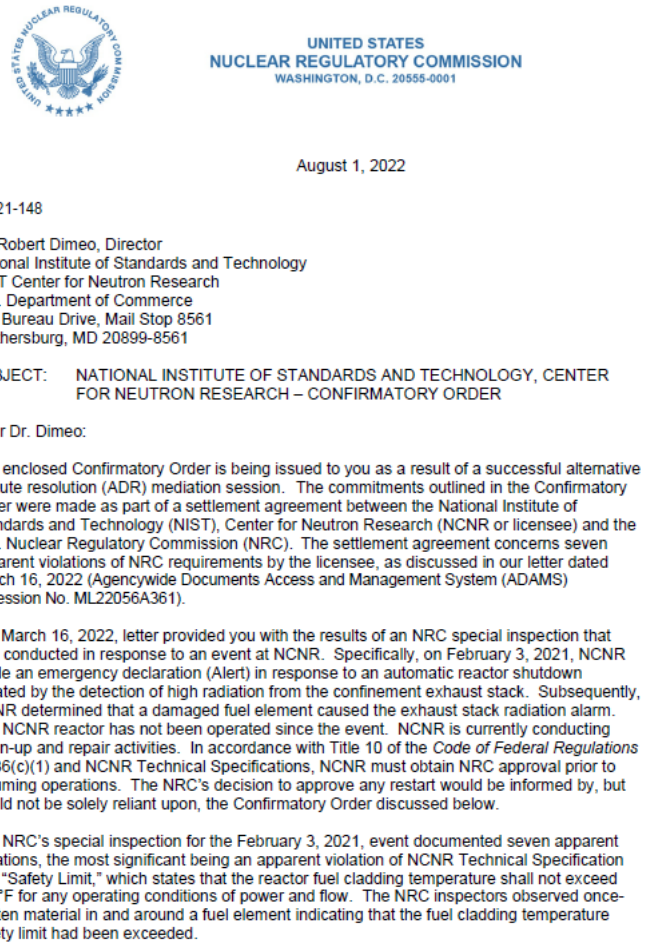
NCNR Status Update

NIST CENTER FOR NEUTRON RESEARCH

08.23.2022

Photo credit: Brian Renegar

Regulatory Developments



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 1, 2022

EA-21-148

Dr. Robert Dimeo, Director
National Institute of Standards and Technology
NIST Center for Neutron Research
U.S. Department of Commerce
100 Bureau Drive, Mail Stop 8561
Gaithersburg, MD 20899-8561

SUBJECT: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, CENTER FOR NEUTRON RESEARCH – CONFIRMATORY ORDER

Dear Dr. Dimeo:

The enclosed Confirmatory Order is being issued to you as a result of a successful alternative dispute resolution (ADR) mediation session. The commitments outlined in the Confirmatory Order were made as part of a settlement agreement between the National Institute of Standards and Technology (NIST), Center for Neutron Research (NCNR or licensee) and the U.S. Nuclear Regulatory Commission (NRC). The settlement agreement concerns seven apparent violations of NRC requirements by the licensee, as discussed in our letter dated March 16, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22056A361).

Our March 16, 2022, letter provided you with the results of an NRC special inspection that was conducted in response to an event at NCNR. Specifically, on February 3, 2021, NCNR made an emergency declaration (Alert) in response to an automatic reactor shutdown initiated by the detection of high radiation from the confinement exhaust stack. Subsequently, NCNR determined that a damaged fuel element caused the exhaust stack radiation alarm. The NCNR reactor has not been operated since the event. NCNR is currently conducting clean-up and repair activities. In accordance with Title 10 of the *Code of Federal Regulations* 50.36(c)(1) and NCNR Technical Specifications, NCNR must obtain NRC approval prior to resuming operations. The NRC's decision to approve any restart would be informed by, but would not be solely reliant upon, the Confirmatory Order discussed below.

