INL's 52 Reactors:
What were they about?

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Advanced Reactors Technical Summit III
Oak Ridge National Laboratory

10 February 2016

www.inl.gov

Idaho National Laboratory

The National Reactor Testing Station was just that

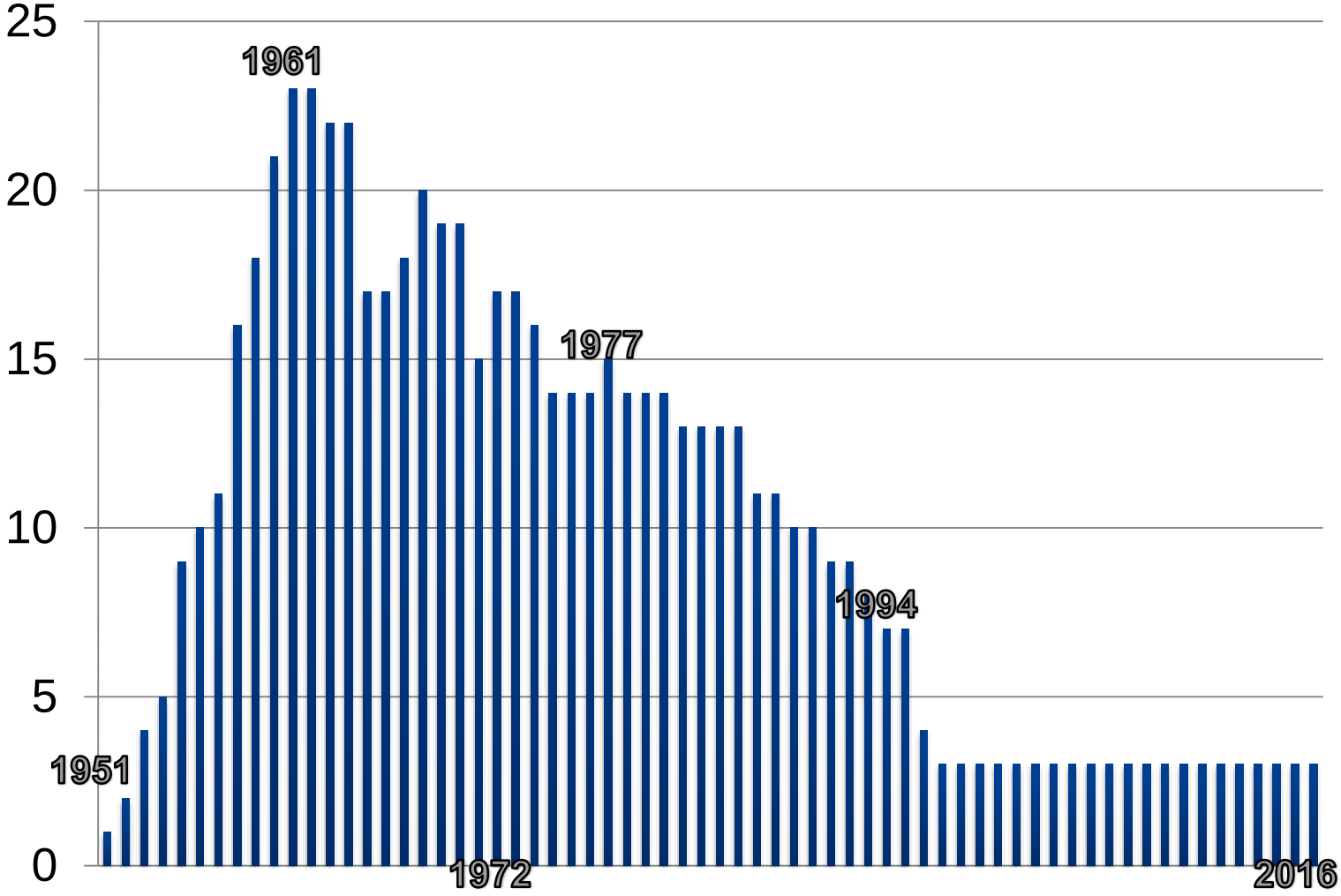
- ~900 square miles of available federal land, far removed from any town
- A large aquifer capable of supplying cooling water
- Multiple contractors could work on many different projects simultaneously
- Aggressive experiments could be conducted in which the outcome was not all that predictable

