pwr PRAGUE 2026



Studsvik's

Practical Experience in Fuel and Material Qualification Supporting Nuclear Plant Long-Term Operation

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Outline

- Short introduction
  - Key business areas
- How Studsvik support NPP's LTO programmes
- Main fuel and material programmes
  - SCIP, SMILE, …
- Conclusions
  - Future visions



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About the Studsvik Group

Providing services to the nuclear industry through the entire lifecycle, from new build to final disposal



NET SALES

883

MILLION SEK 2025

GLOBAL SALES IN

15+

COUNTRIES
IN ALL REGIONS

MORE THAN

500

EMPLOYEES WORLDWIDE

LOCAL OFFICES IN

6

COUNTRIES

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Companies in Studsvik

- Studsvik AB/Studsvik Nuclear AB
  Studsvik Waste Management Technology AB
- AB SVAFO (Vattenfall AB)
- Cyclife Sweden AB (EDF Group, France)
- Element AB (Element Materials Technology, USA)
- Better Energy Solar Park
- Baltic Waters

Nuclear facility

Started in 1947 as the Swedish government's research facility for the development of nuclear technology.

Included own research reactor operated for almost 50 years (closed).

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International hub

Bringing together international organizations for joint research.

A critical global resource for the qualification of fuel and materials.

Center of excellence

World-leading expertise and facilities in testing and an international research center.

OECD/NEA projects since 2004.
Repository studies for SKB Sweden.

Expansion opportunities

- Hub for nuclear technology
- New nuclear initiatives
- inDrum testing facility

Worldwide Network



ANS American Nuclear Society

NEI NUCLEAR ENERGY INSTITUTE

YG young generation

sweden WiN Women in Nuclear

U.S. WIN

BSCC
BRITISH-SWEDISH CHAMBER OF COMMERCE
est. 1954

一般社団法人 日本原子力学会
Atomic Energy Society of Japan (AESJ)

NEA NUCLEAR ENERGY AGENCY

OECD

ENS EUROPEAN NUCLEAR SOCIETY

WORLD NUCLEAR ASSOCIATION

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Our key business areas

New Build

- Fuel and materials testing
- Waste planning for licensing
- Fuel planning (Software)
- SMR project development

Long-Term Operation

- Fuel and materials testing
- Planned outage and maintenance
- Software for fuel management
- Safety systems
- Waste treatment

Decommissioning

- Waste treatment
- Decommissioning services
- Software to manage intermediate fuel

Life Science

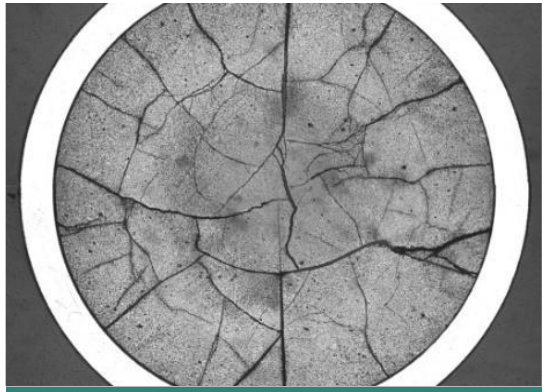
- Isotope source production
- Other services requiring radioactive knowledge and facilities

Nuclear fuel and material qualification programmes



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Fuel and materials qualifications



Nuclear Fuel Qualification



Final Disposal Simulation and Back-end Solutions



Materials Qualification incl. Lifetime Extension



Transport of Irradiated Materials



Hot Cell Technologies and Expertise



Water Chemistry Simulation

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International cooperation projects



- **SCIP V** (Studsvik Cladding Integrity Project) covers both operations and back-end.
  - Members in 15 countries & 40 organizations
- **SMILE** (Studsvik Material Lifetime Extension Project) based on PWR and BWR materials from decommissioned reactors.
  - Members in 10 countries & 20 organizations
- **Nordic nuclear industry programmes:** HCL/PGB (fuel), PGK (BWR water chemistry) and PGP (PWR water chemistry)
- **LAGER** PIE project to better understand and quantify the radial distribution of burnable gadolinium isotopes in a fuel rod with low and relevant burnup.

SCIP – Studsvik Cladding Integrity Project

- Values for nuclear operation
  - Current/important LWR fuel safety-related topics
  - Acceptance by regulators
  - Wide range of LWR fuel types included
- Focus areas
  - SCIP I – Cladding failure mechanisms at high burnup
  - SCIP II – PCI mitigation and additive fuels
  - SCIP III – LOCA FFRD, overheating transients, aspects of PCI
  - SCIP IV – Back-end and LOCA
- SCIP V (2024-2029) – continues to address the back end (creep of irradiated clad&fuel under dry storage conditions, hydride precipitation and reorientation, clad annealing and treatment of failed fuel) and LOCA (FFRD and transient fission gas release and axial gas communication).

