Australian Government

ANSTO

ALL ABOUT ANSTO

Nuclear-based science benefiting all Australians

All about **ANSTO…**

The Australian Nuclear Science and Technology Organisation (ANSTO) is the centre of Australia's nuclear science capabilities and expertise. We are one of the nation's most unique and valued scientific assets, and have a reputation internationally for undertaking outstanding, innovative scientific research.

ANSTO stands at the edge of a new era, one in which our nation's prosperity and the well-being of our citizens are linked to our ability to compete technologically on the world stage. The country's new research reactor – OPAL – is an important step towards securing Australia's future in an age of increasingly sophisticated industrial and medical technologies.

OPAL will be a boon to the national economy – it will enable us to deliver an enhanced range of products and services to Australian and overseas collaborators and customers. We will also play an increasingly significant role in improving the health of Australians through better medical diagnostic tools and treatments.

OPAL will enhance Australia's research capabilities, increase the range of world-class research we undertake – all of which reflects national priorities – and attract the best international researchers to collaborate with us.

Since 1958, scientists and engineers have used ANSTO's nuclear facilities and expertise to increase scientific knowledge and assist Australian industry. Their efforts have produced benefits in many areas essential to Australia's future, including human health, agriculture, manufacturing, minerals, construction and the environment.

The production of radiopharmaceuticals to help in the diagnosis and treatment of a range of serious illnesses is one of the critically important activities ANSTO undertakes. The impartial advice it provides to government on a range of important long-term issues, including climate change, power generation and counter-terrorism, is also an essential role of the organisation.

In the international arena, we contribute to regional and global initiatives that make the world a safer place in which to live. For example, we advise countries, especially in the Asia-Pacific, on effectively managing radioactive materials for medical and industrial uses, and storing radioactive waste without compromising the environment or human safety.

Educate, inform…and **surprise**

- ANSTO's reactor is not a power reactor; water exiting the reactor core is not hot enough to make a cup of tea.
- There has never been an incident at ANSTO, or at any research reactor around the world, which has had any off-site impact on people or the environment.
- OPAL is less than one-hundredth the size of a typical power reactor. The reactor core (which contains all the nuclear fuel) is about the size of a small washing machine.
- There is a good chance that your digital camera, computer or i-pod has some silicon in it that was irradiated at ANSTO's reactor.
- ANSTO works with international agencies to assist in the detection of undeclared nuclear activities and drug trafficking.
- ANSTO's new nuclear research reactor, OPAL, can produce about four times as much nuclear medicine as Australia's first reactor, HIFAR.
- Over half a million Australians each year use an ANSTO-produced nuclear medicine.
- Bones and tendons are irradiated at ANSTO so they are safer to use in transplant operations.
- On average, every Australian will have a medical procedure in their lifetime using an ANSTO-produced nuclear medicine.
- Nearly 950 staff work at ANSTO.
- About 8 000 people visit ANSTO each year.

Science at ANSTO

Environmental

Nuclear science is helping resolve major Australian environmental challenges, including climate change and water management. ANSTO uses both naturally-occurring and man-made isotopes to understand climate change, track air and water pollution and address problems involving water usage, conservation and flow.

Health

ANSTO's health research addresses techniques valuable in the diagnosis and treatment of cancer, and Alzheimer's and Parkinson's diseases. Our radiopharmaceuticals research aims to improve understanding of disease progress, improve diagnosis and assist in developing new treatments.

Materials

ANSTO's materials research capabilities cover mechanical testing, structural integrity and engineering analysis. We assess the remaining life of structures, buildings, operating plants and facilities. Also, in addition to ANSTO's internationally renowned expertise in immobilising problematic radiological waste, the organisation has materials development, processing and characterisation capabilities, and develops advanced materials for high-tech industrial applications.

Minerals

ANSTO also undertakes research and provides consultancy services in the areas of uranium ore processing and radioactivity in minerals processing. We work with mining companies in Australia and internationally to maintain the integrity of the natural environment around mine sites and ensure the safety of mining workers.

Neutron scattering

ANSTO has world-class neutron scattering facilities. Neutrons are 'tools' for investigating atomic and molecular structures, and the properties of matter, that can be used with complementary technologies such as synchrotron radiation and electron microscopy. They are used to solve complex research and industrial problems in a wide range of fields including plastics, minerals, engineering, pharmaceuticals, electronics and biology.

Neutron scattering techniques are being applied to industrial questions ranging from residual stresses in power generator turbine blades, to heavy metal absorption by plants and the design of new drugs. These techniques will also provide insight into some essential biological processes of the human body.

Neutrons are generated by ANSTO's OPAL reactor at Lucas Heights, whilst Australia's X-ray science will be centred around the Australian Synchrotron (which produces X-rays) in Melbourne.

National interest and capability enhancement

ANSTO is using the unique capabilities of nuclear techniques in collaborative research to support the nation's counter-terrorism and 'national interest' research efforts. This includes the use of 'nuclear forensics' to identify illicit nuclear activity, and pursuing improvements in radiological detection. ANSTO also undertakes international collaborations and strategic relationships in a range of research fields, fostering the safe, beneficial use of nuclear science and technology.

