

Singapore Nuclear Research and Safety Institute

The Singapore Nuclear Research and Safety Initiative (SNRSI) was set up in 2014 under the Nuclear Safety Research and Education Programme (NSREP), which was developed with the objective of building up Singapore's capabilities in nuclear safety, science and engineering.

SNRSI aims to concentrate expertise and knowledge in nuclear technology and safety in a single institute and sustain a critical mass of expertise in a range of nuclear-related activities relevant to Singapore and the region through a combination of scholarships, research excellence, education and outreach activities. This initiative received funding of \$62.9 million and \$30 million in 2013 and 2017, respectively, from the National Research Foundation (NRF) in the Prime Minister's Office. The funding tranche of \$66 million in 2025 provides continued support to Singapore's efforts to systematically build up capabilities in this area.

Previously operating out of the Campus for Research Excellence and Technological Enterprise (CREATE) Tower at NUS University Town, the SNRSI team has grown over the last decade to 55 researchers and administrative staff, as well as 34 overseas scholarship recipients. The research team brings together expertise from a wide range of disciplines including nuclear engineering, physics, chemistry, biology, material science, law and policy studies. The Institute aims to double its team by 2030. It has now been redesignated as a full-fledged institute, the Singapore Nuclear Research and Safety Institute.

1. Overview

SNRSI's objectives are to:

- i) Attract, develop and sustain a community of nuclear experts through scholarships, training, undergraduate education programmes and research
- ii) Host research laboratories and technical support capabilities
- iii) Develop relationships and collaborations with regional and international counterparts
- iv) Promote a better understanding of radiation and nuclear-related topics in Singapore

2. Core research areas

SNRSI's core research areas include reactor safety, radionuclide dispersion, radiochemistry, radiobiology and nuclear policy.

i) Reactor Safety

The reactor safety team studies the safety of existing and upcoming reactors, especially those that have the potential to be commercialised, such as pressurised water-cooled reactors, light-water reactors (LWR) and high-temperature gas-cooled reactors (HTGR). Over the years, SNRSI has built a team that can assess the safety of these reactors through the simulation of their normal operating conditions and conditions that could result in failures of the reactor as well as the level of contamination for such failures in these reactors.

ii) Radionuclide Dispersion

The radionuclide dispersion team studies the potential migration and impact of radionuclides, which are radioactive isotopes, in the environment across multiple scales ranging from hundreds of metres to thousands of kilometres. In particular, the team

develops high-resolution numerical models to accurately address these processes in our densely populated urban environment.

iii) Radiochemistry

The radiochemistry team studies and develops methodologies for the detection of radionuclides in common local materials. Such expertise is critical for understanding the base levels of radionuclides in our environment, as well as supports Singapore's efforts in determining levels of contamination in the environment, if any, should there be an incident in any existing nuclear power plant.

iv) Radiobiology

The radiobiology team studies the effects of radiation on biological systems. This is done through a multi-pronged approach to study these effects at the cellular and physiological levels. In particular, the team aims to contribute to the growing body of understanding of the multi-faceted biological response to low-dose radiation.

v) Nuclear Policy

Research on nuclear policy is part of SNRSI's mandate to develop capabilities to understand nuclear science and technology, as well as developments in nuclear energy. The nuclear policy team aims to provide analyses to assess the implications of evolving nuclear energy technologies and regional nuclear energy developments for Singapore.

3. Future plans

In addition to doubling its manpower to about 100 staff by 2030, and fully utilising the new building's potential space for expansion, SNRSI's future plans include:

- Building capabilities in the simulation of radionuclide dispersion in water
- Developing a high-fidelity nuclear reactor simulator for research
- Performing physical experiments on reactor safety using a fluid thermohydraulic test loop
- Developing new methods for the rapid detection of radionuclides in various matrices
- Correlating biological samples from nuclear incidents or medical exposures with experimental data for a holistic understanding of radiobiological responses, including possible adaptive effects from low dose exposure
- Building strong national capabilities in nuclear policy both in SNRSI and in other research institutes in Singapore and become an authoritative source of information and advice on policies for the governance of nuclear energy
- Informing the consolidation of good regulatory practices, nationally and in the region, for a robust nuclear safety, security and safeguards regime