Studsvik work with AM fuel components in Swedish reactors

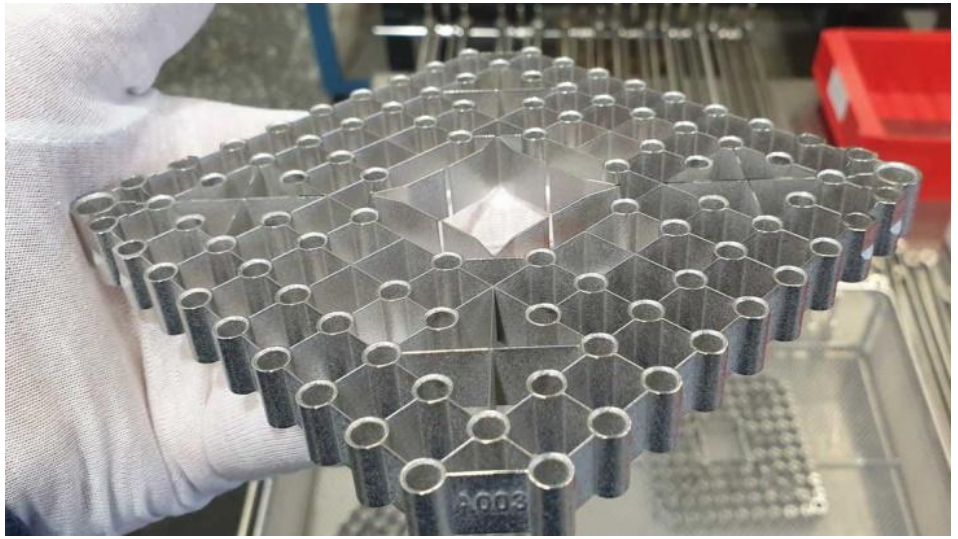
- Forsmark 3 Atrium 11 upper tie plate (**Framatome**)
  ⇨ Individual lead assemblies loaded in core 2022

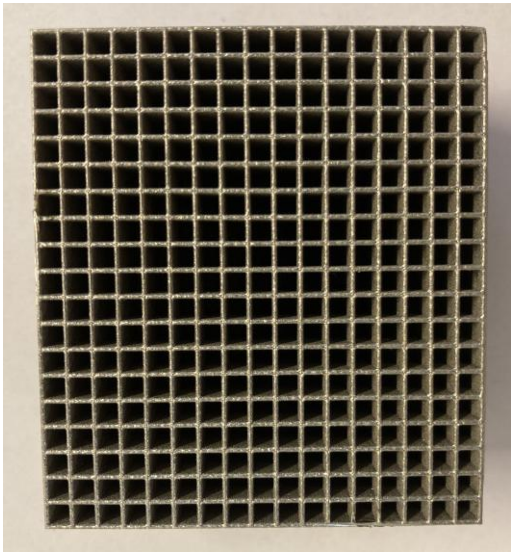
  https://www.world-nuclear-news.org/Articles/3D-printed-fuel-component-installed-at-Swedish-rea

- Oskarshamn 3 Optima3 StrongHold AM debris filters (**WSE**)
  ⇨ Individual lead assemblies loaded in core 2022
  https://info.westinghousenuclear.com/news/westinghouse-creates-and-installs-industrys-first-3d-printed-fuel-debris-filter-for-nuclear-power-plants

- **A**dvanced **M**aterials **T**echnology **V**erification for **I**mplementation in **N**uclear **E**nergy
  AMTVINE collaborative industry-research institute project sponsored by Swedish Energy Agency
  ⇨ Including PIE on AM component irradiated in Swedish BWR

  https://www.ri.se/en/expertise-areas/projects/advanced-materials-technology-verification-for-nuclear-energy





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SMILE (Studsvik Materials Integrity Life Extension) project

- To support LWR operators and authorities worldwide in plant ageing management by providing critical data and mechanistic understanding of materials ageing mechanisms in support of plant ageing management, life extension programs and operating license renewals
- The experimental approach leverages a unique opportunity to harvest materials from Swedish LWRs that have recently shut down after 40+ years of operation
  - Examination and testing of fully aged materials directly relevant to LWRs provides information that can be used to improve and develop models for the prediction of ageing






- 5-year OECD/NEA Joint Project operated by Studsvik
- Started in January 2021
- Currently *20* member organizations from *10* countries
- SMILE 2 has just started in 10/2026

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SMILE Task structure

Task 1
Materials library

- **Subtask 1.1**
  Acquisition of materials
- **Subtask 1.2**
  Documentation of all harvested materials
- **Subtask 1.3**
  Calculations
- **Subtask 1.4**
  Database

Task 2
RPV – Irradiation & thermal embrittlement

- **Subtask 2.1**
  Irradiation embrittlement

Task 3
SS core support structures and internals

- **Subtask 3.1**
  Irradiation embrittlement Including SS welds
- **Subtask 3.2**
  IASCC and corrosion fatigue susceptibility
- **Subtask 3.3**
  Irradiated CASS

Task 4
Austenitic pressure boundary alloys

- **Subtask 4.1**
  DMW and SS welds; SCC resistance in BWRs and PWRs
- **Subtask 4.2**
  Alloy 690/152/52 PWSCC resistance and thermal stability in PWRs

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Conclusion

- Long-Term Operation (LTO) requires robust fuel and material qualification supported by high-quality experimental data ➡ Studsvik provides independent testing, examination and analysis capabilities covering the entire fuel and material lifecycle.
  - Decades of experience in fuel qualification, ageing management, reactor pressure vessel and core internals assessment, hot cell operations, and transport of irradiated materials support safe and economical operation beyond original design lifetimes.
- International collaboration projects such as SCIP and SMILE provide operators, vendors, regulators and research organizations with valuable data to address current and future LWR challenges.
  - Access to materials harvested from operating and decommissioned reactors enables the development and validation of ageing models critical for license renewal and plant life extension programmes.
- As nuclear power expands through both LTO and new build programmes, Studsvik remains a trusted independent partner for fuel and material qualification, helping to reduce risk and accelerate informed decision-making.



Our vision: Studsvik site 2035

AI VISUALISATION

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Thank you for your attention

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