



Support to Your Plant Aging Management and Life Extension Programs

Studsvik is launching SMILE (Studsvik Material Integrity Life Extension), a project that will support Light Water Reactor (LWR) operators and authorities worldwide in plant ageing management. The objective of SMILE is to provide critical data and mechanistic understanding of materials ageing mechanisms in support of plant ageing management, life extension programmes and operating licence renewals.

SMILE is a 5 year Studsvik/OECD/NEA project that also will connect experts from all over the world, creating a forum for knowledge transfer between organisations and age generations. Experimental examinations and testing of aged materials, harvested from LWRs decommissioned after 40+ years of operation, provide the basis.

Ageing degradation of structural materials in LWRs is a significant challenge for their continued safe and reliable operation. It is all the more important for plant life extension beyond the original 30 to 40 year design objective that is being pursued in many countries. Several international studies over the last two decades have identified, categorized and prioritized the main causes of LWR structural materials degradation due to metal fatigue, corrosion-related mechanisms, thermal ageing and neutron irradiation damage. This has led to guidelines from national and international safety organizations for establishing detailed plans for plant ageing management, life extension programmes and operating licence renewals.

Ageing management relies on models of the kinetics of the various mechanisms of degradation as well as validated replacement materials/components where necessary. SMILE aims to support LWR plant operators and national nuclear safety regulators by improving knowledge of materials ageing phenomena and their kinetics.



SMILE will leverage a near-unique opportunity to harvest various components from three Swedish BWRs and one Swedish PWR that have recently been shut down or will soon be withdrawn from service. The data obtained will form the basis for improved models predicting materials and LWR components properties for life extensions to 60 years and possibly up to 80 years.

SMILE is organized into three main tasks that address specific material classes and/or generic primary coolant system components, as follows:

- Low alloy pressure vessel steels:
 - Irradiation embrittlement;
 - Thermal ageing embrittlement;
 - Ingot manufacture and forging related issues;
 - SCC and corrosion fatigue properties of irradiated RPV steels.
- Stainless steel core support structures and internals:
 - Irradiation embrittlement including stainless steel welds;
 - IASCC susceptibility;
 - CASS thermal ageing with irradiation effects.
- Austenitic pressure boundary alloys without significant irradiation effects:
 - Stainless steel and nickel-base alloy weld SCC resistance in BWRs and PWRs;
 - Alloy 690/152/52 PWSCC resistance and thermal stability in PWRs;
 - Low cycle corrosion fatigue in BWR and PWR reactor coolants and high cycle fatigue and wear.



Facts of Studsvik laboratories

- Located ca 100 km south of Stockholm
- Unique testing facilities with nuclear licences
- 7 concrete cells with more than 40 fuel rods examined per year
- Autoclave systems for SCC and fracture mechanical testing of unirradiated and irradiated materials
- Advanced and custom-built test systems for corrosion and chemistry studies under LWR conditions
- Test systems for studies of activity buildup on LWR system surfaces
- 11 lead cells and 8 steel cells with advanced material and mechanical test methods
- In-pile testing and irradiation of various fuel types and materials (in collaboration with test reactors)
- Facilities for advanced chemical and microscopy analysis of fuel and structural materials
- Facility with fuel ponds for measurement of materials and development of equipment
- International transport services
- Safe and efficient maintenance with well-established waste streams

Studsvik offers

- To plant owners, operators and regulatory bodies
 - Critical sets of data required from authorities for life extension projects
 - Independent establishment of material property data for assessment of critical components life expectation
 - Independent expertise obtaining in-depth understanding of mechanisms involved
 - Support of existing models, validation and or development required for life management of reactors
- Expertise and long experience within test set ups and on-line techniques
- A wide selection of advanced analytical tools
- Expertise and experience benchmarked by many international experts

“Together
towards
80 years”

Studsvik

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