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Sandia National Laboratories

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Overcoming Obstacles at the Sandia Critical Experiment

Patrick Ward

Reactor/Assembly Operator at the Annular Core Research Reactor and Sandia Critical Experiment

June 18, 2025

SAND2025-06695C

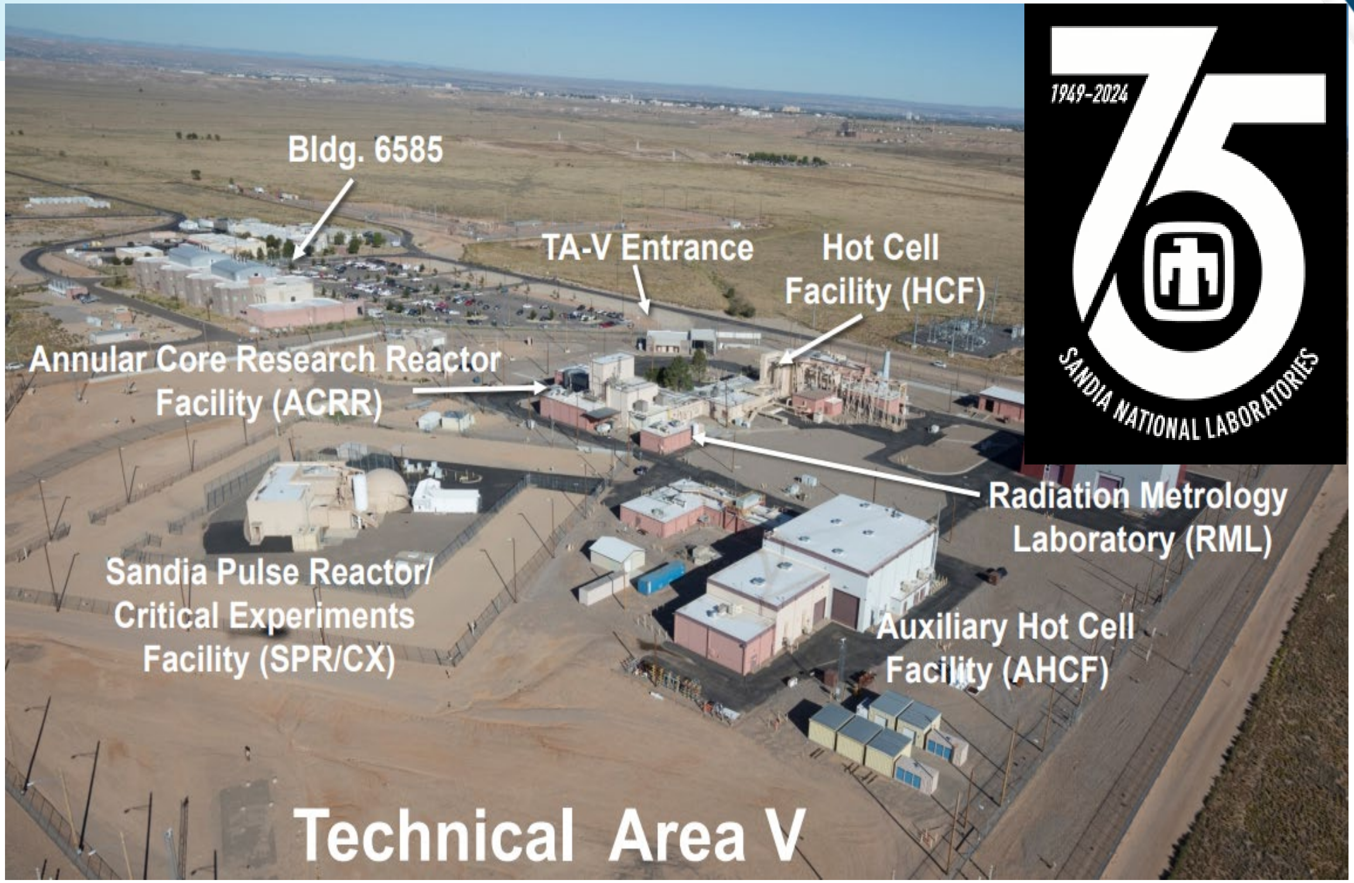
Site Locations

Technical Area Five (TA-V) Facilities

TA-V on Kirtland Air Force Base (KAFB), covers 12 acres, part of the larger Sandia Labs, 2600-acre site. While KAFB spans 51,000 acres in Central New Mexico.

TA-V includes various research & development facilities, and testing areas that support Sandia's programs.

