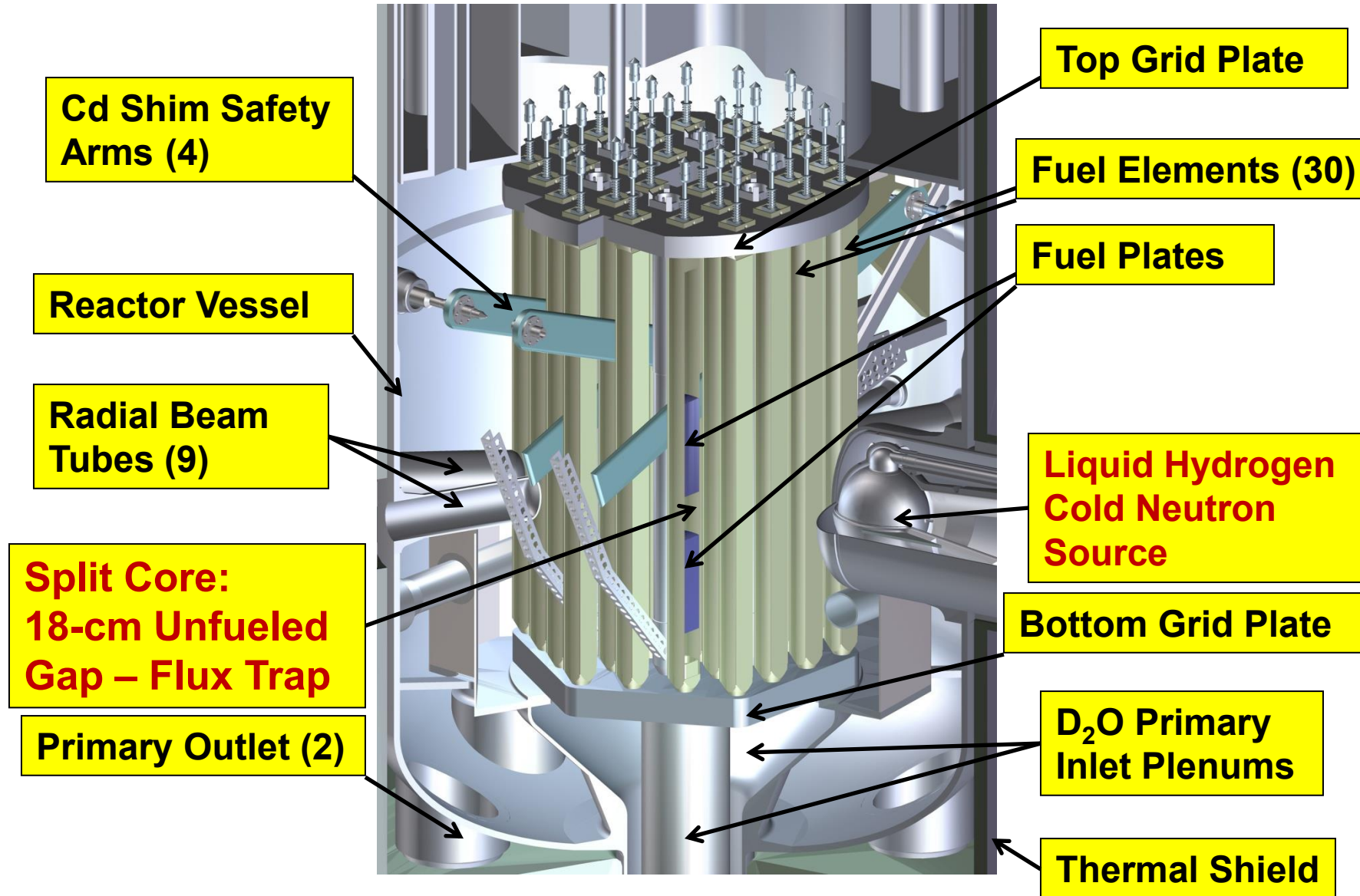


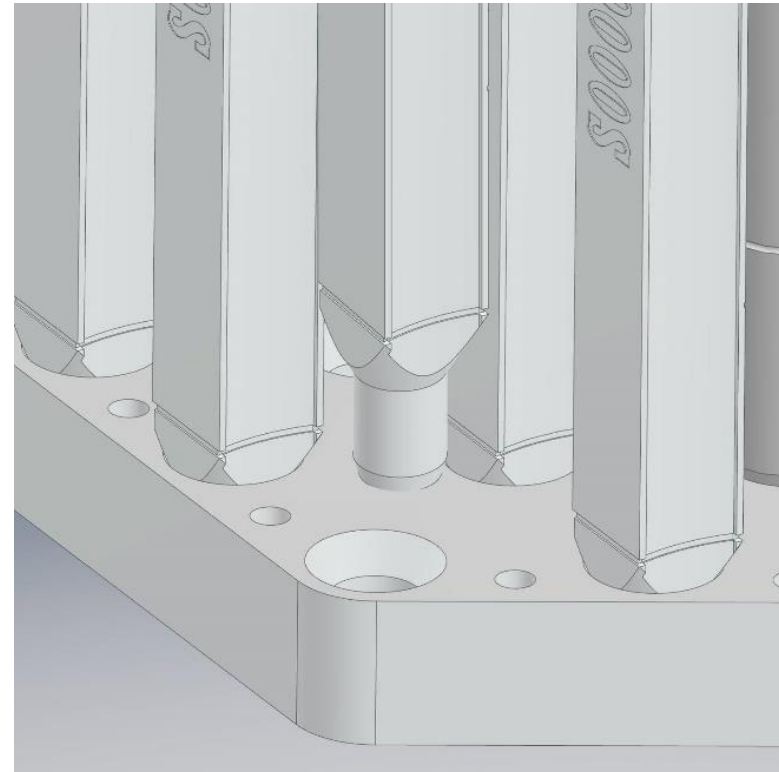
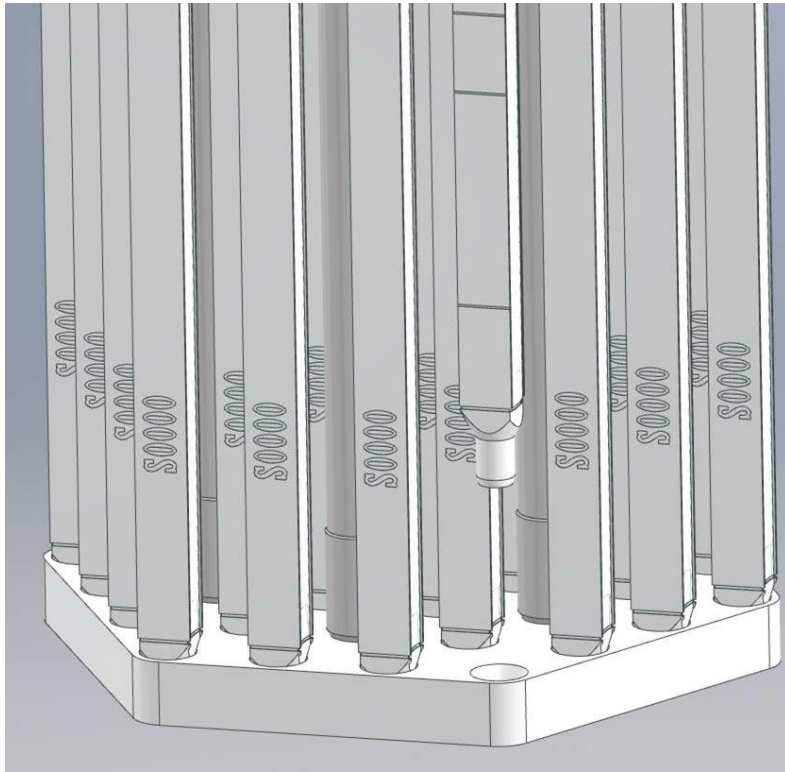
NBSR Recovery: Confirmatory Order, Corrective Actions, Safety Culture, Regulatory Correspondence

Thomas Newton, Ph.D., Chief of Reactor Operations and Engineering
Center for Neutron Research, National Institute of Standards and
Technology, 100 Bureau Dr.,
20899 Gaithersburg, MD, USA

Cut-away View of the NBSR Core



Feb. 3, 2021 event: Unlatched Fuel Element



An unlatched element floats on a jet of primary coolant emitted by the lower grid plate. (right) An unlatched element skews out of its conical seat due to multiple pump starts

- **Change management program**
- **Inadequate management oversight**
- **Culture of complacency, lack of ownership of continuous improvement.**
- **Operator training and qualification program**
- **Procedure use and adherence.**
- **Equipment and tools.**

