

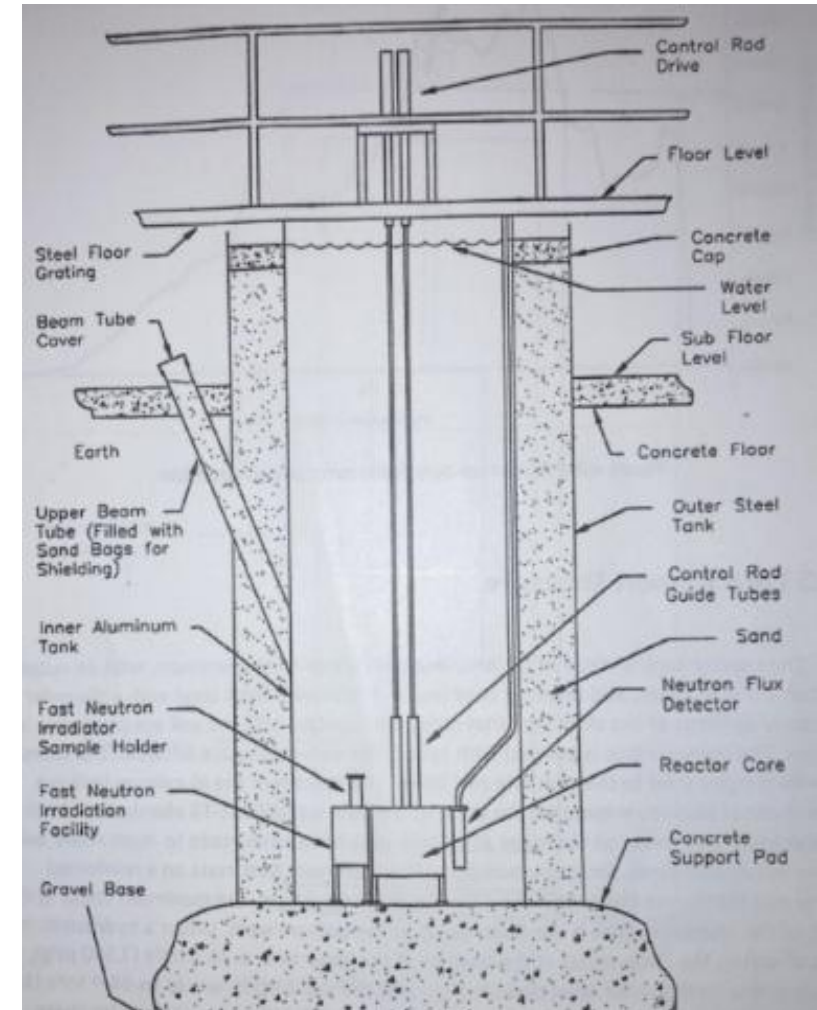
# UUTR Tank Repair Efforts

Andrew Allison | UUTR Reactor Supervisor  
Dylan Ramirez | Lab Assistant



# University of Utah TRIGA Reactor

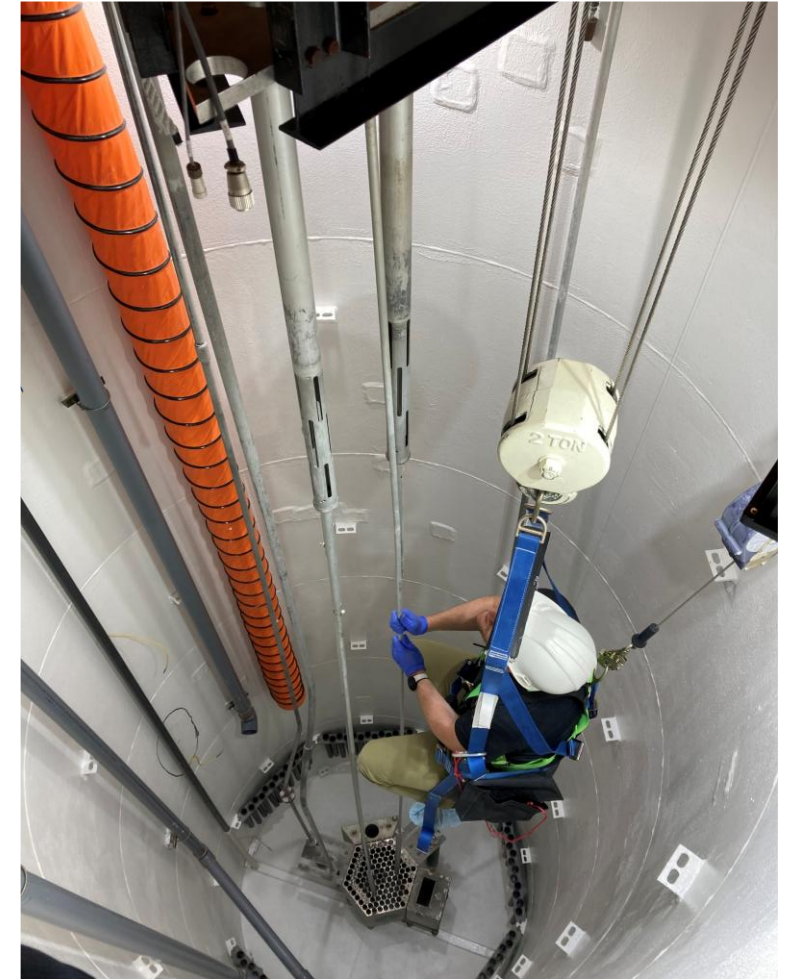
- Natural convection water-cooled pool-type reactor.
- 8000 gallons of water serves as the primary cooling system, as well as a radiation shield.
- Reactor consists of a painted, 5/16in thick aluminum tank (primary tank).
- A secondary tank surrounds the primary tank with a uniform 2ft gap, which is filled with sand.



