US DOE rules out MOX plant

24 August 2015

Disposal of US weapons-grade plutonium in a repository would be more economical than through the continued construction and operation of the Mixed Oxide Fuel Fabrication Facility (MFFF) being built at the Department of Energy's Savannah River site in South Carolina. This is the conclusion of the Red Team, headed by Thom Mason, director of the Oak Ridge National Laboratory set up by US Department of Energy (DOE) in June to review "plutonium disposition options and make recommendations".

The team examined the best way to dispose of 34t weapons-grade plutonium as agreed by the US and Russia in the Plutonium Management and Disposition Agreement signed in 2000. It compared two approaches for plutonium disposal: continued construction and operation MFFF to convert the plutonium into nuclear fuel for use in commercial nuclear reactors (the MOX approach), and dilution or down-blending of plutonium using chemicals before storing it in a deep geological repository (the dilute and dispose option).

While Russia opted to use its plutonium as fuel for fast reactors generating power at Beloyarsk, the report said the use of fast reactors was not considered practicable for the USA as a solution in the short term.

Construction of MFFF began in 2007 using a design is similar to Areva's Melox facility at Marcoule, but modified to handle metal plutonium 'pits' from US weapons and their conversion from metal to plutonium oxide. The estimated cost was $4.9bn with a start date of 2016, but the project has faced delays and technical problems and was "zeroed" in the DOE's 2014 budget when the plant was over 60% built.

The report concluded that the MOX approach, involving continued construction and other necessary activities such as support fuel licensing and reactor modifications, would require an annual budget increase from the current $400m to about $700-800m. Construction of the facility would require a further 15 years and about another three years to be commissioned, which would enable the production of MOX fuel to begin in 2033, the Red Team said. This would not meet the disposal timeframe agreed with Russia.

The report says that the dilute and dispose option could be executed within roughly the same timeframe' but at the current funding level of $400m a year.

The timeframe could be shortened if the MOX approach is discontinued and a "modest increase in funding" provided for the dilute and dispose option. It could be further shortened by the introduction of several process-optimisation measures discussed at length in the report.

The report also says that the dilute and dispose option relies on the availability of national processing and storage facilities for its execution, namely the Waste Isolation Pilot Plant (WIPP) in New Mexico, the Savannah River site in South Carolina and Los Alamos National Laboratory in New Mexico.

The use of existing facilities would require no additional liability related to surveillance, decontamination and decommissioning, which would have to be taken on by DOE for the MOX fabrication facility. This liability would exist regardless of whether the programme for the disposal of plutonium is ever executed in the facility, the report says.

However, the WIPP facility has been unavailable for waste storage since following two incidents in February 2014 including a radiation leak from a disposal chamber about 1km below ground and exposed more than 20 workers to small amounts of radiation.

Earlier in August, the DOE said initial proposals for the reopening of the facility in March 2016 had been postponed indefinitely because of "unanticipated challenges". The report nevertheless concludes that the "constructive on-going engagements with the State of New Mexico regarding WIPP restart bodes well" for the plutonium disposal programme. It may eventually become desirable to explore expansion of WIPP's capacity beyond currently legislated limits, the report said.

Key issues affecting the reopening of WIPP include the need to address the findings and recommendations from the two boards set up by the DOE to investigate the incidents, the implementation of more rigorous site-specific safety analysis standards, and the resolution of problems with the contractor's oversight of the procurement and quality assurance processes for the manufacture and delivery of an interim ventilation system.

The DOE expects to have a revised cost and schedule plan ready in the autumn. "The Department is committed to resuming operations at the Waste Isolation Pilot Plant as soon as it is safe to do so," Bryson said. WIPP has been in operation since 1999 and is the only US repository for the disposal of TRU waste from the military programme.