Team achieves nuclear fuel performance milestone

March 10 2008

Researchers at the U.S. Department of Energy's Idaho National Laboratory, in partnership with three other science and engineering powerhouses, reached a major domestic milestone relating to nuclear fuel performance on March 8.

David Petti, Sc.D., and technical director for the INL research, says the team used reverse engineering methods to help turn the fuel test failures from the early 1990s into successes in 2008. "We wanted to close this loop for the high-temperature gas reactor fuels community," he said. "We wanted to put more science into the tests and take the process and demonstrate its success."

This work is important in Idaho because the Idaho National Laboratory is the U.S. Department of Energy's lead nuclear research and development laboratory.

The research is also key in supporting reactor licensing and operation for high-temperature reactors such as the Next Generation Nuclear Plant and similar reactors envisioned for subsequent commercial energy production.

"Hats off to the R&D fuels team on this major milestone," said Greg Gibbs, Next Generation Nuclear Plant Project director. "This is a major accomplishment in demonstrating TRISO fuel safety. This brings us one step closer to licensing a commercially-capable, high-temperature gas reactor that will be essentially emission free, help curb the rising cost of energy and help to achieve energy security for our country."

The work is a team effort of more than 40 people from INL, The Babcock & Wilcox Company, General Atomics and Oak Ridge National Laboratory.

The team has now set its sights on reaching its next major milestone – achievement of a 12-14 percent burnup expected later this calendar year.

The research to improve the performance of coated-particle nuclear fuel met an important milestone by reaching a burnup of 9 percent without any fuel failure. Raising the burnup level of fuel in a nuclear reactor reduces the amount of fuel required to produce a given amount of energy while reducing the volume of the used fuel generated, and improves the overall economics of the reactor system.

After U.S. coated-particle fuel performance difficulties in the 1990s and a shift in national priorities, research on this type of fuel was curtailed for a time. Funding for the research resumed in 2003 as part of the DOE Advanced Gas Reactor fuel development and qualification program.

The team studied the very successful technology developed by the Germans for this fuel in the 1980s and decided to make the carbon and silicon carbide layers of the U.S. particle coatings more closely resemble the German model. The changes resulted in success that has matched the historical German level.

INL's Advanced Test Reactor was a key enabler of the successful research. The ATR was used to provide the heating of the fuel to watch the fuel's response. The fuel kernel is coated with layers of carbon and silicon compounds. These microspheres are then placed in compacts one-half-inch wide by two inches long and then placed in graphite inside the reactor for testing. The fuel element is closely monitored while inside the test reactor to track its behavior.

Source: DOE's Idaho National Laboratory

Citation: Team achieves nuclear fuel performance milestone (2008, March 10) retrieved 26 April 2024 from https://phys.org/news/2008-03-team-nuclear-fuel-milestone.html