UNM SCHOOL of ENGINEERING

Department of Nuclear Engineering

September 24, 2020

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Enclosed is the 2020 Annual Report for the AGN-201M reactor located at the University of New Mexico - Docket 50-252.

Sincerely,

Carl A. Willis
Chief Reactor Supervisor

Gary W. Cooper, Ph.D.
Reactor Administrator

ec: *Ed Helvenston: Edward.Helvenston@nrc.gov*

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REPORT ON FACILITY LICENSE NO. R-102

THE UNIVERSITY OF NEW MEXICO

JULY 1, 2019 - JUNE 30, 2020

The University of New Mexico's AGN-201M reactor was only used for teaching and training during 2019-2020. There were no changes in facility design, performance characteristics, or operating procedures related to reactor safety during the reporting period.

COVID-19 pandemic controls adopted by UNM in the second quarter of 2020 impacted the use of the reactor; during the period of 3/19/20 - 6/7/20, no operation occurred. In typical years, the reactor logs extensive teaching laboratory use during this period. Student Reactor Operator candidates studying for RO licensure in the Fall of 2019 had been expected to sit for NRC examinations in the Spring of 2020, but this was postponed. Although reactor use was impacted by the COVID-19 pandemic, reactor staffing, security, and surveillances were unaffected, and licensed staff maintained currency in operating hours during the reporting period.

The AGN-201M Reactor Facility is an essential part of our educational program, including public education, and continues to serve us well. The use of the reactor from July of 2019 through June of 2020 was as follows:

Type of Use	**July 1 - June 30 Hours**	**July 1 - June 30 Watt-hours**
Class Demonstrations	0.15	0.08
Faculty Research	0.0	0.0
Graduate Student Research	0.0	0.0
Maintenance and Equipment Check	1.22	3.64
Operator Training and Requalification	17.70	17.6
Teaching	40.95	113.3
Totals for the Year	**60.02**	**134.6**

There were no changes to the facility as it is described in the application for license and amendments thereto, nor were there any changes to the procedures as described in Facility Technical Specifications. No new experiments were performed during the reporting period.

During the reporting period, there were no unplanned scrams. An event occurred on February 25, 2020 in which Safety Rod 1 failed to scram during preoperational testing. This was reported via telephone to the NRC as Event Number 564546 at 18:15 ET, 2/26/2020, as well as to members of the Reactor Safety Advisory Committee (RSAC). Reliable scram behavior of SR1 was restored with the application of a piece of Scotch tape between the rod scram magnet and its driver plate (or armature). Investigation into root causes and a permanent resolution of the issue is ongoing during this reporting period. A written narrative summary concerning this event was submitted to the NRC and is appended to this report for reference.

One maintenance activity was undertaken, the replacement of a defective microswitch on the water level sensor in the shield tank, deemed like-for-like in 10 CFR 50.59 review. A replacement of the entire water level sensing mechanism is envisioned in the future with the goal of making the mechanism more durable and less susceptible to corrosion-induced failure.

During the reporting period, there was no liquid radioactive waste released from the facility nor was there any solid waste released. The annual environmental radiation survey was performed and is attached to this report. All personnel exposures during the reporting period were below 50 mrem per person with the majority of personnel receiving below 5 mrem. No facility visitors received measurable exposures.

An outside environmental survey (attached to this report) was performed on March 5, 2020. At 61% licensed operating power, the highest reading outside the facility was 0.168 mR/hr gamma with 0.8 mrem/hr neutron dose rate.

Carl A. Willis took over the role of Chief Reactor Supervisor from Dr. Robert D. Busch, effective July 1 2020, which is outside the reporting period by one day; this information will also be placed on the 2021 Annual Report.

Dr. Charles Fleddermann continued in his role of Interim Chair, Department of Nuclear Engineering, throughout the reporting period. Incoming permanent Chair Dr. Hyoung Koo Lee is expected to take office on August 3, 2020.

The current personnel assignments are (as of June 30, 2020):

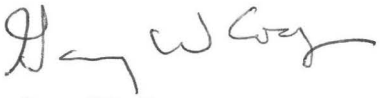
UNM President	Garnett Stokes
Interim Chair, Dept. of Nuclear Engineering	Charles Fleddermann
Reactor Administrator	Gary W. Cooper
Chief Reactor Supervisor	Robert D. Busch
USNRC-licensed Senior Reactor Operators	Robert D. Busch Ken Carpenter Gary Cooper Carl Willis
USNRC-licensed Reactor Operators	Rowdy Davis Jacob Hunt

The makeup of the Reactor Safety Advisory Committee as of June 30, 2020 is:

James Bryson
Matt Burger
Charles Harmon II
David Hayes
David Hindera
Ron Knief
David Summers

There are currently no vacant positions on the committee.

