HOW THE *Advanced Test Reactor* WORKS

THE REACTOR

The Advanced Test Reactor at Idaho National Laboratory is the only U.S. research reactor capable of providing large-volume, high-flux neutron irradiation in a prototype environment.

ADVANCED TEST REACTOR (ATR), LOCATED AT THE ATR COMPLEX ON THE INL SITE 50 MILES WEST OF IDAHO FALLS

Scientists use test reactors to generate high levels of neutron radiation to test new materials, see how advanced fuel behaves in real reactor conditions, or create medical isotopes.

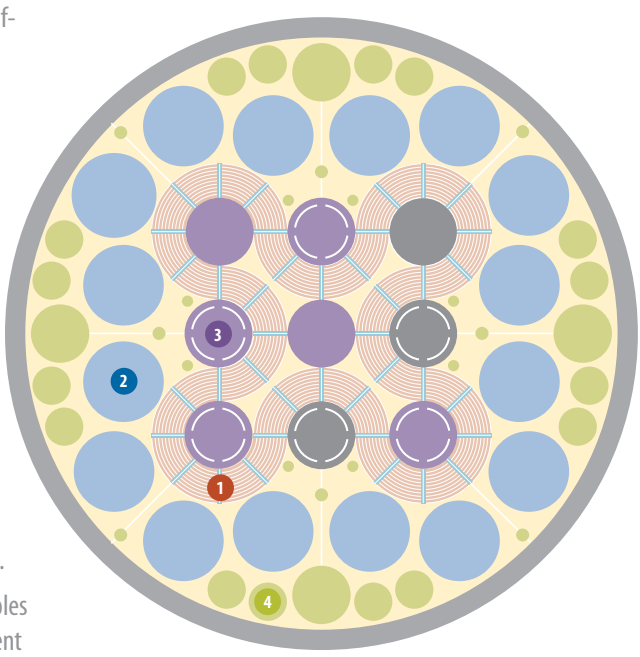
125-160°
(DEGREES FAHRENHEIT) ATR OPERATING TEMPERATURE

77
TEST POSITIONS WHERE EXPERIMENTAL SAMPLES CAN BE PLACED

250
(MWth) MAX ATR POWER LEVEL

~50
TIMES SMALLER THAN THE CORE VOLUME OF A TYPICAL COMMERCIAL POWER REACTOR

1. **The Fuel** - ATR's unique cloverleaf-shaped core allows its corner lobes to run at different power levels, making it possible to expose different areas of the reactor to varying neutron flux levels.
2. **Control Cylinders** - Cylinders surrounding the fuel can be rotated to absorb neutrons or reflect them back toward test loops, allowing precise control of power levels in each loop.
3. **Test Loops** - Multiple experiments can run simultaneously under distinct temperature, pressure and irradiation conditions.
4. **Irradiation Ports** - Material samples that don't require precise experiment conditions can be inserted in dozens of test positions.



THE CORE OF THE ADVANCED TEST REACTOR

Why Test Reactors Matter

Energy
Research reactors enable the testing and demonstration that underlies safe and efficient production of nuclear energy, which supplies roughly 20 percent of U.S. electricity.

Medicine
Medical isotopes can help treat cancer, diagnose disorders or address ailments such as arthritis and hyperthyroidism. Millions of patients around the world benefit from nuclear medicine.

Materials Science
Scientists and engineers use research reactors to test how advanced materials stand up to the extreme conditions inside a nuclear reactor.

Industry
Researchers in both private industry and academia can access the Advanced Test Reactor through its Department of Energy National Scientific User Facility.

The Tests

Test reactors generate volumes of neutrons far higher than those produced by a commercial power reactor. So scientists can put new materials into a test reactor for several months to see how they'd hold up after several years in a power plant. The neutron flux can also be used to create medical isotopes.

Neutrons - As uranium atoms fission, they emit high-energy neutrons that either are absorbed by atoms within the fuel or collide with other materials inside the reactor.

Test capsules - Materials sealed inside robust test capsules can be inserted into the reactor to experience its high neutron flux.

Test materials - Advanced steels, alloys or nuclear fuels can be irradiated inside a test reactor to see how they withstand reactor conditions.

Isotopes - Nonradioactive elements will absorb neutrons inside a test reactor to create radioactive medical isotopes such as cobalt-60.

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