

Severe Accident Long-Term (SALT) Containment Condition Control Processes

Determination of Margins in Long-Term Reliability Analyses of Safety Equipment in Severe Accident Scenarios

Challenge

During severe accidents, fission products, released into the containment, determine the source term for degradation of equipment and thus have a significant influence on the mid- and long-term equipment reliability.

Products from air radiolysis and respective chemicals in sumps and pools lower the pH of water, which is used for spray and cooling, to acidic values. Acidic water is able to degrade critical equipment.

Simple, conservative models and postulations are locally imprecise, show too much degeneration and predict early equipment failures.

Solution

Calculate long-term plant behavior for severe accidents by less conservative, but more detailed source term analyses, fission product distribution and mixing of water pools with high time resolution.

Distinguish between different compartments and their individual degradation progresses based on hazard distribution analyses.

- Calculate the pH value directly from chemical species distribution
- Enable for determination of pH neutralization measures
- Improve local prediction of acidic loads on equipment
- Qualify for mitigation and long-term equipment operation (acid resistance)



Technical information

COCOSYS analysis code evaluates:

- Radiolysis model for HNO₃ creation
- Models for HNO₃ transport behavior
- Transport behavior of fission products
- Water pool local chemical composition

COCOSYS special features:

- Selection of adequate containment model
- Analyze sensitivity of structures and equipment to containment conditions
- Identify detrimental scenarios and analyze impact of potential mitigation actions
- Enables long-term reliability analysis

Customer benefits

- Experience, exchange and vital feedback from international SA research and discussion with regulatory bodies, in the frame of new build projects
- Supports demonstration of compliance with regulatory requirements in the frame of LTE application cases
- Framatome supports customers in cost-efficient realization of regulatory guidelines (e.g. IAEA) by minimizing conservative assumptions
- Larger margins in equipment long-term reliability analyses of severe accident scenarios
- Realistic quantification of local acidic loads for equipment
- Information on requirements for mitigation measures for long-term containment cooling

Key figures

Increased prediction accuracy of **up to ±1.0** in pH of local acidity,

60% increase in reliability during long-term severe accident scenarios, assessment of pH levels of up to **2 months** after initiating event.

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