

March 19, 2021

Executive Director for Operations (EDO)
ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

REFERENCE: Docket No. 50-186
University of Missouri-Columbia Research Reactor
Renewed Facility License Operating License No. R-103

SUBJECT: Written communication as specified by 10 CFR § 20.1007 regarding a reportable event pursuant to § 20.2203(a)(2)(iv)

The University of Missouri Research Reactor (MURR) submits this letter to report a condition pursuant to § 20.2203(a) regarding the dose limits for an individual member of the public in § 20.1301(a)(2).

During maintenance activities on March 4, 2021, on the Mo-99/Tc-99m generator production line, vials of Mo-99/Tc-99m were moved from the inside of the hot cell to an attached shielded glove box. This was done in an effort to lower dose rates within the working space during the maintenance activities. These vials remained in the shielded glove box until the next day. On the morning of March 5, 2021, at approximately 11:00am, a radiation worker removed the vials from the shielded glove box and placed them into an adjacent piece of equipment for temporary storage. At approximately 3:00pm on March 5, 2021, during a routine lab survey, a Health Physics (HP) Technician discovered that the material had created an elevated dose rate within the lab space. At this time, the HP Technician exited the lab and secured the room by having the badge access to the room disabled.

On March 8, 2021, the vials were removed from the equipment under the supervision of an HP Technician and returned to the primary hot cell for long-term storage. This action removed all elevated dose rates in the area. At this time, it was discovered that the radiation worker who originally removed the vials from the hot cell was unaware that the samples were only in the glove box due to maintenance and had assumed that they were decayed samples ready for removal per routine practice. This misunderstanding of the decay period resulted in a misjudgment of the required shielding necessary to store the material. The elevated dose rates resulted in a dose to an unrestricted space (exterior of building) in excess of the public dose limits set in § 20.1301(a)(2).

The following is a description of the event per 10 CFR § 20.2203(b):

(i) Estimates of each individual's dose:

Through the use of camera footage, badge reader logs, and electronic dosimetry, it was determined that no member of the public received any measurable dose from this event. The area in which a dose field was present on the exterior of the building is within the gated perimeter of the research reactor facility and monitored by security cameras. Using camera footage, it was determined that no member of the public entered the dose area and thus no dose above the public dose limit was received. Additionally, there were no members of the public within this production area of the facility during the event, and no dose was received within the facility by a member of the public.

All radiation workers who were present in the area during the event were monitored with electronic dosimetry and did not exceed any level of exposure beyond normal work conditions.

(ii) The levels of radiation and concentrations of radioactive material involved:

At the time of the incident, dose rates were taken within the posted radiation work area and were recorded as approximately 1000 mrem/hr on contact with the storage device, and approximately 500 mrem/hr at 30 cm away. These dose rates were coming out of the front of the device and were entirely contained within an appropriately posted radiation laboratory in which badge access is required and all personnel wear both monthly-read dosimetry and instantaneous electronic dosimetry.

The higher-than-normal dose rate was discovered during a routine laboratory survey performed by a radiation safety technician. At the time of discovery, no dose rate was taken on the external wall of the facility. Access to the room was restricted at the time of discovery (afternoon of Friday, March 5, 2021), and the material was removed and placed into a more heavily-shielded area the following work day (morning of Monday, March 8, 2021). No access to the room was granted once the elevated dose rate was discovered. The material was originally placed into the storage device approximately 4 hours prior to discovery (late morning of Friday, March 5, 2021).

After reconstruction of the event, it was determined that this event resulted in a dose rate external to the building of 10 mrem/hr on contact with the building, and 7 mrem/hr at 30 cm away. Additionally, a dose rate was taken at the nearest walking path which yielded a negligible dose rate of <0.5 mrem/hr. Camera footage of the area was used to determine that no person walked closer to the building than this walking path and thus no person was in a dose area that exceeded the public dose limit because of this event.

