KNF-
SF-02

Failed Fuel Repair

PRODUCTION MANAGEMENT DEPT.

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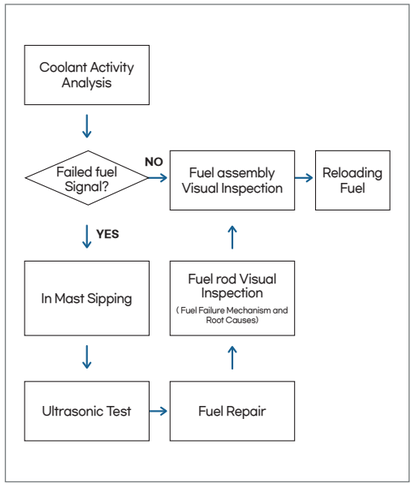
Failed fuel repair is a recovering technology to restore the fuel function as the original ones. Failed fuel rods are replaced with dummy fuel rods and damaged fuel components are replaced with new ones when nuclear fuel is damaged during the operation. There are two kinds of fuel repair methods depending on the nuclear fuel type. One is using a multipurpose fuel repair system and the other one is using spent nuclear fuel storage rack. Tools used in repair process are particularly designed for each fuel types.

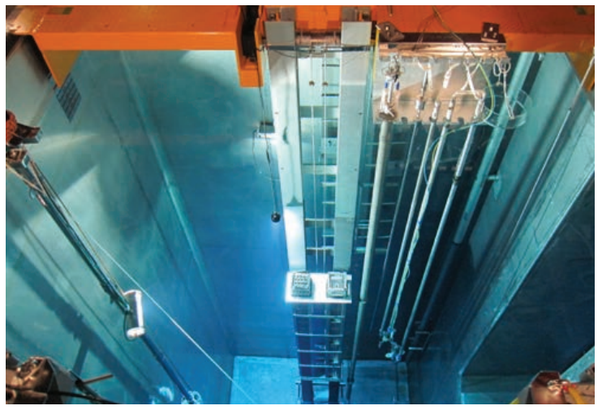
Description

✱ Purpose and Necessity

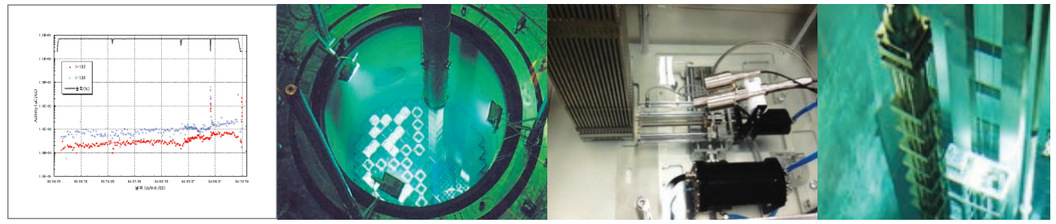
- Save time in emergency core design and improve operating efficiency of a nuclear power plant
- Reuse the failed fuel
- Maintain the fuel integrity for interim storage of a spent nuclear fuel

✱ Flowchart of the main services regarding failed fuel





- The nuclear power plant in-operation monitors the nuclear fuel failure by analyzing the reactor coolant activity. All nuclear fuels can be re-loaded for the next cycle if the coolant analysis says there is no sign of fuel failure. However, once there is a sign of it, IMS and UT must be executed on all nuclear fuels in core to find where it happened. After removing the failed fuel rod and inserting a dummy rod by fuel repair, the failed fuel is recovered its mechanical integrity and can be reloaded in the following cycle core.



< Coolant Analysis > < In Mast Sipping > < Ultrasonic Test > < Fuel Repair >

- With the purpose of analyzing the root cause of the fuel failure and preventing the fuel failure recurrence, accurate visual inspection for the extracted failed fuel rod is performed by using the radiation tolerant underwater camera.

✱ Main equipment for fuel repair

- Top nozzle handling tool
- Fuel rod handling tool
- Fuel rod guide plates
- Fuel rod storage basket
- Fuel rod visual inspection system
- Cameras to monitor repair service
- Multipurpose nuclear fuel repair system [for WH type NPP]

✱ Main process to repair

- Failed fuel repair is processed by the following order.
  ① Nuclear fuel visual inspection before repair,
  ② Top nozzle removal,
  ③ Failed fuel rod extraction,
  ④ Failed fuel rod visual inspection,
  ⑤ Dummy rod insertion,
  ⑥ Top nozzle assembling,
  ⑦ Nuclear fuel visual inspection after repair.

Distinctiveness

✱ Characteristics

- Fuel repair using spent nuclear fuel storage rack
- Fuel repair using multipurpose nuclear fuel repair system

✱ Benefits

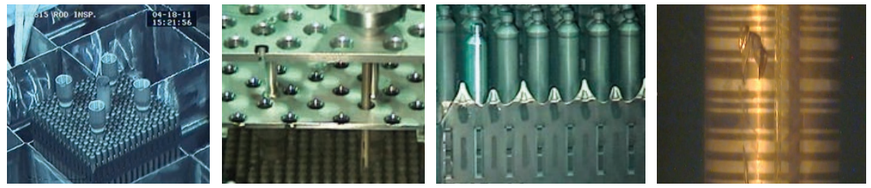
- Enhance plant operation efficiency by preventing emergency core design which requires a lot of time
- Reduce cost by reusing the failed fuel
- Meet the requirement of fuel integrity for interim storage of a spent nuclear fuel

Experience

- Repaired total 532 assemblies(1998~2018)
- Applied to WH-type and Korea Standard Nuclear Power Plant

Deliverables

- Failed fuel repair equipment
- Failed fuel repair service



< Decomposition of top nozzle > < Remove leakage fuel rod > < Insert dummy fuel rod > < visual inspection for leakage fuel rod >

TECHNOLOGY READINESS LEVEL(TRL)

- Actual system proven through operation

BUSINESS MODEL

Technology Transfer
Licensing
Joint search
Service Execution
Others