# Review from TRTR 2025

Between March 2023 and December 2024, the UUTR tank had three identified leaks. The University of Utah then contracted Underwater Engineering Services Inc. (UESI) for inspection and repair of the reactor tank.

Last update concluded with refilling the reactor tank and observation of water level to verify successful tank repair.



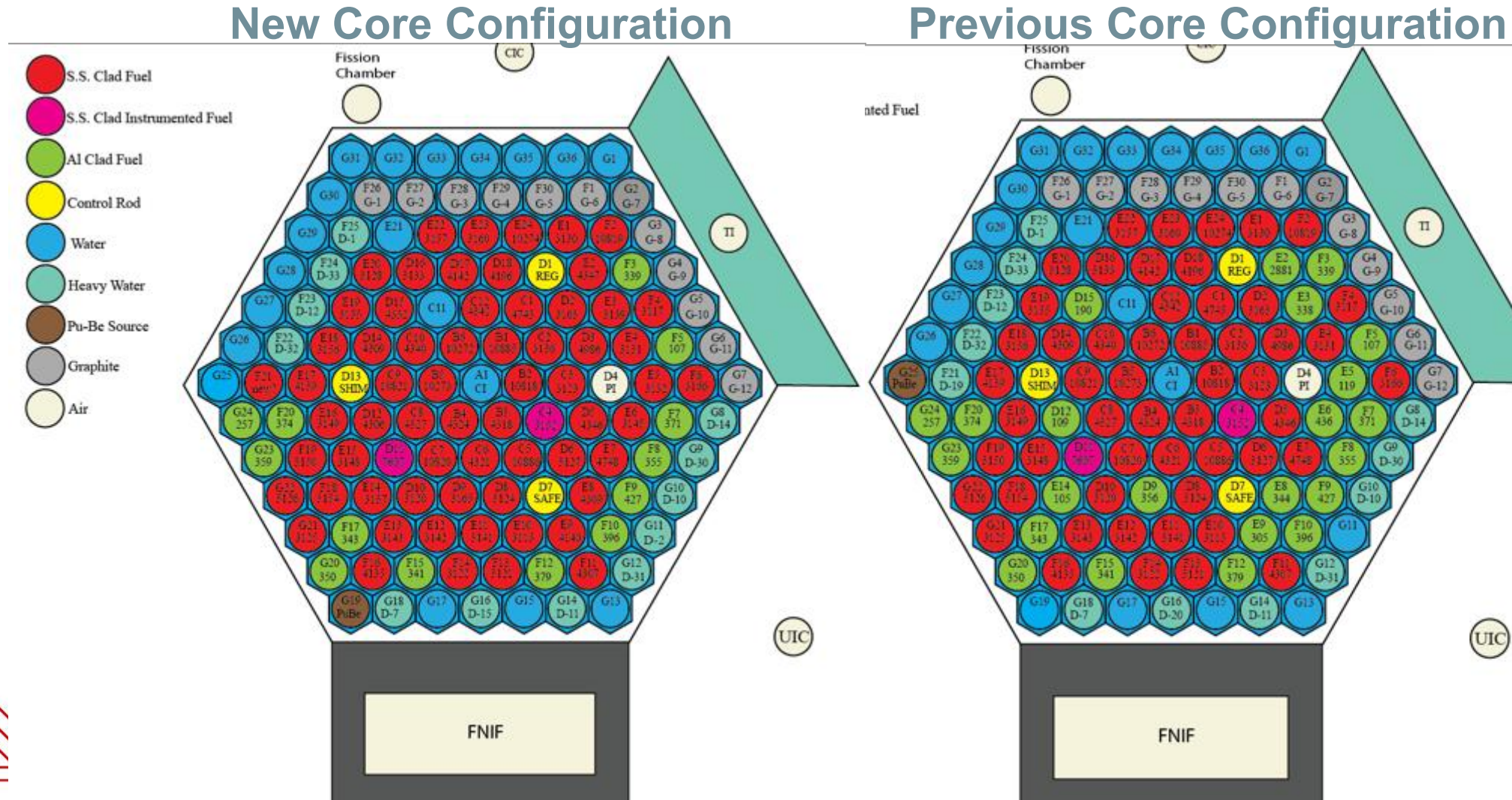
# Recertification of Operators

- Received license exemption from NRC under 10 CFR 55.53(e), which requires that a licensee at a test or research reactor shall actively perform the functions of an operator or senior operator for a minimum of four hours per calendar quarter to maintain an active status. ADAMS Accession number: **ML2507A203**
- Received NRC permission to use alternate site for performing reactor operation portion of annual operating exam IAW 10 CFR 55.59(b). Facility SROs Andrew Allison and Edward Goodell went to Kansas State University for performing a reactor startup and reactivity manipulations.



# Approach to Criticality

New core configuration limits aluminum fuel to just the F and G rings. This allows for a higher maximum fuel temperature in the inner rings.



