

SKC and ANItA

Annual Symposium 2024

at AlbaNova University Center in Stockholm

Welcome to this annual event where the status of nuclear technology research and development work at Uppsala University, the Royal Institute of Technology and Chalmers are presented by young researchers.

Listen to experts, policy makers and politics and be part of the discussion about new nuclear power technology.

October 15th

- 09:30-10:00 *Assembly*
- 10:00-10:15 *Introduction*
Cilla Andersson, SKC
Ane Håkansson, ANItA
- 10:15-10:45 *Preparations for new Nuclear power*
Carl Berglöf, Government Office
- 10:45-11:15 *Collaboration - not competition*
Robert Bergqvist, Rolls-Royce SMR
- 11:15-11:45 *Coffee break*
- 11:45-12:15 *Towards 80 years of operation*
Monika Adsten, Vattenfall
- 12:15-13:00 *Ongoing nuclear research at CTH, UU, and KTH*
- 13:00-13:50 *Lunch*
- 13:50-15:00 *Sigvard Eklunds Prize*
- Announcement of the winners
- Presentation of theses
- 15:00-15:30 *Coffee break*
- 15:30-16:00 *Competence for Nuclear Power*
Marie Claesson, Swedish Energy Agency

October 16th

- 16:15-17:15 *Research Project Presentations session 1 and 2*
- 18:00 *Mixed food at the KTH Reactor Hall*
- 09:00-10:00 *Research Project Presentations session 3 and 4*
- 10:00-10:15 *Quick break*
- 10:15-11:15 *Research Project Presentations session 5 and 6*
- 11:15-11:45 *Coffee break*
- 11:45-12:45 *Research Project Presentations session 7 and 8*
- 12:45-13:00 *Summary and closure of the Symposium*
Cilla Andersson, SKC
Ane Håkansson, ANItA
- 13:00-14:00 *Lunch*

Research Project Presentations

at the SKC and ANItA Annual Symposium 2024

Session 1 (SKC)

Kristoffer Tofveson Pedersen - *Study of core stability during load follow with ROM methods*

The project started 2020 and is carried out at the Department of Physics at CTH. Main supervisor is Christophe Demazière. The main objective of the work is to be able to understand the parameters involved when studying the stability of a nuclear reactor concerning load-follow conditions and to be able to assess whether a core loading is stable or unstable directly from the Reduced-Order Model (ROM), without turning to lengthy and complex high-fidelity simulations.

Shuyue Wang - *Influence of ageing and radiation on ductile fracture in the DBT temperature region*

The project started 2020 and is carried out at the Department of Engineering Mechanics at KTH. Main supervisor is Jonas Faleskog. The main objective of the work is to understand the influence of time-dependent ageing and degradation mechanisms on the ductile behavior of low alloy steels.

Session 2 (ANItA)

Johan Eriksson – *Light-water SMR designs suitable for Sweden's future electric power production needs*

The project started 2023 and is being carried out at the Department of Chemistry and Chemical Engineering at CTH. Main supervisor is Teodora Retegan Vollmer. The main objective of the work is to identify light-water SMRs that are suitable for Sweden's future electric power production needs and, based on novel features of the SMR designs, define the need for further investigation.

Mariam Saad- *An overview of feasibility of utilizing different types of SMRs for production of hydrogen to meet the Swedish future demand.*

The project started 2024 and is being carried out at the Department of Chemistry and Chemical Engineering at Chalmers. Main supervisor is Teodora Retegan Vollmer. The main objective of the work is to compare different types of SMR designs that can be used as an alternative procedure for supplying the current and future hydrogen demanded for industrial purposes.

Flavio Ferella- *Fuel assembly and core design optimization for SMRs*

The project started in late 2023 at the department of Physics and Astronomy of Uppsala University.

In this project we aim to propose methodologies for core design optimization, in particular for what concern equilibrium cycles for Small Modular Reactor and demonstrate the competitiveness with respect to large power plants. The methodologies will be applied to two SMR designs: AP300, a SM-PWR from Westinghouse, and BWRX-300, a SM-BWR from General Electric Hitachi.

Session 3 (SKC)

Ibrahim Batayneh - *SEMRA: Steam Explosion Modelling and Risk Analysis for light water reactors*

The project started 2021 and is carried out at the Department of Physics at KTH. Main supervisor is Dmitry Grishchenko. The main objective of the work is to develop a new code for ex-vessel steam explosions in LWRs.

Gustav Robertsson - *Calibration of fuel performance codes - treating model inadequacies, nuisance parameters, and unrecognized systematic uncertainties*

The project started 2020 and is carried out at the Department of Physics and Astronomy at UU. Main supervisor is Henrik Sjöstrand. The main objective of the work is to improve techniques for calibration and uncertainty quantification in the context of fuel rod performance simulations.