The NRC's special inspection for the February 3, 2021, event documented seven apparent violations, the most significant being an apparent violation of NCNR Technical Specification 2.1, "Safety Limit," which states that the reactor fuel cladding temperature shall not exceed 842°F for any operating conditions of power and flow. The NRC inspectors observed once-molten material in and around a fuel element indicating that the fuel cladding temperature safety limit had been exceeded.

Agreement on enforcement actions reached

Final *confirmatory order* and *supplementary inspection plan* issued to NIST August 1st (public meeting held August 16th)

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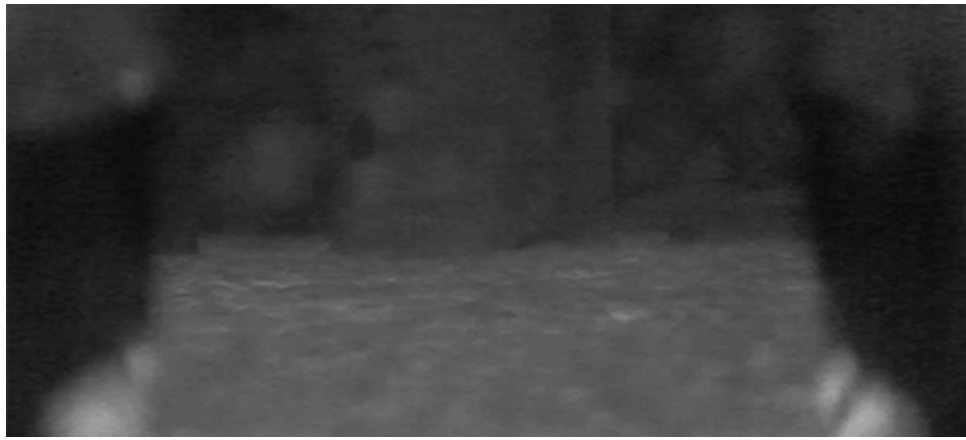
No showstoppers for restart

Progress

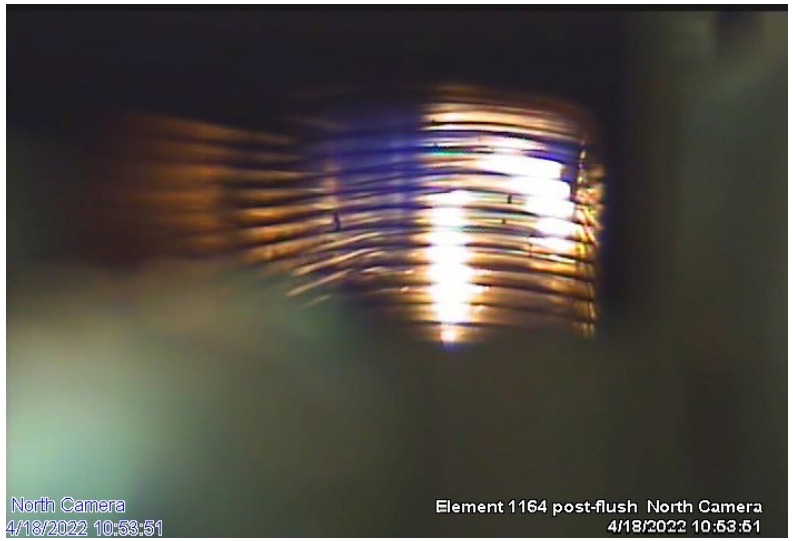
<u>Primary cleanup</u>
Bulk debris removed from reactor vessel
Primary flowed with filter elements
Ultrasonic agitation
CO_2 injection
He sparging

Some improvement in overall radiological conditions in the process room and most work can proceed with controls.



