Australian Government

ANSTO

Annual Report

2018 - 2019

Science. Ingenuity. Sustainability.

Chair's letter

Australian Government | ANSTO

15 October 2019

The Hon Karen Andrews MP
Minister for Industry, Science and Technology
Parliament House
CANBERRA ACT 2601

I am pleased to present the Annual Report of the Australian Nuclear Science and Technology Organisation (ANSTO) for the period 1 July 2018 to 30 June 2019.

This report has been prepared in accordance with the requirements of the *Australian Nuclear Science and Technology Organisation Act 1987 (ANSTO Act)* and section 46 of the *Public Governance, Performance and Accountability Act 2013 (PGPA Act).*

The report has been approved for presentation to you by a resolution of the ANSTO Board members on 23 September 2019, with the exception of the 2018-2019 Consolidated Financial Statements, which were signed on 15 October 2019.

Yours sincerely

Honourable Dr Annabelle Bennett AC SC
Chair

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Aboriginal and Torres Strait Islander readers are warned that this Report contains images of deceased persons.

About ANSTO

- ANSTO leverages great science to deliver big outcomes.
- We partner with scientists and engineers and apply new technologies to provide real-world benefits.
- Our work improves human health, saves lives, builds our industries and protects the environment.

ANSTO is the home of Australia's most significant landmark and national infrastructure for research including the Open Pool Australian Light-water (OPAL) multi-purpose reactor, the Australian Synchrotron, the Centre for Accelerator Science (CAS), the Australian Centre for Neutron Scattering (ACNS) and the National Deuteration Facility (NDF).

Every year around 6500 scientists from industry and academia benefit from gaining access to these state-of-the-art facilities.

As part of enabling a strong national collaborative network, ANSTO is connected with Australian and New Zealand universities through the Australian Institute of Nuclear Science and Engineering (AINSE), providing researchers with access to Australia's nuclear science, technology and engineering expertise and national infrastructure which, in turn, facilitates greater national science collaboration.

ANSTO's many strategic international collaborations with world-leading research institutes and universities ensure Australian scientists are well placed to drive innovation for Australia.

These important partnerships give Australian scientists access to some of the world's most sophisticated research techniques, enabling discoveries that benefit both Australia and the world.

ANSTO is central to Australia's nuclear medicine manufacturing capabilities. Each week ANSTO delivers over 12,500 patient doses of nuclear medicine to over 250 hospitals and medical practices across Australia and the region. On average, more than one in two Australians will benefit from the nuclear medicines that originate from ANSTO in their lifetime.

Australia has a strong international role in nuclear science and technology through ANSTO. As a member of the International Atomic Energy Agency (IAEA) Board of Governors, Australia is committed to the peaceful application of nuclear science and technology. ANSTO's long-term partnership with the IAEA has given our country important global responsibilities.

ANSTO operates research facilities in three locations — Lucas Heights and Camperdown in Sydney New South Wales, and Clayton in Melbourne Victoria.

Our vision

To equip and empower our people to respond to the growing nuclear science and technology needs of Australia and the world.

Our Corporate Plan 2018–2019

ANSTO's Corporate Plan is the enabling document for the organisation to implement our strategic priorities and vision. Approved by the ANSTO Board, the plan is a public document available via the ANSTO website.

Strategic objectives

ANSTO's strategic priorities for **2018–2019** are:

1 **Putting people first**	To equip and empower our people to respond to the growing nuclear science and technology needs of Australia and the world.
2 **World class science and technology outcomes**	To create innovative solutions to complex problems and provide new insights into our world.
3 **Strategic management of landmark and national infrastructure**	To serve users, enable world-class research and create economic impact and benefit.
4 **Nuclear and related expertise and advice**	To provide expert advice, education and services to support Australian policy and strengthen Australia's nuclear knowledge base.
5 **ANSTO's business and innovation**	Provide services and products to our customers that benefit the broader community.

Responsible Ministers

The Hon Karen Andrews MP
Minister for Industry, Science and Technology
From 28 August 2018

Senator the Hon Michaelia Cash
Minister for Jobs and Innovation
1 July 2018 - 28 August 2018

Senator the Hon Zed Seselja
Assistant Minister for Science, Jobs and Innovation
1 July 2018 - 28 August 2018

The Hon Karen Andrews MP

Chair's report

It was with great pleasure that I accepted the appointment of Chair of ANSTO in March this year. Many Australians are aware of the important role that ANSTO plays in our health system through the delivery of nuclear medicines and I am looking forward to continuing to be a part of an organisation that impacts society in this and other ways.

I would like to acknowledge the work and dedication of my predecessor, Jim McDowell, who made a significant contribution to the direction and the growth of ANSTO over his five-year term as Chair.

I would also like to thank Penny Dobson, who acted as Board Chair from September 2018 to March this year, and congratulate her on her re-appointment as Deputy Chair. Penny's contribution to ANSTO has been, and continues to be, of great value.

Much has been achieved since I joined ANSTO. The nandin Innovation Centre has taken shape, the nuclear regulator's granting of an operating licence for the Mo-99 Manufacturing Facility was a significant milestone and the expansion of the Australian Synchrotron's suite of beamlines commenced. These developments will further enhance ANSTO's ability to benefit Australia in the future.

Together with these successes, the organisation has faced significant challenges within our nuclear medicine manufacturing and production facilities over the reporting period. In this relatively small but vital area of ANSTO there have been issues, both with maintaining the ageing nuclear medicine production facility, known as Building 23, and with establishing safe and stable operations within the new Mo-99 Manufacturing Facility.

These bespoke and complex facilities involving radiation are challenging to maintain and to commission. I wish to acknowledge the dedicated teams of people within ANSTO and the wider nuclear medicine community, who endeavour to maintain a reliable source of supply to patients. When such challenges have meant that there has been limited supply of nuclear medicines, the Nuclear Medicine Working Group, comprising representatives from RAINS, ANZSNM, AANMS, NSW Health and GMS, have worked with ANSTO to ensure that critical medicine gets to the places where it is most needed. I know that we all look forward to, and are working to ensure, the sustained ability to provide a more stable and safe operation which will, in turn, support reliable supply.

The Board is also committed to meeting a high standard of governance, which was a particular subject of focus during the reporting period. Improvements in this area will continue to be a key priority for me and the Board.

Progress is being made in identifying, with community support, a suitable site for Australia's National Radioactive Waste Management Facility and I am pleased that ANSTO has provided support to our Department in their efforts to progress this.

I extend my appreciation to the Minister and to our Department for their ongoing advice and support. This includes the acceptance by the Department of an invitation to attend meetings of the Board, where Departmental input has proved invaluable.

Finally, but importantly, I acknowledge the contributions and expertise of my fellow Board members over the reporting period. It is a pleasure to work with such a committed team.

Over the coming years, with the development of the ANSTO Innovation Precinct, it is my hope that Australians will become more aware of the significant beneficial applications of nuclear science and technology to support innovation for our industries. Our success in this area will lead to jobs and growth to benefit all Australians. I look forward to this future with great optimism.

The Hon. Annabelle Bennett AC SC
Chair

Chief Executive Officer's report

During this reporting period, ANSTO has continued to leverage its unique resources and expertise in nuclear and accelerator technologies to support improved outcomes in health, a more sustainable environment and Australian industries.

ANSTO's research-enabling role and commitment to collaborative partnerships were evident in the demand for access to our infrastructure and capabilities. In 2018 more than 3,800 researchers, scientists or industry representatives undertook experiments outlined in more than 1,900 successful project proposals. Many of these users visit ANSTO facilities multiple times each year.

Usually, research and infrastructure access do not lead to a publication in the same year. In 2018, there were 964 publications from ANSTO researchers and users of our infrastructure. Thanks to all staff who facilitated access to our instruments and capabilities.

The temporary relocation of the University of Wollongong's (UOW) Titan Krios cryo-electron microscope and permanent relocation of the Spatz neutron scattering instrument from Germany's Helmholtz-Zentrum Berlin onto the Lucas Heights campus were arranged because of ANSTO's well-established relationships with those organisations and experience as a home for such leading-edge research infrastructure.

Based on its unique capabilities and expertise, ANSTO has an important role in ensuring Australia is connected to key global science initiatives. Along with colleagues from the Australian National University (ANU), ANSTO has continued to contribute to the world's largest fusion experiment, ITER. Work on this project to deliver the technology to create sustainable, clean energy has progressed well during the past twelve months. ANSTO and Australia's role focuses on collaborating on fusion physics and some of the engineering challenges.

Progress has also been made with key translational projects, including: the development of the world's first compressive gamma-ray imaging technology; a first full-scale Synroc® waste treatment facility to treat by-products from our new Mo-99 Manufacturing Facility; the development of a new nuclear medicine for the treatment of late-stage prostate cancer using Lutetium-177 from the OPAL reactor; and the development of a new Positron Emission Tomography (PET) imaging protocol. Progress on a newly-developed type of radiation therapy using synchrotron radiation aims to deliver single session radiation treatment.

The ANSTO Innovation Precinct is moving forward. With eleven businesses now in place at our nandin Innovation Centre, it has quickly become a dynamic and convenient place for industry and ANSTO's science community to come together, connect, share ideas and innovate.

We welcomed the announcement from the New South Wales Government to support the ANSTO Innovation Precinct with a grant of $12.5 million. This generous commitment from the State Government will enable the development of a next-generation nuclear medicine cluster. The funds will also support the establishment of a graduate nexus to connect young researchers with start-ups looking to benefit from working with ANSTO.

ANSTO again played a key role in the convening of the Third National Particle Therapy Symposium in Brisbane in March. Significant progress is being made by Australian clinical and research communities in developing a coherent national plan for particle therapy facilities, including a fully-funded proton therapy facility in South Australia, proposals for proton therapy facilities in Queensland and Victoria and a proton and carbon-ion therapy facility in New South Wales. In addition, Australia continues to develop the skills and knowledge required for a highly-skilled particle therapy workforce to ensure the successful introduction of particle therapy to Australia.

Over the last year, there have been some challenging developments within ANSTO's nuclear medicine business, which manufactures molybdenum-99 in one facility and uses this to produce technetium-99m Gentech Generators in another facility.

Technetium-99m is the most commonly used nuclear imaging agent for the fast and accurate diagnosis of cancer, heart disease and a range of other serious medical conditions. At full production, approximately 135 Gentech Generators are sent out to Australian medical centres, hospitals and clinics a week.

A mechanical breakdown occurred in our Technetium-99m generator production facility, in June 2018, which impacted domestic supply. During the breakdown period, by working with stakeholders in the US, ANSTO was able to import supplies of generators from Lantheus Medical Imaging (LMI) and worked with the nuclear medicine community to minimise the impact on Australian patients.

We acknowledge the commitment of staff and the assistance of government during this time. At all times, they kept the needs of Australian patients at the forefront. We regret the impact on clinicians and patients who were inconvenienced by the disruption.

ANSTO welcomed the Federal Government's budget announcement that provides funds to develop a business case to consider options available to secure long-term sustainability of nuclear medicine in Australia.

The commissioning of the ANSTO Nuclear Medicine Mo-99 Manufacturing Facility occurred during the year. After operations commenced, a failure occurred in one part of the new plant, which has caused an interruption of the supply of Mo-99. The production of Mo-99 is a very complex undertaking in a radiation environment. Supply limitations in the fragile global Mo-99 market have highlighted the important role this radioisotope plays in the Australian health setting and the need for a reliable supply chain.

At the organisational level, we were heartened by the recognition of our commitment to addressing gender equity in our workforce by way of the announcement in late 2018 of our Athena SWAN Bronze Institution Award. It was an important milestone in the journey towards achieving gender equity by 2030.

I would like to thank departing Chair, Jim McDowell, for his significant contribution to ANSTO over the past several years, and welcome new Board Chair, Dr Annabelle Bennett, who has already made invaluable contributions to the organisation.

Importantly I would like to thank all our dedicated staff for their hard work and efforts over this year and pay tribute to their commitment to our organisation.

Dr Adrian (Adi) Paterson
Chief Executive Officer

2018–2019 highlights

ANSTO was one of 20 Australian higher education and research institutions that were recognised at Parliament House, Canberra, at the Inaugural SAGE Awards Gala Dinner.

ANSTO awarded an Athena SWAN Bronze Institution Award

In December 2018, ANSTO was awarded an Athena SWAN Bronze Institution Award, acknowledging our dedication to improving workplace equality, diversity and inclusion.

The progressive award measures organisations, that are members of Science in Australia Gender Equity (SAGE), on criteria including leadership, honesty, communication and engagement and self-assessment.

The award addresses gender equity and diversity in the workplace, not just because it's the right thing to do but because it's the smart thing to do, producing better outcomes for business and innovation.

ANSTO's work in reducing the pay gap between men and women and our efforts to communicate, consult and engage staff via proactive use of surveys and focus groups to educate and inform were acknowledged.

Achieving a Bronze Institution Award requires an institution to demonstrate a solid foundation for improving gender equity in Science, Technology, Engineering and Mathematics (STEM).

Athena SWAN Bronze Award

Nuclear medicine supply commences

Despite experiencing challenges within some areas of ANSTO's Health Products division, on 24 May 2019 ANSTO's new Mo-99 Manufacturing Facility received a licence from the independent regulator, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) and began manufacturing bulk Mo-99 for the domestic and international markets. This is an important achievement for the long-term sustainability of nuclear medicine supply in Australia. This facility will ensure supply of vital nuclear medicine for Australians well into the future, and also provide an opportunity for Australia to be a global leader in this industry and export to a global market.

Once the bulk Mo-99 is manufactured by this facility, it is either transported to the nuclear medicine production facility on site at Lucas Heights or distributed to international customers. Once received by the nuclear medicine production facility, also known as Building 23, the bulk Mo-99 is processed, tested and placed within the Gentech® Tc-99m generators for safe distribution to hospitals and nuclear medicine clinics around Australia.

From early next decade, the waste produced by the facility will be treated on site at Lucas Heights using ANSTO's Synroc facility, which is also part of this project, and is currently under construction.

On 21 June 2019, ANSTO ceased manufacturing Mo-99 after contamination was detected on the outside of a container holding 42 millilitres of Mo-99 in the new facility. Three ANSTO workers were attended to by radiation protection personnel, and initial indications are that two of these workers received a radiation dose above the statutory limit. The three staff members involved in this incident have returned to work and have the full support of ANSTO in their recovery. A comprehensive investigation was undertaken by a multidisciplinary team. This identified improvements that are now being applied across site relating to risk assessment and operationalising of training.

Despite this unfortunate event, ANSTO has been able to largely maintain a supply of Mo-99 to support Australian patients.

As a new production line, there is a settling-in period with the potential for design or practice flaws that may impact production or safety. ANSTO is alert to these possibilities knowing the potential impact on the Australian community.

The Mo-99 Manufacturing Facility is a significant milestone towards ensuring a robust nuclear medicine supply chain for Australia.

ANSTO Innovation Precinct

NSW Government commits $12.5 million to Precinct

ANSTO's globally-connected Innovation Precinct at Lucas Heights is to become a vibrant and inclusive community for scientists, students, start-ups and industries.

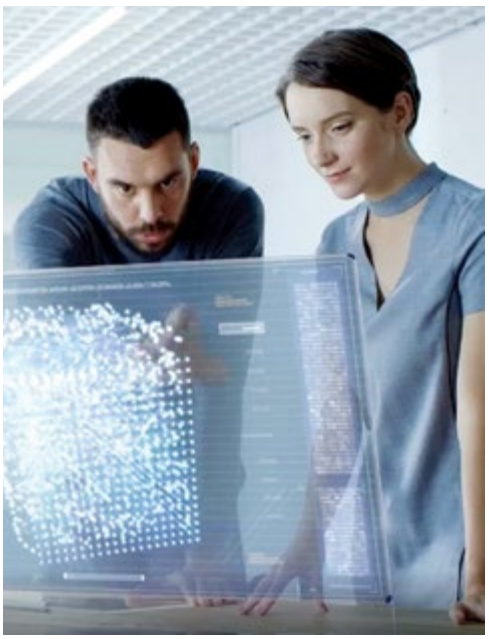
The Precinct will support the development of medical and technological advances that will benefit all Australians well into the future.

In early 2019, the NSW Government committed $12.5 million to support the ANSTO Innovation Precinct in an effort to create smart, sustainable jobs for Southern Sydney and NSW, and fund the expansion of the nandin Deep Technology Innovation Centre.

A key initiative will include a next-generation nuclear medicine cluster, where businesses will collaborate and share knowledge to fast track the development of advanced diagnostics and therapeutics, such as personalised medicine, for the treatment of cancer and other diseases.

A Graduate Institute will also be created, attracting young researchers with start-ups looking to benefit from working alongside one of Australia's most significant and globally-recognised science facilities.

Delivering advancements to support Australia's National Science and Research Health Priority, the creation of a global centre of excellence in next-generation nuclear medicines will lead to more clinical trials of promising nuclear medicines and provide novel treatments not currently available to Australian patients.



Launch of nandin Deep Technology Incubator

In November 2018, ANSTO formally launched the nandin Deep Technology Incubator – the world's only nuclear science and technology incubator.

nandin is the first step towards realisation of the ANSTO Innovation Precinct and provides a full-service innovation hub for entrepreneurs, start-ups and small and medium businesses to embrace challenge-based innovation, design solutions and take science and technology-based products and services to market.

The ANSTO Innovation Precinct and nandin will foster collaborations between Australian scientists and businesses to take advantage of nuclear science with a particular focus on the areas of health, advanced manufacturing, agriculture, food and nutrition.

A first of its kind facility, nandin has been created from the learnings of European leaders in the science innovation space, as CERN's Dr Markus Nordberg attended and spoke at the launch.

