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June 30, 2001

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

Subject: Transmittal of Annual Facility Operating Report for 2000

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 2000. Submission of this report satisfies the requirements of AGN Technical Specification 6.9.1. A copy of this report has also been submitted to the Region IV Administrator, as required by the aforementioned technical specifications.

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

Sincerely,

John S. Bennion
Reactor Administrator

Cc: Mr. Marvin M. Mendonca, Project Manager
Non-Power Reactors and Decommissioning Project Directorate
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Idaho State University
AGN-201M Reactor Facility
License R-110, Docket No. 50-284
Annual Operating Report for Calendar Year 2000

1. Narrative Summary.

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

There were no changes in facility performance characteristics, and operating procedures relating to reactor safety during the reporting period. The only change in facility design resulted from the replacement of existing dashpots located in the control element drive assemblies of the AGN reactor by new units that are essentially identical to the dashpots currently in use at the Texas A&M and University of New Mexico AGN reactor facilities (see section 6 of this report for additional information).

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) The control rod drive mechanisms were inspected and tested with satisfactory results.

(b) Ejection times were measured for all scrammable rods and found to be less than 120 milliseconds.

(c) Control element capsules (cladding) were inspected and found to be in good condition with no evidence of deterioration since last inspection.

(d) The reactivity worths 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 0.036% $\Delta k/k\ s^{-1}$ ($0.048 s^{-1}) for each of the safety and control rods.

(e) The shutdown margin was determined to be greater than 1.64% $\Delta k/k$ ($2.22) 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 5 watts for a total of 43 hours thereby generating 0.39 watt-days (9.33 watt-hours) of thermal energy during this reporting period. A summary of monthly operations for 2000 is given in Table I.

Table I. Summary of Monthly Reactor Operations
(1 January 2000 through 31 December 2000)

Month	Hours	Energy (W-hr)
January	0	0.00
February	2.0	1.19
March	0	0.00
April	3.8	0.00
May	7.9	3.50
June	1.3	0.76
July	2.1	0.00
August	2.9	0.00
September	6.8	0.97
October	9.4	2.03
November	2.5	0.88
December	4.4	0.00
Total	43.1 hr	9.33 W-hr

3. A. Unscheduled Shutdowns and Corrective Actions Taken.

None.

B. Inadvertent Scrams and Action Taken.

2/08/00: While increasing power from 0.01 watts to 4 watts at 11:38 hours for sample irradiation, Channel No. 2 scrammed high at a power level of approximately 3.5 watts. The reactor was restarted and again scrammed high on Channel No. 2 at 11:43 hours. The desired power level was reduced to 3.0 watts, and the amplifier balance points were readjusted. The reactor was restarted and irradiation continued normally. The cause of the scrams was attributed to drift in Channel No. 2.

5/17/00: At 10:35 hours the power level of the reactor was decreased from 3.5 watts to 0.04 watts. The reactor scrammed low on Channel No. 1 before the desired power was reached. The scram was attributed to an error in range switching by a student operator. The reactor was restarted with no further problems.

9/27/00: While performing rod drop procedures an operator error (failure to switch to a higher range) caused a high level scram on Channel No. 1 from a power level of approximately 0.14 watts at 14:36 hours. The reactor was restarted, but subsequently scrammed low on Channel No. 3 at 14:47 hours. This scram was apparently due to a power fluctuation in the building. The reactor was again restarted and shortly after insertion of Safety Rod No. 1 the reactor scrammed low on Channel No. 3 at 15:05 hours. This scram was caused by the failure of the operator to switch to a lower range during restart. The reactor was restarted and the rod drop procedure was completed without further difficulty.

10/15/00: While measuring the reactivity worth of the Fine Control Rod (FCR) the reactor scrammed low on Channel No. 1 at 16:16 hours. The operator did not switch ranges as needed. Reactor restart was attempted but Channel No. 1 again scrammed low before both Safety Rods were inserted. The RaBe neutron source was reinserted in the reactor core and restart proceeded normally.

11/05/00: At 12:36 hours while raising power to 0.01 watts following an intentional scram, the reactor scrammed high on Channel No. 1, caused by the operator failing to switch to a higher range when necessary. The reactor was restarted and the run continued without further incident.

4. Safety-Related Corrective Maintenance

3/26/00: While performing rod maintenance (MP-1) it was noticed that there was a gap of approximately 0.1 inch between the capsule on the FCR and the corresponding shoulder of the extension shaft. Attempts to tighten the capsule on the extension shaft failed. The decision was made to investigate further.

4/13/00: The FCR was disassembled to investigate the gap noticed on 3/26/00. The threads between the capsule and the extension shaft were thoroughly cleaned and coated lightly with anti-seize compound. The O-ring was replaced and the control rod was reassembled. The gap noticed earlier remained. It was concluded that this gap has probably existed for years. The gap will be monitored during future rod maintenance to determine if the dimensions of the gap are changing over time.

6/28/00: The Channel No. 2 chart recorder was found to be sticking and non-responsive at higher power levels. The chart recorder was removed and taken to Mr. Royce Martin (electronics maintenance technician for the Physics Department) for repair. Mr. Martin replaced a transistor and a several resistors which had failed when the transistor shorted. The chart recorder was returned to service on 7/12/00.

