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TRTR/IGORR

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New Safety Basis Strategy for Concurrent Testing at TREAT

Battelle Energy Alliance manages INL for the
U.S. Department of Energy's Office of Nuclear Energy

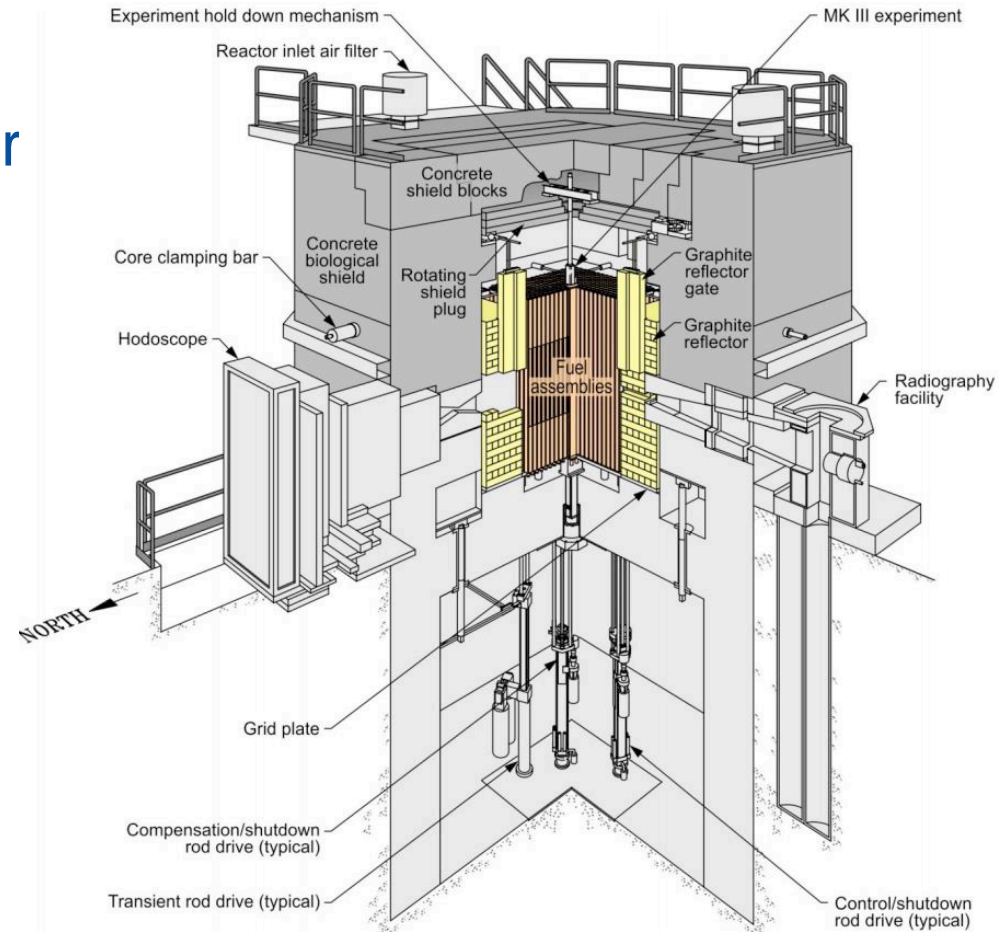
Idaho National Laboratory

Outline

- TREAT Overview
  - Transient Capabilities
- Experiment And Concurrent Testing
  - Definition
  - Types
- Safety Basis Analysis
  - ESA Approach
  - Separate Hazards Analysis
- Safety Basis Confusion – Concurrent Testing
  - Problem
  - Interim Solutions
  - Long Term Solutions

Background of TREAT

- Air-cooled, graphite moderated reactor
- 10,000:1 atoms C to atoms U
- Steady state operation 120 kW
- Minimum Period of 0.023 s
- Peak Power of 19,000 MW
- Peak Energy of 2,900 MJ