The name 'nandin' comes from the Dharawal language and means to look ahead. The innovation centre is located on land understood to have been used as a meeting place for Indigenous people.

The nandin opening included a smoking ceremony. L-R, Uncle Les de Jong, Sutherland Mayor Carmelo Pesce, Adi Paterson and Dharawal Elder, the late, Les Bursill.

UOW partnership sees powerful Titan Krios microscope temporarily housed at ANSTO

The Titan Krios cryo-electron microscope reveals the inner workings of life at the cellular level.

Capable of visualising down to the level of individual atoms, University of Wollongong's (UOW) three-metre tall, one tonne FEI ThermoFisher Titan Krios cryo-electron has a new, albeit temporary, home at ANSTO.

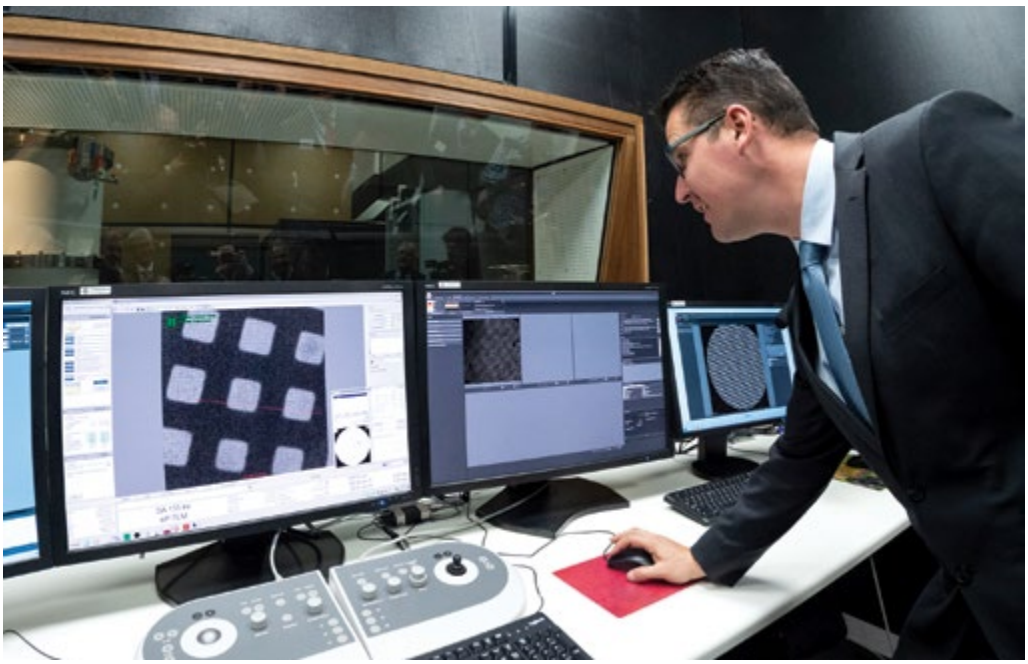
Australia's most advanced and powerful microscope enables scientists to see the inner workings of human cells with unprecedented clarity. This is an important tool to progress medical science and drug development beyond 'trial and error', as the molecular details it reveals are so small and precise it allows the mapping of every nook and cranny of the surface of biological molecules such as proteins and DNA.

This will accelerate research and discovery, enabling new ways of understanding and curing diseases such as motor neurone disease, Alzheimer's and cancer, as well as tackling health challenges like antimicrobial resistance.

The UOW and ANSTO partnership provides a facility to house the Titan Krios while its future home, the purpose-designed Molecular Horizons Building on UOW's Wollongong campus, is built. The microscope will be the centrepiece of Molecular Horizons, UOW's world-leading molecular and life sciences research facility, and part of a suite of transformative technology.

Titan Krios uses electrons rather than light to look at molecules, firing a stream of high-energy electrons through a frozen sample, generating multiple two-dimensional images that scientists then convert to three-dimensional models of molecules, visualising their nano-sized loops and chains.

The microscope can be accessed by scientists from universities and other research institutions across Australia.



Senator the Hon Zed Seselja, Assistant Minister for Science, Jobs and Innovation, commissioned the Titan Krios at a ceremony at the Lucas Heights campus.

CEO Dr Adi Paterson, Prof Bella Lake, HZB, Chair Dr Annabelle Bennett and German Consul-General Sydney Peter Silberberg.

International collaboration leads to neutron reflectometer finding new home at ANSTO

The Spatz neutron reflectometer has commenced operations at ANSTO's OPAL nuclear research reactor, bringing the number of neutron beam instruments at the facility to 15.

Spatz will be widely utilised due to the high demand for neutron reflectometry on the current instrument, Platypus, and its capacity for simultaneous infrared spectroscopy for a wide range of soft matter research applications in biomedicine, energy and materials science.

Reflectometry has been the major growth area in neutron scattering since its inception 20 years ago.

The neutron reflectometer was gifted to ANSTO from Germany's BER-II Research Reactor under an agreement with Helmholtz-Zentrum Berlin (HZB).

It was named 'Spatz', the German translation of 'sparrow', a common bird in Germany, in recognition of its origins.

In October 2018, ARPANSA gave approval for the commencement of neutron beam testing of Spatz, ahead of it becoming operational in June 2019. It is expected to be fully licenced by the end of 2019.

Delivering advancements towards the Australian Government's National Science and Research Priorities through its wide range of soft matter research applications in biomedicine, energy and materials science.

Using new technologies to engage students with STEM

ANSTO's Education Program underpins the organisation's commitment to the national objective of engaging all Australians in science and building scientific capability and skills.

ANSTO's focus is to improve the understanding of nuclear science and technology and to invigorate interest in what a career in STEM can offer young people considering their future.

In August 2018, ANSTO introduced a virtual reality app to engage students, teachers and also the general public on a virtual reality tour of Australia's OPAL multi-purpose reactor and to explore ANSTO science virtually at the scale of an atom. The ANSTO Virtual Reality App was launched as part of National Science Week in 2018 and is available through the Apple App store and Google Play for free download. The App has been extremely popular with students, teachers and the general public with 15,000 downloads in the first 12 months. It was also featured by Apple amongst the top education apps since it was launched.

The OPAL Virtual Reality experience was launched in August 2018, and tens of thousands of students and members of the general public have enjoyed this experience either online or at ANSTO's many outreach events.

These new technologies, such as virtual reality, are particularly effective in showcasing the unseen world of atoms and understand the benefits delivered through the OPAL multi-purpose reactor.

ANSTO's STEM Education Program underpins the organisation's commitment to the national objective of engaging all Australians in science and building scientific capability and skills.

New Board Chair, The Hon Dr Annabelle Bennett AC.

ANSTO welcomes new Board Chair and member

ANSTO welcomed a new Board Chair, the Hon Dr Annabelle Bennett AC SC. Dr Bennett brings a unique combination of science, law and leadership as Chair of ANSTO, with her distinguished and diverse career including as a Federal Court judge, Chair of the National Health and Medical Research Council, Member of the Board of Directors for the Garvan Institute and a Member of the Advisory Council of Questacon.

Initially completing a PhD in cell biology at the University of Sydney, Dr Bennett then moved to law and practiced as a barrister. Dr Bennett is currently Chancellor of Bond University and practices as a consultant Senior Counsel, mediator and arbitrator.

Dr Gordon de Brouwer PSM also joined the Board during the period and brings to ANSTO significant and wide-ranging policy depth. His 30-year career has spanned climate change and energy, natural resource management, Australian and Asian macro-economies and finance, governance, and public sector management and reform.

New Board member Dr Gordon de Brouwer PSM.

A former Secretary for the Department of the Environment and Energy and Associate Secretary of the Department of the Prime Minister and Cabinet, he now serves as Honorary Professor and Distinguished Fellow at the Australian National University; Fellow of the Institute of Public Administration Australia; Member of the Centre for Strategy and Governance; and Member of the Advisory Board of The Nature Conservancy.

ANSTO contributes to ITER – the world's largest engineering project

A team of scientists from ANSTO and the Australian National University (ANU) who represent Australia on the world largest engineering project, ITER, has reported on their plasma diagnostics project. The report was presented to international panel for the Conceptual Design Review at an ITER meeting in France in March 2019.

The Australian group is developing one of over 50 diagnostic systems, a boundary flow monitor, which is focused on the ITER divertor.

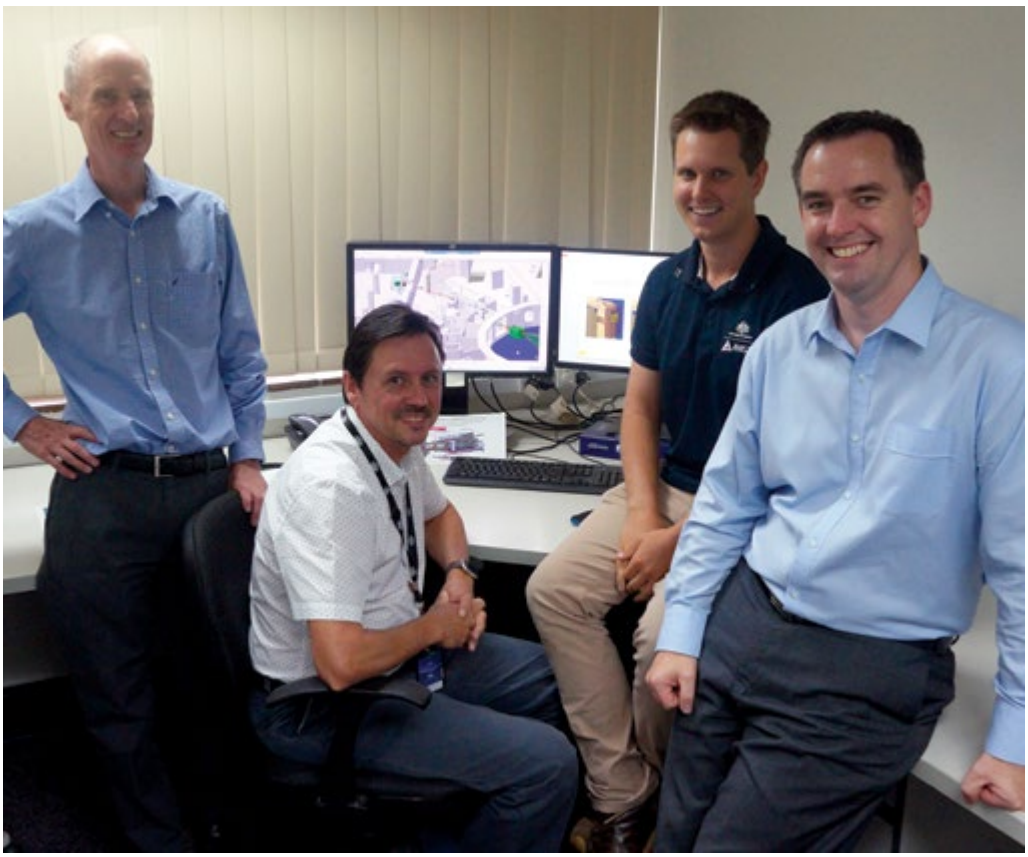
This enormous component, which comprises 54 cassette assemblies, positioned at the bottom of the ITER 'tokamak' vacuum vessel, controls the exhaust of waste gas and impurities from the reactor.

It is the only area where plasma at the highest heat flux comes into contact with the reactor wall.

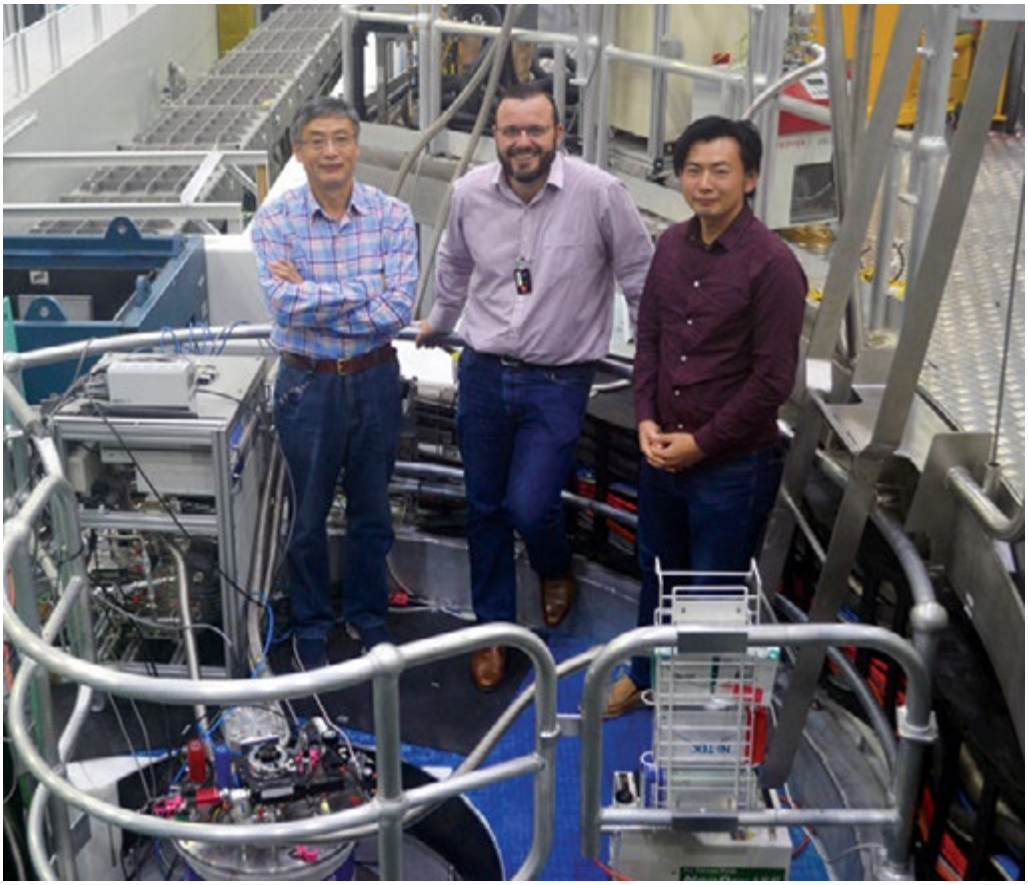
The underlying technology uses advanced coherence imaging systems, developed at ANU, to obtain time-resolved 2D projection images of the spectral and polarisation properties of the plasma.

The review was well received and may lead to an expanded role for Australia in one area of diagnostics for ITER.

Although Australia is not a member state of the project, in October 2016 ANSTO signed a cooperation agreement with ITER to formalise participation on diagnostic systems, theory and modelling of advanced materials.



ANSTO's ITER team (L-R) Dr Richard Garrett, Scott Hopkins, Ryan Beeby and Craig Hughes.



(L-R) Dr Dehong Yu, Dr Richard Mole and Dr Shinichiro Yano standing at the Pelican time-of-flight spectrometer.

Advanced refrigeration technology on the horizon

ANSTO has contributed to a large research collaboration led by the Chinese Academy of Sciences investigating a new class of materials with the potential to be used as an advanced, high-performing, environmentally-friendly and economical form of refrigeration.

The research, which was published in the prestigious journal *Nature* described a colossal barocaloric effect in which significant cooling occurs under low pressure in a new class of 'plastic crystals'.

In these materials the atoms remain in a solid state when they start moving around which produces massive changes in entropy to drive cooling.

The research revealed that a relatively tiny amount of hydrostatic pressure at room temperature induced a huge contraction of the crystal lattice, the structured arrangement of atoms.

The entropy changes found in this class of plastic crystals was ten times larger than those observed in other leading barocaloric materials.

The study highlighted the tremendous potential of the new materials to be used as an alternative to current vapour compression refrigeration.

Neutron scattering techniques on the Pelican time-of-flight spectrometer and Sika cold triple axis spectrometer were among the methods used by collaborating scientists from China, Japan, the US, and Taiwan, who wanted to elucidate the atomic mechanisms at work.

Annual Performance Statement

Introductory statement

We, the Australian Nuclear Science and Technology Organisation (ANSTO) Board, as the accountable authority of ANSTO, present the 2018-19 Annual Performance Statements of ANSTO, as required under paragraph 39(1)(a) of the *Public Governance, Performance and Accountability Act 2013 (PGPA Act)*. In our opinion, this Annual Performance Statement is based on properly maintained records, accurately reflects the performance of the entity, and complies with subsection 39 (2) of the *PGPA Act*.

Entity's Purpose

ANSTO's purpose comprises the following core functions, as provided by the *Australian Nuclear Science and Technology Organisation Act 1987*:

- Conduct research and development in relation to nuclear science and technology;
- Produce and use radioisotopes, isotopic techniques and nuclear radiation for medicine, science, industry, commerce and agriculture;
- Encourage and facilitate the application and use of the results from research and development;
- Manage radioactive materials and waste arising from various prescribed activities;
- Provide goods and services related to core activities;
- Provide advice to government and undertake international liaison in nuclear-related matters;
- Make available (on a commercial basis where appropriate) facilities, equipment and expertise for research in nuclear science and technology;
- Publish scientific and technical reports, periodicals and papers, and provide public information and advice; and
- Facilitate education and training in nuclear science and technology, including through granting scientific research studentships and fellowships, in cooperation with universities, professional bodies and other education and research institutions.

Outcome:

Improved knowledge, innovative capacity and healthcare through nuclear-based facilities, research, training, products, services and advice to government, industry, the education sector and the Australian population.