Primary coolant after CO_2 injection

Back-flushed and inspected fuel elements – some small debris remains in fuel elements and precludes reuse



Alternate startup core configuration analyzed and incorporated into restart plan

Completed analysis of consequences of operating the reactor with residual debris in the primary → no impact to health and safety of the public, staff, or environment

Restart plan developed and submitted to NRC August 15th

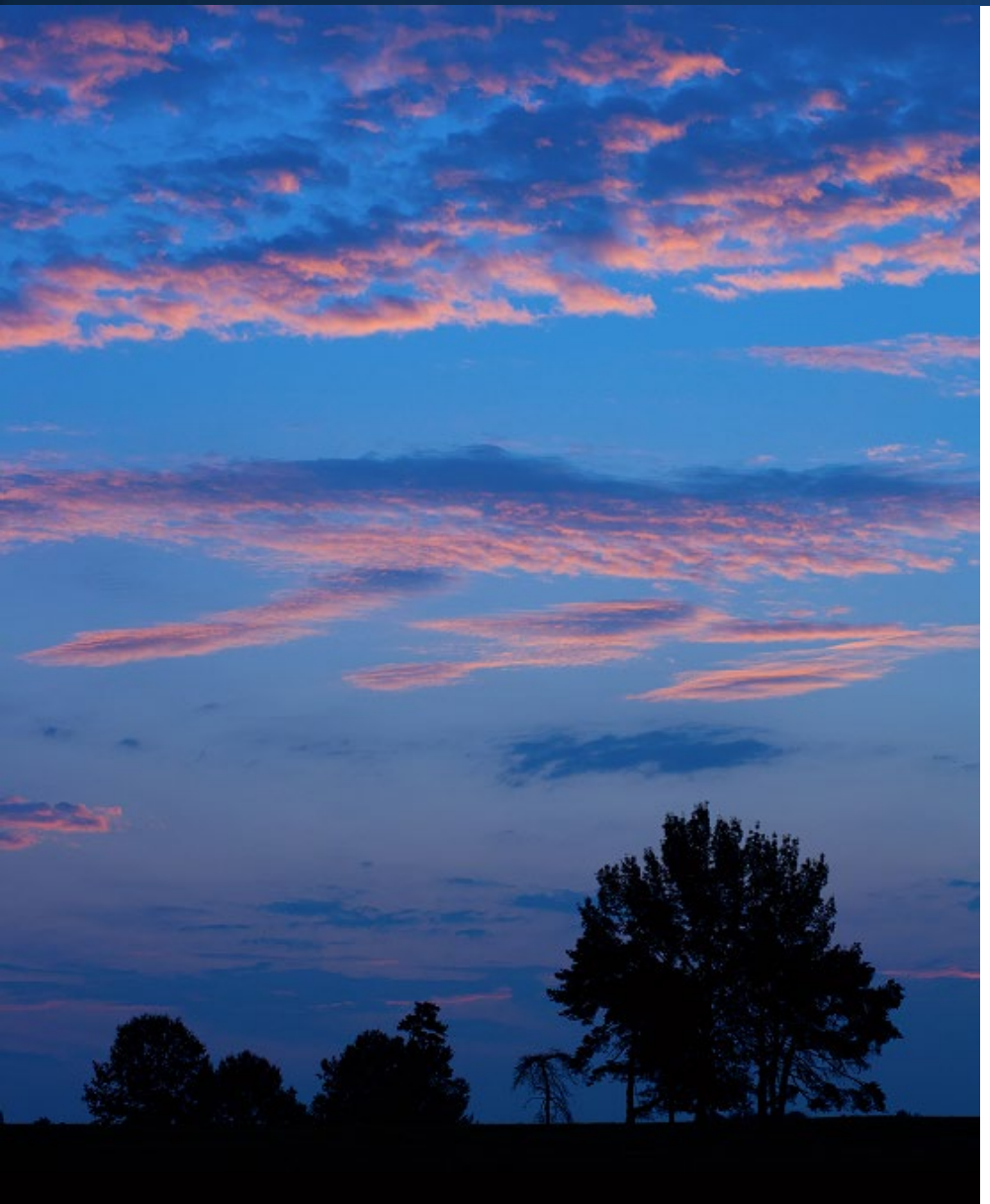
Restart Plan

1 cycle of low-power operations (≥ 6 days) – not opening experimental shutters during testing

4 neutron production cycles (≥ 27 days)

Reduced operations necessary for several cycles – 24 hours/4 weekday – until all unlicensed operators get licensed.