A functional classification of INL's reactors

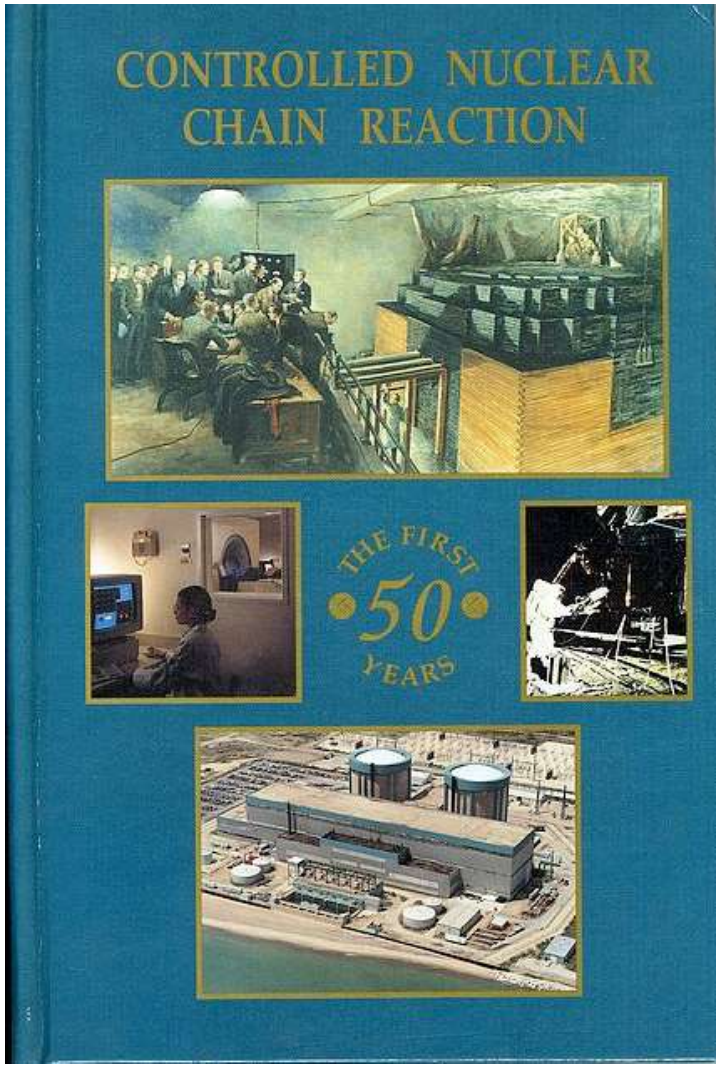
- **Safety testing**
- **Marine propulsion**
- **Fuels and materials testing**
- **Demonstration**
- **Air and Space**
- **Military**
- **Focused experiments**
- **Support for larger reactors**