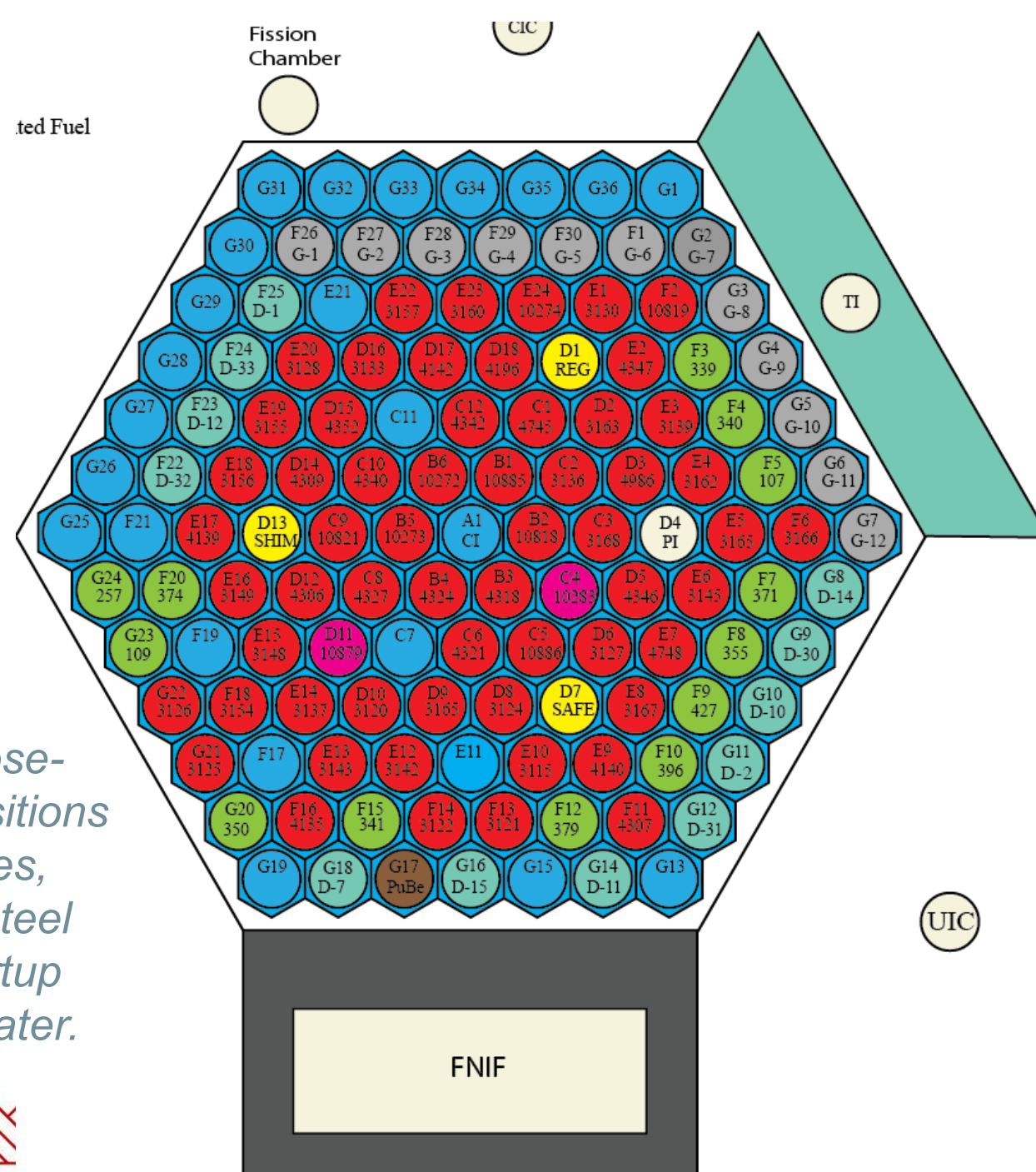
# Approach to Criticality

- Reactor Safety Committee approved a procedure consisting of iterative steps of adding half the estimated number of elements to reach criticality while updating a 1/M plot to validate the estimated number of elements to criticality.

| Number of elements in core | CPS with Rods Removed | CR <sub>0</sub> / CR <sub>n</sub> |
|----------------------------|-----------------------|-----------------------------------|
| 32                         | 3.90                  | N/A                               |
| 42                         | 6.40                  | 0.609                             |
| 47                         | 8.67                  | 0.450                             |
| 58                         | 28.46                 | 0.137                             |
| 65                         | 79.97                 | 0.0488                            |
| 67                         | 118.15                | 0.033                             |
| 69                         | 175.95                | 0.0222                            |
| 71                         | 261.65                | 0.0149                            |
| 73                         | 431.2                 | 0.00904                           |
| 74                         | 576.32                | 0.00677                           |
| 75                         | 1402.45               | 0.00278                           |
| 76                         | 13314.6               | 2.93 E-4                          |
| 77                         | critical              | N/A                               |