Performance Criterion 1 *Full utilisation of our landmark infrastructure*	**Criteria***	**Result**
OPAL Research Reactor: Days at power	300	312
Australian Synchrotron average utilisation: % of scheduled operating time	95%	96%
Accelerators average utilisation: % of available operational time	65%	68%
Neutron beam instruments average utilisation: % of scheduled operating time	85%	92%
Performance Criterion 2 *Human health products*	**Criteria***	**Result**
Radiopharmaceutical doses: potential doses	3,231,659	1,821,439

*Criteria Source: ANSTO's 2018-2019 Corporate Plan and ANSTO Budget Statements, Programme 1.1, Portfolio Budget Statements 2019-20, Budget Related Paper No. 1.11, Industry, Innovation and Science Portfolio

Analysis of the results against the performance criteria.

Consistent with its performance in recent years, ANSTO's landmark research infrastructure continues to operate at high availability and reliability. In 2018-19, all targets were exceeded for Performance Criterion 1 – Full utilisation of landmark infrastructure. This is a reflection of ANSTO's ongoing commitment to asset management, and of the dedication of ANSTO staff who ensure that critical research infrastructure is performing both at a high level and sustainably.

The OPAL reactor continues to build on a strong record of performance, retaining its status as the hardest working and most reliable multi-purpose research reactor in the world. For the reporting period, OPAL achieved 312 days at power. The availability of the reactor is critical in supporting the production of life-saving nuclear medicines, the supply of neutrons for research and the irradiation of silicon for industry.

In 2018-19, ACNS performed well above the targeted operating availability, reflecting the availability of the OPAL reactor, the organisational commitment to comprehensive asset management programs for the instruments and the dedication and expertise of ANSTO's ACNS staff. During this period, neutron scattering capabilities at ANSTO expanded, with the addition of a fifteenth instrument. The Spatz Neutron Reflectometer uses techniques that are well suited to research in biomedicine, energy and materials. The instrument was formerly deployed at Helmholtz Zentrum Berlin (where it was known as Bioref) before it was gifted to ANSTO in 2015, arriving in Australia in early 2017.

CAS is composed of four ion accelerators that underpin much of Australia's accelerator technologies and expertise. Throughout 2018-19, CAS continued to support important research. CAS is currently in the process of building a new end station for the Antares accelerator that will allow for new types of experiments and samples to be analysed. This new capability will produce low energy ions that will be delivered to a gas chamber, opening up new areas of investigation in space research and in particle therapy.

Once again, the Australian Synchrotron has demonstrated why it is one of the leading synchrotron facilities of its kind, exceeding the projected operating time for the reporting period. This facility is currently undergoing a period of expansion as the process of nearly doubling the number of available beamlines begins with the detailed design of the first six new beamlines underway.

ANSTO continues to focus on ensuring the sustainable production of nuclear medicine for all Australians. During 2018-19, the new ANSTO Nuclear Medicine (ANM) facility came online and began commercial operations. The commencement of operations of this bulk nuclear medicine manufacturing facility is an important achievement for the sustainability of nuclear medicine supply in Australia. ANSTO's reported radiopharmaceutical doses during this period are significantly lower than anticipated, largely due to a mechanical breakdown and equipment defects in the ageing nuclear medicine production facility, also known as Building 23. Building 23 dispenses the bulk nuclear medicine, produced at ANM, onto generators, which are then distributed to hospitals and clinics around Australia. The facility is an essential part of the domestic nuclear medicine supply chain; therefore, temporary cessation of generator production at the facility had a significant impact on dose supply. Other contributing factors include a delay to ANM commencing operations, which reduced export of bulk Molybdenum-99 (Mo-99) and a contamination incident in ANM on 21 June 2019, which led to a temporary cessation of production of bulk Mo-99, and subsequent restriction in production, as mandated by the regulator, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). ANSTO's former nuclear medicine manufacturing facility, Building 54, was able to temporarily recommence production as a short-term measure while ANM was unable to operate, but had to cease production on 30 June 2019 when its operating licence effectively expired.

ANSTO remains deeply conscious of its responsibility for ensuring robustness in the entire nuclear medicine supply chain. ANSTO will continue to focus on strengthening risk mitigation and improving operational reliability to ensure that the likelihood of future interruptions to supply is reduced to the maximum extent possible, consistent with efficiency and safety of production. Throughout this process, ANSTO has and will continue to work closely with the nuclear medicine community and other relevant government, regulatory and external stakeholders.

Improving the health of Australia

ANSTO's radiotracers key in developing new treatment for childhood cancer

ANSTO's unique capabilities and expertise in radiotracers for imaging were pivotal in understanding the mechanism of a promising new treatment developed at the Children's Cancer Institute (CCI) for the deadly childhood cancer neuroblastoma.

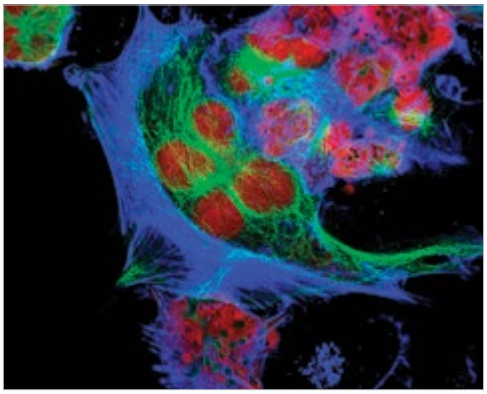
Led by ANSTO's Dr Arvind Parmar and Dr Giancarlo Pascali, in collaboration with CCI's Dr Orazio Vittorio, the study developed a new PET imaging protocol using small quantities of the radioactive form of copper chloride that measured neuroblastoma tumour response to the drug Dextran-Catechin.

Catechin is found in green tea and other healthy foods. When dextran, a naturally occurring polysaccharide, is combined with Catechin, it sustains the anti-canceraction effects of Catechin.

Dr Vittorio's team had previously discovered that neuroblastoma tumour cells need high levels of copper to survive.

The study, featured in the journal *Theranostics*, found Dextran-Catechin works to sever the supply of copper to the tumour by recognising its elevated copper levels, while not affecting healthy cells with a normal concentration of this metal and, in turn, significantly reducing the growth of tumours.

The approach has the potential to be used to understand drug resistance in other types of cancer.



Neuroblastoma cells

The Australian Synchrotron is located at ANSTO's Clayton campus in Melbourne, Victoria.

New Australian Synchrotron drugs key to putting cancer cells to sleep

ANSTO's Australian Synchrotron was used in a world-first study on a new type of anti-cancer drug that can put cancer cells into a permanent sleep, without the harmful side-effects caused by conventional cancer therapies.

The research was conducted by the Walter and Eliza Hall Institute, the Monash Institute of Pharmaceutical Sciences and the Cancer Therapeutics Cooperative Research Centre (CRC), and published in the journal *Nature*.

These first-of-a-kind anti-cancer drugs arrest tumour growth and spread without damaging the cell DNA.

Biochemical and structural studies to elucidate protein interactions of the new compounds and target molecules included X-ray diffraction on the micromolecular crystallography MX1 and MX2 beamlines at the Australian Synchrotron.

The compounds have already shown great promise in preclinical testing.

ANSTO has a key role in Australia's efforts to combat cancer

Promising new type of radiotherapy to deliver a one–two punch to cancer

Neutron Capture Enhanced Particle Therapy (NCEPT) is a radical new type of radiotherapy that combines the precision of particle therapy with the cancer-specific targeting capability of Neutron Capture Therapy (NCT).

Developed by a team at ANSTO, in collaboration with a number of domestic and international academic and research organisations, NCEPT magnifies the impact of particle therapy by capturing thermal neutrons – produced internally at the target as a by-product of treatment – inside cancer cells, where they deliver extra dose to the tumour.

NCEPT uses low-toxicity agents containing boron-10 and gadolinium-157 which concentrate in cancer cells, already approved or under development for other medical applications.

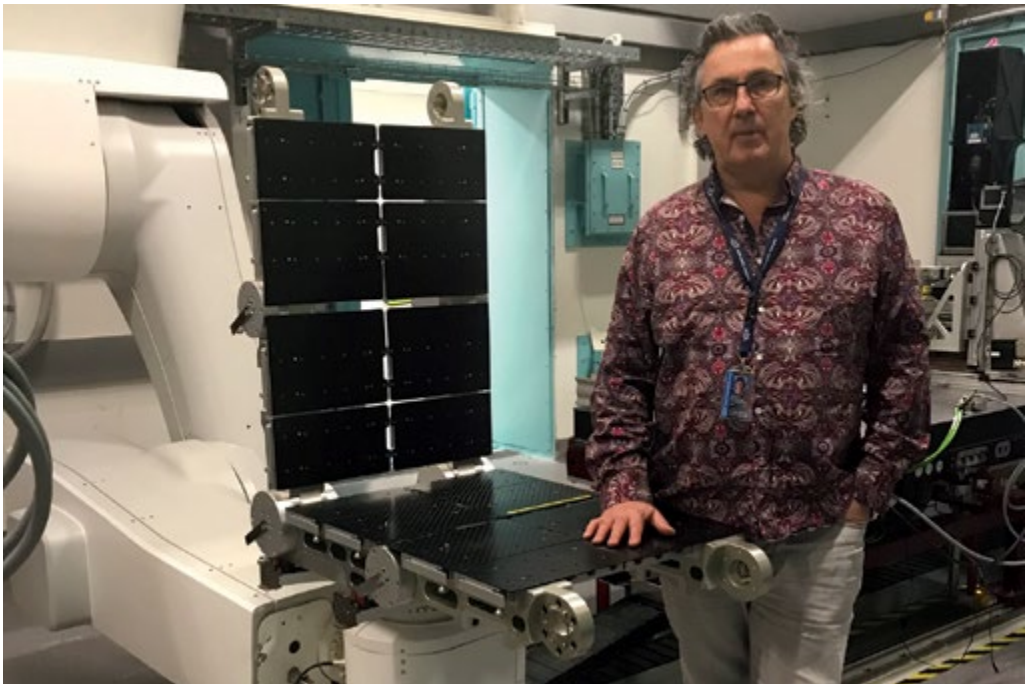
Simulations and experiments on cancer cells have yielded extremely compelling results, indicating that NCEPT achieves equivalent cancer cell control with between one-third and one-fifth of the radiation dose compared to particle therapy alone.

Particle therapy is an advanced form of radiation therapy that precisely delivers energy to destroy tumours with minimal side effects.

NCEPT has generated considerable excitement within the radiation oncology communities in Australia, USA and in particular in Japan, where it has been dubbed "the future of ion-beam radiotherapy".

Discussions have commenced regarding the first clinical trials in Japan and with leading particle therapy companies on potential collaborations.

Dr Mitra Safavi-Naeini (pictured centre in all white) and members of the NCEPT team receiving the 2018 ANSTO Nuclear Science and Technology Award – George Collins Award for Innovation.



ANSTO scientist Dr Daniel Hausermann, who provides technical assistance to researchers using the IMBL, pictured next to the beamline.

Working towards single session radiotherapy for cancer patients

ANSTO's Australian Synchrotron was used in an initiative that could improve radiotherapy treatment for cancer patients by delivering a more effective and less intrusive procedure.

Led by the Royal Women's Hospital, RMIT University and University of Melbourne, it is hoped that the study, conducted using the Synchrotron's Imaging and Medical Beamline (IMBL), will lead to cancer patients needing just a single session of radiotherapy. This could dramatically improve outcomes for cancer patients and reduce the side-effects of the radiation.

The world-first study, published in the *Nature Group* journal *Scientific Reports*, showed that the newly-developed microbeam radiation therapy (MRT) could safely deliver radiation doses up to 20 times higher than currently given in clinical radiotherapy.

Unlike conventional treatment, which irradiates an entire area, killing both the tumour and damaging healthy cells, MRT delivers wafer-thin parallel beams of radiation.

The first trials are likely to target patients with radio-resistant brain, head and neck cancers. Advanced breast cancer patients could also benefit from MRT in the future.

Built with support of the National Health and Medical Research Council, the IMBL is a flagship beamline of the Australian Synchrotron and is one of only a few of its type in the world.

Understanding our environment

Collaboration publishes landmark blue carbon study

ANSTO has contributed to collaborative research published by the University of Wollongong (UOW) in the prestigious journal *Nature* that shows, due to rising sea levels, that tidal marshes could play an even greater role than thought in helping to mitigate the impact of climate change.

'Blue carbon' is a term for the capture and storage of atmospheric carbon in the marine environment. Coastal vegetation stores carbon far more effectively and permanently than terrestrial forests and freshwater wetlands, where organic carbon is often re-mineralised and lost to the atmosphere.

Due to rising sea levels, coastal wetlands may play an even greater role than previously thought in mitigating the effects of greenhouse gas emissions by capturing and storing large volumes of atmospheric carbon dioxide.

ANSTO's environmental scientist, Dr Debashish Mazumder, undertook stable isotope analysis and radiochemist, Atun Zawadzki, used nuclear techniques to determine the rates of sediment accumulation using radioactive isotopes.

The research team – headed up by UOW and including researchers from Macquarie University; Smithsonian Environmental Research Center, USA; Nelson Mandela University, South Africa; Yunnan University, China; and ANSTO – analysed carbon stored in more than 300 salt marshes across six continents.

ANSTO researchers are experts at tracing the tiny 'fingerprints' isotopes leave as they move through earth systems such as waterways, our atmosphere and all living things.

Dr Debashish Mazumder in ANSTO Lucas Heights aquatic laboratories.

South-eastern Australia climate studies

Beyond the last 100 years, there is relatively little information about past variability of rainfall across Australia, so researchers must turn to other natural archives, such as speleothems including stalactites or stalagmites, to fill in knowledge gaps.

ANSTO's Dr Carol Tadros and her colleagues are studying high-resolution rainfall and drip water oxygen isotopic measurements, as well as trace metals from aerosols in the atmosphere that are deposited in the soil, or from bedrock, and make their way into cave stalagmites to confirm past climatic events.

The research, which examined drip water data from Harrie Wood Cave in the Snowy Mountains that was collected over a ten-year period, was published in *Science of the Total Environment*, and will help in deciphering the complexity of geochemical signals in drip water from speleothems in order to reliably reconstruct a history of palaeoclimate (past climate) in south-eastern Australia.

For example, trace elements can be used as a proxy to signify a period of drought or El Niño, so that when researchers look back further in time, they can confirm periods of drought by the proxy.

This information is extremely valuable as it can help anticipate the availability of water resources in the future, potential future climate trends (wetting or drying phases) and ultimately help inform management of limited natural resources.

Image opposite page: Dr Carol Tadros (right) and colleague Dr Pauline Treble at an ANSTO speleothem study site at the Jenolan Caves in the Blue Mountains.

Strong winds impact Southern Ocean's ability to offset climate change

ANSTO's Dr Krystyna Saunders led a research team that has revealed that strong westerly winds weaken the Southern Ocean's ability to store carbon and thereby contribute to faster accumulation of carbon dioxide in the atmosphere.

The study showed there have been large changes in the intensity of Southern Hemisphere westerly winds over the past 12,000 years. This is in contrast to existing climate model simulations that predict only relatively small changes over the same period.

The Southern Ocean currently absorbs over 40 per cent of the carbon dioxide produced by human activities, helping to temporarily mitigate the effects of climate change by slowing down the accumulation of greenhouse gases in the atmosphere.

Radioisotope dating methods were used to date the sediment sequence, while inference models were combined with micro-X-ray-fluorescence core scanning and hyperspectral imaging to determine the sea spray depositions.

By comparing their reconstructed wind intensity data with other climate records, the researchers found that periods of intense wind strength were matched by marked increases in atmospheric carbon dioxide and temperature, as well as declines in sea ice levels.

The results show that further increases in wind strength will likely lead to faster accumulation of carbon dioxide in our atmosphere.

The study, published in the prestigious journal *Nature Geoscience*, is the result of collaboration between researchers from ANSTO, the British Antarctic Survey and the Universities of Bern, Ghent, Aberystwyth and Durham, with logistical support from the Australian Antarctic Division.

Dr Saunders pictured (above) with sediment core and (below) with a colleague at sub-Antarctic Macquarie Island, which lies at a latitude where the winds are strongest. This allowed the researchers to circumvent issues faced in previous study locations.

Dr Andrew Smith's research using the Centre for Accelerator Science (CAS) is investigating a natural air cleanser in the Antarctic ice sheet.

Understanding hydroxl radical and its ability to clean the atmosphere

ANSTO's Dr Andrew Smith and a team from the University of Rochester (USA), Ice Drilling Design and Operation (USA), CSIRO and Australian Antarctic Division, are studying past concentrations of an important component of the atmosphere, the hydroxyl radical, using bubbles of air trapped in Antarctic ice.

The hydroxyl radical (OH) is a naturally-occurring component of Earth's atmosphere that plays a fundamental role in atmospheric chemistry. This is because it is chemically reactive and removes trace gases, including greenhouse and ozone-depleting gases. This 'detergent of the atmosphere' is so chemically reactive that it only exists for about one second before it reacts with something and is consumed. Being so short lived, it is impossible to measure hydroxyl directly in the atmosphere. Instead the rate it removes radiocarbon monoxide (14CO) from the atmosphere is used to infer its concentration. We only have knowledge of hydroxyl concentrations for the last three decades, so to develop a record from the mid-nineteenth century the team have turned to ancient air bubbles trapped in Antarctic ice. After a complex separation and conversion process, each sample, containing just 20 millionths of a gram of carbon derived from carbon monoxide in the air bubbles, is studied using accelerator mass spectrometry (AMS) at ANSTO's Centre for Accelerator Science (CAS).

Here the individual ^{14}C (radiocarbon) atoms in the samples are counted one by one.

The ultimate aim of the study is to have a better understanding of complex processes in the atmosphere and changes that may be occurring because of climate change and pollution. This will better inform future climate modelling.

The research was undertaken at Australia's Casey Station in Antarctica. Photo courtesy Andrew Smith.

ANSTO is one of only a few laboratories in the world capable of making such sensitive measurements.

