

S'pore nuclear safety research gets boost with new institute

Expanded research scope, \$66m grant will also help nation better assess viability

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The Republic's research initiative on nuclear safety is progressing further with a new institute, additional \$66 million in funding and an expanded scope that will help Singapore better evaluate nuclear power's viability for the city-state.

Such research areas include studying nuclear waste, conducting accident simulations, expanding on nuclear policy studies and studying the deployment of underground reactors.

The Singapore Nuclear Research and Safety Institute (SNRSI) in the National University of Singapore was officially launched on July 11 by National Research Foundation chairman Heng Swee Keat.

The institute's predecessor was the Singapore Nuclear Research and Safety Initiative. It did not have its own building, and was housed in the Campus for Research Excellence and Technological Enterprise Tower in NUS.

"As an institute, it will now partner international laboratories to develop expertise in reactor simulation and modelling to analyse the safety of reactor designs," said Mr Heng.

"This will enable it, over time, to build capabilities to assess aspects of the safety of small modular reactor (SMR) designs and their suitability for domestic deployment," he added.

SMRs are advanced and compact reactors that can be factory-assembled and installed in dense urban areas. They are also known to be safer than traditional large reactors, but are now mainly still at a research phase.

The initiative was started in 2014 as Singapore's first foray into nuclear research and had a large focus on nuclear safety and building talent.

For example, the initiative had partnered with Ukraine to study organisms and blood samples from one of the most radioactive places on earth – the Chernobyl Exclusion Zone.

Over 30 scholarships have also been awarded for students to pursue postgraduate studies in areas related to nuclear science and engineering.

"In the decade from 2014, we have invested more than \$150 million in initiating research, developing talent and setting up this new building that we are in," said Mr Heng.

A government study in 2012 had shown that nuclear technologies of that time were unsuitable for deployment in the city-state.

But nuclear technologies have evolved since then to include smaller, safer reactors that could be used in Singapore.

Amid growing international interest in tapping carbon-free nuclear energy, the new SNRSI will expand on studying emerging nuclear technologies, nuclear policy and educating the public about atomic power, which tends to incite fear due to a few high-profile meltdowns.

The \$66 million grant by the NRF will help the institute expand work in five areas.

These are safety, nuclear policy, the dispersion of radioactive particles, the impact of radiation on living things and the rapid detection of elevated levels of radioactivity.

The grant amount was given under the NRF's research, innovation and enterprise 2025 plan, and will last 2½ years from December



National Research Foundation chairman Heng Swee Keat and NUS president Tan Eng Chye (right) observing a cloud chamber that showcases radiation during a tour at the launch of the Singapore Nuclear Research and Safety Institute on July 11. PHOTO: AZMI ATHNI

2024.

SNRSI aims to "become an authoritative source of information and advice on policies for the governance of nuclear energy", it said in a statement.

Mr Heng added that SNRSI has joined the International Atomic Energy Agency's research programme to study and identify viable options to manage used nuclear fuel and waste from different SMR technologies.

"Waste management will likely be a critical factor for public support for domestic nuclear deployment, if and when pursued," he noted.

FEATURES OF THE NEW BUILDING

Built in the middle of a small, forested area at Prince George's Park, the new five-storey institute has a curved facade to avoid felling two large trees next to it.

Radioactive activities and equipment that release radiation are housed in the basement.

The equipment, called irradiators, is used to send pulses of radiation to zebrafish embryos in biological studies, or test the accuracy of radiation detection meters used in local industries.

As a precaution, the institute's irradiators are enclosed in 65cm-thick bunker-style concrete walls to block radiation, while air filtration units remove potentially radioactive particles from the fume hood exhaust.

Due to the terrain on which the building stands, the irradiators point to the soil under the slope of Kent Ridge, and this further protects people in the building.

Singapore has not made a decision to go nuclear.

But since it has limited access to renewable energy, nuclear is among various low-carbon sources that the country is looking into while keeping in mind energy security, affordability and the carbon footprint.

Prime Minister Lawrence Wong had in his Budget speech in February made clear that Singapore will study the potential deployment of nuclear power here.

The country's stance on the controversial power source has been shifting since 2022. That year, a report by the Energy Market Authority mentioned that emerging technology, including nuclear and geothermal, could potentially supply around 10 per cent of Singapore's energy needs by 2050.

Mr Heng noted that while no Asean countries have an operational nuclear plant, some have announced plans for deployment,



such as the Philippines by the early 2030s and Indonesia by 2040.

"Capability building will help us understand the implications of nuclear developments in the region and ensure we are prepared if our neighbours choose to deploy nuclear energy," he said.

The National Environment Agency (NEA) said in a statement: "The national monitoring system serves as a crucial safeguard against transboundary pollution, particularly significant amid the growing interest in nuclear energy programmes across the region."

The NEA manages a suite of tools to keep track of ambient radiation levels, including around 40 radiation monitoring stations for air and water islandwide.

In March, The Straits Times reported that Singapore's coastal monitoring network will be upgraded to include sensors that can measure radioactivity in the waters.

The agency is also working with other countries in the region to set up a South-east Asian early warning network with sensors deployed across the countries and data shared in the event of an emergency.

RESEARCH AREAS

One of SNRSI's research pillars, which looks into the dispersion of radioactive particles, will further help with monitoring efforts.

The institute has a team that models how radioactive pollutants might disperse through the atmosphere or water, within an urban environment to over 2,000km.

Some levels of radiation exist all around us, and the amount of natural radiation a person in Singapore is exposed to over 24 hours is 0.0024 millisieverts. An airline

passenger is exposed to 0.19 millisieverts of radiation on a long flight between Tokyo and New York.

A high dose of 1,000 millisieverts will cause radiation poisoning – a life-threatening condition that includes vomiting, nausea and rectal bleeding.

SNRSI has also been doing computer modelling to study the safety of advanced technologies such as SMRs.

The researchers create computer software to model virtual replicas of existing SMRs, and run accident scenarios to assess their risks and what could happen during a meltdown.

In the future, SNRSI is planning to develop a nuclear reactor simulator for research.

SNRSI will next study the deployment of SMRs underground to optimise land use here, and reduce the risk of any unlikely radioactive leak.

On human health, while the dangers of high levels of radiation are well known, how the body responds to continuous low-dose radiation is an area that SNRSI wants to contribute to.

Mr Heng said that the institute will ramp up research on the effects of low-dose radiation on humans by "studying the impact on our local population with our unique ethnic and geographical landscape".

The institute currently has around 50 experts who specialise in nuclear engineering, physics, chemistry, biology, material science, law and policy studies.

With talent building close to its heart, SNRSI plans to have 100 nuclear experts in its building by 2030.

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The new institute has around 50 experts who specialise in nuclear engineering, physics, chemistry, biology, material science, law and policy studies. It plans to have 100 nuclear experts by 2030. PHOTO: LIANHE ZHAOBAO