Mission & Vision

Studsvik Mission

• To provide world-leading, innovative, customized, valuable and environmentally safe solutions in the global nuclear and radiological markets

Studsvik Vision

• By creating superior value for our customers we will be the preferred and leading solutions provider in our chosen markets
Our offerings

**Fuel & Materials Management**
- Optimization of fuel lifecycle
- Extension of reactor lifetime

**Waste Treatment**
- Practical treatment of radioactive waste

**Waste Management**
- Setting waste management strategy, policy and plans
- Design, license, build & operate waste treatment facilities

**NORM Management**
- Lifecycle management of Naturally-Occurring Radioactive Materials

**Decommissioning Services**
- Specialist services from strategic planning through to waste management

**Radiological Safety, Protection and Engineering**
- Our underpinning core competence
Fuel and Materials Technology

- Fuel and Materials Technology:
  - Studsvik SCANDPOWER software
  - Material Technology business

- Focus on:
  - Fuel and Materials Optimisation
  - Spent and Failed Fuel Management
Fuel and Materials Management
Efficiency (Minimize Fuel Cost)
Operation and Safety (Fuel Integrity & Regulatory Compliance)

Fuel Design
Operation
Post-Operation

Optimize Fuel Lifecycle & Extend Reactor Lifetime
Materials Technology: Key Offerings

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<th>Pre-Operation</th>
<th>Operation</th>
<th>Post-Operation</th>
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<tr>
<td>• Review of supplier material and concepts used in NPPs</td>
<td>• Life management (RPV)</td>
<td>• Fuel Testing (PIE)</td>
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<td>• Fuel licensing support</td>
<td>• Radiation dose management</td>
<td>• Failed fuel</td>
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<td>• Fuel behavior scenarios</td>
<td>• Water chemistry information system</td>
<td>• Analysis</td>
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<td>• Anticipated</td>
<td>• Primary circuit failure analysis (components)</td>
<td>• Management</td>
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<td>• Final repository</td>
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<td>• Activity mapping NPPs</td>
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Research programs / projects

• Swedish utilities research programs (BFUK)
• HCL Swedish utilities Hot Cell Investigations
• SKB Final disposal of fuel program
• SCIP Studsvik Cladding Integrity Program (I, II, III)
• NRC LOCA testing program, Part of SCIP II
• Bilateral programs / projects on fuel and materials and corrosion and water chemistry
• Thermal ageing Phd project
• Zorita Internals Research Project
• F4E GRTs - Corrosion studies of VV materials under ITER relevant operational conditions
• Mulitmetal concertium
• JHR concertium
Swedish utility research program

- Materials integrity
  - IGSCC
    - Effects of temperature and K
    - Input for disposition lines
  - PWSCC
    - Effects of hydrogen, temperature and K
    - Effects of Li, B, Zn and impurities
- Irradiated materials
  - IASCC
    - Irradiation effects on fuel & material properties

- Activity build-up and CRUD
  - Fuel crud / System oxides / Release
  - AOA
    - Secondary side water chemistry optimization
- Electrochemical monitoring and modeling
- Trouble shooting

NiOOH from R4
Loop for Corrosion studies at high linear flow rates
Designed for testing corrosion of Ni-base alloys
All hot parts of titanium
Flow rates up to 18 m/s
Studied the effect of environment, alloy composition and flow rate on the corrosion

Non destructive and destructive characterisation
- Weighing
- Ellipsometry
- SEM
- TEM
The effect of hydrogen on the oxide formation in the crack tip of Alloy 600 in simulated PWR environment – combining CGR testing and HR microscopy

ICG. 17-22 May 2015. Ann Arbor
Activity build-up studies using radiotracer techniques

Safeguard materials integrity
Reduce doserate
Minimize release

Study the influence of water chemistry activity build-up
Evaluate oxides formed, by high resolution microscopy
Correlate oxide microstructure and activity uptake
ALARA

Study recontamination

Ag-110m och Sb-124 increasing doserates
Cross technical issues

Influence of Li content on the initiation of IASCC

- Elevated Li at the very surface of thick oxide location
- Evidence of local boiling & Li induced breakaway corrosion

A. Puranen et al, LITHIUM AND BORON ANALYSIS BY LA-ICP-MS
RESULTS FROM A BOWED PWR ROD WITH CONTACT, Proceedings of Top Fuel 2015
Thermal ageing on cast or welded stainless steel – PhD project
Financed by Forsmark, OKG, Ringhals, SSM and Studsvik

- Characterize thermal aged components by microstructural analysis and mechanical testing
- Model the macroscopic properties from the microstructural properties
- Develop a micromechanical test method for measuring relevant parameters for thermal aged components
Zorita Internals Research Project

- Material from a decommissioned power plant have been made available and was transported from Spain to Studsvik. Doses up to ~50 dpa.

- Work is now on going to study the IASCC initiation and propagation as well as to determine the mechanical properties of this material.

- The overall objective of the Zorita Internals Research Project (ZIRP) is to generate data on the effects of irradiation on reactor internal material, to get data for aging management and plant life extension work etc.
SCIP Studsvik Cladding Integrity Programme

• An OECD-NEA project with Studsvik as the principal investigator
• Running 5-year programs funded by project members (27 organisations in 13 countries)
• SCIP 2004-2009. Cladding failure mechanisms at high burnup
• SCIP II 2009-2014. PCI mitigation and behaviour of additive fuels
• SCIP III 2014-2019. LOCA and overheating transients

Paris, June 2014
SCIP III – Objectives

Support the nuclear community by analysing and quantifying:

- The thresholds of fuel fragmentation in a LOCA transient
- The fuel response in overheating transients:
  - Fuel condition after an off-normal temperature transient
  - Loss of coolant from the spent fuel pool (SFP)
  - Effect of axial load in the LOCA quench phase
- The mitigating effect of the ramp rate on PCI
Studsvik repository research

• Leaching of spent nuclear fuel in hot cell for more than 30 years
• Duration from days and months (instant release) to several decades (matrix dissolution)
• Leaching under different environments: temperature, pressure, water content, atmosphere
• Large range of analytical techniques
• Results used for development and validation of SNF dissolution models

Autoclave tests of SNF

Radiolysis experiment of SNF

Fuel leaching in the Hot Cell
Thank you for your attention!
Studsvik