What's Next?



Continue to mitigate hot spots in primary plumbing in the process room

Refuel reactor

NIST & NCNR continue working towards completing many enforcement actions (pre- and post- reactor startup)

NRC performs supplementary inspections prior to startup and beyond
NRC completes Technical Evaluation Report informing restart decision
NRC authorizes restart
NRC/NIST public meeting with local community

Schedule user experiments

Reactor restart

***Technical readiness* restart date: November 1, 2022** ← Does **NOT** include regulatory uncertainties

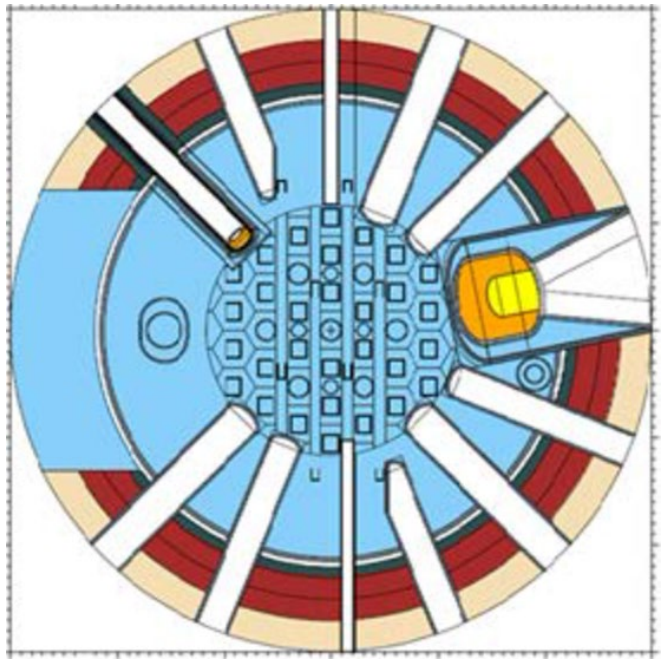
Risk item	Probability	Potential impact
Cleanup of primary inadequate • Unacceptable operating consequences	Medium	High
Concept for startup core cannot be implemented	Low	High
Procedure revisions required for startup delayed	Low	Low
NRC does not authorize restart • Not satisfied with restart plan • Not satisfied with progress towards corrective actions • Protracted deliberations for issuing permission to restart	Medium	High

