design, performance characteristics, and operating procedures relating to reactor safety during the reporting period.

B. Results of Major Surveillance Tests and Inspections:

- (1) Channel tests performed on all safety channels and scram interlocks were found to be satisfactory and within specifications.
- (2) Power and period calibrations were performed with satisfactory results.
- (3) The shield water tank was inspected and no leaks or excessive corrosion were observed.
- (4) The seismic displacement interlock was tested satisfactorily.
- (5) (a) Control element capsules (cladding) were inspected and found to be in good condition with no evidence of deterioration since the previous inspection.
(b) The control rod drive mechanisms were inspected and tested with satisfactory results.
(c) Ejection times were measured for all scrammable rods and found to be less than 130 milliseconds
(d) The reactivity worth of all safety and control rods were measured, as well as the time required to drive each rod to its fully inserted position. Reactivity insertion rates were determined to be less than $0.037\% \Delta k/k \text{ s}^{-1}$ ($\$0.050 \text{ s}^{-1}$) for all rods.
(e) The shutdown margin was determined to be greater than $1.38\% \Delta k/k$ ($\$1.86$) with both the most reactive scrammable rod and the fine control rod fully inserted.
(f) All surveillances were within the appropriate Technical Specification requirements.

2. Operating History and Energy Output.

The reactor was operated at power levels up to 4.9 watts for a total 96.1 hours thereby generating 2.21 watt-days (53.1 watt-hours) of thermal energy during this reporting period. A summary of monthly operations for 2007 is given in Table I.

Table I. Summary of Monthly Reactor Operations
(1 January 2007 through 31 December 2007)

<u>Month</u>	<u>Hours</u>	<u>Energy (W-hr)</u>
January	3.0	0.14
February	14.6	0.38
March	7.3	0.84
April	10.1	15.13
May	2.7	3.70
June	1.1	0.27
July	2.9	0.14
August	7.8	0.71
September	1.2	0.00
October	12.1	0.51
November	19.1	11.87
<u>December</u>	<u>14.4</u>	<u>19.38</u>
Total	96.1 hr	53.07 W-hr

3. A. Unscheduled Shutdowns and Corrective Actions Taken.

- 9/13/07: During the pre-start-up checkout procedure, the glass cover in the Channel No. 2 power meter, which was cracked, shifted in such a way that motion of the meter needle was impeded. The reactor check-out procedure was aborted. The glass was then replaced and operations resumed a few days later after verifying meter operability.
- 12/7/07: The pre-start-up checkout procedure was aborted when it was discovered that the scram annunciator lights did not energize when power to the console was turned on. Investigation found that a power resistor in a filtering circuit associated with the power supply for the scram chassis had overheated causing the solder joints to melt and the resistor to detach from the circuit. The resistor was replaced along with several vacuum tubes, which restored operability of all scram functions.
- 12/20/07: The pre-start-up checkout procedure was again aborted when it was discovered that the scram annunciator lights did not energize when power to the console was turned on. Further investigation revealed that a full-wave diode vacuum tube in the scram chassis (tube V6, type 5U4) was providing only half-wave rectification, causing the 200- Ω power resistor to overheat. The vacuum tube was replaced, which corrected the problem. The system was returned to service after a check of all scram functions were verified to be operable.

B. Inadvertent Scrams and Action Taken.

There were 11 inadvertent scrams during this reporting period. Table II summarizes the inadvertent scrams, known or suspected cause, and action taken. Most of the scrams (82%) resulted from suspected voltage transients associated with the building electrical power. One scram (9%) was the result of a manual range switching error by a student who was operating the reactor as part of undergraduate nuclear engineering laboratory course. The remaining scram (9%) was caused by drift in the Channel 2.

Table II. Summary of Inadvertent Scrams
(1 January 2007 through 31 December 2007)

Date	Time	Scram Type	Cause	Action
2/2/07	11:23	No Cause Indicated	Suspected Power Transient	Restart
2/2/07	11:30	No Cause Indicated	Suspected Power Transient	Restart
2/2/07	11:33	No Cause Indicated	Suspected Power Transient	Terminated run.
2/23/07	10:40	No Cause Indicated	Suspected Power Transient	Restart
2/23/07	11:50	No Cause Indicated	Suspected Power Transient	Restart
2/23/07	11:53	No Cause Indicated	Suspected Power Transient	Restart
2/23/07	11:59	No Cause Indicated	Suspected Power Transient	Terminated run.
10/25/07	15:43	No Cause Indicated	Suspected Power Transient	Restart
11/8/07	17:55	Channel 1 - High	Operator Switching Error	Restart
12/16/07	17:24	Channel 2 - High	Channel Drift	Terminated run.
12/20/07	13:09	No Cause Indicated	Suspected Power Transient	Terminated run.

4. Safety-Related Corrective Maintenance

9/13/07: Replaced glass cover on Channel No. 2 meter.

12/8/07: Replaced 200- Ω power resistor in scram chassis, as well as several vacuum tubes (6Y6, 6L6, and 5U4). These actions restored operability to the scram chassis.