- GIF-Gamma Irradiation Facility
- Hot Cell & Auxiliary Hot Cell
- SPR-Sandia Pulsed Reactor Facility – Critical Experiments

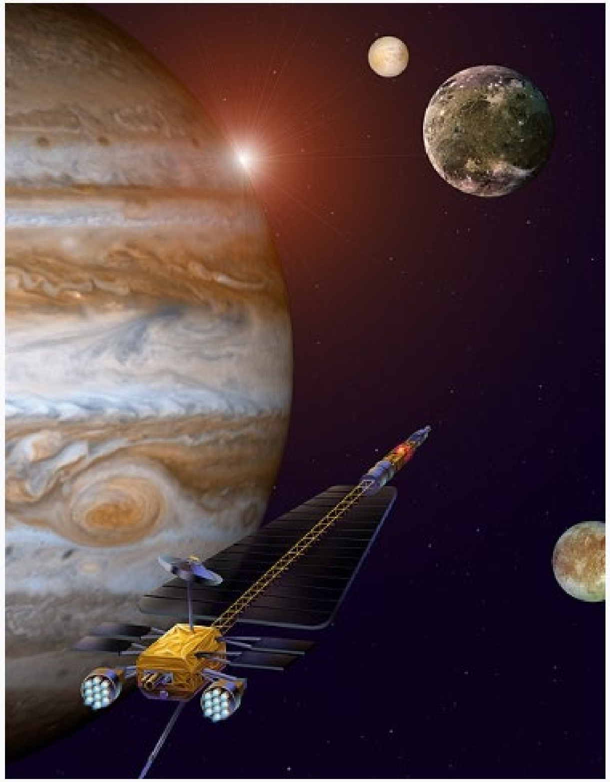


Site Locations

Past Experiment Programs at TA-V

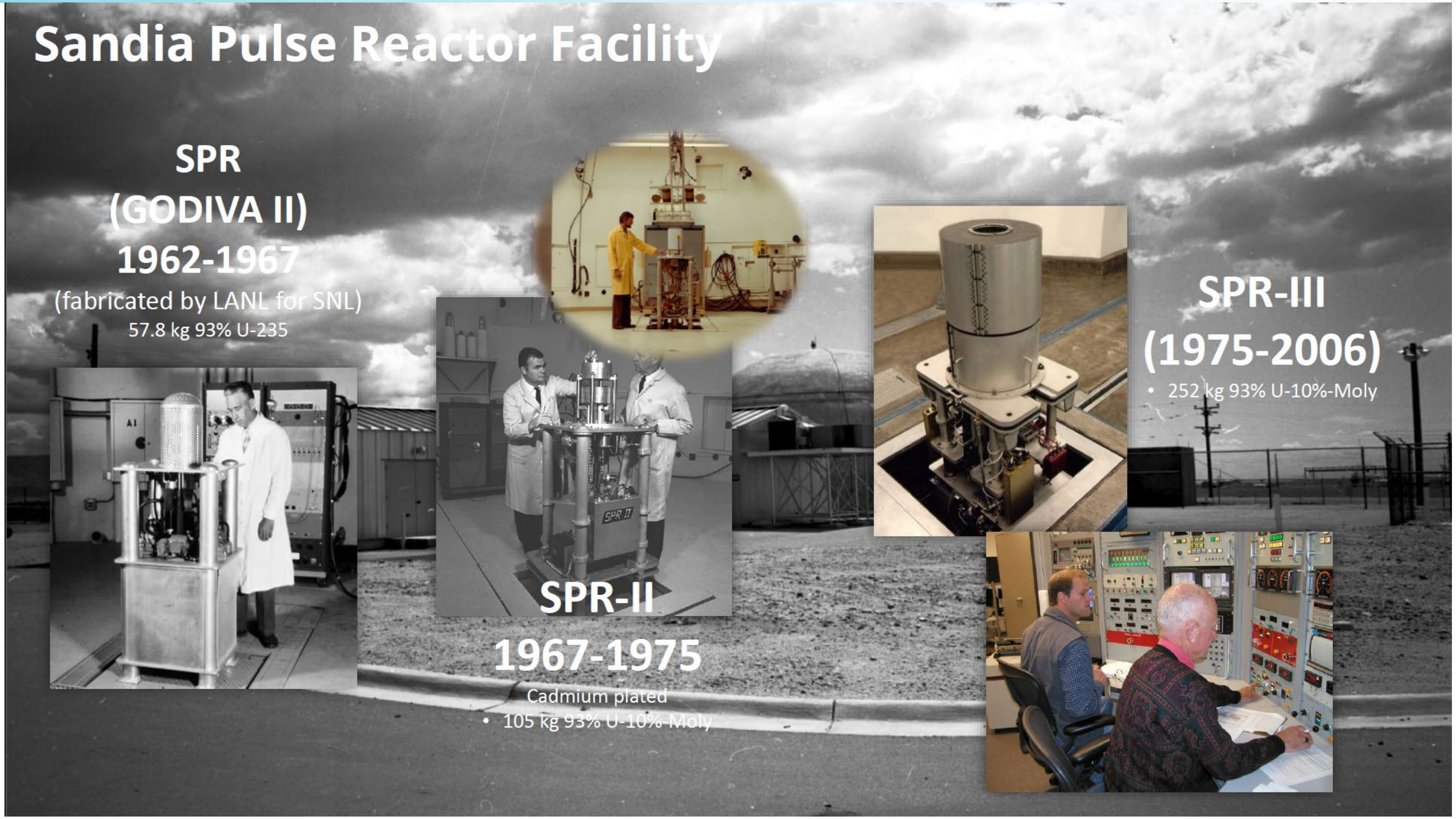
TA-V has been involved in many nuclear experiment programs over the years:

- Weapon Component Testing – Our original and continuing mission.
- Radiation Effects Sciences – New methods based on scientific discovery.
- Fast Reactor Safety –Advanced fuel and cladding testing, Clinch River Breeder Reactor, effective equation of state, and molten fuel.
- Light Water Reactor Safety – Three Mile Island, severe fuel damage and fission product release from debris beds, TRISO fuel development.
- Nuclear Pumped Laser (FALCON), Part of Reagan's Star Wars Defense.
- Medical Isotope Production (Mo-99, I-125) – Domestic isotope production initiatives.
- Space Power (Jupiter Icy Moons Orbiter) – Advanced reactors for space power and radioisotope thermoelectric generators.



Sandia's Critical Experiment (CX) History

Repurposing an old HEU facility

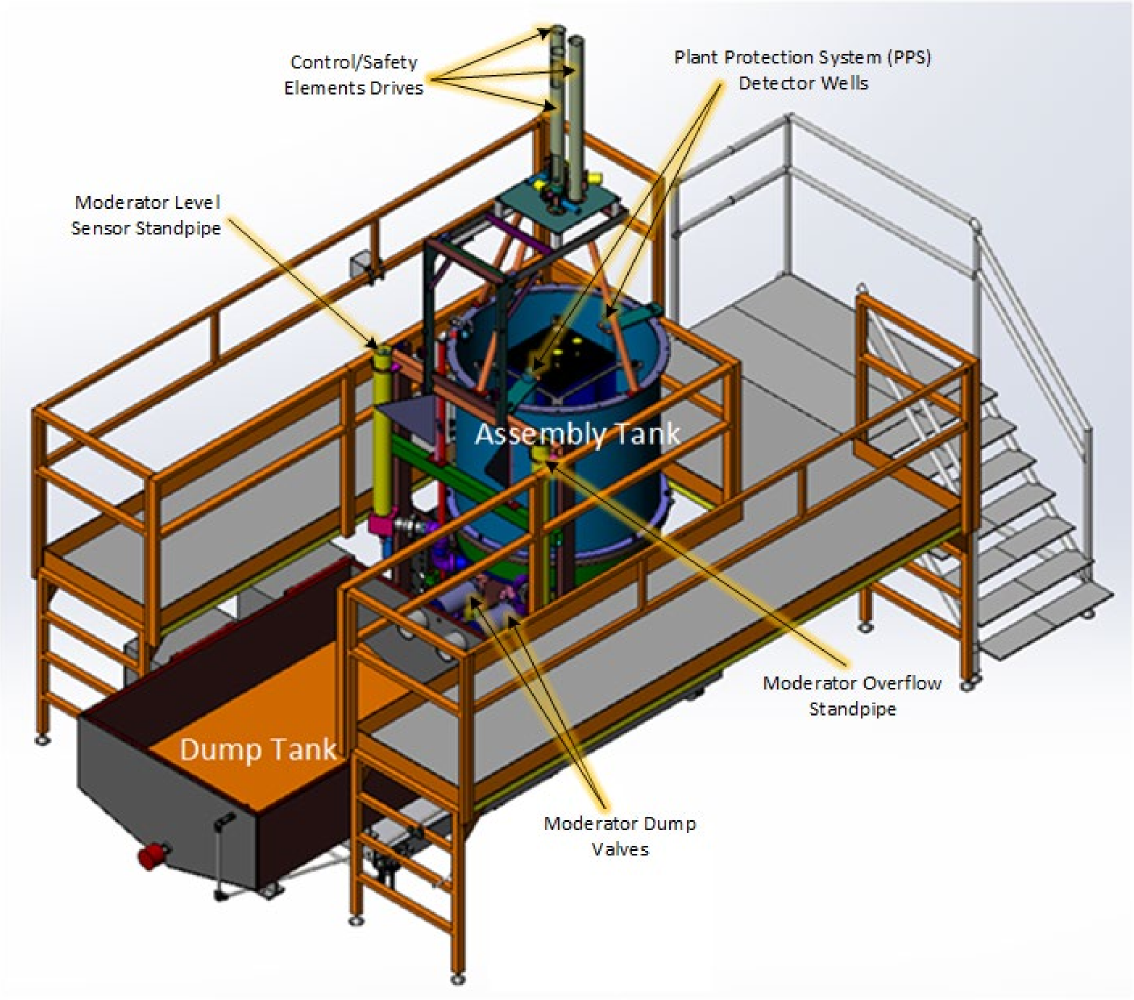


CX History Continued

CX Today

Notable Design Features

- Assembly tank
  - Fuel rods and grid plates
  - Elevated for gravity release of moderator to the dump tank
  - Provides full water-reflection and water level control
- Dump tank
  - Moderator resides in dump tank until operations
  - Heater maintains temperature
- Moderator Overflow Standpipe
  - Maintain water level in assembly tank
  - Water continually circulated between dump tank and assembly tank
- Control and Safety Elements
  - B4C absorber section followed by fueled section
- Plant Protection System
  - Two fission chambers



Lessons Learned

Design with maintenance in mind

- CX was originally only expected to operate for 1 year and a few hundred operations
  - We now have a couple thousand operations since the early 2000s
- Due to design, changing out the core is arduous and increases risk of damage
  - Risk of damaging fuel followed control and safety elements
