framatome

^{14}C REMOVAL FROM SPENT RESIN

Carbon Stripping for Declassification and Medical Isotope Production

The Carbon Stripping System (CSS) reduces disposal cost of spent resins and creates additional revenue streams.

Challenge

The operation of heavy water reactors produces large amounts of the carbon isotope ^{14}C. In the moderator cleaning system, the radioisotope is removed by ion exchange resin, which once saturated, is considered radioactive waste. However, ^{14}C and the resins together are unstable and therefore, potential emissions may occur during storage and disposal. Depending on the ^{14}C content, the resins are classified as intermediate level waste with all the associated costs.

Nevertheless, ^{14}C has many uses, from pharmaceutical studies to diagnosis of various respiratory diseases. Although the radioisotope occurs naturally in the upper atmosphere, it must be artificially produced to obtain the quantities needed for pharmaceutical applications.

Solution

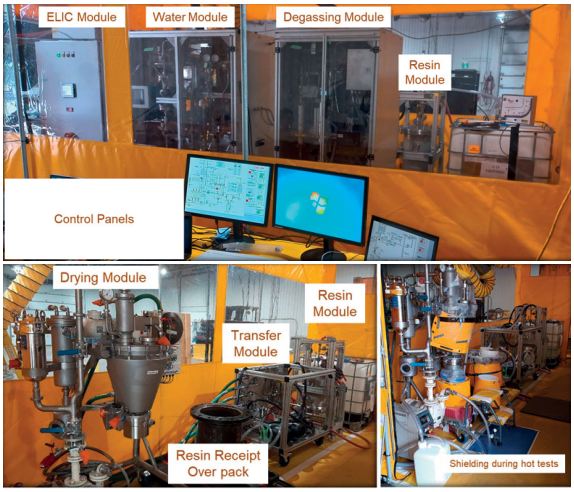
Framatome has developed the first economically feasible way to separate ^{14}C from ion exchanger resins from the moderator cleaning system in heavy water reactors. The captured ^{14}C is chemically bound, generating a long-term stable waste form for safe storage and disposal.
With a sufficiently high quality of ^{14}C, the separated isotopes can be harvested and sold to the pharmaceutical industry to be used for isotopic labeling in medical studies and healthcare applications.

With the radioactive ^{14}C removed from the spent resins, down stream treatment (e.g., liquefaction, drying, thermal treatment), can further reduce the volume of the resins, greatly reducing costs and simplifying the disposal procedure.

Customer benefits

- Small amounts of ILW due to capturing or harvesting ^{14}C.
- Declassification of spent resin to LLW.
- Further volume reduction through down stream technologies.
- Additional revenue by selling harvested ^{14}C.

Your performance
is **our** everyday **commitment**



Set-up of a test facility for radioactive resin waste

Technical information

The CSS consists of 2 - 3 separate steps.

- First an organic acid is used to release the carbonate fixed on spent moderator resins. After the water phase is stripped, the carbon dioxide ($^{14}CO_2$) is removed from the gas phase and fixed onto the adsorber.
- In the second step the organic acid used in the first step is decomposed for safe disposal.
- In an additional treatment step, the volume of the stripped resins can be further reduced (e.g., by liquefaction, drying or thermal treatment).

> 98 %
Recovery rate of ^{14}C from the resins

< 6 %
Remaining ILW classified waste

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