The University of New Mexico's AGN-201M reactor continues to be used extensively for teaching experiments as a part of our undergraduate and graduate programs. These experiments include approach-to-critical, reactor period and reactivity measurements, importance functions measurements, sample activation, control rod calibrations, and reactor power and neutron fluence measurements. The reactor is also used throughout the Fall, Spring and Summer sessions of the University. All experiments have received prior approval from our Reactor Safety Advisory Committee.



Gary W. Cooper
Reactor Administrator

Attachments: Environmental Survey, copy of Narrative Letter for Event Number 54546

Attachment 1: Environmental Survey

HEALTH SCIENCES
OFFICE OF RESEARCH

RS-40-7-R3 | Nuclear Engineering AGN-201 Reactor Operational Radiation Survey

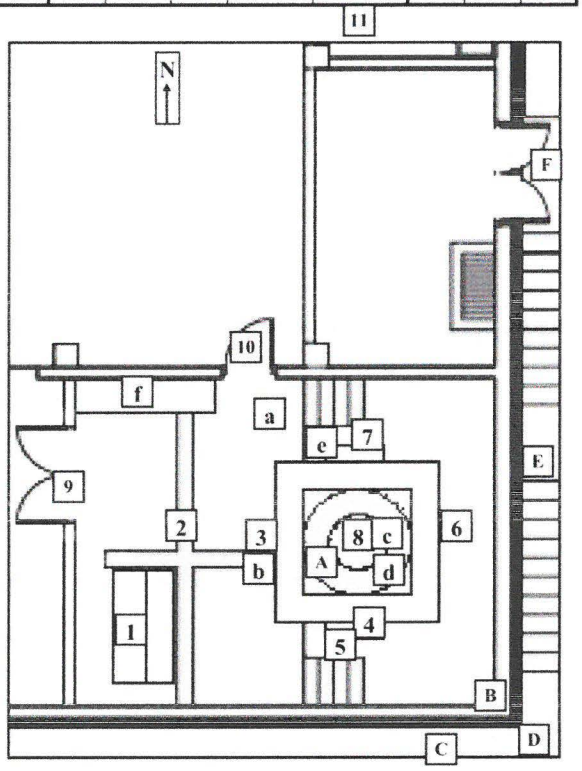
Date: 03/05/2020 ***Surveyed By:*** Mathew Eden

Type of Operation: Routine ***Reactor Power:*** 3.03 watts Max Operating Power 5 watts

Instruments Used:

Make	Model	SN	Detector	SN	Cal date:	Background					MDA (dpm)		
											(α)	(β)	(γ)
Ludlum	9DP	25009135	Internal		08/22/19	In[1]	0.012	Out[2]	0.006	mR/hr			
Ludlum	12	97339	42-4	PR096733	08/26/19	In[1]	0	Out[2]	0	mrem/hr			
Atomlab	950	10080618	Internal		10/24/19	206				cpm			122
Protean (1)	MPC 900	11178004	Internal		04/12/19	(α)	0.27	(β)	70	cpm	7	154	
Protean (2)	MPC 900	11178005	Internal		04/15/19	(α)	0.87	(β)	78	cpm	9	172	

	Location	γ dose rate (mR/hr)	neutron dose rate (mrem/hr)
Reactor Room 065			
1.	Console	0.550	1.2
2.	Center – west wall and reactor	1.570	2.4
3.	Reactor - glory hole access*	10.000	20.0
4.	Reactor - south tank shield	14.700	10.0
5.	Reactor - south skirt shield	2.500	24.0
6.	Reactor - east wall	16.100	8.0
7	Reactor - north wall	16.100	12.0
8.	Reactor - top center	178.000	38.0
9	West door	0.500	2.8
10.	North door	1.480	3.6
11.	Facility manger office 085	0.026	0.0
Outside Measurements			
A.	Roof top - 10' in from S and E sides	0.022	0.0
B.	Roof top - SE corner	0.015	0.0
C.	5' W of SE corner - waist level (1m)	0.014	0.0
D.	SE corner of building - ground level	0.013	0.0
E.	Lower flower bed - ground level	0.162	0.4
F.	Service doors - east side of building	0.168	0.8



Smear Survey Results
Results (net dpm)

	Location	α	β	γ		Location	α	β	γ
a.	Floor – north entry, stair case	0	0	0	f.	N. bench top	0	11	20
b.	W. reactor wall – glory hole	0	0	0	g.				
c.	Top of reactor - shield, ports	1	10	3	h.				
d.	Top of reactor - floor	1	9	6	i.				
e.	Stair case hand rail	0	21	28	j.				

