

EDF Pioneers the Use of Non-metallics to Mitigate and Repair Active Nuclear Pool Leaks



French regulations require the declaration and potential repair of any leak exceeding 1.25 gallons per hour. To manage radiological risks, EDF Energy installed leakage recovery systems in all spent fuel pools in the 1990s. However, traditional repair methods that use welding are challenging due to the inability to drain the pools, meaning repairs must be conducted underwater with divers/robotics, along with other associated constraints from competing outage activities. The need for a safer, more practical alternative to traditional welding methods led EDF to pursue non-metallic repair solutions, with EPRI playing a central role in supporting the methods for inspecting and repairing the leaks, including material aging research and implementation guidance.

Benefits

Non-metallic repair (NMR) methods significantly reduce implementation costs, increase the ability to access hard-to-reach areas compared to welding, and support in-situ repairs without the need to locate the exact leak point. The NMR process also avoids any thermal impacts associated with welding on the structural materials of the pool. Using this approach, EDF estimates repair costs will be cut by a factor of 10 to 20 compared to traditional welding, while also reducing downtime and associated lost generation revenue. In addition, the approach enables faster interventions, resulting in significant time savings.

The non-metallic method also enhances safety through reduced radiological exposure, eliminates personnel and divers working in hazardous environments, and avoids remote underwater inspection processes to identify the exact location of the leaks.

Application

From 2003 to 2015, EDF's research and development efforts explored non-metallic repair materials to address active leaks in nuclear pools, leveraging EPRI guidance and collaborative research to pioneer an innovative, first-of-a-kind solution. After receiving authorization in 2012 to use the method internally, EDF partnered with Bouygues Construction in 2018 to implement it across France and the UK, with the flexibility to expand internationally. By 2025, all 19 EDF sites had adopted the non-metallic repair method, with the Blayais Nuclear Power Plant serving as the pilot site due to its urgency and the method's demonstrated effectiveness in preventing potential ground contamination.

The method has received regulatory endorsement, with global interest growing due to its improved inspection technology, scalability, and compliance with evolving regulations.

The utility relied on the following EPRI reports for this project:

- Welding and Repair Technology Center: Non-Metallic Repair of Nuclear Fuel Pool Liners, 3002021072



Figure 1
Spent fuel assembly as it is transported through the transfer canal at Blayais Nuclear Power Plant.

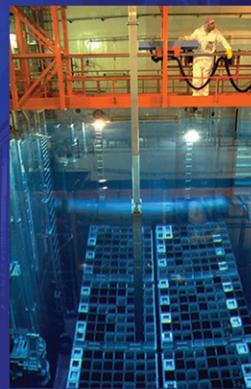


Figure 2
Overhead crane operations during the transportation of the spent fuel delivery at the spent fuel pool at Blayais Nuclear Power Plant.



Figure 3
A diver in EDF's Gravelines Unit 3 NPP.