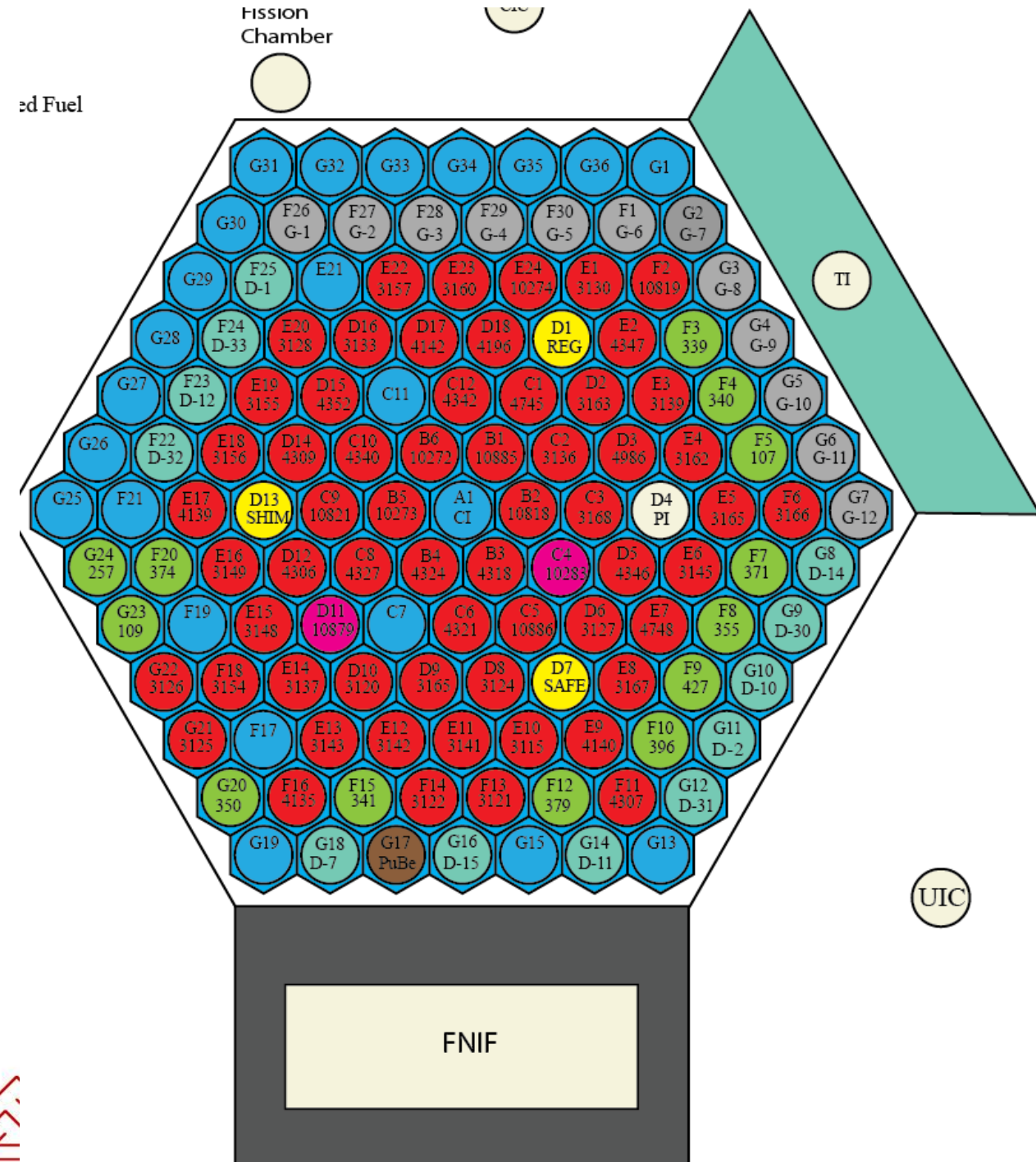
# Core Configuration 26 minus 5

- MCNP 6.3 Keff:  $0.98304 \pm 0.00022$
  - Excess Reactivity: subcritical
  - Removed Elements: F21, F19, F17, C7, E11
  - Used MCNP to estimate number of elements for criticality and excess reactivity/shutdown margin of core configuration after criticality.
  - UUTR TS 5.3.1: *The fuel shall be arranged in a close-packed configuration except for single element positions occupied by in-core experiments, irradiation facilities, graphite dummies, aluminum dummies, stainless steel dummies, control rods, heavy-water elements, startup sources, and vacant positions that are filled with water.*
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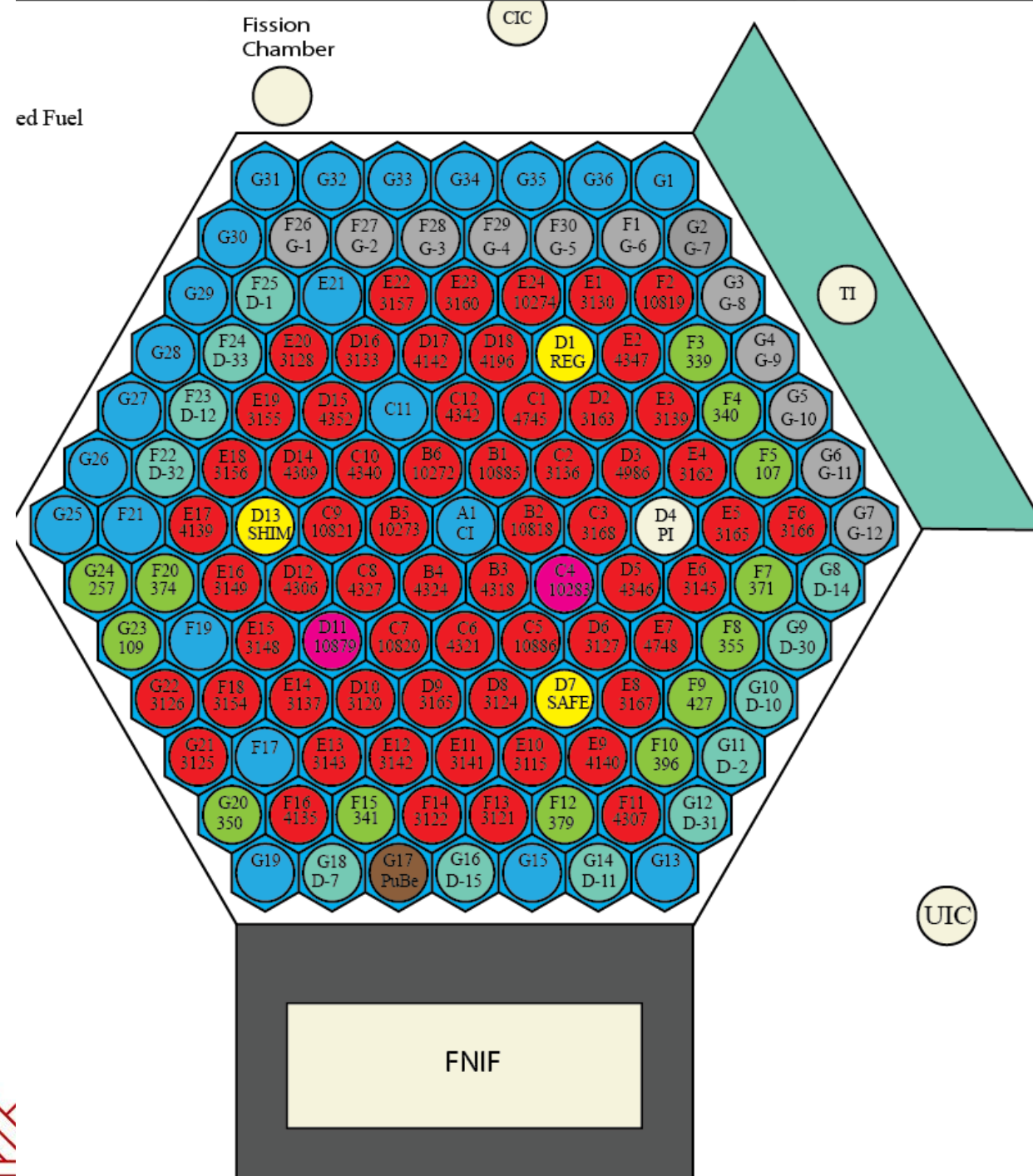
# Core Configuration 26 minus 4

