U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

BACKGROUNDER
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Mixed Oxide Fuel

With the end of the Cold War, the United States and the former Soviet Union began dismantling thousands of nuclear weapons. This work left large amounts of excess uranium and plutonium. Neither country wanted this material to be turned back into nuclear weapons. It must be kept safe and managed in a way that protects the environment, health and safety.

The United States and Russia worked together on a plan to make sure the material will not be used in weapons in the future. In 2000, they signed an agreement committing each country to dispose of 34 metric tons of surplus plutonium. In 2002, the Department of Energy (DOE) proposed irradiating the plutonium. Under this plan, it would be combined with uranium to make mixed oxide (MOX) fuel to power existing U.S. commercial nuclear reactors. Burning MOX fuel in a reactor makes it difficult to use the plutonium for any other purpose. Once taken out of a reactor, the MOX fuel would not be reprocessed or reused.

MOX fuel has been fabricated for many years in Europe. It is produced in the United Kingdom and France today. These countries use plutonium separated from commercial spent fuel to make MOX fuel. Commercial MOX-fueled light water reactors are used in France, the U.K., Germany, Switzerland and Belgium. In the U.S., MOX fuel was fabricated and tested in several commercial reactors in the 1970s. But that work stopped after the U.S. government ended its support for reprocessing in 1977.

MOX Fuel Fabrication Facility

In 1998, Congress gave the NRC authority to regulate DOE's MOX fuel fabrication facility. The NRC would evaluate both safety and environmental impacts, and perform inspections during construction and operation. The operator had to get NRC approval to begin construction and an NRC license to begin operations.

DOE hired a contractor in 1999 to design, construct and operate the facility at the Savannah River Site near Aiken, S.C. The contractor would also shut it down when plutonium disposition was completed. The NRC received an environmental report in December 2000. The construction application followed in February 2001.

The NRC held several public meetings in the course of analyzing the environmental impacts. Some of the areas covered included: health and safety, waste management, transportation, handling of hazardous materials, background radiation, water and earth resources, air quality, land use, noise, ecological resources, socioeconomic issues, and natural disasters. In January 2005, the NRC issued a final Environmental Impact Statement.

The NRC also held meetings and took comments on several drafts before authorizing construction and publishing a final Safety Evaluation Report in March 2005. NRC reviewed:

- General information about the applicant and the plant site;
- The applicant's financial qualifications to construct and operate the facility;
- Provisions to protect workers and the public from radiation exposure, chemical exposure, fires, and other emergencies;
- Plans to protect against theft, loss or diversion of special nuclear material; and
- Management and administrative procedures.

The contractor applied in 2006 to possess and use nuclear material at the facility. The NRC documented its review in a 2010 final Safety Evaluation Report. The NRC would only issue an operating license after verifying that all the principal structures, systems and components have been properly constructed.

Construction began in 2007. DOE has proposed halting construction due to the cost. Congress has continued to fund the project.

MOX Use in U.S. Reactors

As the regulator, the NRC must review and approve license amendments to allow the use of MOX fuel. DOE had originally proposed to burn the MOX fuel in two commercial reactors – Catawba and McGuire.

Fuel for nuclear power plants in the U.S. is made of low-enriched uranium. Normal reactor operations create plutonium in that fuel. Some of the plutonium is then burned in the reactor. MOX fuel would contain 5 percent plutonium at the outset.

The NRC issued a license amendment in March 2005 to Duke Power to test four MOX fuel assemblies at its Catawba plant in South Carolina. The assemblies were manufactured in France using plutonium from U.S. weapons. The NRC also approved revisions to Duke's plans to provide enhanced security for the MOX assemblies.

In April 2005, the MOX fuel was delivered from France to DOE, then shipped safely to the plant. Duke introduced the MOX into its Catawba reactor in late spring 2005. The lead test assemblies were in the reactor for two power cycles. After their removal, the fuel rods were sent to Oak Ridge National Laboratories for testing in 2009.

Additional information on MOX can be found on the NRC's website.

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