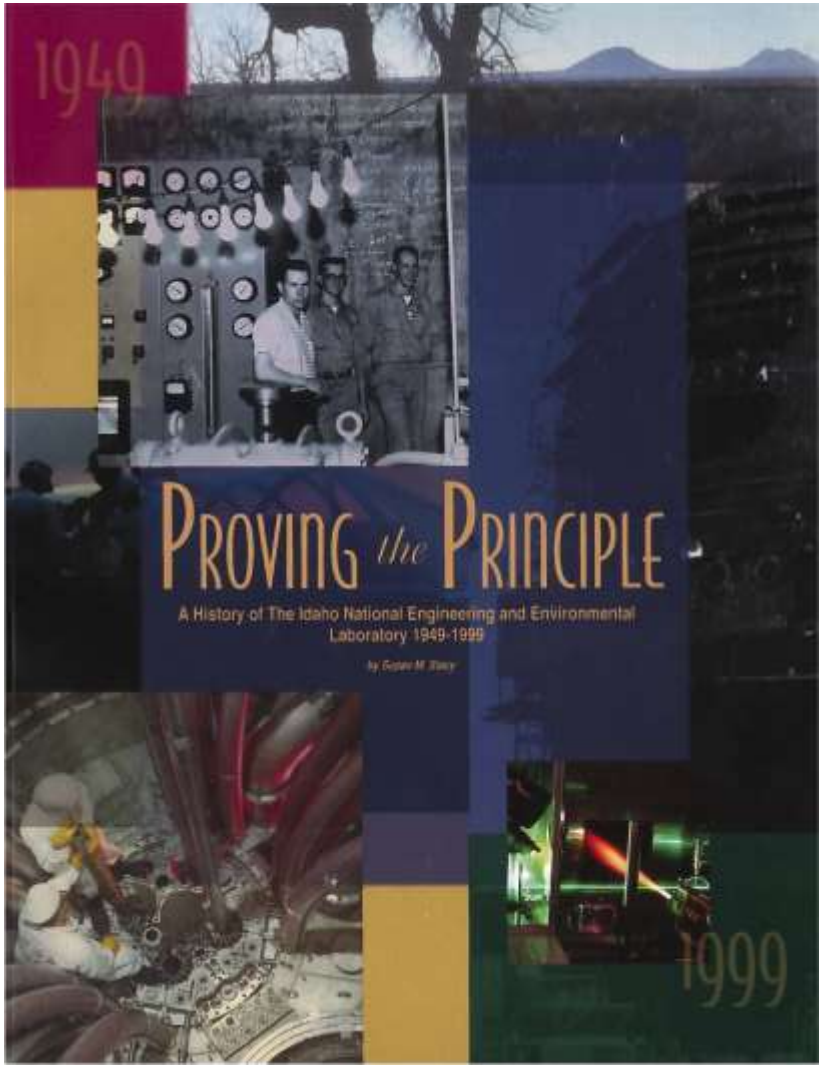
Some reactors served more than one purpose

INL's operating reactors by year



Understanding the context and the details





Primary source for this presentation

Safety testing including transients

LOFT

SPERT IV

TREAT

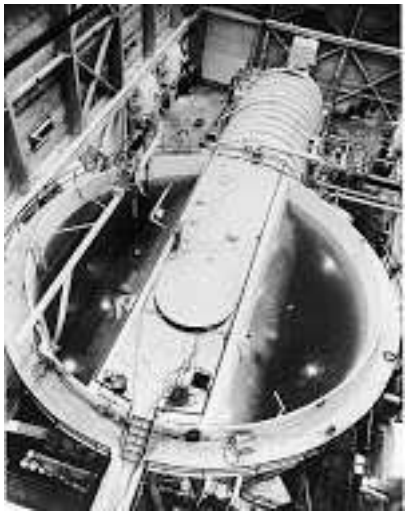
EBR-II

BORAX I

PBF

Marine propulsion

S5G



S1W aka STR

A1W

Nautilus Prototype

High Temperature Marine Propulsion Reactor 630A (civil)