  - Current solution: Updating design of new core grids with ergonomics in mind as well as standing up an effort to make spare parts for control and safety elements
- Run to failure with obsolete components has caused headaches when things do fail and we have to find an equivalent replacement part
  - Things tend to break in the middle of important experiments
  - Current solution: Update control console with modern like for like components and begin preventative maintenance program for certain components

Lessons Learned

Keep drawings up to date

- Modifications were made to the control console before the implementation of tracked changes with our engineering group.
  - Discovered during ongoing console upgrade work
  - Current Solution: All modifications go through our engineering branch and trigger drawing revisions

Lessons Learned

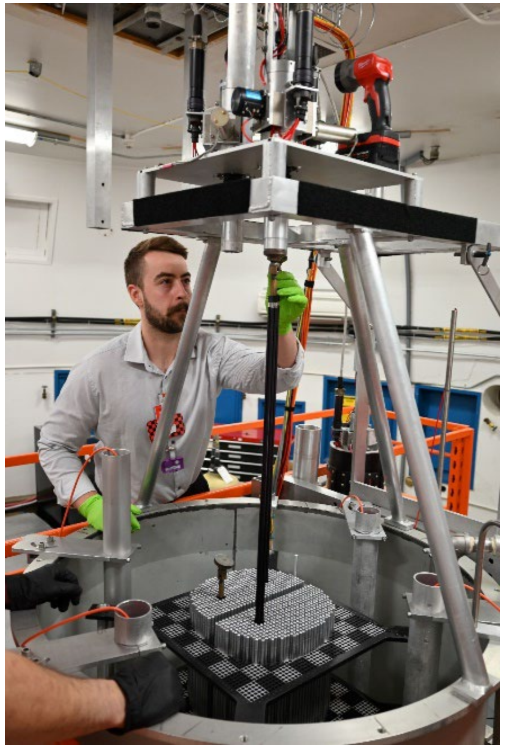
Keep design requirements simple

- Over defining requirements for new experimental core grids led to delays
  - Manufacturing could not meet our over-specific requirements
  - Example: Anodize per specification 9904102 Type II vs coat to prevent against oxidization
  - Current solutions:
    - Work with suppliers to find what specifications are reasonable and achievable
    - Keep it simple. Make requirements only as specific as needed

Sandia NCS Hands-On Training Course

14 years of NCS courses (over 500 students)

This course is designed to meet the ANSI/ANS-8.26, "Criticality Safety Engineer Training and Qualification Program," requirement for hands-on experimental training.



Sandia Critical Experiments Program

Acknowledgements

The critical experiments at Sandia are supported by the DOE Nuclear Criticality Safety Program (NCSP), funded and managed by the National Nuclear Security Administration for the Department of Energy.