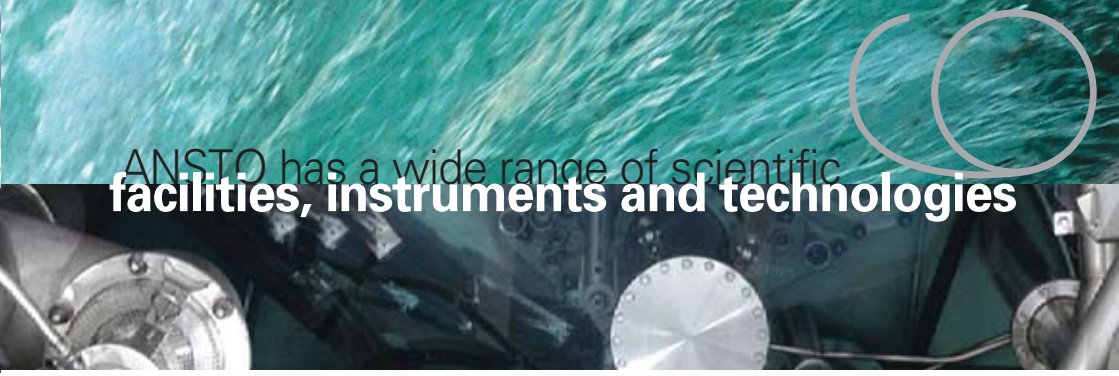
ANSTO science in your world

- OPAL's neutron scattering facilities let scientists look at biological material to help understand how proteins work in the body or how a drug does its job.
- Neutron beams are being used to measure the stresses and strains in engineering components like turbines and brake rotors, to help make them work more efficiently and for a longer period of time.
- ANSTO scientists are using nuclear techniques to better understand the water cycle in catchments: groundwater run-off, evaporation, transpiration and rainfall.
- By analysing tree rings, ice cores, corals and sediments, ANSTO scientists are looking into 'climates' of the past to better understand potential future climate changes.
- ANSTO instruments can detect tiny amounts of materials and are used for forensics and environmental monitoring.
- By understanding the structure of materials at the nano and molecular levels, ANSTO scientists can alter materials' physical properties to, for example, lock up radioactive waste long-term; produce highly durable concrete; and quickly grow waste-eating bacteria.
- Working with doctors in medical research institutes, ANSTO is developing new radioactive 'tracers' for early-stage detection of cancers and neurodegenerative diseases such as Alzheimer's and Parkinson's.
- ANSTO's science has helped solve archaeological and historical puzzles related to bushranger Ned Kelly, Aboriginal cave paintings, Charlemagne's crown and human migration in the Pacific and Indian Oceans.

ANSTO science in your **world**

Some innovations our scientists have devised:

- A water-recycling unit to cut household water consumption by 60%.
- A method enabling drugs to be released into the human body that target specific organs, at a pace prescribed by physicians to suit the patient and the disease.
- A method to improve the quality and integrity of knee replacements.
- A process to link pharmaceuticals and radioisotopes within unique 'cages' that help with cancer diagnosis.
- Improved cancer-fighting pharmaceuticals with unique abilities to identify, diagnose and treat tumours.
- A technique for applying a scratch-proof, lightweight coating to sunglasses, atom by atom.
- Techniques to assist authorities identify illicit nuclear materials hidden within legal shipments of radioisotopes.
- Software to help mining companies accurately assess environmental hazards and better protect biodiversity.



ANSTO has a wide range of scientific **facilities, instruments and technologies**

Some major ones are noted below:

OPAL

OPAL, Australia's new world-class research reactor, is helping this country maintain its advanced position at the frontiers of international science. It is the centre-piece of the facilities we offer at ANSTO. It provides greatly increased capacity for irradiation of radioisotopes for nuclear medicine and industry, and the performance of its neutron beam instruments for scientific research will rank it as one of the top three research reactors in the world.

National Medical Cyclotron

The National Medical Cyclotron, an accelerator facility adjacent to the Royal Prince Alfred Hospital, near central Sydney, produces radiopharmaceuticals used to diagnose heart conditions, neurodegenerative and thyroid diseases, and cancer. A cyclotron is an electrically powered machine that accelerates charged particles to high speeds and beams them at a suitable target, producing a nuclear reaction that creates a radioisotope (an essential part of a radiopharmaceutical). Cyclotrons produce different types of radioisotopes than reactors.

Accelerators

The Australian National Tandem Accelerator for Applied Research (ANTARES) and Small Tandem for Applied Research (STAR) are particle accelerators. They provide ultra-sensitive radioisotope analysis for environmental studies, atmospheric research, oceanography, archaeology, bio-medicine and nuclear safeguards. They are also used to develop new materials technology and understand the characteristics of materials – biological, geological or man-made.

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Public information

ANSTO produces regular updates on our science and technology, has available a range of publications and conducts free site tours. For bookings, information or for regular updates on our science and technology, please contact us.

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