SUCCESS STORIES
PLANT LIFE MANAGEMENT
Customer: Fortum

Challenge: The unit 1 of the Loviisa nuclear power plant started its commercial operation in 1977. Neutron radiation embrittlement of the reactor pressure vessel (RPV) during the plant's life and its potential effect on safety margin during postulated thermal transient have been a concern already during the plant design and build-up phase. To mitigate embrittlement and ensure the integrity of the RPV's during their entire service, Fortum launched a programme that included analyses and plant modifications at both units. An essential part of the programme was also to design and install material surveillance capsules inside the RPV to ensure knowledge on development of RPV material embrittlement and on effect of the measures to reduce embrittlement.

Solution: VTT has supported Fortum using its research infrastructure and expertise by:
• Developing the Master Curve method to assess the RPV embrittlement, and
• Executing an extended surveillance testing program and providing basis for the safety case

Key benefits: The programme and conclusions on RPV lifetime have helped Fortum to ensure integrity of the RPVs during the extended service of the plant units. Fortum has a culture of continuous improvement of its production units. Numerous other improvements in safety and performance including power upgrading of Loviisa Nuclear Power Plant have been designed and implemented by Fortum. The existing operational licences of Loviisa NPP units are valid until the end of 2027 (unit 1) and 2030 (unit 2).

COLLABORATE WITH US
You can work with us in many ways
• CONTRACT RESEARCH PROJECTS are tailor-made to your needs. Results are confidential and delivered exclusively to you.
• JOINTLY-FUNDED PUBLIC PROJECTS are carried out and funded in cooperation with businesses and public funders (EU, national funds, etc.) and/or other partners. Costs, risks, results and benefits are shared with all participants.
• KNOWLEDGE TRANSFER PROJECTS – we help to develop skills and capacities within your organization, as necessary to cover your long-term needs.
• LICENSING – we provide you with methods, tools, and techniques protected by intellectual property rights

Quality of our operations
• We employ skilled and motivated personnel, and well-maintained and safe facilities and equipment
• All our key testing, inspection and calibration methods are accredited
• VTT quality management system is certified for ISO 9001:2000

ASK US MORE!
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VTT’s nuclear expertise and research infrastructure

VTT Technical Research Centre of Finland Ltd has a unique set of sophisticated experimental facilities, analysis and modelling software, and professional staff with decades of experience and multi-technological background and state-of-the-art knowledge from research projects.

We are committed to serve the industry in developing new plants and technologies, operating existing power plants in safe and economical manner, helping to make customer business sustainable and profitable.

We study irradiated and non-irradiated specimens, investigate into root causes, and solve problems caused by stress corrosion cracking, irradiation, corrosion, erosion, vibration, thermal fatigue, thermal ageing etc.

Nano-, micro- and macro-scale material characterization and modelling – we use it to provide exact answers to help solving your problem.

SOLUTION-DRIVEN STRUCTURAL INTEGRITY AND MATERIAL RESEARCH
VTT has 30-year experience of structural integrity-based material performance and durability in nuclear applications:

- Reactor pressure vessels
- Primary circuit components
- Concrete structures
- Coatings, electric cables
- Radwaste disposal materials

We work for operators, suppliers and designers of plant and equipment, as well as regulators.

We are an independent organization, and we respect the requirements concerning independence of methods and tools, and the impartiality of experts and management. We collaborate with other research organizations to complement our services.

AIRCRAFT IMPACT TESTING AND ANALYSIS
We conduct unique experiments for studying the effect of aircraft crash type loads on reinforced concrete structures in a medium scale. Our test facility features:

- Different sizes, hard or soft projectiles
- Impact energies up to 750 kJ
- Various thicknesses of specimens
- Testing frames for 2 m wall span
- Records of displacements, acceleration and strains.

We study liquid release velocities and droplet sizes in an impact of liquid-filled projectiles simulating the fuel tanks.

We use test results to perform numerical analysis of real cases to support the design.

We are able to manufacture test specimens locally in Finland.

NEW AND FLEXIBLE EXPERIMENTAL INFRA
VTT offers flexible multi-scale experimental and material testing environments:

- Hot cells*
- Radiological labs*
- Microscopy (LOM, SEM, TEM)
- Simulated primary circuit environments
- Metallurgy labs
- Mechanical workshops*

We offer test results analysis and further support from our nuclear domain experts.

- Brand-new, available from 2017

SAFETY AND ENGINEERING ANALYSES
VTT has a wide variety of commercial and in-house developed analysis software codes in use to supply information on system behaviour on all levels of detail: fuel and reactor core internals, thermo-hydraulic and integrated systems, severe accidents, releases and doses, and life cycle assessment. Both deterministic and probabilistic safety assessment services are available.

- Custom-designed NDE solutions and techniques for nuclear power applications
- PWR-, VVER- and BWR-specific solutions
- Training for NDE users on optimized techniques

We can help you!

We work for operators, suppliers and designers of plant and equipment, as well as regulators.

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REMOTE-OPERATED TECHNOLOGY PLATFORM
VTT develops remote-operated technologies and control solutions for nuclear applications.

Full-scale remote-operated technology platform with robotic solutions was developed by VTT and Tampere University of Technology for ITER reactor.

NEW MATERIAL TEST REACTOR
In-core testing of NPP materials - VTT will have access to 2% share of Jules Horowitz Reactor’s capacity (expected by 2021), as representative of Finland in international project consortium.

Read more: www.vttresearch.com/nuclear