Solutions for Australian industry

Progress on low energy electronics

ANSTO researchers are part of a large international collaboration developing an advanced material that is able to switch between a unique electrically conductive state to an insulating state, simply by applying an electric field.

The work, published in the prestigious journal *Nature*, represents a step towards the development of a new generation of ultra-low energy electronics that function at room temperature.

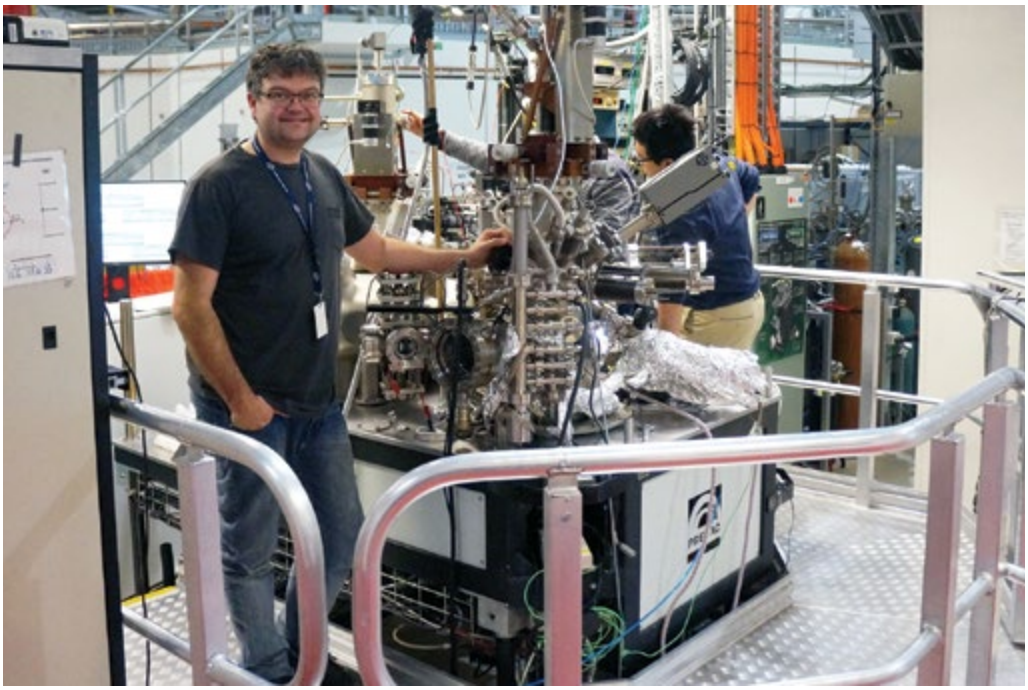
Co-author ANSTO's Dr Anton Tadich, collaborated with fellow researchers on the use of photoemission techniques at ANSTO's Australian Synchrotron using X-ray Photoelectron Spectroscopy (XPS) and the Advanced Light Source in the US for Angle Resolved Photoelectron Spectroscopy (ARPES).

The variable energy of the Australian Synchrotron's soft x-ray beamline was able to highlight the chemistry of the topmost layers of the material's surface with high precision, demonstrating the growth of the pure material known as a topological Dirac Semimetal, a new class of material that promises unique properties for next generation low energy consumption electronics. The measurements provided a unique complement to the Scanning Tunneling Microscopy (STM) performed at other facilities.

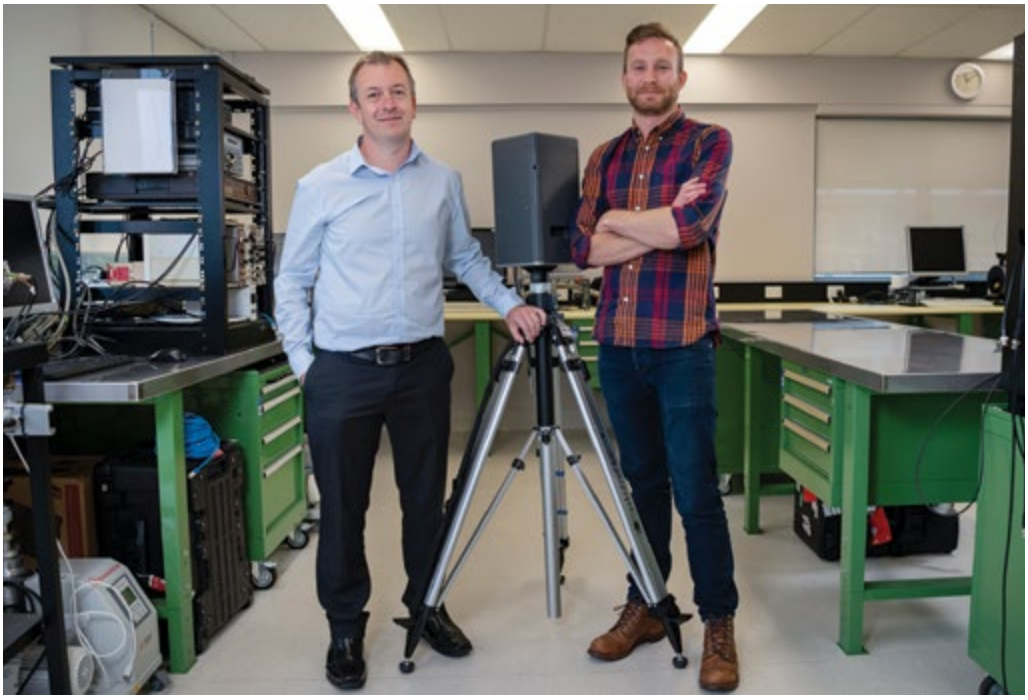
This new material is subject to far less electrical resistance than in materials used in conventional transistors—requiring less power consumption when the transistor is switched from 'off' to 'on', an operation performed billions of times per second in computer chips.

Unlike superconducting materials which require extremely low temperatures, topological Dirac Semimetals can perform at room temperature.

The collaboration included scientists from Monash University, the ARC Centre for Future Low Energy Electronics (FLEET), the Monash Centre for Anatomically Thin Materials, Singapore University of Technology, National University of Singapore, and Yale-NUS College in Singapore.



Dr Anton Tadich is a Senior Beamline Scientist on the Soft X-ray Beamline at ANSTO's Australian Synchrotron.



David Boardman (left) and Mathew Guenette with the portable radiation imaging system.

Innovation in safer, faster gamma radiation imaging technology

One of the most challenging aspects of dealing with radiation is that it is not visible which can lead to radiation exposure when trying to measure it.

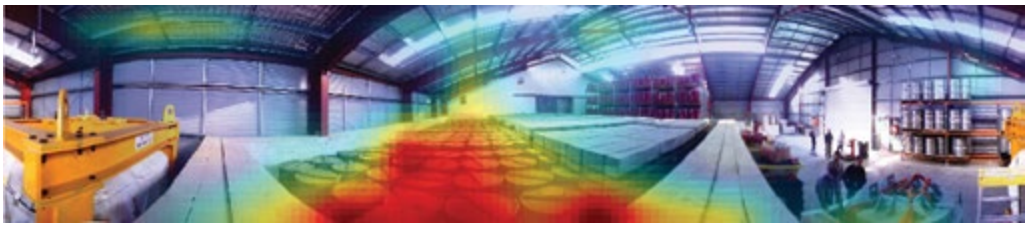
A new imaging technology developed at ANSTO makes it possible to image, identify and locate gamma-ray radiation in a safe and timely manner.

The portable system, developed by ANSTO physicist Dr David Boardman and his team, can be remotely deployed and therefore reduce radiation exposure to workers.

The technology combines spectroscopic gamma ray images with a 360° by 90° panoramic optical image to enable the fast and accurate identification of gamma emitting radionuclides and pinpoint their location.

An advanced prototype of the portable system has been tested in various locations around ANSTO, where it is proving to be very effective in localising sources of radiation.

The technology has the potential to be used in numerous industrial settings where there is radiation, such as nuclear reactors, nuclear medicine facilities and high energy physics laboratories.



An optical image overlayed with the thorium gamma emissions, from nuclear waste drums, produced by the new system.

The research of ANSTO's Mia Maric (left) and Dr Ondrej Muránsky is providing insights into the behaviour of structural materials in a molten salt environment.

Understanding materials in extreme environments

An international team of researchers led by ANSTO has found that cold-rolling (plastic deformation) leads to increased susceptibility of structural materials to molten salt corrosion.

ANSTO's Dr Ondrej Muránsky and Ms Mia Maric headed the research, which has relevance for future Molten Salt Reactor (MSR), Concentrated Solar Thermal (CST) as well as Thermal Energy Storage (TES) systems, which use molten salt as an energy transfer and energy storage medium.

The study, published in *Corrosion Science* was done on 316L Stainless Steel, which is utilised in current nuclear reactors and is also being considered as the structural material for future nuclear and non-nuclear energy-generation systems (MSR, CST) as well as energy-storage (TES) systems.

Using electron diffraction and neutron diffraction techniques at ANSTO, the investigators found that microstructural (crystal) defects introduced during the cold-rolling process make the material stronger but also more susceptible to molten salt corrosion.

The use of High-Resolution Neutron Diffraction (HRND) on the Echidna instrument revealed an increase in the amount of microstructural (crystal) defects, whilst the Electron Back-Scatter Diffraction (EBSD) technique revealed a significant increase in the grain boundaries in cold-rolled condition when compared to the annealed (not cold-rolled) condition of the 316L alloy.

It was found that cold-rolling has an unexpected effect on the molten salt resistance of the cold-rolled alloy – higher amount of cold-rolling leads to higher molten salt corrosion attack.

This implies that there is an increased susceptibility of the cold-rolled material to react with the molten salt and as a result undergo accelerated corrosion when compared to annealed (not cold-rolled) material.

Collaborating institutions included the University of New South Wales (UNSW), Eötvös University and the University of California Davis.

Looking deeply into nitrogen cycling

Nutrients added to soil can be dispersed from their intended primary use via losses to the atmosphere, rivers and aquifers.

In a three-year Cotton Research Development Corporation (CRDC) study, a multidisciplinary team of scientists from ANSTO and the University of New South Wales are looking at the irrigation sector's impact on the nitrogen cycle from its application in the field and subsequent contributions to the atmosphere, surface waterways and aquifers.

The research, led by ANSTO's Dr Dioni Cendon, will study areas in the Murrumbidgee, Namoi and Nogoa River valleys. The three regions were selected because they cover a diverse range of climatic, hydrogeological and farming practices in eastern Australia.

Detailed isotopic monitoring of selected nitrogen will enable apportionment between natural and anthropogenic sources. This research will provide evidence that can be used to map the cotton industry's nitrogen cycle footprint in the selected river catchments.

Celebrating our people

ANSTO awarded an Athena SWAN Bronze Institution Award

In December 2018, ANSTO was awarded an Athena SWAN Bronze Institution Award, acknowledging our dedication to improving workplace equality, diversity and inclusion including our work in reducing the pay gap between men and women. See page 8 for more details.

Dr Robert Acres

STA STEM Ambassador

Dr Robert Acres, Industry Support and Engagement Scientist was selected as a STEM ambassador. The STEM Ambassador Program operated by Science and Technology Australia (STA) is an initiative born from the success of Science meets Parliament. STA has worked for almost 20 years to connect parliamentarians with leaders in a range of scientific and technological disciplines. This Program is aimed at establishing an enduring impact by connecting STEM professionals with federal decision makers over a period of 12 months.

Dr David Boardman and the Gamma-ray Imaging with Compressed Sensing team (joint winners)

2018 ANSTO Nuclear Science and Technology Award – George Collins Award for Innovation

Dr David Boardman and the Gamma-ray Imaging with Compressed Sensing team were joint winners of the 2018 ANSTO Nuclear Science and Technology Award – George Collins Award for Innovation for developing cutting-edge camera technology as a new tool that enables the visualisation of gamma radiation – creating safer environments across a range of industries. See further details on page 29.

Dr David Boardman (fourth from right) and the Gamma-ray Imaging with Compressed Sensing team at the 2018 ANSTO Nuclear Science and Technology Award.

Dr Tom Cresswell

Science & Technology Australia Board

Radioecologist Dr Tom Cresswell was elected to the Board of STA, the country's peak body representing about 70,000 Australian scientists and technologists. The organisation is committed to influencing debate on public policy for science and technology and providing a voice for its members. Cresswell was elected as a Cluster representative for the Chemical Sciences for two years.

Dr Tamim Darwish

The Australian Society of Cosmetic Chemists award for best technical paper

Tamim Darwish, Manager of Operations at the National Deuteration Facility, submitted a paper and delivered a presentation on the potential for the cosmetics industry to use deuterated materials to investigate the relationship between structure and function in cosmetic ingredients and beauty products and for quality control purposes.

Leena Hogan

Dr Joan R. Clark Research Scholarship

ANSTO radiochemist, Leena Hogan, was awarded the prestigious 'Dr Joan R. Clark Research Scholarship' from the University of Sydney to carry out research at the world-renowned Sloan Kettering Cancer Center in New York. As part of her PhD studies at ANSTO and the University of Sydney, Hogan has been working on new ways to attach radionuclides, like gallium-68, to biological vectors to produce new radiopharmaceuticals. Utilising the facilities in New York, will allow her to determine if the new ligand system – developed during her PhD called 'NOTET' – works better than 'NOTA' or 'DOTA' which are the current gold standards for gallium-68 radiolabelling.

Dr Adrian Hawley

2018 Monash Faculty of Pharmacy & Pharmaceutical Sciences Research Impact Award

ANSTO Australian Synchrotron Scientist on the SAXS beamline, Dr Adrian Hawley, was a key member of The Boyd Group who were awarded the 2018 Monash Faculty of Pharmacy & Pharmaceutical Sciences Research Impact Award (Economic & Social) for their work on looking at milk for anti-malarial drug delivery. Dr Hawley was eligible to be included in the team award through his adjunct Monash University role.

Dr Michael James

2019 Australian Research Council College of Experts

ANSTO Australian Synchrotron Senior Principal Scientist, Dr Michael James, has been appointed to the Australian Research Council (ARC) 2019 College of Experts. In 2019, there will be 194 members of the College. The College plays a key role in identifying research excellence in the ARC National Competitive Grants Program, moderating external assessments and recommending applications for funding. The College also assists the ARC in recruiting and assigning assessors and in implementing peer review reforms in established and emerging disciplines, as well as interdisciplinary areas.

Dr Inna Karatchevtseva

2019 Defence Materials Technology Centre (DMTC) Awards for Excellence

Dr Inna Karatchevtseva was recognised for her contribution to the partnership with Thales Australia to develop an Australian supply chain for critical components of submarine sonar transducer equipment.

Dr Joanne Lackenby

Science and Technology Australia – Superstar of STEM

ANSTO nuclear safety specialist, Dr Joanne Lackenby, was selected as a 2018 Superstar of STEM. The Superstars of STEM are exemplary individuals working in science, technology, engineering and mathematics, who are great role models to encourage girls to consider a career in STEM.

Joanne is very active in outreach, is the President of Women in Nuclear (WiN) Australia Inc. and holds an Executive Position for WiN Global. Joanne is also a participant in ANSTO's LGBTIQA+ group, which encourage ANSTO to be an employer of choice for LGBTIQA+ scientists and engineers, and in turn increase diversity in STEM.

Gabriel Murphy

2018 ANSTO Nuclear Science and Technology Award – Early Career Researcher

Gabriel Murphy received the *2018 ANSTO Nuclear Science and Technology Award – Early Career Researcher* for contributing to new and improved ways to manage, handle and store nuclear waste. With a focus on uranium, he used ANSTO facilities including the Australian Synchrotron and the Australian Centre for Neutron Scattering to further his investigations.

Gabriel Murphy receiving the 2018 ANSTO Nuclear Science and Technology Award – Early Career Researcher award from ANSTO Board member, Professor Brigid Heywood.

Dr Helen Maynard-Casely

2018 ANSTO Nuclear Science and Technology Award – Excellence in Science Communication and Outreach

Instrument Scientist, Dr Helen Maynard-Casely, received the *2018 ANSTO Nuclear Science and Technology Award – Excellence in Science Communication and Outreach* for her work interpreting complex scientific ideas in planetary science, and promoting the power of science and ANSTO using social media and her ongoing contributions to online media channel The Conversation.

Australian Institute of Physics (AIP) national lecturership

Dr Maynard-Casely was also selected as the AIP 2019 'Women in Physics Lecturer' and will present a national series of public and school lectures on neutron scattering in the second half of 2019. The tour will take in every state and the Australian Capital Territory – with talks in capital cities and some of the surrounding regions. Dr Maynard-Casely was selected because of the significant contribution she has made to physics using neutron and X-ray scattering to investigate small molecules and ices under pressure and her skills as a science communicator.

Professor Andrew Peele

Australian Academy of Technology and Engineering (ATSE) Fellow

In October 2018, Director of ANSTO's Australian Synchrotron, Professor Andrew Peele, was selected as a Fellow of ATSE. The Academy brings together the brightest minds in technology, engineering and science to offer world-leading, evidence-based, practical advice on all matters scientific and engineering. Since becoming Director of the Australian Synchrotron, Professor Peele has been a driving force to secure funding for future development of the facility whilst garnering recognition of the value that the Australian Synchrotron is able to deliver, particularly in the area of health research.

Joint winner of the CEO Award for Sustained Contribution Award, the late Dr Mark Reinhard (centre) at the 2018 ANSTO Nuclear Science and Technology Awards night. Pictured with ANSTO's Group Executive, Nuclear Science & Technology and Landmark Infrastructure Simone Richter (left) and ANSTO CEO Dr Adi Paterson.