Comments:
*Glory hole open
[1] Background measured in room 083
[2] Background measured at NE area of roof

Attachment 2: Narrative Summary Letter for Event Number 54546

THE UNIVERSITY OF NEW MEXICO

Department of Nuclear Engineering

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USNRC
Washington D.C., 20555

Narrative of Event at the University of New Mexico's AGN-201M Nuclear Reactor
License R-102, Docket 50-252

Around 1:30 pm on Tuesday, February 25, 2020, a pre-operational checkout was being performed on the reactor. As a normal part of that checkout, there are two steps to be done to confirm that the rod interlock is operating and then the reactor shall be scrammed to confirm the operability of the scram system and the control rods.

The interlock check involves:

1. Check Safety Rod #2 and the Coarse Control Rod are not operable without Safety Rod #1 fully inserted.
2. Fully insert Safety Rod #1. Then check to make sure the Coarse Control Rod is not operable unless Safety Rod #2 is fully inserted.
3. Fully insert Safety Rod #2. Then insert the Coarse Control Rod at least 5 cm to verify operability with the full insertion of Safety Rods #1 and #2.

The interlock check was done and all requirements fulfilled.

Then the manual scram check is to be performed by pressing the manual scram button.
At this point, Safety Rods #1 and #2 and the Coarse Control Rod should scram. However, it was determined that only Safety Rod #2 and the Coarse Control Rod scrammed. Safety Rod #1 was still "attached" to the magnet and was being driven out along with the drive motor.
At this point, we were not in compliance with the Limiting Conditions for Operations, 3.2 Reactor Control and Safety Systems, part a. The fine control rod, coarse control rod, and the two safety rods shall be operable and the carriage position of the fine and coarse control rods shall be displayed at the console whenever any rod is above its lower limit.

Assuming that one of the conditions of "operable" for the Safety Rods is that they scram when requested, then Safety Rod #1 was not operable.

To evaluate the situation, Safety Rod #1 was driven in and then subjected to a couple of Manual Scram signals. In all of these tests, Safety Rod #1 did not scram (The fuel bearing rod and control plate did not separate from the electro magnet). At this point, the rod was removed from the reactor and put on the test bench. A series of tests were performed to determine the cause of the problem. The current to the magnet was being removed upon initiation of a scram, the Safety Rod #1 associated scram electronic components were checked and found to be in working order.

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2. JL

Finally, it was determined that the rod and plate were "sticking" to the magnet, but could be separated when the rod was subjected to some downward force. The plate and bottom of the magnet were cleaned as much as possible. The rod scrammed the first time, but not subsequently. Then scotch tape was placed on the plate to break any potential air seal and provide a 0.05 mm offset. After this was done, the rod performed as expected; scramming each time the manual scram was pushed. After a series of tests to assure correct operation, the scram time was measured three times. The results were; between 345 and 350 milliseconds for the three tests. Thus, Safety Rod #1 was returned to its operable condition. The rod was reinstalled in the reactor and test to assure that it would scram in its operational configuration.

After consultation with our Reactor Safety Advisory Committee (RSAC), we were given the go ahead to restart. We will continue to do the pre-op check outs and keep a sharp eye on the behavior of Safety Rod #1. The issue with Safety Rod #1 did not affect the shutdown margin of the reactor, and at no time was the reactor operated when Safety Rod #1 was not in operable condition. We plan to do follow up maintenance and problem identification the week f March 9th. We have a simple gauss meter that will allow us to determine if either the plate or the magnet has residual magnetism. This will be checked for all three scrammable rods (Safety Rod #1, Safety Rod #2, and the Coarse Control Rod). If there is residual magnetism, then we will use a demagnetizer on the affected areas.

Previous Event – Found out that a similar issue occurred many years ago at Idaho State University's AGN-210. According to Dave Clovis, who was there at the time:
"The armature eventually becomes magnetic. We put a capacitor in the circuit for each magnet. This dissipates the magnetic field quickly."

We have checked our current circuitry and found both capacitors and diodes on each magnet. These were included in the console redesign of 1970 for the specific purpose indicated. We did a check on the diodes and all appeared to be operational.

Robert D. Busch
Chief Reactor Supervisor
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Event Number 54546, called in 18:15 Eastern Time, 2/26/20