The radioactive material involved in this event was a combination of multiple vials of Mo-99/Tc99m (half-lives of 66 and 6 hours, respectively) material used in the production facility of Mo-Tc generators. These vials are the result of flushing the system to ensure the system is primed for the next production run. They are held in the hot cell post-processing for storage and decay. The estimated activity of the combination of vials is 13 Ci of Mo-99. The material was removed from the hot cell during routine maintenance and placed in a piece of measurement equipment that utilized 1.5 inches of lead shielding in the front and 0.5 inches of lead shielding on the back.

(iii) The cause of the elevated exposure levels:

The root cause of the elevated exposure was the lack of understanding of the shielding necessary to prevent excessive dose rates in the area that this event occurred. In this case, a lead-shielded piece of equipment was used for storage of vials containing radioactive material. However, the shielding was not adequate for the amount of activity that was placed into the device. This problem was compounded by the fact that the equipment was positioned on an exterior facility wall. The elevated exposure was experienced on the exterior wall of the building directly on the back side of this piece of equipment.

A contributing factor to the elevated exposure was that the normal storage location for the material in question was inoperable at the time of the occurrence. Also, a lack of communication by radiation workers in this part of the facility led to a misunderstanding of the true activity of the vials. Additionally, the production line was performing developmental work in addition to normal production work, which resulted in a limited amount of in-cell storage space.

The final factor was a lack of HP staff involvement at the point in time the material was removed from its original shielded environment. If HP staff would have been present, then a complete assessment of the area would have occurred and a dose rate would have been taken, thus preventing dose rate external to the building to exceed the public dose limit of 2 mrem in any hour.

(iv) Corrective steps taken or planned to ensure against a recurrence:

- Initial action taken upon discovery of the event included disabling badge reader access to the room to secure against further personnel exposure. This secured the area and contained the created HRA. Additionally, the material was returned to the hot cell to provide additional shielding as soon as was practical on the next business day.
- Procedural changes will be made in the area that will require increased HP involvement in removing items from hot cells and glove boxes. This corrective action will prevent future instances of inadvertently creating high dose rate areas by increasing immediate knowledge of dose rates from items as they are removed from shielding.
- Additional surveys were taken on the exterior of the building during other uses of the equipment involved in this event. Those additional surveys were taken during worst case routine use of the equipment (largest activity using device's primary function). These surveys demonstrated that dose rates external to the building remained lower than the 2 mrem/hr limit. These surveys will continue to be performed in future instances where dose rate may be a concern.
- Members of the Mo-Tc generator production team and HP Technician staff were informed of the event as well as the issues created. Additionally, the same staff will be retrained as soon as practical on all the above corrective actions. The retraining will emphasize the following items:
 - Ensuring all items are removed from hot cells under the supervision of HP and dose rate measurements performed.
 - Understanding of HRA and what should be done if an HRA is created.
 - Understanding how dose rate inside building could affect external building dose rates.
 - Reviewing any procedure revisions.

If there are any questions regarding this report, please contact me at (573) 882-5204. I declare under penalty of perjury that the foregoing is true and correct.

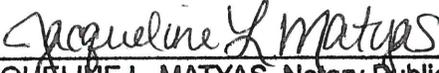
Sincerely,

Daniel Doenges
Reactor Health Physics Manager

ENDORSEMENT:
Reviewed and Approved,

J. David Robertson, PhD
Reactor Facility Director

- cc: Reactor Advisory Committee
- Reactor Safety Subcommittee
- Isotope Use Subcommittee
- Dr. Thomas Spencer, Interim Vice Chancellor for Research and Economic Development
- Mr. Geoffrey Wertz, U.S. Nuclear Regulatory Commission
- Mr. Craig Bassett, U.S. Nuclear Regulatory Commission

State of Missouri
 County of Boone
 Subscribed and sworn to before me this
19 day of March, 2021

 JACQUELINE L. MATYAS, Notary Public
 My Commission Expires: March 26, 2023



JACQUELINE L. MATYAS
My Commission Expires
March 26, 2023
Howard County
Commission #15634308