Dr Mark Reinhard (joint winner)

2018 ANSTO Nuclear Science and Technology Award – CEO Award for Sustained Contribution Award

ANSTO's Nuclear Stewardship Leader, the late Dr Mark Reinhard, was a joint winner of the 2018 ANSTO Nuclear Science and Technology Award – CEO Award for Sustained Contribution Award for his expertise in nuclear forensics and metrology with far reaching contributions to a range of industries including nuclear medicine and international security.

Strategic and International Scientific Advisory Council

Mexican synchrotron facility

Professor Peele and International consultant and RMIT University senior research fellow, Dr Victor Del Rio, were appointed to assist with the development of a $500 million-dollar synchrotron facility in Mexico. The facility is being developed into one of the world's leading research centres – able to respond to worldwide epidemics and global health threats like swine flu. It will be one of the first of 'new breed' facilities, featuring innovative technology with an order of magnitude in power improvements over existing synchrotron facilities.

Michael Saleh

2019 Defence Materials Technology Centre (DMTC) Awards for Excellence

Michael Saleh, a senior structural engineer, received two awards for his leadership and contribution to the development of advanced and innovative modelling and testing regimes that will improve the safety and functionality of next generations of defence equipment platforms. His work on DMTC projects over nearly a decade was recognised, including previous contributions to blast and shock models for land vehicles and his current efforts to develop and validate modelling that will improve an understanding of the operational longevity of navy ships.

Siobhan Tobin

2019 Rhodes Scholarship

ANSTO Graduate Siobhan Tobin was awarded the 2019 Rhodes Scholarship for Victoria, one of only 100 awarded worldwide. The Rhodes Scholarship is the oldest programme of its kind in the world, having been first awarded in 1902, enabling young people the opportunity to study at the distinguished University of Oxford.

Dr Katie Sizeland

Science and Technology Australia – Superstar of STEM

ANSTO scientist, Dr Katie Sizeland, was selected as a 2018 Superstar of STEM. The Superstars of STEM are exemplary individuals working in science, technology, engineering and mathematics, who are great role models to encourage girls to consider a career in STEM. Katie is the recipient of multiple awards, including the Young Scientist Medal at the European Advanced Materials Congress (2018), the top prize at the Australian Synchrotron User Meeting for Postgraduates (2015) and has been awarded a place on Homeward Bound, a global leadership program for Women in STEM (2019). Katie has participated in the Science Meets Parliament event and is setting up ANSTO's NextGenSTEM program at the Australian Synchrotron.

Homeward Bound STEM leadership program

Dr Sizeland, was also chosen for the 2019 Homeward Bound STEM leadership program for her expertise in the area of nanotechnology and her potential to lead and enact change. Homeward Bound is a global leadership initiative for women with a background in STEM. The 12-month program includes online learning to increase leadership capacity, strategic capability and collaboration, and culminates in a meeting of all 100 participants from around the world in Ushuaia, Argentina before a life-changing expedition to one of the most ecologically sensitive and inspiring areas on Earth, Antarctica, at the end of 2019.

Dr Mitra Safavi-Naeini and the Neutron Capture Enhanced Particle Therapy (NCEPT) team (joint winners)

2018 ANSTO Nuclear Science and Technology Award – George Collins Award for Innovation

Dr Mitra Safavi-Naeini and the Neutron Capture Enhanced Particle Therapy (NCEPT) team were joint winners of the *2018 ANSTO Nuclear Science and Technology Award – George Collins Award for Innovation* for developing a potential powerful, new, enhanced weapon in the fight against cancer by improving a type of radiotherapy to deliver more powerful and targeted doses of nuclear medicine. See further details on page 22.

Dr Mitra Safavi-Naeini (at lectern) and the Neutron Capture Enhanced Particle Therapy (NCEPT) team accepting the George Collins Award for Innovation at the 2018 ANSTO Nuclear Science and Technology Awards.

Joint winner of the CEO Award for Sustained Contribution Award, the late Dr Lou Vance, accepting his award at the 2018 ANSTO Nuclear Science and Technology Awards night.

Dr Lou Vance (joint winner)

2018 ANSTO Nuclear Science and Technology Award – CEO Award for Sustained Contribution Award

ANSTO Research Scientist, the late Dr Lou Vance, was a joint winner of the *2018 ANSTO Nuclear Science and Technology Award - CEO Award for Sustained Contribution Award* for his 30 years as an academic and ANSTO scientist working to improve nuclear waste management.

Dr Yingjie Zhang

The Australian – Research magazine

Nuclear Fuel Cycle researcher, Dr Yingjie Zhang, was recognised as a national leader in his field for his contributions to crystallography and structural chemistry on actinides and lanthanides by *The Australian* newspaper in its *Research* magazine. According to the data analysis methodology provided by League of Scholars, Zhang had the most papers published in top 20 journals in 'Crystallography and Structural Chemistry' and a total of 1,353 citations from 113 publications.

Putting science to work through knowledge exchange and innovation

ANSTO's nandin Innovation Centre was launched on 20 November 2018 with six founding members. During the reporting period the membership of in the centre grew from three to 10 housing a diverse range of start-ups, entrepreneurs and businesses focused on developing new solutions for health and respiratory medicine, safety systems and emergency services, air quality infrastructure design and fabrication, cybersecurity, defence and aerospace, automated asset tracking and management and more.

nandin is the first realisation of much broader plans for the ANSTO Innovation Precinct, which will foster close engagement between Australian scientists and both local and international businesses, placing southern Sydney at the heart of innovation in Australia. In February 2019, ANSTO welcomed the $12.5 million grant from the NSW Government to support the expansion of the ANSTO Innovation Precinct (see more about nandin and the NSW Government grant on pages 10-11).

nandin continues to expand focus on challenge based innovation in collaboration with Design Factory Melbourne (Swinburne University, Australia) and IdeaSquare (CERN, Switzerland) with the NSW Government committing $2.5 million funding over five years to enable nandin to become a node of the Design Factory Global Network.

The broader ANSTO Innovation Precinct was highlighted in the Greater Sydney Commission's South District Plan. The innovation and research precinct requires a partnership between multiple tiers of government to realise its full potential as an economic catalyst in the District. For this reason, it is identified as a Collaboration Area by the Commission. At the end of 2018 the unique challenges for ANSTO were identified and throughout 2019 the Commission has facilitated collaboration between ANSTO and the Sutherland Shire Council, NSW Government departments and agencies, and other stakeholders to:

- improve transport connections and accessibility to and from ANSTO
- enhance ANSTO's economic and employment role
- provide essential infrastructure to support the innovation precinct
- embrace the ecological and indigenous values inherent in the site.

ANSTO has continued to engage with industry to develop solutions to business challenges and increase the commercial competitiveness of our research partners. Noteworthy successes during the reporting period include: supporting OncoSil Medical during its clinical trial by providing irradiation services and manufacturing of its product; the establishment of new industry clusters focused on seafood provenance using isotopic techniques; and the creation of a national automation and robotics group.

ANSTO's deuteration and neutron techniques have been recognised by the cosmetics industry. During the reporting period, the Australian Society of Cosmetic Chemists recognised the potential of deuterated materials to investigate the relationship between structure and function in cosmetic ingredients and beauty products and for quality control purposes. See more on page 33.

Over the year, two internal ventures based on ANSTO research have developed.

In July 2018, construction commenced on the first of its kind Mo-99 waste treatment facility using ANSTO Synroc® technology. Industry leading advancements in automation and robotics will allow the entire plant to be automated from a seamless operating interface. Handover of the building is expected in the later half of 2020 which will allow plant commissioning phases to commence.

Border Technologies continued to progress their commercialisation plan, including securing their first commercial agreement this year. This venture houses a suite of ANSTO-developed intellectual property which includes a new imaging technology that makes it possible to image, identify and locate gamma-ray radiation in a safe and timely manner. There are also several technical concepts in development, concentrating on enhanced particle therapy, machine learning and behavioural analysis in nuclear security.

Products and services

Health Products

Health Products is a commercial division of ANSTO responsible for the manufacture, production and distribution of radiopharmaceuticals, radio chemicals, cold kits and accessories for use in patient treatment and research across Australia and also globally.

ANSTO's Health Products division enables the supply of approximately 12,500 patient doses of technetium-99m (Tc-99m), the daughter isotope of molybdenum-99 (Mo-99), to Australian patients each year. Tc-99m is used to support the diagnosis of a range of common illnesses including heart disease, cancer and skeletal injuries. ANSTO's Health Products division also supplies a number of other radioisotopes used in both diagnosis and treatment of disease.

ANSTO experienced a number of challenges within the Health Products division during this financial year, but still managed to deliver the equivalent of 1,821,439 patient doses within the reporting period.

The challenges experienced by the Health Products division in 2018-19 drove substantial reviews of equipment and processes to improve the safety and reliability of product supply. While those will ultimately drive improvements at ANSTO, unfortunately during this reporting period there were some significant interruptions to the production of our Gentech Tc99m generators. Due to a mechanical breakdown within the nuclear medicine production facility known as Building 23 during the period from June 2018 until February 2019, ANSTO was required to send bulk Mo-99 from its Lucas Heights site to its international partner in Boston. The Australian Mo-99 was placed into generators which were then sent back to ANSTO for local distribution to hospitals and clinics. As Mo-99 is a health product that disappears through natural decay over time, there were unique and complex challenges to overcome in order to mitigate the impacts on Australian patients.

Following the mechanical breakdown in Building 23, a generator supply Working Group was convened with representation from the Australian nuclear medicine community to assist in the management of disruptions for clinicians and technicians within the Australian clinical setting. ANSTO wishes again to use this opportunity to acknowledge the support from the members of the group and the wider nuclear medicine community, in working together with us to minimise impacts on Australian patients.

The manufacture and distribution of some more specialised, niche health products within the Building 23 facility has been put on hold since March 2019 to allow for a more substantive review of equipment and processes. Early next financial year, ANSTO will commence temporarily importing these products to support local demand and minimise the impact on Australian patients.

Exported Low Enriched Uranium (LEU) Molybdenum-99 (Mo-99)

Mo-99 is produced at ANSTO via a process starting with LEU target plates that are irradiated in the OPAL reactor. OPAL also uses LEU fuel, and together with the LEU used for producing Mo-99, ensures that ANSTO is consistent in its support of non-proliferation targets globally.

In 2018-2019, ANSTO provided all of Australia's domestic Mo-99 requirements, and significant additional product was provided to customers overseas, when available.

This export Mo-99 was sold by ANSTO to a number of countries, with the key customers being in the USA, Japan, China and India. It is estimated ANSTO's share of the global Mo-99 market was over 15 per cent in the 2018-2019 financial year.

ANSTO Nuclear Medicine

ANSTO Nuclear Medicine (ANM) Pty Ltd is a subsidiary of ANSTO that was established to own and operate the new Mo-99 production facility that only uses LEU. The new Mo-99 facility is based at ANSTO's Lucas Heights campus, and is located next to OPAL.

The ANM facility will secure Australia's supply of Mo-99 for the domestic market for many decades to come. In addition, the new facility will position Australia as a global leader in the high-end manufacturing of LEU Mo-99 required for approximately 80 per cent of nuclear medicine scans worldwide.

Commissioning of the facility was completed during the 2018-2019 financial year, to demonstrate the effectiveness of the safety and operational systems. Approval to commercially operate the new Mo-99 facility was given by ARPANSA in early April 2019. This approval was initially for 30 production runs only. ARPANSA then granted a full licence to operate the new Mo-99 facility in late May 2019.

The TGA granted ANM a Good Manufacturing Practice (GMP) licence towards the end of the 2017-2018 financial year. This licence allows the production of Mo-99, which is a therapeutic product.

Adjacent to both OPAL and the new Mo-99 facility is the SyMo construction site. SyMo is owned by ANM and is a waste management facility that will utilise ANSTO's Synroc technology to treat the liquid waste that results from production of Mo-99. Construction has now commenced on SyMo with an expected completion date towards the end of the 2020 calendar year.

PETTECH Solutions

On 2 January 2019, the business of ANSTO's wholly-owned subsidiary company, PETTECH Solutions Pty Ltd was sold to Cyclotek NSW Pty Ltd. PETTECH Solutions Pty Ltd, remains the owner of the major assets (building, cyclotron and hot cells) and is entitled to a share of profits from the Cyclotek NSW business for providing access to these facilities for the new company to operate its business.

Silicon Irradiation

Silicon Irradiation increased its global market share to 50 per cent in 2018. Revenue from silicon irradiation, also known as neutron transmutation doping (NTD) in 2018-2019 was over 30 per cent higher than the prior year.

After further processing by power electronics manufacturers, NTD silicon is used in high-end electronic switching devices. These devices are used in a range of high-power semiconductor applications such as power grid infrastructure, industrial automation, wind turbine systems, high-speed trains and the automotive industry. The long-term outlook for NTD silicon remains strong.

Minerals

ANSTO's Minerals business provides practical solutions and innovative technologies to the mining and minerals industry via the provision of consultancy and process development services. In addition, it undertakes industry-funded research to develop and improve processes for the treatment of ores containing uranium, rare earths and other critical metals.

Minerals also provides consulting services to mining and minerals processing operations managing naturally occurring radioactive materials (NORM), applying its extensive knowledge to the efficient management and mitigation of risks that may be associated with NORM.

Minerals has established a strong reputation with its clients for high quality technical development, utilising its excellent pilot plant facilities to allow the scale up of a range of metallurgical unit operations. The benefits accrue from both the technical expertise applied as well as the strong focus on delivering improved energy efficiency and overall economics of processing. Minerals also has the only rare earth solvent extraction pilot plant outside of China capable of producing individual rare earth products of greater than 99.9 per cent purity.

Minerals continues to diversify its consultancy work, undertaking a number of technology trade-off studies and providing input to pre-feasibility and feasibility studies covering a wide range of metals including zirconium, uranium, rare earths, vanadium, niobium, copper and lithium.

Radiation Services

Comprising the Radiation Consultancy, Radiation Safety Training and Instrument Calibration groups, ANSTO's Radiation Services business unit is the leading provider of radiation protection services and advice in Australia.

There has been a commercial downturn in many sections of the radiation protection industry, but with a strong reputation and extensive practical experience across a broad range of radiation protection issues in industry, Radiation Services continues to maintain strong revenue and profitability.

Much of the consulting focus has been on establishing longer-term contracts with key clients including the larger scale characterisation and remediation of legacy buildings and sites, and the management of high activity sources, utilising a range of ANSTO's resources. In the training area, the development of industry specific training has been very well received.

Australia's research infrastructure

OPAL

At the heart of ANSTO's research capabilities is the state-of-the-art OPAL reactor, which is one of the world's most effective multi-purpose reactors.

OPAL is used for scientific research, the production of medical radioisotopes, and the irradiation of silicon for use in microelectronics and other specialised irradiations for research and industry.

OPAL continued to consolidate its reputation as one of the world's most reliable and available multi-purpose reactors. In 2018, OPAL achieved full design power of 20.0 MW thermal, enabling an average five per cent increase in neutron flux for irradiations and research. In the 2018-2019 financial year, the OPAL reactor operated for 312 days with a reliability of 98.3 per cent.

Sustained safe operations have been achieved through the expertise of OPAL staff and robust asset management. ANSTO's capital investment in OPAL has enhanced operational resilience and safety, with optimised realisation of asset value through the life extension of key infrastructure. OPAL upgrades have enabled the remote condition monitoring of critical plant, minimising radiation exposure for staff and supporting the continuity of supply of medical radioisotopes. A focus on operational sustainability in 2018-2019 has resulted in reduced energy consumption of some reactor systems while maintaining safety and performance.

High reliability OPAL operations have supported strong levels of utilisation. OPAL has continued to be used for the irradiation of new radioisotope products that are being trialled for brachytherapy treatment of cancer. The OPAL utilisation team is increasing the capacity for irradiation of these products through optimised target configuration within existing facilities. ANSTO's collaboration with researchers to produce the irradiated products supports the global development of targeted treatments that minimise damage to healthy tissue and are better tolerated by patients.

OPAL's reputation for high reliability continues to attract international researchers, Australian scientists and industry clients to use ANSTO's world-class neutron capabilities for developing

OPAL multi-purpose reactor pool.

research outcomes. The Cold Neutron Source has operated with 97.9 per cent reliability, providing low energy neutrons to further insights into the molecular structure and dynamics of molecules such as proteins and polymers.

In August 2018, ANSTO achieved the first shipment of spent OPAL fuel to France for reprocessing as part of the complete 'end-to-end' spent fuel management plan in place for the lifetime of the reactor. Under this plan, OPAL's spent fuel will be progressively sent to France in approximately seven year intervals for reprocessing, with residual waste returned to Australia for long-term storage at the NRWMF.

ANSTO has set a target of 282 days of safe operation in 2019-2019, which incorporates a planned extended maintenance shutdown period to ensure the ongoing high efficiency, safety and reliability of the reactor into the future.

Australian Synchrotron

ANSTO's Australian Synchrotron uses Australia's biggest particle accelerator to produce powerful beams of X-ray and infrared light and supports a broad range of applications from medicine and mining through to environment and artworks.

During this period, the Australian Synchrotron supported in excess of 1000 experiments over 5300 visits. Every significant research active university in Australia and New Zealand as well as government agencies and departments, forensics and medical research institutions, art galleries, museums, and over 200 companies have benefited from research undertaken at the Australian Synchrotron.

A significant technical upgrade to the SAXS/WAXS beamline end-station provided increased throughput resolution and sensitivity, allowing it to continue to deliver world leading research outcomes for its users in the fields of electronics, materials engineering and life sciences.

Over the year, more than 15 workshops and events were run by, or at, the Australian Synchrotron. The largest event during the year was the 10th International Particle Accelerator Conference of nearly 1,200 delegates.