- MCNP 6.3 Keff:  $0.98762 \pm 0.00023$
- Excess Reactivity: subcritical
- Removed Elements: F21, F19, F17, C7



# Core Configuration 26 minus 3

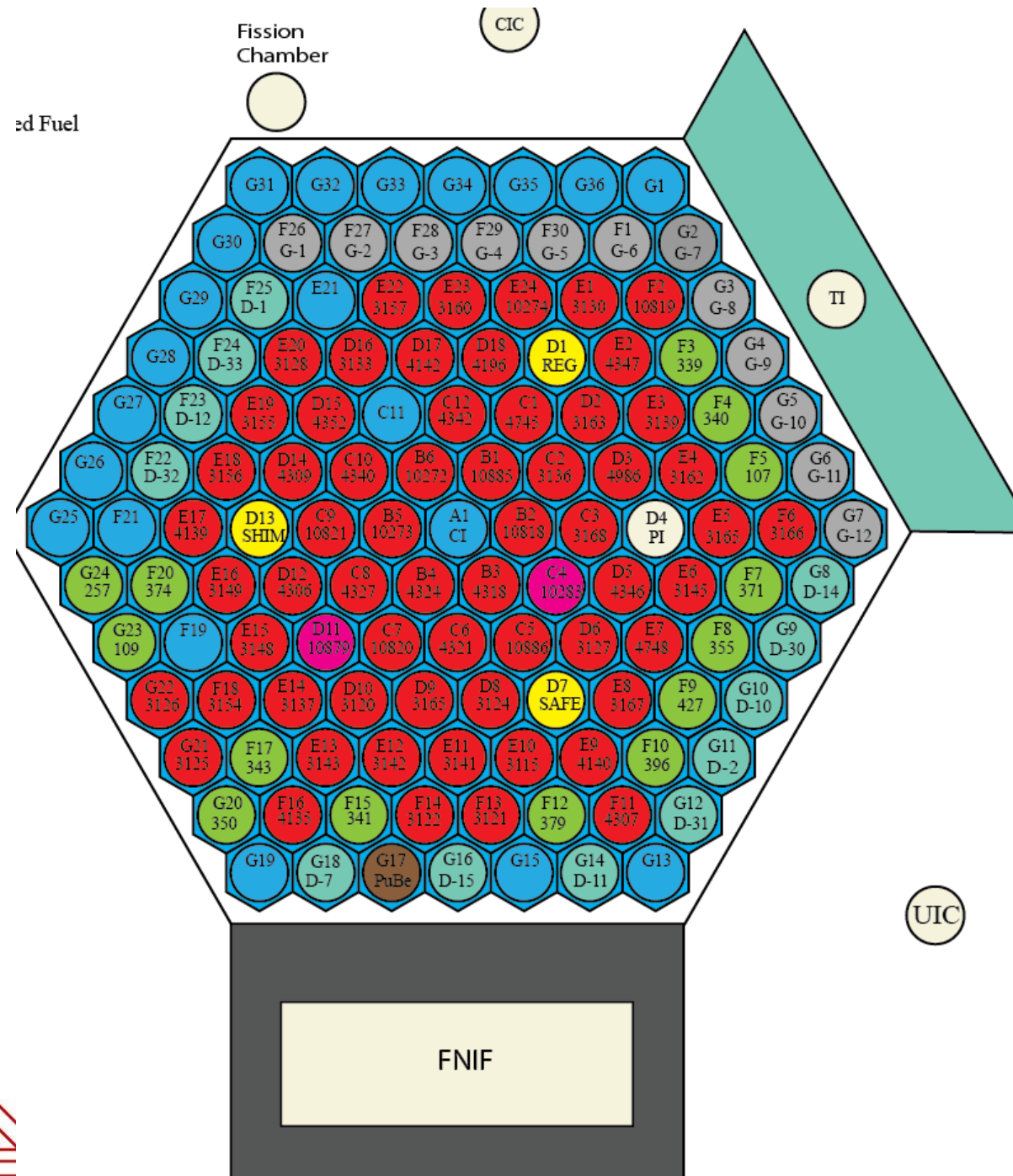
- MCNP 6.3 Keff:  $0.99767 \pm 0.00007$
- Excess Reactivity: N/A subcritical
- Removed Elements: F21, F19, F17