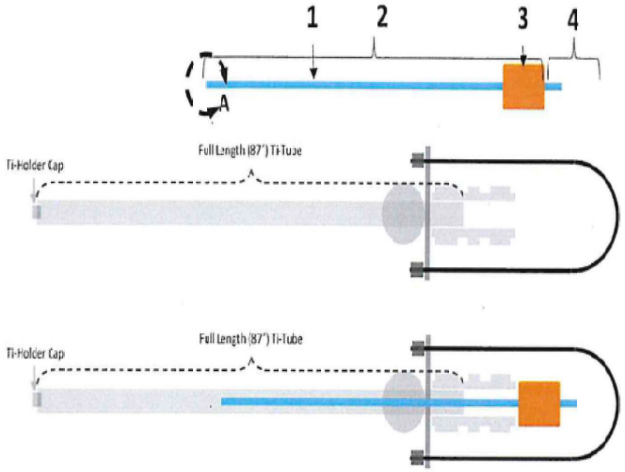
TREAT Transients

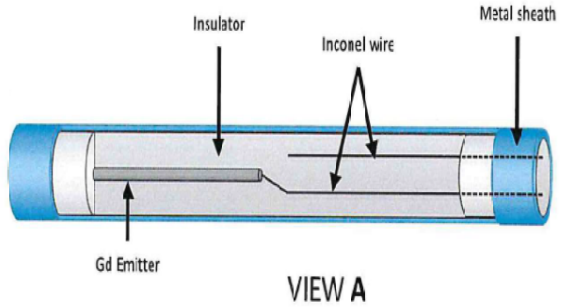
Experiments

Concurrent Testing

- Any item in the reactor but not dictating reactor performance (Along for the Ride)

- Current Tests:
  - Self-Powered Neutron Detectors,
  - Optical Fibers
  - Thermocouples
  - Impedance Sensors
  - Transducers





- Usually housed in ¼” titanium tubes

- Placed in cooling channels in reactor.
  - Corner of 4 fuel elements

Safety Basis Approach

- Safety Analysis Report (SAR-420)
  - Bounding Accident Analysis
  - Requirements for Experiments

- Experiment Safety Analysis - Experiments
  - Shows Compliance to SAR
  - Written for each experiment type or group
  - TS-420 LCO 3.4.5

- Hazards Evaluation – Concurrent Testing
  - Reactivity Worth
  - Source Term (if needed)
  - Thermal

Experiment Confusion

- Discussions with DOE
  - Recall experiment definition
    - Items such as detectors, flux monitors, sensors. etc. are exempt.
  - Confusion as to what CT was categorized.
- Conclusion
  - Exempted items were only devices that were part of the reactor and needed to perform reactor functions.
  - CT and all devices should be considered Experiments

Interim Solutions

- Reactor placed in safe state
- All reactor operations halted till path forward developed
- Changes to safety basis compliance developed
  - Two Options
    - Remove concurrent testing
      - Months of core characterizations needed.
    - Develop ESAs for all test currently in use
      - Month of document creation and review needed
      - ESAs for non-fueled items hard to write
    - Decision to continue to utilize CT and develop ESA for all devices.
      - 4-5 Months to develop, create, and issue new documentation.

Long Term Solutions

- Extensive SAR-420 revision
  - Define all items intended for irradiation in the reactor as Experiments.
  - Defined different levels of Experiments
    - Complex Experiment
      - An EXPERIMENT that requires trial transients to be performed before insertion into the reactor for transient operation as specified in the EXPERIMENT safety analysis (ESA).
    - Experiments
      - Experiments that do not require containment or reactor performance to be verified.
- Procedure for creation of ESAs revised
  - Gives experiment analysis requirements for each type of experiment.
  - Give a graded approach based on the hazards involved (fissile material, non-fueled).
  - ESA created for each type with different levels of rigor.

Questions

References

- [1] Idaho National Laboratory, "Transient Reactor Test (TREAT) Facility FSAR. SAR-420," Revision 6. 2022.
- [2] Idaho National Laboratory. “Experiment safety Analysis- Coolant Channel Concurrent Testing Experiment Safety Analysis” TREAT-ESA-005. 2022
- [3] Idaho National Laboratory. “Experiment safety Analysis- Experiments Operated in MARCH-BUSTER” TREAT-ESA-002. 2022
- [4] Idaho National Laboratory, "Transient Reactor Test (TREAT) Facility FSAR. SAR-420," Revision 7. 2023.

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