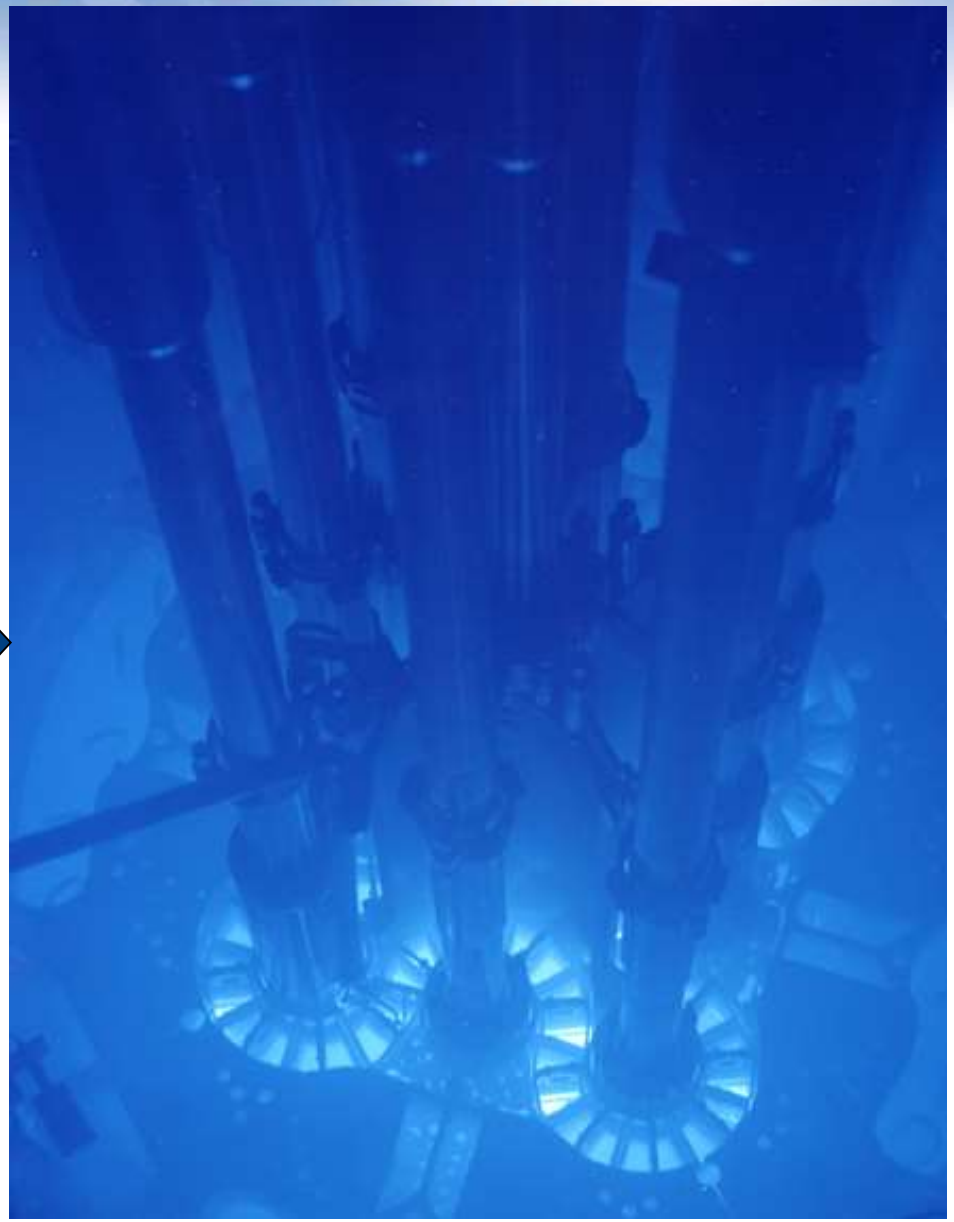
Reactors for testing fuels and materials

Experimental Breeder Reactor II (EBR-II) 1964-1994

Advanced Test Reactor (ATR) 1967-present

Engineering Test Reactor (ETR) 1957-1981

Materials Test Reactor (MTR) 1952-1970

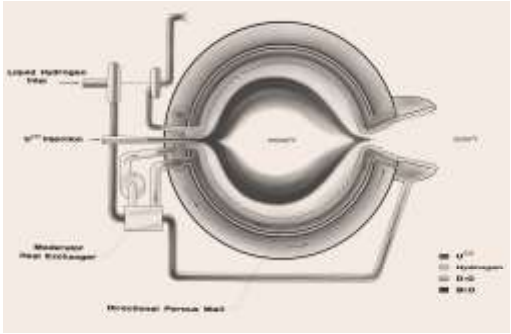


Air and space propulsion

Aircraft Nuclear Propulsion HTRE units on public display at Historic EBR-1 site

Courtesy of General Electric Aircraft Engines Division

SNAP 10A (1964-1966)

