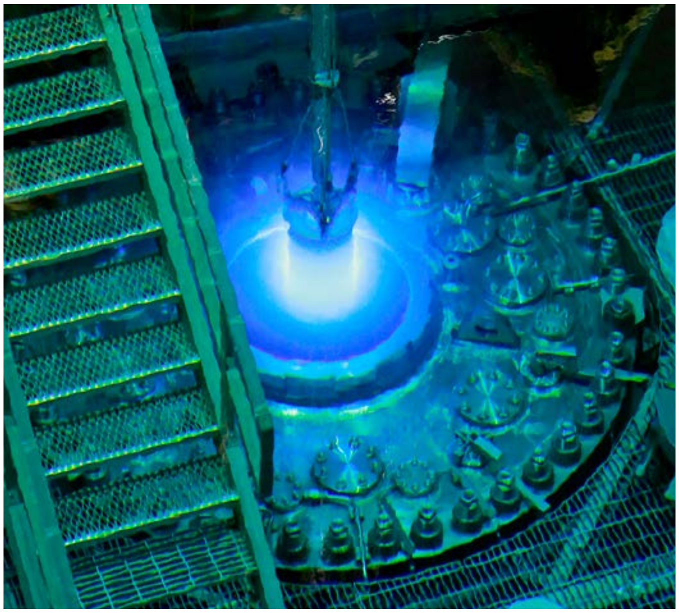

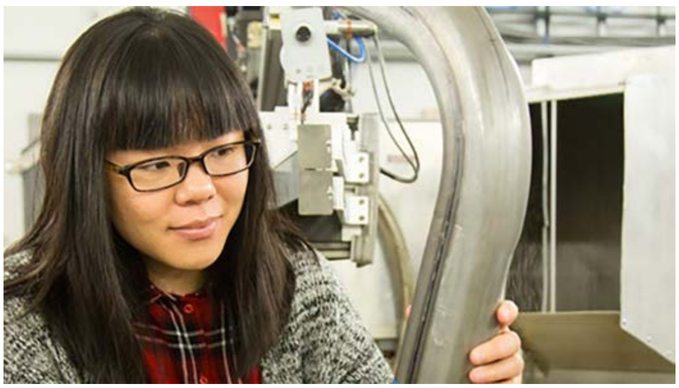

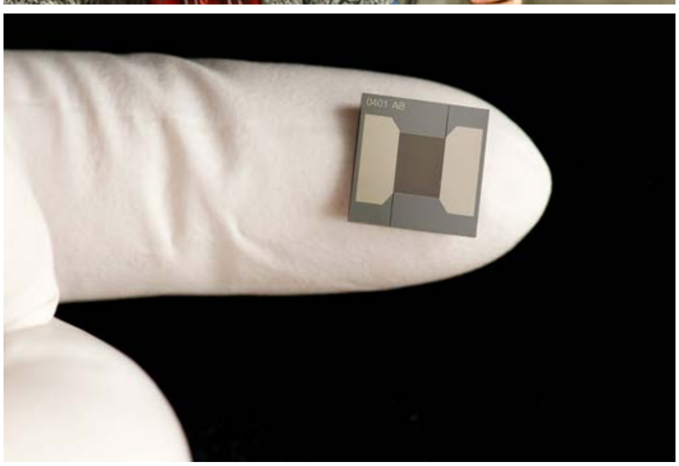

ABOUT THE IMAGES

The High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory during routine refueling. (Source: Jason Richards/ORNL)

U.S. Steel industrial research engineer uses neutrons to study a lightweighted advanced high strength steel component to better design automotive components that are lighter, more durable, and safer. (Source: Genevieve Martin/ORNL)

The radioactive isotope nickel-63—used in ion mobility spectrometry to detect trace amounts of chemical warfare agents or explosives and for other national security purposes—can only be produced at HFIR and the Russian SM3 reactor. (Source: U.S. Department of Energy)

Why Neutrons are Critically Important to U.S. Science, Industry, and National Security

The U.S. must make significant upgrades to its neutron science facilities in order to ensure that they can continue to serve the nation's needs. A new report, developed at the request of the U.S. Department of Energy's Office of Science, considers all aspects of neutron science and applications—from fundamental physics to industrial uses in many sectors of the economy to neutron-produced medical isotopes—as well as the growing use of neutrons to investigate the structure and properties of virtually every new material. The report analyzes these needs and recommends two parallel courses of action. Its findings include:

Reactor-based sources provide a continuous flux of neutrons that play essential roles in:

- **Key areas of research**: to assess properties of solid, biological, and quantum materials not obtainable by other means, and to probe the properties of elementary particles;
- **Production of critical radioactive isotopes**: for use in cancer therapy and other areas of medicine, as industrial sensing agents, and for national security;
- **Industrial applications**: for optimizing pharmaceutical production, detecting strain in turbine blades or stress in automobile welds, and improving oil and shale gas recovery.

The U.S. High Flux Isotope Reactor is unique, but it is also at risk:

- **It is the most powerful source of neutrons** for research and for isotope production in the western world, but it is 55 years old;
- **The reactor vessel is aging** from radiation damage, and upgrades to the vessel and other components would enhance operations and research opportunities;
- **Conversion to a new type of fuel** would lower the risk of nuclear proliferation;
- **Demand for access for research and isotope production** greatly outstrips the reactor's present capacity, limiting U.S. research productivity.

What the Report Recommends:

- **Plan to replace the reactor vessel and change fuel** as soon as possible, in a single operation, while also upgrading the reactor's capacity for both research and isotope production;
- **In parallel, start design of an entirely new reactor**, designed for maximum flexibility for future, expanded needs in neutron research and isotope production.