Corrective Actions

**Programmatic : Aging Reactor Management,
Corrective Action Plan and Continuous
Improvement Plan**

**Procedures: revised to INPO 11-003, increased
requirements for latch checks and procedural
adherence**

**Equipment made for rotational and visual latch
verification**

**Training: enhanced standards for qualification and
proficiency, designed for higher personnel attrition**



Confirmatory Order actions

CO issued August 1, 2022

- 1. Communications to staff – complete**
- 2. Independent nuclear safety program assessment – initial report drafted, under review**
 - 1. Problem ID and resolution (CAP) – complete**
- 3. Operator Training (for startup) – complete**
- 4. Procedure enhancement – 30-month effort**
- 5. Benchmarking with other facilities – ongoing**
- 6. Employee engagement (rewards and recognition)– complete**
- 7. Leadership accountability, safety culture training – awaiting assessment (#2)**
- 8. Technical issues related to the event – on schedule**

Enclosure A

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)	Docket No.: 05000184
National Institute of Standards and Technology)	License No.: TR-5
Center for Neutron Research)	
U.S. Department of Commerce)	EA-21-148

CONFIRMATORY ORDER MODIFYING LICENSE
EFFECTIVE UPON ISSUANCE

The National Institute of Standards and Technology (NIST), Center for Neutron Research (NCNR or licensee), U.S. Department of Commerce (DOC) is the holder of License No. TR-5, issued by the U.S. Nuclear Regulatory Commission (NRC or Commission) pursuant to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR). NIST refers to the larger National Institute of Standards and Technology organization while NCNR refers specifically to the licensee and operator of the National Bureau of Standards Test Reactor (NBSR or reactor). The license authorizes the operation of the NBSR in accordance with conditions specified therein. The facility is located on the NIST campus in Gaithersburg, Maryland.

This Confirmatory Order (CO) is the result of an agreement reached during an Alternative Dispute Resolution (ADR) mediation session conducted on May 10, 2022, May 19, 2022, and June 2, 2022, to address seven apparent violations.

- **October 1, 2021: restart request submitted to NRC including root causes, and corrective actions**
- **NIST provided further supplements by letters between June through November, 2022, discussing the completion of actions necessary to support restart.**
- **NRC supplemental inspection began August 15, 2022**
 - (not to be confused with the special inspection that began Feb. 2021)

Operation with debris

- **Extensive cleanup efforts were made throughout 2022.**
 - However, impossible to assure that all material was removed.
- **After multiple discussions with NRC, it was decided to submit an LAR for operation with small amounts of unclad fuel debris**
 - Submitted October 19, 2022
 - After a round of RFIs, NRC approved LA on February 1, 2023



- **Decision made not to reuse elements from 2/3/21 core**
- **Combination of new and 7-cycle elements to be used**
- **Discussions with NRC on updated SAR vs. NRC approved (2011) version**
 - Sahin presentation
- **LAR submitted Feb 2, 2023 with exigent request**
- **LA approved March 2, 2023**

Path to restart

- **Nov. 28, 2022: NRC completes restart audit process**
- **2023:**
 - February: spent fuel shipment to allow new fuel receipt
 - March 2: Public meeting on restart
 - March 9: NRC issues restart permission, Technical evaluation report:
 - Supplemental Inspection Team findings
 - Confirmatory Order
 - License amendments
 - SSC review, design bases
 - Enhanced oversight
 - March 16: initial criticality and startup to 50 kW

**OFFICE OF NUCLEAR REACTOR REGULATION
TECHNICAL EVALUATION REPORT**

**Concerning The National Institute of Standards and Technology
National Bureau of Standards Test Reactor
Related to Reactor Restart Following Exceedance of the Fuel
Cladding Temperature Safety Limit**

**Renewed Facility Operating License No. TR-5
Docket No. 50-184**

March 9, 2023

Initial (low power) operations have revealed the presence of fission products in reactor He sweep gas

- **Probably ~ 1 gram of material near core**
- **No direct connection from He sweep gas to ventilation. However, minor FP contamination in personnel spaces near ventilation**
- **Small amounts seen in effluents, not near regulatory limits**
- **Short- and long-term engineering fixes in the works**
- **Routine operations at 1 MW started June 1 in preparations for operator licensing**
- **Ascension to higher powers requires an adequate number of licensed operators for 24/7 operations**

Lots more to do!

- **Continued assessments of safety culture progress**
- **He sweep gas and ventilation testing and modifications**
- **Ascension to higher powers**
- **Procedure updates**
- **Stand up training shift**
- **Enhance QA, CAP, and safety programs**

- After 25 Months of outstanding efforts by Reactor Operations, Engineering, Health Physics staff (and NRC!), the NBSR successfully restarted.
- Fission products from small amounts of residual material remain a concern.

Questions?

THOMAS NEWTON

Thomas.Newton@nist.gov

NIST Center for Neutron Research

100 Bureau Drive, Gaithersburg, 20899, USA