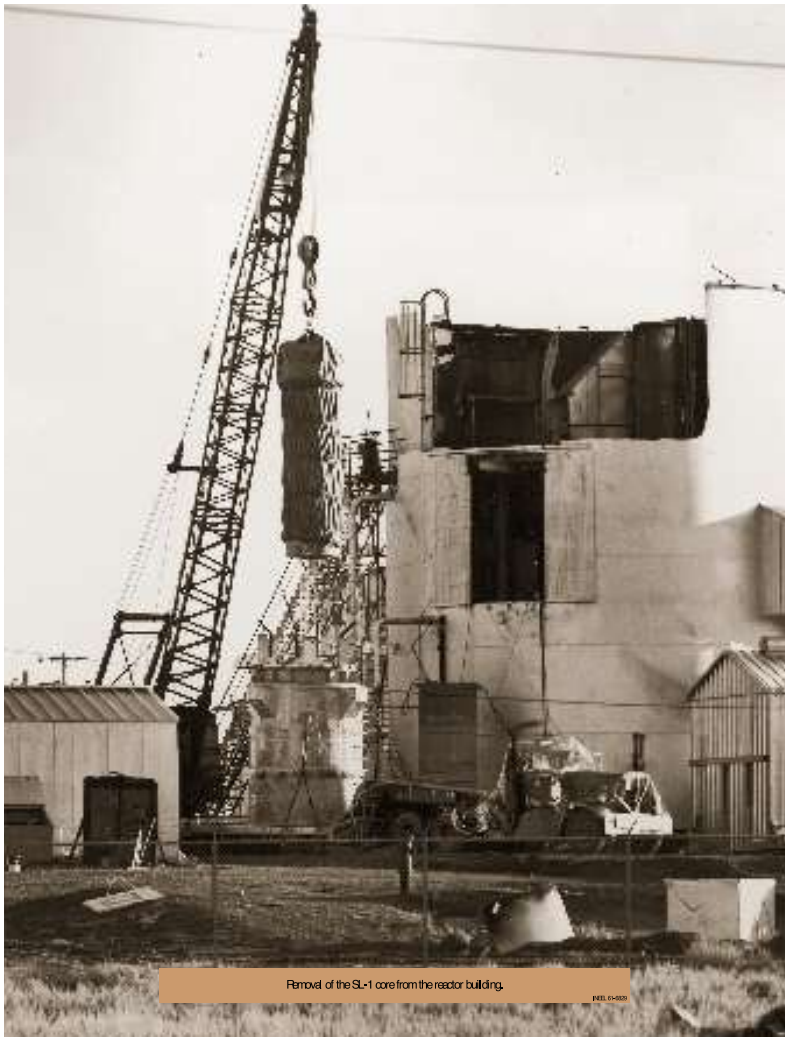


INEEL 71-3705

Spherical Cavity Reactor Critical Experiment 1972-73

Demonstration

Military



The Gas Cooled Reactor Experiment (GCRE) was a water moderated, nitrogen cooled reactor that was the first phase in the Army's intended development of a mobile NPP (1960-1961)

In 1961, an accident at the Army's Stationary Low-Power Reactor (SL-1) killed 3 men and destroyed the facility

The Mobile Low-Power Reactor No. 1 (ML-1) designed to be transported in < 40t modules by cargo planes or low-bed trailers. ML-1 operated for 664 hours between 1961 and 1964

Focused experiments

MAJOR FACILITIES/EXPERIMENTS

- **ZPPR (1969-1992)**
  - 20 full scale fast reactors ranging in design size from 100 kWe to 1200 MWe
- **ZPR-3 (1955-1970)**
- **BORAX (Boiling water reactor experiment) 1953-1964**
  - Proved the viability of the BWR concept
  - Powered City of Arco in 1955

MISCELLANEOUS FACILITIES

- Experimental Organic Cooled Reactor
- Hot Critical Experiment 1958-61
- Nuclear Effects Reactor 1968-70
- Organic Moderated Reactor 1957-63
- SUSIE, RMF,THRITS

Peter Collins examining ZPPR-16

Little reactors supporting bigger facilities

- **Support for irradiation facilities**
  - Advanced Reactivity Measurement Facility (ARMF) 1960-74
  - Coupled Fast Reactor Measurement Facility (CFRMF) 1968-91
  - Advanced Test Reactor Critical Facility (ATRC) 1964-present
  - Critical Experiment Tank (1958-61)
  - Engineering Test Reactor Critical Facility (ETRC) 1957-82
- **Neutron Radiography Facility (NRAD)** since ~1978
  - Provides neutron radiography and tomography on irradiated samples