Australian Centre for Neutron Scattering

The Australian Centre for Neutron Scattering (ACNS), which is partially funded through the National Collaborative Research Infrastructure Strategy (NCRIS), is home to 15 neutron beam instruments, where scientists apply neutron scattering techniques to solve complex research and industrial problems such as the development of renewable, clean energy technologies or new battery materials, and studying the structural integrity of materials such as airplane turbines.

During the period, ACNS hosted in excess of 570 users over 1,450 visits including supporting 12 commercial projects.

ANSTO, in partnership with HZB, opened the Spatz neutron reflectometer at ACNS in June 2019. See further details on page 13.

Improvements made to several instruments, including replacement high performance neutron detectors and sample environment equipment, have increased capabilities and provided significant operational efficiencies.

ACNS' neutron guide hall.

ANSTO researcher Dr Klaus Wilcken in the CAS Sirius accelerator control room.

Centre for Accelerator Science

The Centre for Accelerator Science (CAS), which is partially funded through NCRIS, consists of four megavolt-range accelerators – the 2MV Small Tandem for Applied Research (Star), the 10MV Australian National Tandem Research Accelerator (Antares), a 1MV low energy multi-isotope accelerator (Vega) and a 6MV tandem accelerator (Sirius) – with 17 beamlines and end stations, 11 ion sources and a suite of sample processing laboratories.

Continuing developments on the Vega and Sirius accelerators have led to world-leading performance. Vega was shown to have the best sensitivity performance for plutonium analysis, while Sirius performance is on par with leading overseas laboratories for analysis of radioisotopes of beryllium and aluminium.

During the period 2018-2019, CAS supported over 120 users from 60 different institutions. Almost 80 per cent were from the university sector, including leading national and international institutions such as The Imperial College (London), the University of Rochester (New York), the Australian National University and the University of Melbourne.

Through collaboration with the IAEA, CAS has developed a way of measuring black carbon air pollution which is being used by IAEA's collaborating laboratories to help countries better understand the impact they are having on the environment.

National Deuteration Facility

The National Deuteration Facility (NDF), which is partially funded through NCRIS, produced nearly 135 deuterated molecules and supported more than 130 scientific users from almost 40 institutions during the period. These included users from 16 Australian universities and Australian technology companies Astrazeneca Australia and Pharmaxis Pty Ltd.

Leading international organisations accessing the NDF included the international neutron scattering facilities Helmholtz Zentrum Berlin (Germany), the European Spallation Source (Sweden) and the European Molecular Biology Laboratory as well as top 100 ranked universities of Columbia, California, Santa Barbara, Maryland, Edinburgh, Glasgow, Lund and Auckland.

The NDF provided valuable input as members of advisory panels in Europe (European Spallation Source in Sweden and the European Chemical Deuteration Network) and at workshops in Japan at the Japan Proton Accelerator Research Complex.

Capital investment

A new extension to the Integrated Waste Management Facility (known as Building 20b) will enable ANSTO to continue the safe and responsible management of Low Level Solid Waste (LLSW) generated from critical ANSTO operations such as the production of nuclear medicine from the newly built ANSTO Nuclear Medicine (ANM) Facility. It also provides ANSTO sufficient storage capacity to store LLSW in accordance with the regulatory framework and international best practice in preparation for the siting, construction and operational commencement of the NRWMF. The new facility has been designed to provide ample storage capacity and concurrently, provide ANSTO with the infrastructure to commence processing of the entire LLSW inventory in an ageing storage shed known as Building 59.

The core design ethos of the new facility was to maximise the benefits for ANSTO while minimising the risks to personnel and the environment. The key features of the new facility are the novel use of automation for material handling. ANSTO has invested in an Automated Storage and Handling System (ASRS) that is capable of cataloguing pallets with LLSW and dispatching them to a known storage section in a high density racking assembly. The pallets can easily be retraced for inspection and recalled to an end conveyor for the next stage in the waste processing cycle. Overall, the ASRS effectively eliminates the use of forklifts for handling pallets within the facility and reduces the overall dose rate received by operators by maintaining large distances to the bulk storage racking, thus adding to human safety and security. Furthermore, due to the use of the ASRS, the building footprint was significantly reduced leading to an optimised and sustainable design. The building also features a semi-automated building crane with a dedicated container grab. The automation feature enables an operator to choose a co-ordinate and execute the crane's smart features to precisely drive the container with conditioned LLSW to its destination. The feature allows the majority of the container movement zone to be a no-go area which again significantly increases the safety for personnel and aids in maintaining the principles of ALARA as per international best practice.

The new extension, built by Stephen Edwards Constructions, was nominated for an award with the Master Builders Association of Australia.

Integrated Waste Management Facility extension.

Engaging with ANSTO

The key objective of ANSTO's Education and Engagement programs is to enhance the knowledge of teachers, students and the general public on the applications and benefits of nuclear science and technology and provide insights into what a career in STEM can offer young people who are considering their career choices.

Overall, we have seen an increase in the level of engagement with ANSTO from various sectors in the community during the reporting period. This is evident by the increase in engagement through our online platforms, and by the continually strong numbers of visitors to our two main sites.

ANSTO offers education activities and resources suitable primary right through to tertiary students.

In August 2018, ANSTO introduced a new look to more clearly showcase the outcomes and benefits we deliver to all Australians. The original branding for ANSTO was introduced in 1987 and 31 years on, there was an opportunity to present a more modern ANSTO focused on science, ingenuity and sustainability. The relaunch of the ANSTO brand was supported by a new website and introduction of the first of a series of new apps to present ANSTO's science in new and innovative ways to invigorate interest in Australian science (learn more on page 14).

Australian Government

ANSTO
Science. Ingenuity. Sustainability.

Education

The 2018-2019 year saw a continued growth in the popularity and scope of ANSTO's key education programs.

ANSTO has a growing number of online resources, including written material, virtual reality technology apps and animations available to teachers and students. The programs are designed to complement in-class studies and are aligned with the NSW Education Standards Authority (NESA) and Victorian Certificate of Education syllabus outcomes.

As a first for Australia, during the reporting period, ANSTO was able to facilitate and support three Australian teachers to participate in a two-week CERN teacher program.

This experience has led to ANSTO working closely with the three successful teachers to produce new physics resources for all secondary teachers to use.

The delivery of ANSTO's Teacher Professional Development program continued across Australia, with 34 teachers participating in the first course delivered in Tasmania. ANSTO now has six NSW Education Standards Authority (NESA) accredited courses covering: Nuclear Science in Senior Chemistry; Physics and Year 9 and 10 Science; and Nuclear Science in Years 5 and 6. Nationally, ANSTO has assisted in the development of over 250 teachers within the reporting period.

ANSTO provides video conference experiences to schools across Australia so that students can talk directly to our scientists and education officers, and receive support for their studies in science. Some of our video conference formats enable students to have direct involvement in designing and testing nuclear science experiments using

Over 15,000 people visited the Lucas Heights campus in 2018-2019.

Students enter the Big Ideas Forum by submitting a 40 second video answering the question 'What problem would you like to see scientists solve for the future?' for their chance to spend an exciting week with our researchers.

equipment that may not be available in their schools. ANSTO has also supported over 290 video conferencing activities over the past five years. These provide an accessible and affordable, online incursion alternative to the ANSTO science excursion program, which is particularly beneficial for rural and regional schools. Almost 3,000 students in remote and regional areas of Australia took part in ANSTO video conference experiences, enabling students to talk directly to scientists and receive support for their science studies.

In the last five years from 2014-2018, close to 68,000 primary and secondary school students have participated in ANSTO's STEM education activities, an almost 70 per cent increase on the previous five years.

Specialised science tour programs available at our two main campuses in Sydney and Melbourne have provided school students with unique opportunities to go behind the scenes and visit scientists at work, as well as witness theoretical science being put into action.

Over 15,000 people visited the Lucas Heights campus in 2018-2019.

Providing valuable insights into STEM careers

In addition to supporting teachers and students achieve curriculum outcomes, ANSTO has a range of events and activities that are designed to engage young people in pursuing a career in STEM. These range from very popular day-long STEM-based workshops to immersive science experiences. For example, the Girls in the Lab Workshop gives nearly 30 selected female secondary students from the Sutherland Shire the opportunity to experience the working life of a scientist or engineer. The Big Ideas Forum is a week-long experience offered to 22 students from around Australia. Students are invited to pose a question to be solved by science and then have the opportunity work closely with ANSTO researchers to experience how researchers would approach the question and go about solving it. These programs have once again been very successful, and we are anticipating further growth in 2019-2020.

ANSTO's Big Ideas Forum brings 22 students and 11 teachers from across Australia to Sydney to meet world-class researchers and go hands-on with amazing technology.

ANSTO's successful series of Fact or Fiction shows provides participants with a fun and interactive opportunity to learn more about science.

International engagement

IAEA

During the period, ANSTO continued its leadership role at the IAEA, primarily demonstrated through the Regional Cooperative Agreement (RCA), participating in projects across areas such as food safety and authentication, non-destructive testing and examination methodologies in industries, environmental and climate science, and cancer and non-communicable diseases management. Australia presently participates in all eleven projects, taking the lead in three of them, namely the assessment of the vulnerability of coastal landscapes and ecosystems to sea-level rise, the role of soil and water quality in minimising land degradation and enhancing crop productivity, and the enhancement of medical physics services in the region through education, training and standards development.

The RCA is an intergovernmental agreement of 22 IAEA Member States in East and South Asia and the Pacific, under which people from developing member countries are educated and trained in the safe and peaceful uses of nuclear science and technology for a range of applications in health, environment, industry and agriculture.

In February 2019, ANSTO hosted the visit of IAEA Deputy Director General Chudakov, the head of the Department of Nuclear Energy, to strengthen the relationship and opportunities for collaboration between ANSTO (Australia) and that Department.

ANSTO staff also continued to play prominent roles in IAEA expert groups, chairing the International Expert Group on Nuclear Liability (INLEX), the Standing Advisory Group on Nuclear Applications (SAGNA), and the International Decommissioning Network (IDN).

Forum for Nuclear Cooperation in Asia (FNCA)

The FNCA is another multilateral forum of importance to ANSTO, Australia and the Asia-Pacific region. Like the RCA, the FNCA facilitates technical cooperation using nuclear science and technology amongst the 12 member countries. Australia is represented by ANSTO in three of the eight projects – radiation safety and radioactive waste management, research reactor utilisation and climate change science, the latter led by ANSTO.

The FNCA member states continued to exchange and share information, with this year's focus being on the legal and regulatory framework of environmental impact assessments (EIA) in the nuclear industry. ANSTO's presentation of Australia's national policy, processes, and procedure on nuclear-related activities, including the *Environment Protection and Biodiversity Conservation (EPBC) Act,* offered insights to the member states.

Sri Lanka CKDu

ANSTO's efforts to investigate Chronic Kidney Disease of Unknown Cause (CKDu) in Sri Lanka continued to progress well. During the period, ANSTO completed an initial study into the chemistry of groundwater in the North-Central Province; convened a second workshop for Sri Lankan experts in Colombo; and ran a Clean Water Hackathon for Australian university students to develop novel solutions for dehydration in CKDu-affected communities. In partnership with collaborators at the Sri Lankan Presidential Taskforce for Prevention of Chronic Kidney Disease and the Sri Lankan Ministry of Health, Nutrition and Indigenous Medicine, ANSTO has identified three priority research projects which will be completed in the next two years, with a focus on risk reduction and early detection.

ANSTO acknowledges the contribution of the Australian Department of Foreign Affairs and Trade, which has provided nearly $700,000 of funding support for the project.

ANSTO and the National Measurement Institute (NMI), which share areas of common interest in both measurement and research, signed a MOU formalising collaboration on 6 March 2019.

Bilaterals – Memoranda of Understanding

ANSTO signed several MOUs in the past year with various international institutions with the aim of further strengthening potential cooperation in the research and development and applications of nuclear science and technology. See Partnerships and collaborations section on page 52-58 for more information.

International outreach

ANSTO has been active on the international stage in the past year. CEO Dr Adi Paterson and GIA led Australia's delegation to the IAEA Ministerial Conference on Nuclear Science and Technology (NST) at IAEA headquarters in Vienna, from 28 to 30 November. Dr Paterson delivered an invited presentation to the Plenary on improving the representation of women at the IAEA and in the nuclear industry more broadly. Dr Paterson also delivered a presentation on the future of nuclear technologies for the treatment of cancers to a TEDx event run in parallel to the Conference. Australia, Belgium and the Netherlands also co-hosted a side event on the importance of reactor-based production for securing global supply of nuclear medicine. Both the TEDx event and the nuclear medicine side event attracted the attendance of a large number of delegates.

The CEO also attended the 2018 Pacific Basin Nuclear Conference in San Francisco where he was invited to be part of two international panels on *Nuclear Energy – the Path Forward* and on *Advancing Nuclear Medicine*. The CEO spoke on the *Nuclear Fuel Cycle in Australia* and *Advances in Nuclear Medicine – an Australian Perspective*.

ANSTO also hosted high level visits from the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD), namely NEA Director General Magwood and Deputy Director General Iracane. Australia, through ANSTO, is an active participant in NEA activities such as the NEA Steering Committee, the Nuclear Development Committee, the Generation IV International Forum (GIF) and the High-Level Group on the Security of Supply of Medical Radioisotopes (the mandate of which expired in October 2018).

CEO Adi Paterson (left) with Director of the Thorium Molten Salt Reactor (TMSR) Center, Professor Hongjie Xu.

Support to Government

As mandated by the *ANSTO Act*, ANSTO plays a vital role in providing expert and technical advice to the Australian Government on all matters relating to nuclear science, technology and engineering. ANSTO also plays a critical role in contributing to and informing policy making in these areas.

ANSTO's support for government and policy making is achieved through various mechanisms.

ANSTO maintains ongoing engagement with the Minister for Industry, Science and Technology and the Department of Industry, Innovation and Science, other relevant Ministers and their departments, as well as other key agencies and stakeholders. ANSTO acts as the secretariat for both the Nuclear Agencies Consultative Committee (NACC) and Research Agencies Meeting (RAM), two separate forums that enable discussion and collaboration amongst Government departments, agencies and research institutes. NACC is a quarterly meeting that enables the exchange of information and provides a platform to ensure a consistent approach to issues related to nuclear science, technology, safety and engagement with international counterparts. The RAM brings together more than 20 government departments, agencies and research institutes with the goal of enhancing science and research collaboration and policy at the domestic and international level. Over the last 12 months, participation in the RAM has grown by approximately 20 per cent.

Throughout 2018-2019, the Minister's Office and the Department were kept informed of significant events and critical developments in a timely manner. ANSTO works with the Department on a daily basis, keeping them abreast of ANSTO's operations, achievements and activities. Further, ANSTO responds to requests for expert or technical advice regarding nuclear science and technology, and provides input into the development and revision of science, research and innovation policy.

The Hon Karen Andrews MP visiting ANSTO's new Mo-99 production facility.

Minister Kevin Anderson (front row, second from left) visiting the ANSTO neutron guide hall in May 2019.

ANSTO also regularly and proactively engages with Federal and State parliamentarians and local councilors, to update them on ANSTO activities as well as relevant developments in nuclear science and technology. A focus during 2018-2019 was ongoing engagement with the NSW Government to support the growth of ANSTO's Innovation Precinct. In February 2019, the NSW Government announced a $12.5 million commitment to support the ANSTO Innovation Precinct. See page 10-11 for more details.

ANSTO also made significant contributions to major policy inquiries and research reviews to support Australian science and innovation policy making. These included the joint review of the Australian and New Zealand Standard Research Classification (ANZSRC), the Medical Research Future Fund Priorities Consultation and the Women in STEM Decadal Plan.

ANSTO also continued to provide technical support and advice to the Federal Government regarding the establishment of the NRWMF. ANSTO's expertise stems from decades of experience in safely managing radioactive waste from the production of nuclear medicines. Additionally, ANSTO continued to welcome visits from members of the local communities surrounding nominated sites to its Lucas Heights campus to help them gain a better understanding of Australia's nuclear industry and the kinds of wastes that will be managed at the NRWMF. Several ANSTO staff also joined the Department on visits to areas surrounding nominated sites to provide further information and answer questions.

Additionally, ANSTO has supported and led a number of important parliamentary processes to support Australia's accession to the Generation IV Framework Agreement and the Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology 2017. These are important milestones that have enabled ANSTO and Australia to benefit from the activities of these important multilateral collaborative forums. ANSTO also led the governmental and parliamentary processes to conclude an Intergovernmental Agreement between Australia and France to enable the reprocessing of OPAL spent fuel by the French company Orano from 2018.

ANSTO also continued to provide expert advice to the Foreign Affairs and Trade portfolio in relation to the peaceful uses of nuclear energy, nuclear security and nuclear non-proliferation.

Partnerships and collaborations

Asia Oceania Forum for Synchrotron Radiation Research (AOFSRR)

AOFSRR is an association of all synchrotron operating and user nations in the Asian region. Its mission is to strengthen regional cooperation in and to promote the advancement of synchrotron research.

ANSTO has had a close association with the AOFSRR since its inception in 2006, when the then ANSTO-operated Australian Synchrotron Research Program joined as a foundation member representing Australia. Since 2012, ANSTO has served as the financial manager of the AOFSRR to facilitate the payment of membership fees by the eight full member nations.

ANSTO's Professor Andrew Peele, Director of the Australian Synchrotron and AOFSRR Council member for Australia, and Dr Richard Garrett, the AOFSRR Secretary-Treasurer, will represent ANSTO and Australia at the forthcoming meeting of the Council and a one day special symposium as part of the 14th Asia-Pacific Physics Conference to be held in Malaysia in November 2019.

Atomic Energy of Canada Ltd (AECL)

In May 2019, ANSTO signed an MOU with the Atomic Energy of Canada Ltd (AECL). The agreement is wide-ranging, reflecting AECL and ANSTO's leading roles and broad interests across the nuclear industry. Discussions have already identified a number of areas of potential mutual collaboration, including sharing experiences on obtaining resources for nuclear infrastructure, risk management benchmarking, and collaboration on decommissioning and decontamination.

