

SCC Advanced Testing Facility for Environment of high Temperature water in Yokosuka (SAFETY)

Purpose:

Austenitic stainless steels with low carbon content have been used in light water reactor (LWR) components such as core shrouds and primary loop recirculation (PLR) piping. However, stress corrosion cracking (SCC) was observed in core shrouds and PLR piping. The occurrence has stimulated the quasi-national standard to tolerate the operation of power plants with cracking. There are few dates for the establishment of SCC growth rate diagram in the standard. In order to obtain further dose rate reduction in Japanese LWR, it is important to develop some innovating water chemistry techniques, on-line health monitoring methods for structural material integrity, and high quality evaluation techniques for FAC behavior. This facility intends to conduct the following research.

1. Study on SCC initiation and propagation behavior for sophistication of the standard
2. Development of the advanced water chemistry for reduction of exposure and corrosion inhibition

Outlines:

This facility consists of the following test apparatus

1. SCC initiation and propagation test for light water reactor components.
2. Formation and accumulation mechanism of the radioactive corrosion products for the reduction of radiation exposure.
3. Advancement for the FAC forecasting model.

These facilities make it possible to contribute the rational and safe operation of light water reactors.

Specifications:

<SCC test machine>

1. 「BWR Mother Loop」 Temperature: < 300 °C, Pressure: < 10 MPa, flow rate : <100L/ h , Formation of high temperature and high pressure water.
2. 「PWR Sub-Loop」 Temperature: < 360 °C, Pressure:< 21 MPa, flow rate : < 1L/ h , Formation of high temperature and high pressure water.
3. 「Constant Load Test Machine (PWR type, BWR type)」 Autoclave capacity: 20 ℓ , Ultimate load: 30kN (tensile), Tensile system: biaxial-three consecutive test specimens (0.5T-CT specimen), Load: high-sensitivity inner load cell, It is possible to evaluate the SCC initiation and its growth properties of LWR structural materials in high temperature and high pressure water.
4. 「Ultra long-term SCC test machine (BWR type)」 Autoclave capacity: 50 ℓ , Pipe material and liner material of autoclave: Titanium, It is possible to evaluate the SCC countermeasure technique for LWR components by large-size test specimen.

<Water chemistry test machine>

1. “Crud Generation and Deposition Behavior Test Facility (for PWR)”
 - It is possible to analyze amounts and chemical state of crud layer deposited on fuel cladding sample.
 - Maximum solution temperature 360 °C
 - Maximum pressure: 21MPa
 - Steaming ratio of fuel cladding surface: 3kg/m²sec
2. “FAC test facility”, Temperature: < 200 °C, Pressure: < 10 MPa, flow rate : < 10L/ h , [On-line measurement of FAC rate]
3. “In-situ water chemistry analyzer”
 - It is possible to conduct in-situ analysis amounts and chemical species of crud ion/particle in the test solution.
 - Fluorescence X-ray spectroscope
 - Atomic absorption spectrophotometer
 - Ion chromatograph

Location and Date of Installation:

Yokosuka Campus, February 2007



Constant Load Test Machine (BWR type)



Crud Generation and Deposition Behavior Test Facility



On-line corrosion monitoring system of “FAC Test Facility”