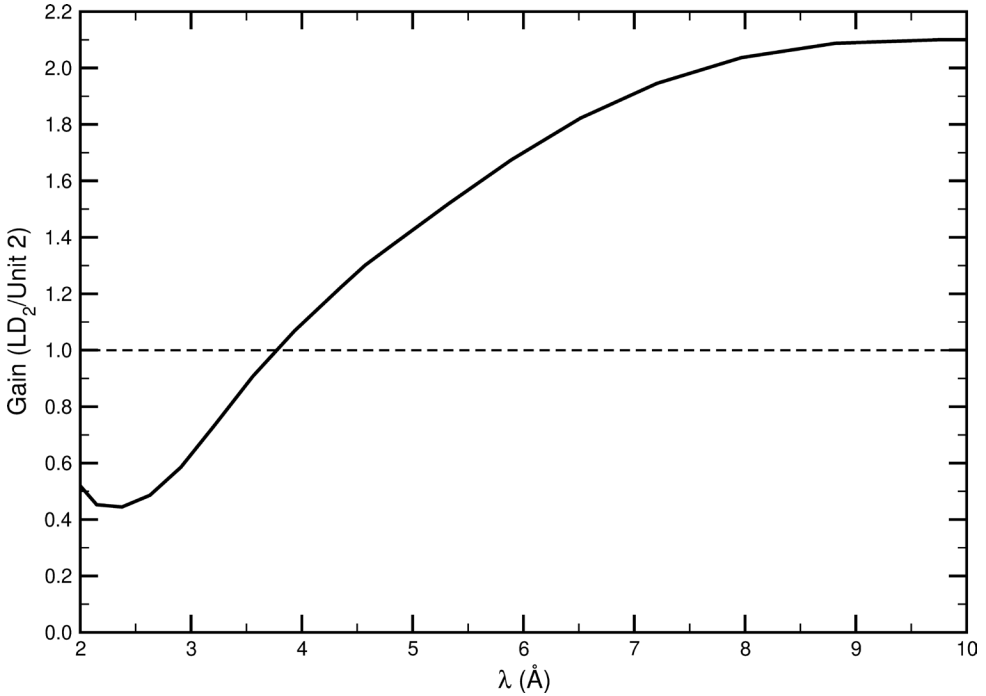
Low impact: will not significantly affect restart
Medium impact: could delay restart until beginning of 2023
High impact: could delay restart until March/April 2023 or later

Note: COVID continues to be a risk that could lead to delays in several of the items above

Cold Source Upgrade Outage

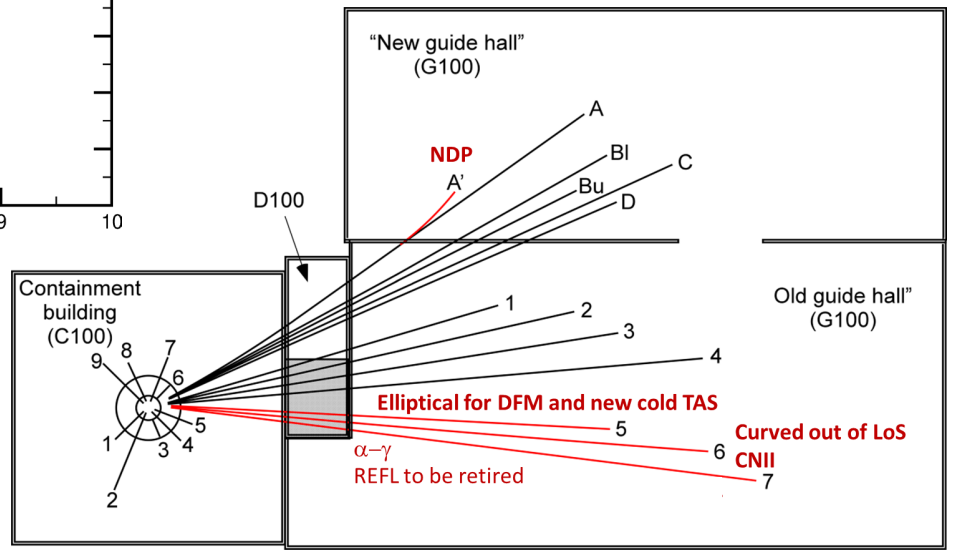
Planned major facility outage to replace the *cold neutron source* and several *neutron guides*





Installation requires a 12-month outage originally planned to start in early 2023

Performance gains for 2/3 of all neutron instruments



Cold Source Outage Decision

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If I think the reactor won't restart by early 2023 **AND** I think we'll have the cold source close to on schedule, we should commit to installing the D2 cold source & new guides ASAP. Earliest possible restart would be September 2023. This plan maximizes long-term operating days.

If I think the reactor is restarting by early 2023, we should commit to operating approximately 4 cycles before installing the D2 cold source & new guides. We divert resources to an accelerated "Plan B" NSE schedule. Earliest we would be ready for an upgrade outage is June 2023. This plan promotes early as possible operation.

Decision by September 6, 2022.