Session 4 (ANItA)

Salma Hussein - *Core monitoring and diagnostics in SMRs*

The project started in 2023 and is carried out at the Department of Physics at Chalmers University of Technology. The main supervisor is Paolo Vinai. The main objective of the work is to investigate a core monitoring technique based on reactor neutron noise for SMRs. The work employs machine learning algorithms to identify perturbations from the reactor neutron noise response.

Vikram Rathore - *Evaluating fuel performance under load-follow conditions in small modular reactors using TRANSURANUS*

We have analyzed the impact of hypothetical load-follow operations on fuel performance using the TRANSURANUS fuel performance code. Various load-follow scenarios, differing in frequency, duty cycle, and amplitude, were applied to existing Light Water Reactor (LWR) power histories, and their effects on fuel performance were systematically evaluated.

Graeme Trundle - *On the way from Forsmark natural circulation reactor tests to BWRX-300 modelling.*

Validating system codes for modeling natural circulation is essential for the safety analysis of small modular reactor designs.

This study employs TRACE and PARCS to simulate natural circulation tests conducted on the Forsmark 1 BWR, aiming to enhance the modeling of future SMR BWRs, including the BWRX-300.

Session 5 (SKC).

Mustafa Subasic - Corrosion fatigue in LWR environment at cyclic thermal and mechanical loads

The project started 2020 and is carried out at the Department of Engineering Mechanics at KTH. Main supervisor is Pål Efsing. The main objective of the work is to contribute to improved assessment tools and methods against corrosion fatigue at mixing points and systems with stagnant and/or turbulent flow.

Yi Meng Chan - Application of artificial neural networks in reactor physics calculations

The project started 2021 and is carried out at the Department of Physics at KTH. Main supervisor is Jan Dufek. The main objective of the work is to develop more accurate nodal data representation compared to the models in the current literature. This would allow for more flexible and accurate reactor simulations than possible with existing data models.

Session 6 (ANITA)

Fredrik Petersson - Experimental studies on boric acids effect on light water chemistry in small modular reactors

Boric acid is widely used in today's PWRs as neutron absorber, for SMRs it has been proposed as a possibility to remove boric acid completely. In this presentation, we try to elucidate how boric acid affects the overall chemistry of the nuclear reactor. Its effect on structural materials is also investigated.

Artur Tamm - Electronic losses in radiation damage events (experiments and modelling)

Developments on quantifying electronic-ion coupling both experimentally and from first principles will be presented for Zr and Ge. This new information is used to parameterise the EPH model for use in large-scale molecular dynamics simulations of radiation damage in materials.

Session 7 (New research)

Vidar Ekström - Towards a nuclear re-industrialisation – A study of external hurdles along the way

The future of new nuclear energy depends on not only the technology itself, but also on more external factors. This research aims to look into a select few of these external factors, and study how they stipulate the conditions for a possible nuclear re-industrialisation. The research will be conducted through

qualitative, semi-structured interviews with stakeholders and actors from different sectors involved in the planning for new nuclear energy.

Maria Helena Aubets Oliva - Dissolution and radionuclide release from corium in contact with water

In this project we will study the dissolution and fission product release from samples with prototypic composition (synthetic corium) in contact with water. And determine the kinetics and mechanism of the process and the impact of Corium composition, constituents of the aqueous phase, ionizing radiation, and temperature. The goal is to determine how various radionuclides as a result of the interaction between Corium and water and atmospheric gas may significantly affect the accident site safety.

TBD - Regulatory perspectives and licensing Status of ANITA project E2

Session 8 (ANITA)

Esraa Darwish - Progress in Solvent Extraction Method for Spent Nuclear Fuel Recycling: Current Developments and Future Directions

The project started in 2023 and is being carried out at the Department of Chemistry and Chemical Engineering at Chalmers University. The main supervisor is Christian Ekberg. The main objective of the work is to develop a solvent extraction method to recycle actinides (U, Pu, Np, Am, and Cm) from dissolved spent nuclear fuel for reuse in future fuel manufacturing.

Claudia Olaru - Proliferation resistance assessment using the INPRO methodology:

Introducing light-water SMRs in Sweden The project started 2023 and is carried out at the Department of Physics and Astronomy at UU. The main supervisor is Sophie Grape. The main objective of the work is to provide safeguards concepts and solutions for the introduction of SMRs in Sweden by studying the logistical, legislative and technical aspects of non-proliferation & safeguards for SMR deployment.

Maria Morgunova - Reviving nuclear energy in Sweden - how long will it take?

The project started 02/2023 at Uppsala University, Division of Industrial Engineering and Management, coordinated by Åse Linné. The focus is on the existing setting for nuclear energy deployment in Sweden. We share preliminary results on perceptions and visions of different groups of actors about prospects of nuclear energy in Sweden.