# Core Configuration 26 minus 2

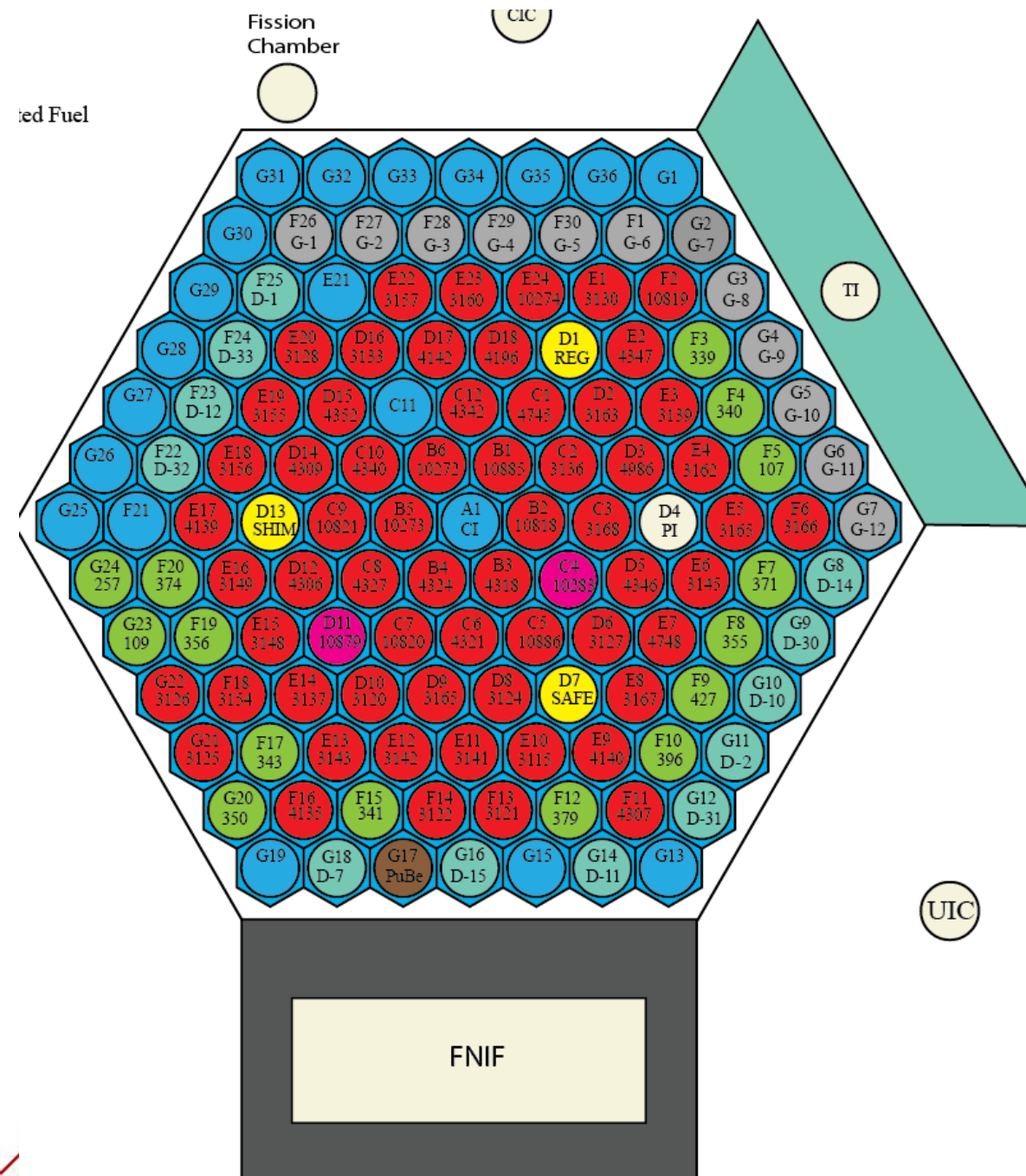
- MCNP 6.3 Keff:  $1.00068 \pm 0.00007$
- Expected Excess Reactivity:  $\$0.097 \pm \$0.010$
- Actual Excess Reactivity:  $\$0.382$
- Shutdown Margin:  $\$2.19$  (with safety rod at top of core)
- Actual Shutdown Margin:  $\$1.121$
- Removed Elements: F21, F19

Reached criticality on November 6th,  
2025.

