

Boron Recycling Unit

Boron recovery – compact, cost-effective, and retrofittable solution for all types of NPP

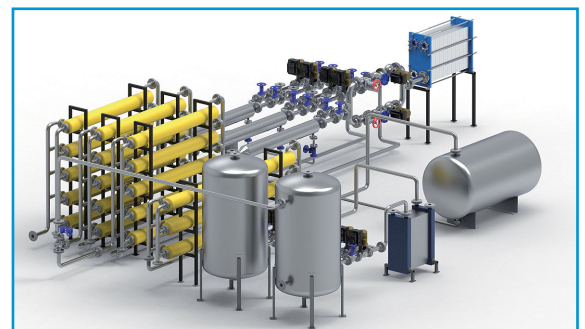
Framatome's retrofittable boron recycling system avoids costly boron disposal while enabling MOX usage, power upgrades, and FlexOp. Using energy- and space-efficient membrane processing, it recycles the valuable Boron-10

Challenge

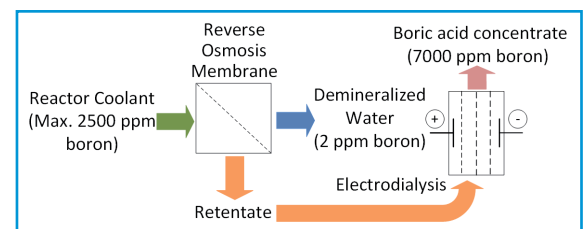
Managing boron recycling in PWRs is critical for reducing operational costs, meeting strict environmental regulations, and optimizing reactor performance. Traditional evaporation units for boron recovery require significant space, high energy input, and complex auxiliary systems. Furthermore, existing plants and new-build projects face increasing pressure to lower the overall costs of boron disposal while complying with strict environmental standards.

Solution

Framatome's Boron Recycling Unit provides a compact and energy-efficient solution for boron recovery, specifically designed for retrofitting existing PWRs or integration into new builds. Utilizing proven Reverse Osmosis (RO) membrane technology in combination with electrodialysis, the system continuously extracts and concentrates boron from the primary coolant. This enables its reuse while producing demineralized water for further processing. Unlike traditional evaporation units, the RO system requires significantly less space and energy, as it eliminates the need for coolant heating. Its modular and compact design simplifies integration and reduces complexity, with fewer components and minimal requirements for instrumentation and control (I&C) or auxiliary systems.



3D model of the Framatome Boron Recycling System



Principle of boron recycling with reverse osmosis membrane in combination with Electrodialysis

Key features

Input: Reactor coolant with up to 2500 ppm boron.

Output: Boric acid concentrate (7800 ppm boron), demineralized water (2 ppm boron).

Capacity: 200 t/day demineralized water.

Electricity usage: ~1 MW power (6x less than evaporators).

Size: ~ 10 m³ vs. 20 m³ evaporator column.

Operation: Batch and continuous modes.

Maintenance: Low, modular membranes.

Integration: Fits in CVCS auxiliary units.

Customer benefits

- **Cost Savings:** Avoids expensive disposal of borated coolant under REACH and reuse valuable enriched Boron-10.
- **Energy Efficiency:** Uses 6 times less energy than traditional boric acid evaporators, significantly reducing operational costs by eliminating the need for high thermal heat input for coolant evaporation.
- **Space Optimization:** Compact footprint enables easy retrofitting and integration in existing facilities.
- **Operational Flexibility:** On-demand production of demineralized water supports load-follow operation.
- **Sustainability:** Complies with environmental regulations and minimizes waste disposal.

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is **our** everyday **commitment**

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