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June 30, 2000

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

Subject: Transmittal of Annual Facility Operating Report for 1999.
Notification of Changes to Facility Telephone Numbers

Dear Sir/Madam:

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 1999. Submission of this report fulfills the requirements of AGN Technical Specification 6.9.1. A copy of this report has also been sent to the Region IV Administrator, as required by the aforementioned technical specification.

Also, please be advised that the three-digit prefix of all telephone numbers to Idaho State University have been changed from "236" to "282".

If you have any questions concerning the report, please contact 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
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

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Idaho State University
AGN-201M Reactor Facility
License R-110, Docket No. 50-284
Annual Operating Report for 1999

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 last 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 120 milliseconds

(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 0.041% $\Delta k/k\ s^{-1}$ ($0.055 s^{-1}) for all 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 75.0 hours thereby generating 2.90 watt-days (69.5 watt-hours) of thermal energy during this reporting period. A summary of monthly operations for 1999 is given in Table I.

Table I. Summary of Monthly Reactor Operations
(1 January 1999 through 31 December 1999)

Month	Hours	Energy (W-hr)
January	0.0	0.00
February	2.3	0.00
March	11.7	0.40
April	9.1	7.57
May	15.4	14.81
June	27.0	42.31
July	2.7	4.25
August	0.0	0.00
September	0.0	0.00
October	2.6	0.01
November	0.0	0.00
December	4.2	0.13
Total	75.0 hr	69.48 W-hr

3. A. Unscheduled Shutdowns and Corrective Actions Taken.

None.

B. Inadvertent Scrams and Action Taken.

3/09/99: While raising Safety Rod No. 1 at 20:33 hours, the reactor scrammed low on Channel No. 1. The position of the Re-Be startup source was adjusted and the reactor was restarted. The problem reoccurred causing two more low level scrams on Channel No. 1 at 20:47 and 21:13 hours.

3/20/99: While measuring the Fine Control Rod worth, at 10:31 hours, the reactor scrammed high on Channel No. 1 due to failure to switch ranges. During the restart attempt, the reactor scrammed low on Channel No. 2. The reactor was restarted without further problems.

3/23/99: While raising power from 0.01 watt to 1.0 watt at 15:21 the reactor scrammed low on Channel No. 1. This was caused by the operator switching the range selector switch two positions instead of one position. Reactor restart was attempted, but Safety Rod No. 2 would not drive because the control element

did not make contact with the electromagnet due to variability in the down position of the drive carriage. The run was terminated to adjust dashpot position to allow the control element to engage the electromagnet.

5/18/99: While increasing power from 0.1 watt to 4.5 watt for sample irradiation the reactor scrammed with no cause indication given. The reactor was restarted and again scrammed while increasing power. A third restart was successful. Line-power voltage fluctuations (noise) were assumed to be the cause of the scrams.

6/10/99: While increasing power from 0.1 watt to 4.5 watt at 14:09 the reactor scrammed with no cause indicated. The reactor was restarted and scrammed with no cause indicated at 14:13. The reactor was restarted and again scrammed without indicated cause at 14:18. Another restart was attempted with the same results at 14:22. At this time it was noticed that the trace on the Channel No. 2 chart recorder indicated the scams occurring at approximately the same power level. The zero and calibration points for the Channel No. 2 amplifier were adjusted and the reactor was restarted. The reactor scrammed again at 14:27 hours with no cause indicated. The reactor was restarted and power was increased slowly (~40 second period) to 4.5 watts. The irradiation continued without further trouble. Suspected cause: drift in Channel No. 2.

6/11/99: At 13:05 hours after operation at a steady power of 4.5 watts for 16 minutes the reactor scrammed high on Channel No. 2. The reactor run was terminated. Suspected cause: drift in Channel No. 2.

6/15/99: During reactor startup at 13:01 hours the reactor scrammed low on Channel No. 3. The reactor was restarted without incident.

6/16/99: During reactor startup at 11:03 hours one of the control elements fell away from the electromagnet. The reactor was restarted without incident.

6/17/99: While increasing power from 0.01 watt to 4.5 watt at 11:09 hours, the reactor scrammed with no cause indicated. The reactor was restarted and again scrammed at 11:12 hours. The reactor was restarted and again scrammed with no cause indicated at 11:29 hours. The reactor was restarted and power was increased very slowly to 4.5 watts. No further problems were encountered. Suspected cause: drift in Channel No. 2.

4. Safety-Related Corrective Maintenance

1/22/99: Mounted replacement dashpot on existing SR-2 mount in the test stand. The

replacement dashpot failed during testing.