Austin Health

ANSTO's partnership with Austin Health established a state-of-the-art PET Solid Targetry Laboratory at the Austin Hospital. The laboratory enables research into new nuclear imaging techniques to benefit patients affected by different types of cancers. The partnership provides a reliable and cost-effective system for the production of relevant long-lived PET radionuclides which are suitable for the radio-labelling of biomolecules for research and clinical imaging applications. A collaboration agreement was renewed by ANSTO and Austin Health in February 2018 for a period of three years, with a view to increasing scientific impact and benefit to end-users through the joint capabilities.

Australian Collaboration for Accelerator Science (ACAS)

ACAS was established in 2010, between the four major accelerator centres in Australia: ANSTO, the ANU, the Australian Synchrotron and the University of Melbourne.

The mission of ACAS is to become an umbrella organisation for all megavolt accelerator systems in Australia. Its aim is to promote and increase the use and understanding of accelerator science activities in Australia, and to link with major international accelerator centres.

Internationally, collaborative research projects with the European Organization for Nuclear Research (CERN), and with the Japanese free-electron laser facility at the Japan Synchrotron Radiation Research Institute (SPring-8), are ongoing.

Australian Institute of Nuclear Science and Engineering (AINSE)

AINSE provides a platform for training and cooperation in the nuclear science and engineering fields. Its membership comprises 43 Australian and New Zealand universities and scientific organisations, including ANSTO, making it one of the few scientific institutions with such a wide membership. AINSE facilitates world class research and education in nuclear science and engineering and promotes the use of ANSTO and other associated nuclear capabilities by offering scholarships in early career research and supporting training programs such as schools, conferences and workshops. New programs include a PhD Scholarship with AINSE, ANSTO and the Embassy of France in Australia and a residential student scholarship for PhD students undertaking research for more than six months per year at an ANSTO facility. AINSE also offered an educational tour in Japan in August 2018 to inform delegates about particle therapy treatments in Japan, with a focus on carbon-ion therapy. AINSE is working in collaboration with ANSTO to provide assistance with ANSTO's development of a Graduate Institute.

CNES (French Space Agency) and INSERM (French National Institute of Health and Medical Research)

CNES and INSERM together conduct research into the mechanisms of cell radiosensitivity and radiobiology in the context of low level exposure to space-induced radiation. ANSTO, CNES and INSERM signed a three way MOU in February 2019 to collaborate on research into the effects of low doses of X Rays and high linear energy transfer (LET) particles for space exploration. Under the MOU, a Principal Researcher from CNES will be seconded to ANSTO until December 2020 to establish collaborative projects in these areas.

European Organization for Nuclear Research (CERN)

ANSTO has a formal agreement with CERN which allows respective scientists to collaborate together and receive reciprocal use of research infrastructure.

The agreement has enabled collaborative research in accelerator science, health and life sciences, information technology and radiation detection. By engaging with CERN, ANSTO and Australia are benefiting from cutting-edge research and are able to develop expertise in areas such as particle-therapy platforms and large-scale accelerator facilities.

ANSTO and CERN have established a new initiative to allow selected Australian science teachers to participate in CERN's annual International High School Teacher Programme. ANSTO, via its Discovery Centre, and CERN jointly reviewed over 20 applications from Australian science teachers, and have selected three teachers to join the 2019 Programme in July. ANSTO and CERN intend to continue this Programme annually.

Defence Science and Technology Group (DST)

ANSTO and the DST are engaged in joint activities and projects, including ongoing cooperation to strengthen Australia's capability to deter, detect and respond to incidents that involve nuclear or other radioactive material. A key activity is leveraging the significant contribution made by DST to the BR—GHT project to construct new beamlines at the Australian Synchrotron. Both organisations are working together to make optimal use of ANSTO's infrastructure combined with shared research capability to ensure common objectives in materials and health are realised.

Helmholtz-Zentrum Berlin (HZB)

In October 2016, ANSTO renewed its Memorandum of Understanding (MoU) with the renowned large-scale German research organisation, HZB, which further advances a program of collaborative scientific research on energy materials.

In February 2017, ANSTO transferred the BioRef neutron reflectometer from the BER-II Reactor to ANSTO under a donation agreement that was signed in October 2015. See further details on page 13.

ITER

The ITER project, located in southern France, is a collaboration by 35 nations to build the world's largest tokamak, a magnetic fusion device that has been designed to prove the feasibility of nuclear fusion as a large-scale and carbon-free source of energy. ITER will be the first fusion device to produce net energy and to maintain fusion for long periods of time.

ANSTO, ANU and the ITER Organisation have initiated two collaborative research projects under the agreements concluded in 2016-2017, a project to install a unique ANU designed and developed plasma diagnostic imaging instrument on the ITER reactor, and a continuation of materials investigations related to plasma-wall interactions in ITER. ANSTO has signed three Implementing Agreements with the ITER Organisation to formalise these projects.

The Australian ITER Team, comprising ANU and ANSTO researchers and engineers, presented the plasma imaging diagnostic design to an international review panel in March 2019, as part of ITER's formal Conceptual Design Review process. The project received very favourable feedback from the panel, which requested that the team consider extending the role of the diagnostic to measure several additional critical plasma parameters.

Japan Atomic Energy Agency (JAEA)

The ongoing shutdown of Japan's research reactors following the Fukushima accident in 2011 has led JAEA to seek increasing cooperation with international neutron scattering facilities, including the ACNS at ANSTO.

Japan Proton Accelerator Research Complex (J-PARC)

ANSTO undertook several activities under the MoU with J-PARC, which was signed in July 2015. In January 2019, an ANSTO expert from the National Deuteration Facility participated in a workshop 'Deuterium Labelling Study for Neutron Science' in Japan. The staff member presented a Plenary Lecture and provided further advice on efforts to bring Japan's capability in chemical deuteration of molecules to world-class maturity.

Jilin University

ANSTO and Jilin University, located in Changchun, China, have a research collaboration MoU to pursue joint research in areas including palaeontology, engineering, environmental materials and medical sciences. In particular it is aimed at promoting the application of ANSTO's neutron and synchrotron imaging capabilities to palaeontology in collaboration with Jilin University's Dinosaur Evolution Research Center.

Macquarie University

An agreement between ANSTO and Macquarie University is helping geologists and scientists better understand everything from where earthquakes might occur to where gold is deposited. The partnership is promoting work to replicate environments located 400 kilometres beneath the Earth's surface. The study of the physical and chemical processes at these depths will provide a better understanding of the Earth, including how mineral deposits are formed. Furthermore, by providing a fuller working model of the processes that occur in the Earth's interior, scientists hope to better understand how to predict and anticipate geological events such as earthquakes and volcanic eruptions.

This research makes complementary use of the ANCS's neutron beam instruments and high energy X-rays at the Australian Synchrotron to study geological samples under high pressure and temperature.

Monash University

ANSTO's agreement with Monash University is helping facilitate knowledge sharing and creating new training and development opportunities for researchers in the areas of biomedical imaging, cancer therapy, accelerator science and neutron science. ANSTO and Monash are in early discussions on opportunities for accelerator-based production of therapeutic medical radioisotopes.

National Institute for Radiological Sciences (NIRS)

NIRS, a laboratory of Japan's National Institutes for Quantum and Radiological Science and Technology (QST), has been a world leader in particle therapy for over two decades, and has pioneered the development and use of carbon ion therapy. ANSTO's collaboration with NIRS has been developing in recent years with increased use of NIRS facilities by ANSTO researchers, and with NIRS providing advice on the development of particle therapy in Australia.

A MoU between ANSTO and QST was signed in September 2018, formalising ongoing collaborations between ANSTO and NIRS. In particular NIRS is a key partner in ANSTO's development of the Neutron Capture Enhanced Particle Therapy (NCEPT) technique. See further details on page 22.

National Measurement Institute (NMI)

The NMI is a division of the Department of Industry, Innovation and Science, with a mission to deliver measurement for a fair, safe, healthy and competitive Australia. ANSTO and the NMI signed a research collaboration MOU in March 2019 to facilitate joint application of metrology to nuclear science and infrastructure, and research collaboration in areas such as environmental pollution, food security and materials metrology.

RIKEN SPring-8 Centre

ANSTO has an MOU with the Japanese SPring-8 Centre that gives Australian scientists access to its world leading photon science facility – the SPring-8 Angstrom Compact free-electron Laser. The MoU was signed by ANSTO on behalf of the ACAS, so that its benefits extend to ANSTO's ACAS partners, namely the University of Melbourne, the Australian National University and the Australian Synchrotron.

ANSTO is negotiating a renewed MoU with the RIKEN SPring-8 Centre and the Japan Synchrotron Radiation Research Institute (JASRI), which is expected to be concluded in late 2019.

Shanghai Institute for Applied Physics (SINAP)

ANSTO and SINAP have an ongoing collaboration since signing a MoU in 2011, including the establishment of the ANSTO-SINAP Joint Materials Research Centre in 2014 and a regular series of joint workshops. A major restructure, at the behest of the Chinese Academy of Sciences, has resulted in the Shanghai Synchrotron Radiation Facility being split off from SINAP, and joining the Shanghai Advanced Research Institute (SARI). ANSTO is pursuing continued engagement with the remaining SINAP, focusing on nuclear materials research, and with SARI with a focus on synchrotron research and accelerator science.

ANSTO and SINAP signed a new MoU in March 2019, as part of a joint workshop held at ANSTO. ANSTO and SARI have subsequently agreed to the text of a MoU which is expected to be signed in August 2019.

Taiwanese Ministry of Science and Technology

ANSTO has a partnership with the Taiwanese Ministry of Science and Technology that funded the construction of a cold neutron triple-axis spectrometer, Sika, which was constructed by National Central University in 2012. The National Synchrotron Radiation Research Centre (NSRRC) commissioned and operates the instrument, introduced it into the Australian Centre for Neutron Scattering user program and promotes its use to users in Taiwan

Thailand Institute of Nuclear Technology (TINT)

In May 2019, ANSTO signed an MOU with the Thailand Institute of Nuclear Technology (TINT) that will enable both organisations to strengthen the cooperative programme in nuclear science and technology in areas of mutual interest between the two parties, including environmental science, radioactive waste management, and research reactor operation.

Thailand and Australia are both members of the IAEA-led Regional Cooperative Agreement (RCA) and the Forum for Nuclear Cooperation in Asia (FNCA), collaborating on a range of projects in nuclear technologies.

University of New South Wales (UNSW)

A collaboration between ANSTO, UNSW and the Centre for Nuclear Engineering at Imperial College, London, is delivering a nuclear engineering program, the only one of its kind in Australia. UNSW's Master of Engineering Science degree with a specialisation in Nuclear Engineering provides graduate students with the opportunity to train for a career in the nuclear industry. The program features contributions from national and international specialists in the nuclear engineering sector, including staff from ANSTO.

University of Sydney

ANSTO and the University of Sydney signed a new Strategic Relationship Umbrella Agreement in April 2019, which covers a broad range of collaborative activity. One key area of collaboration is with the University's Brain and Mind Centre, with which ANSTO is a joint partner in a node of the National Imaging Facility. ANSTO operates the National Research Cyclotron Facility as well as sharing advanced imaging capability. A key focus for the collaboration is to develop new radiotracers, instruments and scientific methods that extend the potential applications of molecular imaging in the future.

University of Tokyo

The Institute for Solid State Physics (ISSP) at the University of Tokyo and ANSTO have a MOU covering access by Japanese researchers conducting collaborative non-proprietary research, intended for publication in the open refereed literature, at the neutron beam facilities at the ACNS. The ISSP acts as a central funding agency for Japanese researchers to assist them in accessing international neutron scattering facilities.

University of Tsukuba

ANSTO and the University of Tsukuba in Japan have a formal collaboration which enables both to benefit from each other's expertise and experience in the areas of physics, materials science, nuclear science and technology, mathematical modelling and scientific computing, and allied disciplines. Materials science is a particular focus of this collaboration.

University of Wollongong (UoW)

An ANSTO-UoW Steering Committee was established in 2014–2015 to coordinate and develop their relationship. An annual research seed funding scheme is jointly funded by the two organisations, to assist UoW and ANSTO researchers to form substantial research partnerships with visibility and prominence, both nationally and internationally. Nine projects have been funded for 2019, with a total of $120,000 awarded. An annual workshop is held, hosted alternately, which includes status reports from the projects which have received seed finding in the past.

ANSTO is hosting UoW's new cryo-electron microscope at its electron microscopy facility while a dedicated building is constructed in Wollongong. The new instrument is state of the art in electron microscopy and enables mainly biological samples to be studied at atomic resolution at cryogenic temperatures (approximately -196 C). The microscope was commissioned on 9 August 2018 by Senator the Hon Zed Seselja, then Assistant Minister for Science, Jobs and Innovation, at a joint ceremony at ANSTO. See page 12 for further information on the microscope and the research it enables.

Our Organisation

Organisational chart

Members of the Board

Mr James (Jim) McDowell

Board Chair
LLB (Hons)

Independent business person with 35 years' experience in aerospace and defence, and former CEO BAE Systems Saudi Arabia

Appointed
12 December 2013

Appointed Chairman
21 August 2014

Resigned effective
31 August 2018

The Hon Dr Annabelle Bennett AC SC

Board Chair
Remuneration & Nomination Committee and the Commercial Committee Chair
BSc (Hons), PhD, LLB., D Univ (hon Causa), D Laws (hon Causa)

Chancellor of Bond University and practicing consultant Senior Counsel, mediator and arbitrator

Appointed
21 March 2019

Term concludes
20 March 2024

Ms Penelope (Penny) J Dobson

Deputy Board Chair
Dip Pharm, MPS, MBA, GAICD

Global pharmaceutical executive and business person

Appointed
24 April 2014

Appointed Deputy Chair
14 March 2018

Appointed Acting Chair
1 September 2018 – 24 March 2019

Reappointed effective
24 April 2019

Term concludes
23 April 2024

Dr Adrian (Adi) Paterson

BSc, PhD

Chief Executive Officer and materials engineer

Appointed
1 March 2009

Reappointed effective
1 March 2017

Term concludes
28 February 2022

Emeritus Professor Stephen Buckman AM

BSc (Hons), PhD, FAPS, FAIP, FinstP

Academic and researcher at ANU

Appointed
13 August 2015

Term concludes
12 August 2020

Gordon de Brouwer PSM

BComm (First Class Hons), MComm, PhD

Senior leader in the Australian Government

Appointed
4 April 2019

Term concludes
3 April 2024

Professor Brigid Heywood

BSc (Hons), PhD

Vice-Chancellor of the
University of New England

Appointed
28 June 2016

Term concludes
27 June 2021

Ms Esther (Carol) Holley

Risk & Audit Committee Chair
BA, FCA, FAICD

Non-executive Director and Chair
of various Risk and Audit Committees

Appointed
25 February 2016

Term concludes
24 February 2021

Professor Andrew Scott AM

MBBS (Hons), MD, FRACP, DDU, FAICD, FAANMS

Nuclear medicine physician,
scientist, and academic

Appointed
26 September 2007

Reappointed
29 September 2011

Reappointed
26 September 2016

Term concludes
28 September 2021

Professor Margaret Sheil AO

BSc (Hons), PhD, FRACI, FTSE, FANZSMS

Vice-Chancellor and President
of Queensland University of Technology

Appointed
28 June 2016

Resigned effective
30 June 2019

ANSTO Executive Leadership Team

CEO
Adi Paterson

Group Executive,
People, Culture, Safety and Security
Robert Blissett

Group Executive,
Transformation & Engagement
Shaun Jenkinson

Group Executive,
Capital Programs and Chief Engineer
Con Lyras

Group Executive,
Nuclear Operations
Pamela Naidoo-Ameglio

Group Executive,
Nuclear Science & Technology and
Landmark Infrastructure

Simone Richter

Group Executive,
Customer Advocacy and Value Chain

Jayne Senior

Group Executive,
Customer Advocacy and Value Chain
Projects

Michael Beckett

Chief Information and Digital Officer

Marianne Morton

Interim-Group Chief Financial Officer

Steve Jennaway

Corporate governance

ANSTO statement on corporate governance

The Board of ANSTO is committed to meeting a high standard of corporate governance and it was a particular area of focus during the 2018-19 financial year.

The following statement outlines ANSTO's governance arrangements.

ANSTO is an Australian Government Corporate Commonwealth entity with its own Board that is established and constituted under the provisions of the *Australian Nuclear Science and Technology Organisation Act 1987 (ANSTO Act)*. ANSTO forms part of the portfolio responsibilities of the Minister for Industry, Science and Technology.

The *ANSTO Act* defines the organisation's functions and powers, and details the responsibilities and duties of the ANSTO Board and the Chief Executive Officer (CEO) to manage the organisation. It also defines staffing, financial management and governance arrangements necessary for the efficient and effective management of the organisation and its subsidiaries.

As a Corporate Commonwealth entity, ANSTO's operations and governance arrangements are subject to the provisions of the *Public Governance, Performance and Accountability Act 2013 (PGPA Act)* and the Rules issued pursuant to that Act.

Over the 2018-19 financial year, ANSTO continued to ensure its operational framework and corporate governance arrangements met the requirements of both the *ANSTO Act* and the *PGPA Act* and the associated Rules.

These arrangements are underpinned by ANSTO's core values and Code of Ethics, which are reviewed and adapted to accommodate organisational change and to reflect national and international best practice.