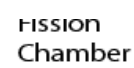


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- MCNP 6.3 Keff:  $1.00324 \pm 0.00007$
- Expected Excess Reactivity:  $\$0.459 \pm \$0.010$
- Actual Excess Reactivity:  $\$0.516$
- Expected Shutdown Margin:  $\$1.73$  (with safety rod at top of core)
- Actual Shutdown Margin:  $\$1.13$
- Removed Elements: F21



- ed Fuel



FNIF

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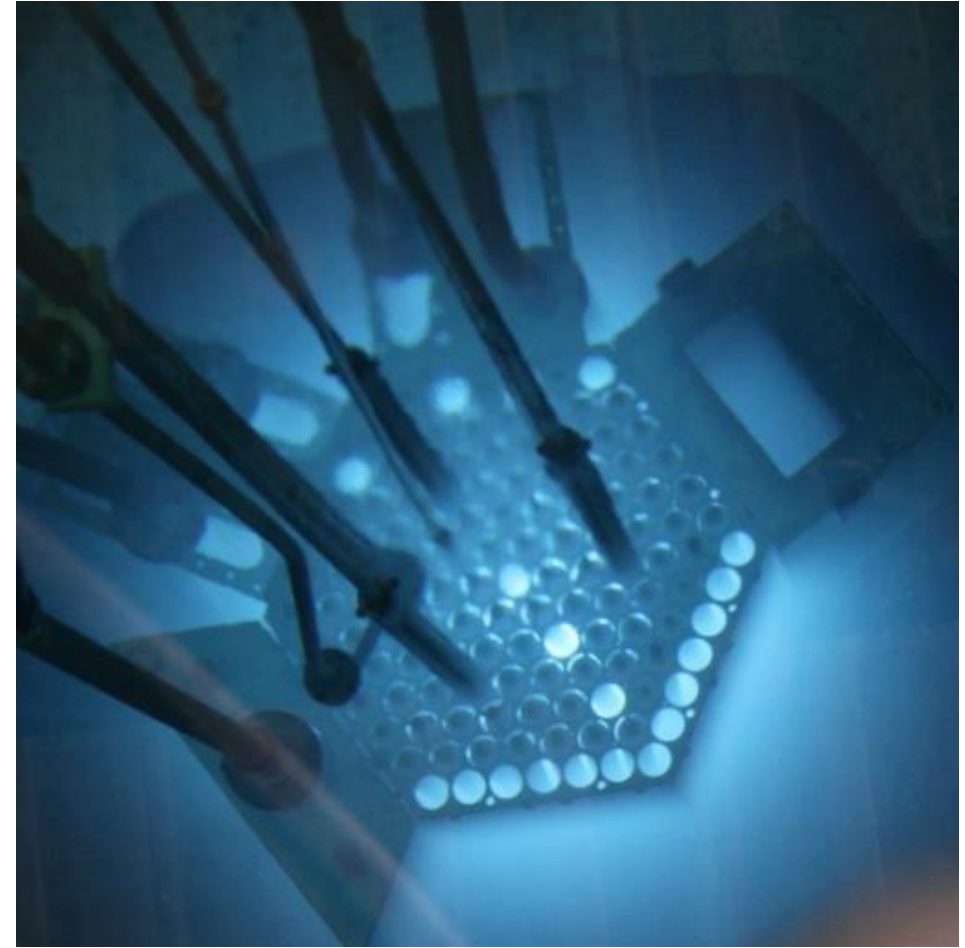
# Water Chemistry Issues

- Staff attempted 11 thermal power calibrations between November 8th and December 3rd. While operating at power, pH would begin to rapidly lower. Reactor operator would shutdown prior to pH reaching Technical Specification LCO Limit of 5.5.
- Discussed issue with TRTR community which advised:
  - This phenomena is commonly observed in open water DI systems
  - Our LCO limit is probably too restrictive
  - Request a license amendment to lower our LCO to 5.0



# Future Leak Prevention

- Multiple through-holes in the reactor tank proved the presence of severe pitting, but ultrasonic testing confirmed overall tank thickness of 5/16 inches.
- Wet sand between the two tanks, combined with the dissimilar metals of the primary and secondary tanks, created the potential for galvanic corrosion.
- Contracted with Infinity Corrosion Group (ICG) and Intermountain GeoEnvironmental Services (IGES) to complete installation of an active Cathodic Protection System.



# Corrosion Protection System

Corrosion Protection System consists of:

- Four 3" x 80" mixed metal oxide canister anodes installed at 12ft deep in the sand between tanks
- Estimated Service Life: 25 years
- PVC pipe monitoring well in sand keeps track of the moisture between tanks
  - PVC pipes are considered equivalent to a SAR system
- The rectifier (pictured) is rated for:
  - DC Output: 40V, 16A



# Monitoring Well

UUTR was originally constructed with 2 monitoring wells in 1973. They were checked by facility staff in 2023 and discovered to be broken or filled with sand. To effectively monitor for future tank leaks, a new monitoring well was established.



