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Use of highly selective ion exchangers in different decommissioning projects

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Fortum's highly selective ion exchanger media CsTreat®, CoTreat®, and SrTreat® have been used in several nuclear waste treatment projects. The media has found use at operating power plants, decommissioning sites, and for example also at reprocessing facilities. Most notable recent example of the use of the Treat products is the Fukushima accident site's water treatment program, where CsTreat and SrTreat have been used. In this paper two examples of the use of the Treat products in recent decommissioning projects (Doundrey and Bradwell in the UK) is presented. Further, the role of the Treat products in the future decommissioning of Loviisa plant in Finland is discussed. Finally, the nuclide and boron removal system is at Paks in Hungary is presented.

1. Doundreay site, UK: Na and Na/K coolant of fast breeder reactors were dissolved and the resulting water containing salt ions was decontaminated using CsTreat. Total of 57 tons of Na/K coolant from the Doundreay Fast Reactor (DFR) and 1500 tons of Na coolant from the Prototype Fast Reactor (PFR) were purified during years 2002-2012. Cs-134 and Cs-137 activity in the purified liquid was below detection limit, with the highest achieved decontamination factors for Cs being as high as 4 million.
2. Bradwell NPP, UK: Fuel element debris (FED) containing magnesium-aluminum alloy (Magnox) material is treated in the Discharge Abatement Project (ADAP). FED is recovered from underground storage silos, dissolved, and the resulting dissolved salt solution is treated using CsTreat and CoTreat in order to remove both Cs and activated corrosion products. Very high selectivity towards the target nuclides is important, as the solution contains very high background of competing Mg ions. Operation started in 2013 and very first results are becoming available.
3. Loviisa NPP, Finland: Loviisa power plant is two unit VVER-type plant. Current operation licenses are expiring in 2027 and 2030. It is planned that during the decommissioning stage CsTreat and CoTreat will be used to purify most of the radioactive water at the plant. Waters include the primary circuit, fuel pools, and different tanks (including boric acid storage tanks) so that the waters can be released to the sea. Only some dozens of litres of secondary waste, i.e. spent ion exchanger mass, will be produced. This provides considerable cost advantage compared to solidification of several hundred cubic meters of boric acid water. Similar approach of nuclide removal can be used at different PWR plants located on the seaside, both during operation and decommissioning.
4. Paks NPP, Hungary: Paks is currently operating NPP with four VVER-type units. At Paks Fortum's CsTreat material is used to remove Cs from the evaporator concentrate. Hungarian technology is used to remove corrosion products. Additionally, a large fraction of boron is removed (in the form of sodium tetraborate) using Fortum's technology, as only small amounts of boron can be released to the river Danube. After treatment the concentrate is nearly free of radioisotopes and contains only a fraction of original boron concentrate and thus can be released to the river Danube. Recovered solid boron (sodium tetraborate) can be released from the radiological control. A process which combines nuclide and boron removal can be used to treat boric acid waters when little or no boron release is allowed. This process in relevant both during operation and decommissioning.

Country or International Organization

Finland

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