ARMF and CFRMF

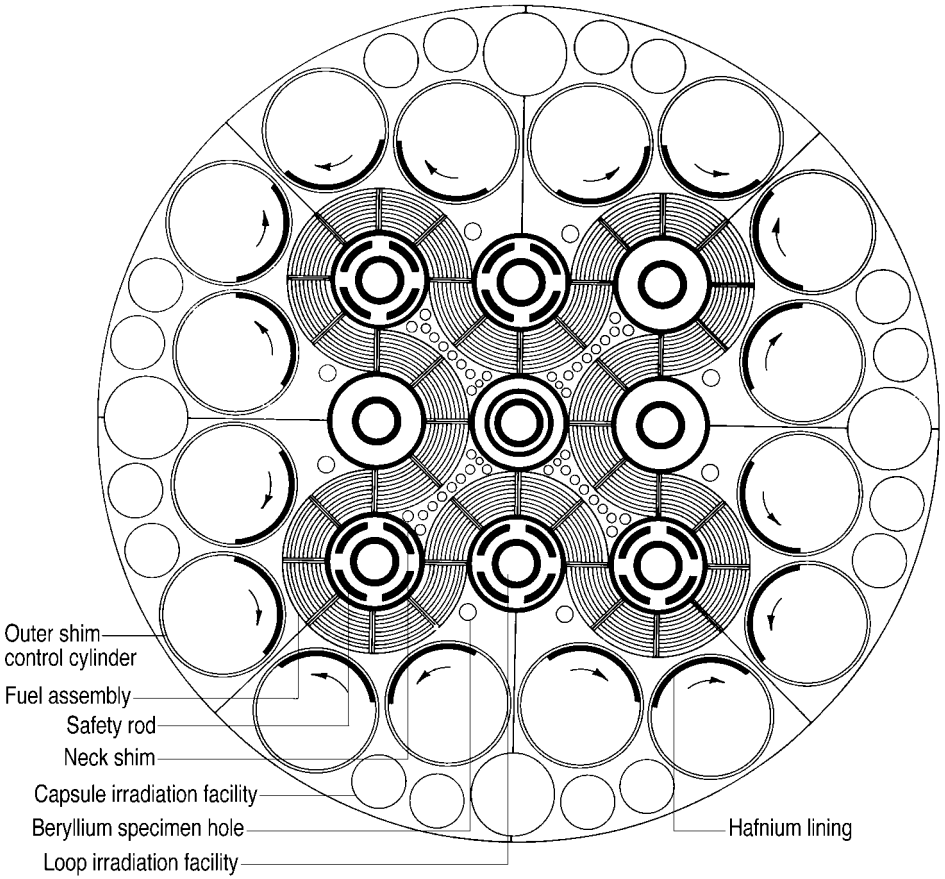
NRAD

Some perspective on INL's reactors

- **During the 1950's and 60's, the test reactors were supporting concepts that were being industrialized in the AEC's power reactor demonstration program, including pressurized water, boiling water, sodium, gas and organic cooled reactors built at utility sites around the country.**
- **In 1955, five new reactors started up on the INL site, a 100% increase.**
- **In 1994, three of the remaining 7 operating reactors shut down, a 43% decrease.**
- **In spite of the demise of the aircraft program and the SL-1 accident in 1961, the number of operating reactors peaked at 23 in 1961 and 1962.**
- **The last major reactor to start up was LOFT in 1973.**
- **Most reactors were not designed for long lifetimes—just to provide quick test data.**
- **On the other hand, ATR's components are replaceable, so there is no defined lifetime.**

Notable innovation and impact

- **Enabling commercialization of PWRs, some two thirds of the world's nuclear plants.**
- **Enabling BWRs, another 20%**
- **Enabling nuclear propulsion**
- **Very high flux test test reactors**
- **Inherent safety**
- **Integral Fast Reactor**
- **Safety licensing basis**
- **Advanced fuel development**
- **First nuclear electricity**
- **Nuclear data**
- **Measurement techniques**
- **Decommissioning**



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