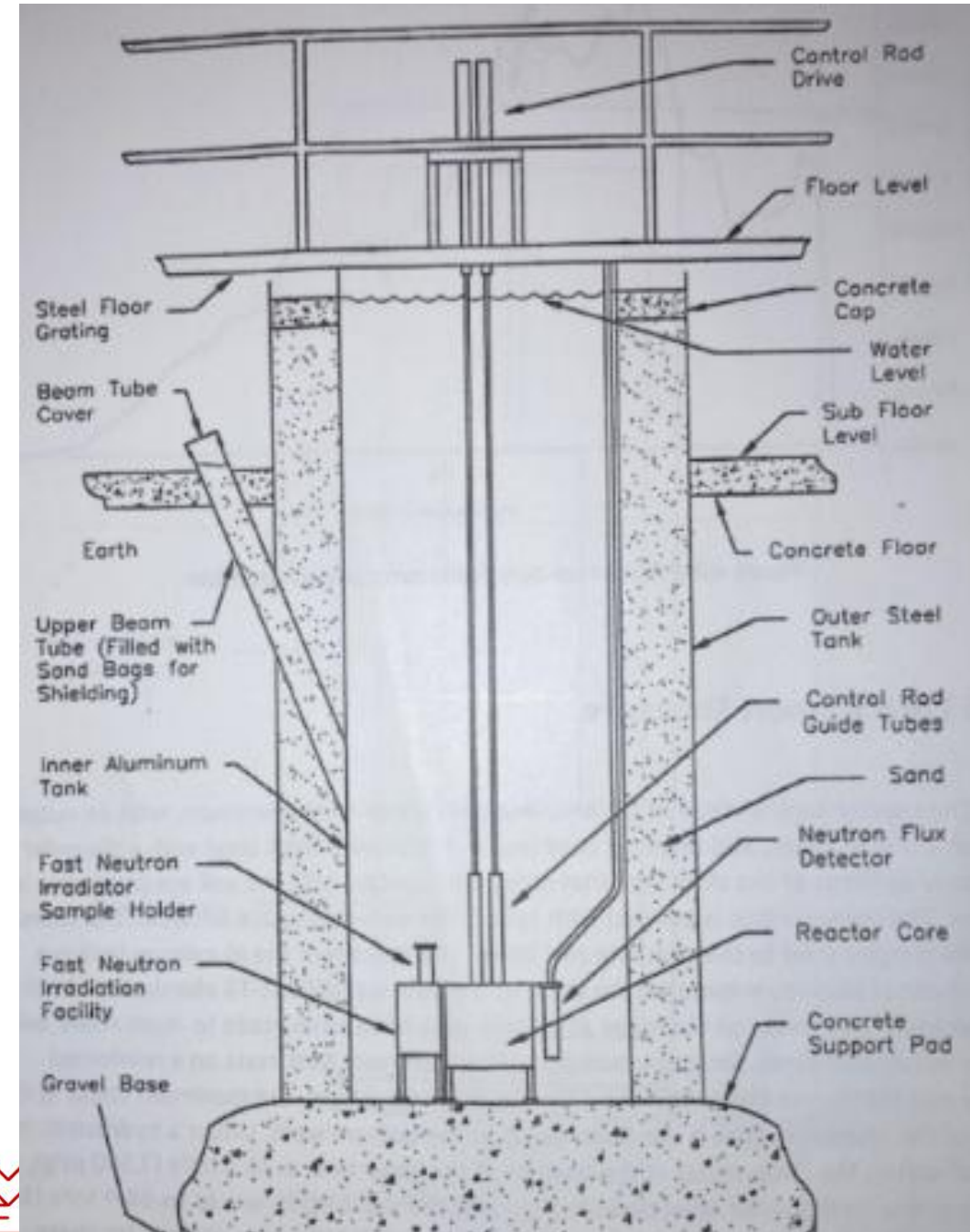
Monitoring well of the space between tanks



Concrete support pad prior to well installation

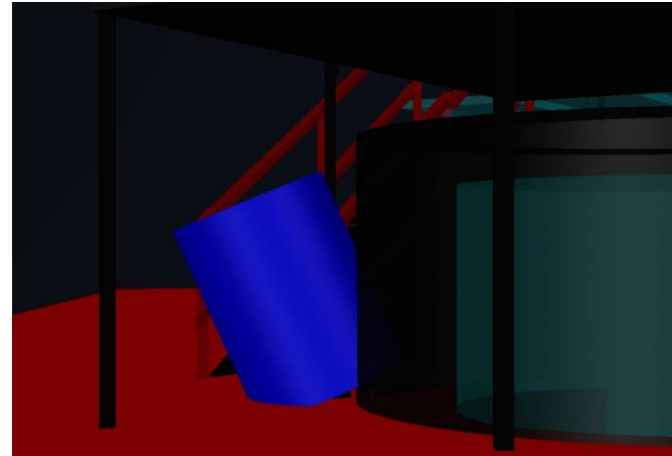
# Beam Port Project

The UUTR TRIGA Reactor currently has 3 unused beam ports, but facility staff had an interest in establishing a beam pipe for the last 5 years. This beam port project would allow the UUTR reactor to serve the local engineering community by providing neutron radiography capabilities.



# Beamport Characteristics

- Total available neutron flux (before beamstop):  $2.5e7 \pm 1.4e5$  n/cm<sup>2</sup>/s
- Neutron dose rate in experiment chamber:  $500 \pm 28$  rem/hr
- Photon dose rate from prompt fission & neutron capture generated gammas:  $750 \pm 56$  rem/hr
- Facility is funding mechanical engineering capstone project to design a shutter and beam stop for future licensing submission.



AUTOCAD model of the beam port  
assembly at the UUTR reactor  
facility



UUTR Beam Port

# Beam Port Assembly

During the disassembly process in 2024, UUTR was able to test the fit of the manufactured pipe in the beam port assembly.

It did not fit.

A team of mechanical engineering students will design a shutter for the beam to reduce dose during accidental exposure to the beam.



AUTOCAD model of the inner section of the beam port in contact with the water



Evaluation of fit of inner section of beam port

# Thank you!

The floor is open for questions!

