# Small modular reactors: a challenge for spent fuel management?

## By Irena Chatzis

Small modular reactors (SMRs) have been the talk of scientists and researchers in the nuclear industry for many years — but to what extent will their debut, expected next year, create challenges in spent fuel management? It depends, say experts, on the particular SMR design and a country's existing spent fuel management practices.

SMRs are relatively small and flexible: they have a power capacity of up to 300 MW(e) and their output can fluctuate in line with demand. This makes them particularly attractive for remote regions with less developed grids, but also for use as a complement to renewables and for non-electric applications of nuclear power. SMRs can be manufactured and then shipped and installed on site, so they are expected to be more affordable to build.

Globally, there are about 50 SMR designs and concepts at different stages of development. Three SMR plants are in advanced stages of construction or commissioning in Argentina, China and Russia, which are all scheduled to start operation between 2019 and 2022.

Countries with established nuclear power programmes have been managing their spent fuel for decades. They have gained extensive experience and have proper infrastructure in place. For these countries, management of spent fuel arising from SMRs shouldn't pose a challenge if they opt to deploy SMRs based on current technologies, said Christophe Xerri, Director of the Division of Nuclear Fuel Cycle and Waste Technology at the IAEA.

"Since this type of small modular reactor will be using the same fuel as conventional, large nuclear power plants, its spent fuel can be managed in the same way as that of large reactors," Xerri said. Even for SMRs based on new technologies, such as high temperature gas cooled reactors, which will use fuel packed in graphite prismatic blocks or graphite pebbles, countries that have nuclear power plants will already have solutions in place for storing and managing spent fuel. "They can either use existing infrastructure or adjust it for the new radioactive waste streams," Xerri said.

Countries that are new to nuclear power should carefully consider spent fuel management and establish a relevant infrastructure as they work on introducing nuclear energy. They will need to do this even if they choose conventional nuclear power plants or SMRs based on current technologies. "They will face more challenges if they opt for first-of-a-kind or less-established technology, as there will be less experience and fewer benchmarks for managing the entire fuel cycle," Xerri said. "Solutions for managing spent fuel and radioactive waste arising from SMRs will be one of the most important factors to take into account when choosing a technology, along with the security of fuel supply."

Some SMR designs have features that could reduce the tasks associated with spent fuel management. Power plants based on these designs require less frequent refuelling, every 3 to 7 years, in comparison to between 1 and 2 years for conventional plants, and some are even designed to operate for up to 30 years without refuelling. Nevertheless, even in such cases, there will be some spent fuel left, which will have to be properly managed.

To address these issues and support newcomer countries, more research and development work is required on the fuel cycle for some SMR technologies. Engineers and designers have a unique opportunity to work on solutions for the improved management of spent fuel and radioactive waste for SMRs in the early stages of development, Xerri highlighted. "This approach will help address uncertainties related to the back end of the fuel cycle, reduce costs and enhance societal acceptance of nuclear power," he said. The IAEA is involved in several ongoing activities on SMRs and is intensifying its efforts to support Member States' research and development in this area.