2/12/99: While attempting to install modified dashpot, problems were found with the Channel No. 2 amplifier. The N-cell battery was replaced. A blown 3 amp fuse was found and replaced. OA2 tube was observed to be arcing, it was replaced. 6Y6GA/GY6G tube was found not to be heating up, it was replaced. The GBW4 tube was noticed to be arcing. A replacement was acquired and installed the next day.

2/16/99: The installed height of the SR-2 dashpot was adjusted by exchanging metal spacers on the mounting hardware.

2/25/99: Dashpot modification is tested on the test stand.

3/06/99: While continuing dashpot testing the rod drives mounted on the test stand refused to drive down. The center panel lights were noted to be weakly illuminated.

3/08/99: The 30 volt F-61U transformer was replaced with a spare unit. A broken wire was found on the SR-2 terminal strip and repaired. The SR-2 up-limit switch was replaced with a new microswitch. Wires connecting to the SR-2 element engage switch were found to be crushed and shorted. These wires were replaced thereby correcting the problem.

3/23/99: Rubber bushings added to the bottom studs of the Safety Rod No. 2 dashpot to allow for variable carriage position.

3/25/99: Teflon piston in Safety Rod No. 2 dashpot removed for fabrication of additional Teflon piston with provisions for a washer to prevent deformation of the piston under static and dynamic loading by SR-2 control element.

3/30/99: Modified SR-2 dashpot installed and adjusted.

11/22/99: The Channel No. 1 float tube was found to be sticking and not allowing the detector to raise to highest position. The surface of the tube was cleaned of debris and dirt. Function improved.

12/09/99: The Channel No. 2 amplifier was found to be saturating. The amplifier and chart recorder were taken to Physics Department Electronics Technician for service.

12/14/99: The Electronics Technician replaced the EV5886 matched tubes in one of the 4102 input tube assemblies in the Channel No. 2 amplifier. The technician also

cleaned the chart recorder. The amplifier and chart recorder were reconnected to the reactor console and allowed to stabilize. Grounding connections to the console chassis were checked for satisfactory contact.

12/20/99: The operation of Channel No. 2 was verified by comparison with Channel No. 3 behavior. Surveillance Procedure No. 2 was performed to check the trip points and behavior of Channel No. 2.

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 1999.

B. Changes to Procedures.

None.

C. Experiments.

No new or untried experiments or tests were performed during 1999.

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
J. Frank Harmon
Terry W. Smith
Michael E. Vaughan

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: 1.52 μCi.

   The AGN-201 Reactor was operated for 75.0 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 1.52 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 1999 through 31 December 1999)

Month	Ar-41 (μCi)
January	0.000
February	0.000
March	0.009
April	0.165
May	0.323
June	0.924
July	0.093
August	0.000
September	0.000
October	0.000
November	0.000
December	0.003
Total activity:	1.517 μCi

   C. Solid Waste - Total Activity: None.

8. Environmental radiation surveys, performed at the facility boundary while the reactor was operating at 70% of full licensed power (3.5 watts), measured a maximum combined neutron and gamma dose equivalent rate of less than 0.5 mrem hr^{-1} at the outside walls of the building proximal to the reactor.

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	1/1/99 - 12/31/99	Regular
John S. Bennion	1/1/99 - 12/31/99	Regular
Kermit A. Bunde	1/1/99 - 12/31/99	Occasional
Todd C. Gansauge	1/1/99 - 12/31/99	Regular
Dirk Howlett	1/1/99 - 12/31/99	Occasional
Raed Jaber	1/1/99 - 12/31/99	Occasional
Sad Jarall	1/1/99 - 12/31/99	Occasional
Michael F. Jolley	1/1/99 - 12/31/99	Occasional
Jay F. Kunze	1/1/99 - 12/31/99	Regular
Gary McLaughlin	1/1/99 - 12/31/99	Occasional
Jon McWhirter	1/1/99 - 12/31/99	Regular
Joseph Nielsen	1/1/99 - 12/31/99	Occasional
Alan G. Stephens	1/1/99 - 12/31/99	Occasional
Miles Whiting	1/1/99 - 12/31/99	Occasional

Dose Equivalent summary for Reporting Period:

Measured Doses

1/1/90 - 12/31/99 Whole-Body Dose Equivalents: $\leq$10 mrem for most personnel.
Minimum Detectable Dose Equivalent per Monthly Badge = 10 mrem.

None of the 155 visitors to the facility during 1999 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 IV.

Table IV. Summary of Whole-Body Exposures
(1 January 1999 through 31 December 1999)

Estimated whole-body exposure range (rem):	Number of individuals in each range:
No Measurable Dose	10
Less than 0.10	4
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: Todd C. Gansauge, Reactor Supervisor
John S. Bennion. Reactor Administrator