7/19/00: The Channel No. 2 amplifier was found to have blown a fuse. The fuse was

replaced, but this action did not restore the function of the amplifier. The amplifier was taken to Mr. Royce Martin for repair. Mr. Martin replaced a 6BW4 tube in the amplifier power supply circuitry. The amplifier was returned to service on 7/26/00.

7/28/00: Testing of prototype dashpot replacement begins. Prototype dashpot found not to supply sufficient dampening. A piston with closer tolerances will be manufactured.

7/31/00: Testing of prototype dashpot continues. More dampening is still needed. A neoprene pad was installed on the base of the dashpot.

8/10/00: Testing of dashpots continues. It was discovered that the threads that accept the dashpots are slightly different between the three scrammable rod drives. The threads in each dashpot were deepened to allow each dashpot to thread into the three slightly different drive plates.

8/18/00: Dashpot testing concludes. The replacement dashpots were found to function well and will be placed into service after measuring scram times and verifying the dampening action of each dashpot.

8/31/00: Replacement dashpots were installed on all three scrammable control elements.

11/04/00: The low temperature in the reactor room (63° F) caused the temperature interlock to open. A small space heater was placed behind the brick shield wall to increase room temperature.

11/06/00: Channel No. 2 amplifier and chart recorder were found to be behaving abnormally. The amplifier and recorder were taken to Mr. Royce Martin for testing. Mr. Martin replaced a 6BW4 tube. No problems were found with the chart recorder.

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 2000.

B. Changes to Procedures.

None.

C. Experiments.

No new or untried experiments or tests were performed during 2000.

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
Jay F. Kunze - Dean, College of Engineering
John S. Bennion - Reactor Administrator
Todd C. Gansauge - Reactor Supervisor
Thomas F. Gesell - Radiation Safety Officer
Terry W. Smith
Michael E. Vaughan
Chad Pope

6. Summary of Changes Reportable under 10 CFR 50.59.

Following the recommendation of the Reactor Safety Committee during its January 2000 meeting, four new dashpots were fabricated based on engineering drawings of dashpots that are currently in service at the Texas A&M AGN reactor. The new dashpot design, which is essentially identical to the design of dashpots currently in use at the University of New Mexico AGN reactor, is much simpler and more robust than that of the existing dashpots that have been in service in the ISU AGN reactor. The new dashpots were extensively and carefully tested in the facility control rod test stand and determined to satisfactorily perform their intended function. Three of the dashpots have been installed in the scrammable rod drive assemblies (Safety Rod No. 1, Safety Rod No. 2, and the Coarse Control Rod); the fourth dashpot will serve as a spare. A final report of this modification is in preparation and will be submitted to NRC for review within 30 days.

7. Radioactive Effluents.

A. Liquid Waste - Total Activity Released: None.

B. Gaseous Waste - Total Estimated Activity Released: 0.20 μCi (Ar-41).

The AGN-201 Reactor was operated for 43.1 hours at power levels up to approximately 5 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 0.20 μCi. 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 II.

Table II. Summary of Monthly Gaseous Radioactive Effluent Releases
(1 January 2000 through 31 December 2000)

Month	Ar-41 (μCi)
January	0.000
February	0.026
March	0.000
April	0.000
May	0.076
June	0.017
July	0.000
August	0.000
September	0.021
October	0.044
November	0.019
December	0.000
Total activity:	0.204 μCi

9. Radiation Exposures.

Personnel radiation exposures are reviewed quarterly by the Radiation Safety Officer. 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 III:

Table III. Personnel Monitored for Exposure to Ionizing Radiation

Name	Monitoring Period	Duty Category
Kazi Ahmed	1/1/00 - 12/31/00	Occasional
John S. Bennion	1/1/00 - 12/31/00	Regular
Thomas Collens	4/1/00 - 12/31/00	Occasional
Todd C. Gansauge	1/1/00 - 12/31/00	Regular
Jay F. Kunze	1/1/00 - 12/31/00	Occasional
Jon D. McWhirter	1/1/00 - 12/31/00	Regular
Joseph Nielsen	1/1/00 - 12/31/00	Occasional
Vavilala Umakanth	10/1/00 - 12/31/00	Occasional
Miles Whiting	1/1/00 - 12/31/00	Occasional

Dose Equivalent summary for Reporting Period:

Measured Doses

1/1/00 - 12/31/00 Whole-Body Dose Equivalent: ≤10 mrem for most personnel.
Minimum Detectable Dose Equivalent per Quarterly Badge = 10 mrem.

None of the 182 visitors to the facility during year 2000 received a measurable dose. Therefore, the average and maximum doses are all well within NRC guidelines. A summary of whole-body dose equivalent for facility personnel is presented in Table IV.

Table IV. Summary of Whole-Body Dose Equivalent
(1 January 2000 through 31 December 2000)

Estimated whole-body dose equivalent range (rem):	Number of individuals in each range:
No Measurable Dose	4
Less than 0.10	5
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:	9

Report prepared by: Todd C. Gansauge, Reactor Supervisor
John S. Bennion, Reactor Administrator