12/21/07: Replaced vacuum tube 5U4 in the scram chassis. This action restored operability to the scram chassis.

5. Modifications.

A. Changes in Facility Design.

There were no changes to the facility design to the extent that changed a description of the facility in the application for license and amendments thereto during 2007.

B. Changes to Procedures.

None.

C. Experiments.

No new or untried experiments or tests were performed during 2007.

D. Reactor Safety Committee.

As of the end of the reporting period, membership of the Reactor Safety Committee (RSC) consisted of the following individuals:

Frank H. Just - Chair
Michael E. Vaughan – Alternate Chair
Jay F. Kunze - Dean, College of Engineering and Reactor Administrator
John S. Bennion - Reactor Supervisor
Richard R. Brey - Radiation Safety Officer
Thomas F. Gesell
Robert Boston
Richard E. McCracken

6. Summary of Changes Reportable under 10 CFR 50.59.

None.

7. Radioactive Effluents.

A. Liquid Waste - Total Activity Released: None.

B. Gaseous Waste - Total Estimated Activity Released: 1.15 μ Ci.

The AGN-201 Reactor was operated for 96.1 hours at power levels up to approximately 4.9 watts. At this power level Ar-41 production is negligible and substantially below the effluent concentration limit given in 10 CFR 20 Appendix B, Table 2. The total activity of Ar-41 released to the environment was conservatively estimated at 1.15 μ Ci. This activity corresponds to the total activity

of all gaseous radioactive effluent from the facility. A monthly summary of gaseous releases is given in Table IV.

Table IV. Summary of Monthly Gaseous Radioactive Effluent Releases
(1 January 2007 through 31 December 2007)

<u>Month</u>	<u>Ar-41 (μCi)</u>
January	0.003
February	0.008
March	0.018
April	0.380
June	0.006
July	0.003
August	0.015
September	0.000
October	0.011
November	0.257
<u>December</u>	<u>0.419</u>
Total activity:	1.148 μCi

C. Solid Waste - Total Activity: None.

8. The latest environmental radiation surveys, performed at the facility boundary while the reactor was operating at 20% of full licensed power (1.0 watt), measured a maximum combined neutron and gamma dose equivalent rate of less than 0.1 mrem hr^{-1} at the outside walls of the building proximal to the reactor. The total equivalent dose rate at 100% power at these locations was less than 1 mrem hr^{-1} .

9. Radiation Exposures.

The Radiation Safety Officer reviews personnel radiation exposures quarterly. Annual reports of ionizing radiation doses are provided by the Radiation Safety Officer to all monitored personnel as required under the provisions of 10 CFR 19.

Personnel with duties in the reactor laboratory on either a regular or occasional basis have been issued radiation dosimeters by the Idaho State University Technical Safety Office. The duty category and monitoring period of personnel are summarized in Table V:

Table V. Personnel Monitored for Exposure to Ionizing Radiation

<u>Name</u>	<u>Monitoring Period</u>	<u>Duty Category</u>
John S. Bennion	1/1/07 - 12/31/07	Regular
Kenyon Hart	1/1/07 - 12/31/07	Regular
Daniel Montenegro	1/1/07 - 12/31/07	Regular
Jay F. Kunze	1/1/07 - 12/31/07	Occasional
Jason Andrus	9/1/07 - 12/31/07	Occasional
Michael Bailey	9/1/07 - 12/31/07	Occasional
Ryan Loveland	9/1/07 - 12/31/07	Occasional
Ashoak Nagarajan	1/1/07 - 12/31/07	Occasional
Surendra Prajapati	9/1/07 - 12/31/07	Occasional
Caleb Robison	9/1/07 - 12/31/07	Occasional
Jill Rydalc	9/1/07 - 12/31/07	Occasional
Karen Shropshire	1/1/07 - 6/30/07	Occasional
Philip Tufts	1/1/07 - 6/30/07	Occasional
Clinton Wilson	1/1/07 - 12/31/07	Occasional

Dose Equivalent summary for Reporting Period:

Measured Doses

1/1/2007 - 12/31/2007 Whole-Body Dose Equivalents: less than 100 mrem for all personnel.
Minimum Detectable Dose Equivalent per Monthly Badge = 10 mrem.

None of the 95 visitors to the facility during 2007 received a measurable dose. Therefore, the average and maximum doses are all within NRC guidelines. A summary of whole-body exposures for facility personnel is presented in Table VI.

Table VI. Summary of Whole-Body Exposures
(1 January 2007 through 31 December 2007)

Estimated whole-body exposure range (rem):	Number of individuals in each range:
No Measurable Dose	1
Less than 0.10	13
0.10 to 0.25	0
0.25 to 0.50	0
0.50 to 0.75	0
0.75 to 1.00	0
1.00 to 2.00	0
2.00 to 3.00	0
3.00 to 4.00	0
4.00 to 5.00	0
Greater than 5 rem	0
Total number of individuals reported:	14

Report prepared by: John S. Bennion, Reactor Manager/Supervisor
Kenyon Hart, Reactor Supervisor designee
October 20, 2008