The world's first complete, fueled and full-length test assemblies of Advanced Technology Fuels were installed in 2019 by Southern Nuclear at Plant Vogtle Unit 2 in Georgia.
Source: Southern Nuclear

As the world looks to do more with nuclear technology, researchers are finding ways to make it more resilient. A fuel that can adapt to the most challenging conditions and remain stable could be one of those breakthroughs.

ADVANCED TECHNOLOGY FUELS

At the core of reactor safety

Nuclear technology is largely invisible in our lives and yet, it plays an integral part in them every day from safe, clean electricity, potable water and safer food supply to a host of other benefits we don't even realize.

The importance of nuclear is only increasing with the urgent need for low-carbon electricity to meet growing demand.

Increasing nuclear energy's resilience to the impact of external forces has been an ongoing pursuit of both operators and the science community, with continual improvement of technologies being introduced as the result of research and operational experience. One area of innovative research is the redesign of the fuel.

Nuclear power is generated when uranium fuel that is made up of small, solid pellets securely contained in fuel rods made of steel. The fuel generates heat that boils water that in turn creates steam to power a conventional generator (the same equipment you would find in hydro-electric or fossil fuel power plants). Unlike fossil fuels, nuclear fuel does not create emissions. It does create heat and with it, radioactivity, both of which must be safely and securely contained.

With Advanced Technology Fuels (ATF) that are now being researched and developed, the fuel could withstand unforeseeable events that would otherwise cause it to overheat.

The U.S. Department of Energy (DOE) and materials research institutions around the world have turned their attention to ATF. The concept involves the development of fuels and fuel rods that can withstand higher temperatures for longer periods of time. In part, this research focuses on replacing traditional cladding materials with new alloys and changing some fuel design features.

In 2018, sample quantities of the first ATF designs were loaded into a U.S. commercial reactor. A wider range of research and development is also ongoing in the United States at Oak Ridge National Laboratory and Idaho National Laboratory test reactors.

Concurrent with the U.S. effort, the Paris-based OECD Nuclear Energy Agency is spearheading collaborative research and development on ATF, advancing the scientific knowledge essential for its development. NEA brought together 38 leading experts from 35 organizations, representing 15 countries, in a ground-breaking effort.

New regulations require nuclear plants to have countermeasures and actions to mitigate the consequences of any severe accidents, including even the most highly-improbable scenarios. All these innovations are significantly strengthening safety for current plant operations.