

# Lessons Learned

## Superconducting Magnet Quenching Incident

November 2023

### What Happened:

A Nuclear Magnetic Resonance (NMR) machine in Natural Sciences 1 (NatSci 1) quenched unexpectedly in early November. During a quenching event, the temperature of the coil windings of the superconducting magnet increases, resulting in the sudden boiling off the cryogenic liquids in the system. Immediately before the incident, a graduate student was performing measurements using the NMR. A sample was collected and analyzed by the graduate student while noting measurements on the NMR, and then walked to the adjacent office to work on a computer, away from the magnet. Although not directly relevant to the incident, the graduate student was wearing closed-toe shoes and long pants, as appropriate for the type of work conducted in this space. Earlier in the day, it was noted that the machine showed no visible signs of impending quenching, as such an event would be visible through a cloud of vapor or ice on the outside of the magnet. The NMR had been used by another individual prior to the graduate student and no issues or impending quenching signs were observed. After the graduate student retrieved his sample from the magnet and walked towards the door at 9:10 am to leave the room, he heard a loud noise and turned to see the magnet quenching. He left the room immediately and notified the PI. As a result of the magnet heating up, helium and nitrogen were released, and the fire alarm was triggered. Occupants evacuated the building.

### Primary factors that contributed to the incident:

Per the SOP for “Superconducting Magnet Filling Procedure”, liquid nitrogen is refilled every week and the SOP was followed by lab personnel. The magnet in NatSci 1 is on a regular schedule to be re-filled with helium and nitrogen. During the last two refills, it was observed that liquid nitrogen would boil off, but after adding additional liquid nitrogen, the instrument would quickly equilibrate and run as normal, thereafter. **Despite observing unusual equipment performance, no reports of these concerns were reported.**

The unreported unusual observation of liquid nitrogen boiling off during the last two refills could have been indicative that the NMR / equipment is reaching the end of its’ usable life span.

### Root Cause of the incident:

The root cause of this incident is the lack of follow-up on observed unusual indicators on the NMR/equipment that may have indicated that the equipment was not properly operating.

**Steps that can be taken to prevent this type of incident:**

- Develop and implement regularly scheduled Preventative Maintenance (PM) plan for equipment.
- Discuss aging equipment with school leadership and plan and timeline for equipment replacement.
- Develop and publish an equipment specific Emergency Action Plan.
- Install a visible and audible oxygen sensor/alarm.
- Ensure smoke detectors close to the machine are not covered by conducting a daily inspection of the workspace.
- Ensure that observations of unusual equipment performance are immediately reported to the PI, school leadership, and EHS.

**Where to Get Help or More Information:**

For more information or assistance, please contact EHS at (949) 824-6200 or at [safety@uci.edu](mailto:safety@uci.edu).