

JNC Successfully Simulates FBR Core Melt in Joint Research with Kazakhstan

On September 28, the Japan Nuclear Cycle Development Institute (JNC) announced that it had successfully developed, in a joint research effort with the Republic of Kazakhstan, advanced technology to simulate a core melt in a fast breeder reactor (FBR). After a rather large amount of test fuel – approx. 8kg – was melted in the Impulse Graphite Reactor (IGR) at Kazakhstan's National Nuclear Center (NNC), its migration was determined via changes in signals from neutron detectors installed inside the reactor. It was the first such test using an amount of fuel on this scale.

The final aim of the test project is to understand the entire process, from the melting of high-temperature fuel, to its contact and mixing with sodium around the core (especially at the bottom part), and from that point to proper cooling. In an FBR core melt accident, the behavior of melted, high-temperature fuel determines the consequences of the accident. But in order to simulate such an accident for a better understanding of the fuel's behavior, it is necessary to have both a high-performance facility and a high level of testing technology. As large-scale tests had been deemed difficult before, the appropriateness of core melt measures was conventionally evaluated using highly conservative assumptions.

JNC developed new testing technology to determine the inherent safety properties of FBRs from objective test data, and to properly reflect them in designs and safety evaluations. It then created the core-melt situation in a double container placed inside the IGR and studied the behavior of the test fuel.

To do that, it was essential to develop the technology to heat test fuel to a predetermined level and to measure the movement of melted fuel. And that was only possible with the high level of skill and experience of NNC's IGR team. Among domestic and overseas test reactors available for safety testing, the IGR was the only one able to meet the requirements of this project – specifically, to heat 8kg of test fuel in such a short time.

In the current test, sodium was not used, but will be used later in two tests to be carried out by the early part of next year, to obtain data simulating the actual accident state.



NNC's IGR

Kazakhstan's NNC used to be engaged primarily in military and private testing involving nuclear power and space development, and has a great deal of accumulated experience and data using its test reactor, high-temperature materials and testing technology. When Kazakhstan became independent, it declared itself a non-nuclear state, joined IAEA and NPT, and limited itself to R&D for the peaceful utilization of nuclear power. Using its test facilities and technologies, Kazakhstan takes part in joint research with overseas parties.

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