



February 16, 2020

Document Control Desk

U.S. Nuclear Regulatory Commission

Washington, DC 20555-0001

Subject: Report of NCNR declaration of Alert

Ref: NRC Event Report 55094, Docket 50-184, Facility License TR-5

Sirs and Madams:

On February 3, 2021, the NCNR (NIST Center for Neutron Research) declared an alert as a result of detecting fission products in the helium sweep gas above the reactor and elevated readings on the ventilation stack monitor. An initial report to the NRC Operations Center was made that day in accordance with TR-5 TS 6.7.2(1)h and TR-5 Emergency Plan 7.1. There was no time in which any technical specification was violated. This letter is a 14-day report of that occurrence, as required by TS 6.7.2(1).

### **Circumstances Prior to Event**

The NCNR research reactor (NBSR) operates 24/7 on a nominal 38-day fuel cycle. On February 3, the NBSR was undergoing a routine startup following a normal maintenance and refueling period. Startup of the reactor began at 0816 and reactor power was taken to 10 MW (half power) at 0900, as is routinely done during a startup.

### **Circumstances of Event**

At 0906, the operator began raising power to go to full power. At 0907, when the reactor power had just reached 15 MW, there was a sudden drop in power, down to about 7 MW, followed less than a minute later by sudden increases on several radiation monitors, including the stack radiation monitor, RM 4-1. At 0909, the stack monitor reached its setpoint of 50kcpm, tripping a major scram, which scrams the reactor and seals the confinement building, preventing the possibility of any further release. Based on the fact that the fission product monitor in the helium sweep gas system indicated well above the 50kcpm criteria for an alert, the reactor shift supervisor recognized the potential for a fuel cladding failure and declared an Alert at 0916, in accordance with NBSR Emergency Instruction 0.3 2.2.2.

At 0910, because of increasing radiation levels in the confinement building, the building was evacuated of all personnel (a total of eight people) except for the reactor shift

supervisor and Chief of Reactor Operations (CRO), who stayed behind a few minutes to assure that the reactor was in a safe condition. The CRO contacted the Chief of Reactor Operations and Engineering (CROE) at 0921. The CROE contacted the NCNR Director at 0927 and notified the NRC of the Alert declaration at 0929.

Of the personnel present in the confinement at the initiation of the event, six were either in the control room or near the reactor top and exposed to the release. Their clothing was found to be contaminated. In addition, four individuals entered the confinement later at 1205 wearing protective clothing to align the reactor systems for a shutdown configuration.

Site boundary radiation surveys began at 0912 and continued throughout the event. Air grab samples and charcoal/particulate samples, both at the 400 m EPZ boundary and from the stack were taken throughout the day. All stack samples taken showed the presence of fission product gases. Initially Cs-138 and Xe-138 were the primary isotopes seen on the stack samples, with later stack samples showing primarily Xe and Kr isotopes. No iodine isotopes were seen on any air sample. The initial air sample taken at the boundary at 1040 showed a very small concentration of Cs-138 at 0.5% of 10CFR20 Appendix B Table 2 values. All other boundary air samples did not show the presence of any radioisotopes, with the exception of one taken on Feb 4, which showed very minute concentrations (< 0.1% EC) of Xe-133 and Xe-135.

Due to the difficulty of ascertaining the quantities of Kr-83m and Kr-85 (which are pure beta emitters), it was necessary to extrapolate stack measurements to try and quantify the potential dose at the boundary. We were able to determine that all isotopes were below our detection limits at the fence line which allowed for the downgrading from an Alert to a Notice of Unusual Event (NOUE) and NRC was notified at 1532. Further analysis during the day was able to better quantify the maximum levels and at 1935 we were able to determine that all isotopes were below 50 EC, at which point we terminated the NOUE.

## **Discussion**

Initial internal and external dose assessments based on electronic personal dosimeters (EPD) worn at the time were made on the ten exposed individuals. Results showed that the maximum external dose was on the individuals leaving the control room last, being 200 mrem. Based on initial assessments, internal doses are low. Further analysis and sampling are ongoing and will be used to further refine doses to personnel.

Radiation dose monitors at the NIST fence line did not show an increase in the dose rate during this event. An analysis of all air samples taken indicate the dose at the 400m boundary as a result of this event was less than 0.5 mrem.

In a review of this event so far, indications are that no regulatory limits for NIST personnel or members of the public were exceeded, that all reactor protection systems and instrumentation performed as designed, and that personnel responded appropriately and adroitly.

**Cause of Event**

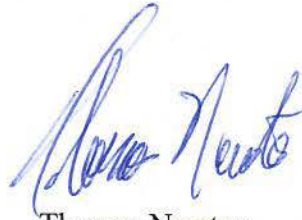
Determination of the cause of this event is under investigation. Imaging equipment has been obtained to ascertain the state of reactor fuel. Once this is done, a root cause investigation will be performed, and corrective actions implemented before the reactor will be authorized for restart. Results of this investigation will be shared with NRC.

Please feel free to contact the undersigned if you have any questions.

Respectfully submitted,



Robert Dimeo  
Director  
NIST Center for Neutron Research



Thomas Newton  
Deputy Director and Chief of Reactor  
Operations and Engineering  
NIST Center for Neutron Research