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SF-05

SAFER: Safely Adapting FastenER

NUCLEAR FUEL DESIGN DEPT. Kim Hyeong Koo
T. 042-868-1183 E. hkkim@knfc.co.kr

Among the Westinghouse type spent fuel(SF) stored in spent fuel pools(SFP), there are many SFs which are concerned about the separation of top nozzle(TN) and guide tubes(GT) due to the corrosion of GT sleeves connecting TN and GT.

SAFER is a supplementary tool to handle these fuels. It is installed at the SF GT bulge and fastens the TN and GT with high clamping force.

- The NRC investigated the cause of the accident and surveyed the similar cases. It turns out there were several similar accidents including the fuel for Kori 1 unit.
- The IGSCC(Intergranular Stress Corrosion Cracking) made of SS304 material was found to be the main cause of the top nozzle separation. SS304 is a GT sleeve material that contains high carbon.
- Supplementary tool is necessary to handle the SF with SS304 GT sleeve safely.(Latest nuclear fuel have replaced the related material with SS304L to prevent the same type of damage)

Description

● Background

- NRC Information Notice 2002-09
 - In 2001, there was a fuel drop accident caused by TN separated from GT during handling the fuel for SF inspection in the SF Pool in North Anna power plant, USA.

- SFP storage tank saturation
 - The capacity of the domestic SFP storage tank is expected to be saturated in the near future.
 - All of the SF with risk of top nozzle separation must be checked before the dry storage in accordance with decommission of Kori 1 unit.



- The SFs with top nozzle separation risk require precautionary measures.

● Purpose and Necessity

- To enhance the SF handling integrity with top nozzle separation risk stored in domestic SFPs.
- Currently about 1,500 bundle of SF with the top nozzle separation risk are stored in SFP.
- To handle these fuels safely, it is necessary to install a supplementary tool.

- SAFER is about 15 cm in length and is convenient for storage and handling.

● Benefits

- Prevent TN separation during SF removal.
- For the domestic SF dray storage project followed by SFP saturation, for a start, SAFER can be applied to the about 1,500 bundle of SF with TN separation risk
- SAFER's excellent function can attract overseas markets

Technology Readiness Level (TRL)

Field demonstration of Prototype

Business Model

- Technology Transfer
- Licensing
- Joint Search
- Service Execution
- Others

Distinctiveness

● Characteristic

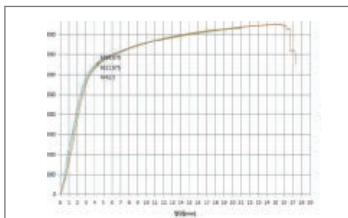
- SAFER is installed at the GT bulge to provide high-strength fastening force with dual structure fastening force of friction and geometric interference force.
- Installation of four SAFERs provides high-strength fastening force that is more than 3 times the weight of the fuel assembly(3g), and superior performance compared to other products.(2g for 6 installations)
- Since SAFER uses screw fastening method, it contributes to the improvement of SF integrity compared with the conventional method which requires excessive installation force to the GT to obtain high friction force.

Experience

- Factory and Site Acceptance Test of SAFER was completed
- The development of Installation/Removal tools was completed
- Promotion of licensing and commercial application(KORI2)

Deliverables

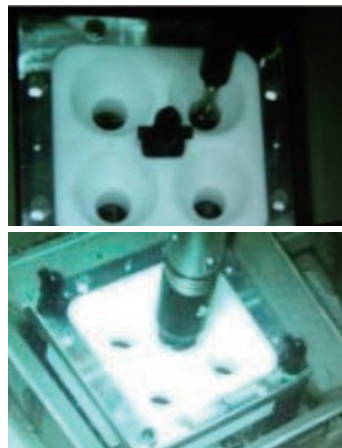
- SAFER, A package of SAFER Installation/Removal Tools
- Engineering services for SAFER installation, related integrity and safety assessment technology



< Fastening Strength Test >



< Factory Acceptance Test >



< Site Acceptance Test >