Ministerial oversight

From 28 August 2018 and as at 30 June 2019, the Minister responsible for ANSTO was the Hon Karen Andrews MP, Minister for Industry, Science and Technology. Senator the Hon Michaelia Cash, then Minister for Jobs and Innovation, and Senator the Hon Zed Seselja, then Assistant Minister for Science, Jobs and Innovation, were the responsible Ministers for ANSTO from 1 July 2018 to 28 August 2018.

Under the *ANSTO* and *PGPA Acts*, the relevant Minister and the Finance Minister may provide the ANSTO Board with Directions with respect to the performance of the functions or the exercise of the powers of the Board or the organisation, including a need to comply with a specific Government Policy Order. No Ministerial Directions, issued under either the *ANSTO Act* or *PGPA Act*, were received by the ANSTO Board in 2018-19.

In June 2015, the Hon Ian Macfarlane, then Minister for Industry and Science, provided the ANSTO Board with a Statement of Expectations (SOE) covering the Government's policy context; partnerships and collaboration; science assets and staff; and communication with the Minister's office and the Department. This SOE still applies. At the time, the ANSTO Board responded with a Statement of Intent that sets out how the ANSTO Board would meet the Minister's expectations as articulated within the SOE. That Statement of Intent also still applies.

Under section 19 of the *PGPA Act* and in accordance with the SOE, ANSTO is required to provide its responsible Minister with written notification of specified events and, more generally, to keep the Minister informed of its operations and those of its subsidiaries. During 2018–19, ANSTO provided 68 briefs on ANSTO's operations to the Minister and/or the Assistant Minister. ANSTO staff also had regular meetings with ministers, parliamentarians and staff from relevant government departments to discuss ANSTO's activities. ANSTO advised the Minister and/or Assistant Minister of significant events, including disruptions in the supply of nuclear medicine, a direction from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) regarding safety at the ANSTO Health facility, and a contamination event at ANSTO Nuclear Medicine.

During 2018-19, ANSTO also advised the Minister of three events under section 72 of the *PGPA Act* regarding ANSTO or its subsidiaries:

1. In October 2018, ANSTO advised the Minister that it had deregistered ANSTO subsidiary, Synchrotron Light Source Pty Limited. The Minister tabled a statement in both houses of Parliament notifying the Parliament of the event.
2. In December 2018, ANSTO advised the Minister that it had subscribed to additional shares in Clarity Pharmaceuticals Ltd. The Minister tabled a statement in both houses of Parliament notifying the Parliament of the event.
3. In February 2019, ANSTO advised the Minister that it had formed a Joint Venture company, Applied Molecular Therapies Pty Limited (AMT), with Cyclotek Theranostics Pty Limited, and subscribed to shares in AMT. The Minister tabled a statement in both houses of Parliament notifying the Parliament of the event.

ANSTO Board

ANSTO is governed by a Board which is the 'accountable authority' responsible to the Australian Government under the *PGPA Act* for the overall direction, performance and governance of the organisation.

ANSTO's operational framework and corporate governance arrangements support the effective operation of the ANSTO Board in the execution of its statutory and fiduciary duties under relevant legislation, particularly the *ANSTO* and *PGPA Acts*.

The general functions of the Board, as set out in the *ANSTO Act*, are to ensure the proper and efficient performance of the functions of the organisation and to determine the policy of the organisation with respect to any matter, having regard to the current policies of the Commonwealth Government.

The responsibilities and duties of the Board and its relationship with Executive Management are set out in a Board Charter. These responsibilities reflect the mandatory duties that apply to accountable authorities under sections 15 to 19 of the *PGPA Act*.

The principal governance responsibilities of the Board are to:

- select, appoint and monitor the performance of the CEO;
- establish and monitor the strategic direction of the organisation;
- determine and approve 'major' policies of the organisation;
- oversee the operations of the organisation, ensuring the organisation operates in a safe, responsible and ethical manner, and is compliant with legal and regulatory obligations;
- monitor financial performance; and
- ensure the establishment of effective organisational governance, risk management, compliance, and assurance mechanisms.

The effectiveness and performance of the Board and the individual members of the Board are evaluated annually as part of a structured annual review process. During 2018-19, Board members completed an online questionnaire regarding Board and Committee performance. The results of the survey were discussed by the Board as a group.

The remuneration and allowances payable to members of the Board, including the CEO, are determined by the Commonwealth Remuneration Tribunal.

Disclosure of interests and related entity transactions

Board members declare material interests in accordance with the *ANSTO* and *PGPA Acts* as appropriate.

The Board has processes for managing conflicts of interest, including a requirement that, unless determined otherwise by the other Board members, members absent themselves from discussions and voting where a member has declared a material professional or personal interest, or where a potential or actual conflict of interest or duty arises. For the 2018-19 financial year, the Board is satisfied that it has discharged its duties and obligations regarding conflicts of interest in accordance with relevant requirements.

ANSTO follows the Government Procurement Guidelines and has a system of delegated powers for all transactions that enables transactions to be appropriately considered.

There were 46 transactions above $10,000, which came to a total combined value of $10.89 million.

Composition of the Board

As of 30 June 2019, ANSTO's Board comprised the CEO and eight non-executive members drawn from the broader community who are not involved in the day-to-day management of the organisation. All non-executive members are appointed by the Governor-General in Council. Under the *ANSTO Act*, the CEO is appointed by the ANSTO Board. As it is a significant appointment, it is also endorsed by the Cabinet.

The CEO manages the affairs of ANSTO, subject to the directions of, and in accordance with, policies determined by the Board. Executive management and Subject Matter Experts attend Board meetings as required to report on matters relevant to their individual areas of responsibility and expertise. The Secretary of the Department of Industry, Innovation and Science, or one of the Deputy Secretaries, attends the Board meeting as an observer at the invitation of the Chair. ANSTO has a Company Secretary who assists with the running of the Board and advises on governance matters. The Company Secretary attends all Board meetings.

Each Board member brings complementary skills and experience to the Board relevant to the principal activities and operations of ANSTO.

Board members are able to seek independent professional advice in accordance with their duties, responsibilities and obligations as members of the Board. Board members have access to all relevant information, including discussions with management and subject matter experts. The Board participates in regular site visits. Newly appointed Board members are inducted in the organisation's operations and activities, and their duties and responsibilities as a member of the Board of a Corporate Commonwealth entity.

The Board meets regularly in accordance with a formally approved timetable and agenda. Nine Board meetings were held during the 2018-19 financial year. Between 1 September 2018 and 20 March 2019, the Board was led and meetings were chaired by the Deputy Chair, who was acting Chair pending the appointment of a new Chair. Details of the number of Board meetings attended by each member during the 2018-19 financial year are outlined in **Table 1**.

Table 1

Member	Eligible to attend	Attended
Mr Jim W McDowell (Chair)[1]	1	1
The Hon Dr Annabelle Bennett AC SC (Chair)[2]	4	4
Ms Penelope J Dobson (Deputy Chair)[3]	9	9
Dr Adrian (Adi) Paterson (CEO)	9	9
Emeritus Professor Stephen Buckman, AM	9	8
Dr Gordon de Brouwer, PSM[4]	4	4
Professor Brigid Heywood	9	9
Ms Carol Holley	9	9
Professor Andrew M Scott, AM	9	9
Professor Margaret Sheil, AO[5]	9	8

1. Resigned 31 August 2018 **2.** Appointed 21 March 2019 **3.** Acting Chair between 1 September 2018 and 20 March 2019
4. Appointed 4 April 2019 **5.** Resigned 30 June 2019

Board committees

The ANSTO Board delegates certain functions to a Risk and Audit Committee (RAC), in accordance with the *PGPA Act* and Rules and corporate governance best practice. It also operates a Remuneration and Nominations Committee and a Commercial Committee.

Risk and Audit Committee

The Risk and Audit Committee (RAC) assists the ANSTO Board in the discharge of its responsibilities by providing independent oversight, advice and assurance to the Board on the appropriateness of ANSTO's systems of risk oversight and management, financial reporting processes, performance reporting arrangements, systems of internal control, and systems to ensure compliance with relevant laws and policies.

The role, purpose and responsibilities of the RAC are set out in the RAC Charter, which is reviewed yearly.

The Board is responsible for the appointment of RAC members, including the RAC Chair.

The RAC consists of at least three members appointed by the Board who are required to have appropriate qualifications, knowledge, skills or experience to assist the RAC to perform its functions, including an understanding of systems of risk oversight and management and systems of internal control. At least one member should have accounting or related financial management experience and/or qualifications, and a comprehensive understanding of accounting and auditing standards.

The Chair of the Board, the CEO, and the ANSTO Group Chief Financial Officer cannot be members of the RAC.

However, the Chair of the Board and other Board members may attend RAC meetings as observers. Members of the ANSTO management team (including the Group Chief Financial Officer, Deputy Chief Financial Officer, Head of Internal Audit and the General Counsel) attend meetings of the RAC as advisors and observers, by invitation of the RAC Chair. The Company Secretary is the secretary to the RAC and attends all RAC meetings.

Representatives from the Australian National Audit Office (ANAO) and their contracted service provider (currently KPMG) also attend RAC meetings, by invitation of the RAC Chair.

The Risk and Audit Committee met on four occasions during the 2018-19 financial year. Details of the number of RAC meetings attended by each member during the year are provided in **Table 2**.

Table 2

Member	Eligible to attend	Attended
Ms Carol Holley (Chair)	4	4
Emeritus Professor Stephen Buckman, AM	4	4
Ms Penelope J Dobson[1]	2	2
Professor Brigid Heywood	4	4
Professor Andrew M Scott, AM	4	4
Professor Margaret Sheil, AO[2]	4	3

1. Not a member of the Committee while Acting Chair between 1 September 2018 and 20 March 2019
2. Resigned 30 June 2019

Remuneration and Nominations Committee

The Remuneration and Nominations Committee assists the Board in fulfilling its responsibilities with regard to: overall remuneration policy and strategy; performance and remuneration of the CEO; the approach to performance and remuneration of the Senior Executive Team; and succession planning and nominations for Board Members and the CEO. The objectives, duties and responsibilities of the Committee are set out in the Remuneration and Nominations Committee Charter.

The Remuneration and Nominations Committee consists of the Board Chair, the CEO and one or more non-executive Board members appointed by the Board. The Board Chair is the Chair of the Committee. The Group Executive – People, Culture, Safety and Security attends Committee meetings by invitation, as do other relevant persons by invitation of the Committee Chair. The Company Secretary is the secretary to the Committee and attends all Committee meetings.

The committee met on four occasions during the 2018-19 financial year. Between 1 September 2018 and 20 March 2019, the Deputy Chair, who was acting Chair of the Board during this period, chaired the Remuneration and Nomination Committee. Details of the number of Remuneration and Nominations Committee meetings attended by each member during the 2018-19 financial year are provided in **Table 3**.

Table 3

Member	Eligible to attend	Attended
Mr Jim W McDowell (Chair)[1]	1	1
The Hon Dr Annabelle Bennett AC SC (Chair)[2]	1	1
Ms Penelope J Dobson (Acting Chair)[3]	4	4
Dr Adrian (Adi) Paterson	4	4
Emeritus Professor Stephen Buckman, AM	4	4
Professor Margaret Sheil, AO[4]	3	2

1. Resigned 31 August 2018 **2.** Appointed 21 March 2019 **3.** Acting Chair between 1 September 2018 and 20 March 2019
4. Appointed to the Committee on 21 August 2018 and resigned 30 June 2019

Commercial Committee

The Commercial Committee provides independent oversight, review and evaluation of particular commercial activities. The objectives, duties and responsibilities of the Committee are set out in the Commercial Committee Charter.

The Commercial Committee consists of at least three non-executive members of the Board. External parties may be appointed to the Committee but may not outnumber the number of non-executive Board members on the Committee. There were no external parties on the Committee during the 2018-19 financial year. The Chair of the Board is the Chair of the Committee unless the Chair delegates this role to another non-executive member. Senior Management and other relevant parties attend Committee meetings by invitation of the Committee Chair. The Company Secretary is the secretary to the Committee and attends all Committee meetings.

The Committee met once during the 2018-19 financial year. Between 1 September 2018 and 20 March 2019, the Deputy Chair, who was acting Chair of the Board during this period, chaired the Commercial Committee. Details of the number of Commercial Committee meetings attended by each member during the 2018-19 financial year are provided in **Table 4**.

Table 4

Member	Eligible to attend	Attended
Ms Penelope J Dobson (Acting Chair)[1]	1	1
Dr Adrian (Adi) Paterson (CEO)	1	1
Emeritus Professor Stephen Buckman, AM	1	1
Professor Brigid Heywood	1	1
Ms Carol Holley	1	1
Professor Margaret Sheil, AO[2]	1	1

1. Acting Chair between 1 September 2018 and 20 March 2019 **2.** Resigned 30 June 2019

External audit

The Commonwealth Auditor-General, through the Australian National Audit Office (ANAO), is the external auditor for ANSTO and its Australian-based subsidiaries. The auditors of ANSTO's USA-based subsidiary, ANSTO Inc., are WIPFLi LLP. For the 2018–19 financial year, the ANAO contracted KPMG to assist with the external audits of ANSTO and its Australian-based subsidiaries. During the year KPMG hosted ANSTO's 'whistleblower' reporting service (FairCall) and reviewed ANSTO's HIP Patent Specification.

Risk management

Under section 16 of the *PGPA Act*, the ANSTO Board is responsible for the establishment and maintenance of an appropriate system of risk oversight and management and an appropriate system of internal control.

Management is accountable to the ANSTO Board for designing, implementing and monitoring the risk management framework and its integration into the day-to-day activities of the organisation. The ANSTO Enterprise Risk Management Framework:

- supports the achievement of ANSTO's strategic and business goals and objectives;
- supports ANSTO's decision-making processes and risk behaviours;
- provides a standardised approach of practicing risk management; and
- provides a clear roadmap to improve risk management.

The ANSTO Board determines the nature and extent of the risk it is willing to accept in achieving the organisation's strategic objectives, consistent with ANSTO's risk appetite and the prudent, proper and ethical use and management of public resources. The ANSTO Board has a particular interest in those risks that may impact the safety of operations and/or negatively impact the sustainability, and reputation of the organisation.

The RAC receives regular reports and briefings on ANSTO's top risks and risk management activities, as well as on the risk management maturity of the organisation.

Internal control

The ANSTO Board is ultimately responsible for the establishment and maintenance of a system of internal control that provides 'reasonable assurance' that ANSTO's objectives will be achieved relative to the effectiveness and efficiency of its operations, the reliability of financial and non-financial reporting and compliance with applicable laws and regulations.

The RAC assesses, reviews and monitors ANSTO's internal control systems on an ongoing basis and provides advice to the ANSTO Board on the adequacy and effectiveness of such arrangements including arrangements for the delegation of authority.

Fraud control

Section 10 of the PGPA Rule places a legal obligation on the ANSTO Board to take all reasonable measures to prevent, detect and deal with fraud, including by:

- conducting fraud risk assessments;
- developing and implementing a fraud control plan;
- having an appropriate mechanism for preventing fraud;
- having an appropriate mechanism for detecting incidents of fraud or suspected fraud;
- having an appropriate mechanism for investigating or otherwise dealing with incidents of fraud or suspected fraud; and
- having an appropriate mechanism for recording and reporting incidents of fraud or suspected fraud.

In accordance with the above obligations, ANSTO conducts fraud risk assessments of its exposure to possible fraud, corrupt conduct and other forms of unacceptable behaviour, and is strengthening its fraud control arrangements through the implementation of a comprehensive Fraud Control Plan. Within the context of this plan, ANSTO has established or enhanced fraud control and ethics policies, standards and procedures that serve to minimise the incidence of fraud and other forms of unacceptable behaviour, including procedures and processes for fraud prevention, detection, reporting and investigation.

In addition, ANSTO operates a public interest disclosure scheme in accordance with the *Public Interest Disclosure Act 2013*. Complementary to this scheme ANSTO has a confidential, independent and externally hosted reporting service (FairCall) which provides another avenue for staff and contractors to report any concerns about unacceptable, unethical or illegal activities in the workplace.

All instances of fraud are to be reported to the RAC.

Business ethics

ANSTO's Code of Ethics provides ANSTO employees with a framework for ethical decision-making and articulates the standards of behaviour, values and actions expected of all individuals who work for ANSTO. The Code explains the principles covering appropriate conduct in a variety of contexts, and informs employees on how to deal with their work colleagues, stakeholders, other organisations and the community in an appropriate manner.

The Code is supported by a range of policies, guidelines and instructions that address additional matters in more detail, including: making public comment; bullying and harassment; gifts and benefits; and email and internet usage.

ANSTO's values and ethical standards are reinforced through various means, including training and awareness, staff engagement surveys, and the ANSTO Enterprise Agreements.

Business resilience

The continuity of ANSTO's operations is critical and is a key focus area of the Board, the CEO and Executives.

Many of the services delivered by ANSTO are critical to the economic and social well-being and health of the Australian community.

ANSTO has introduced the new Business Resilience Framework and Learning and Improvement Strategy that align with national standards and international best practice. This holistic and integrated approach focuses on building resilience and reliability across ANSTO's critical functions and infrastructure, including the OPAL reactor.

Legal and regulatory compliance

ANSTO operates within a complex and highly regulated environment. In recognition of this environment, ANSTO has established a range of strategies, policies, systems and responsibility and accountability arrangements to ensure compliance. The continuing development and improvement of ANSTO's compliance framework remains a key focus.

Internal audit

The ANSTO Board has established an Internal Audit function as a key component of ANSTO's governance framework.

The primary purpose of Internal Audit is to provide the ANSTO Board and CEO with independent and objective assurance and advisory services that 'add value' and help improve operational performance. The scope of Internal Audit's activities encompasses all financial and non-financial functions, systems, programs, projects, activities and processes across the ANSTO Group. Internal Audit engagements generally involve:

- appraising the adequacy and effectiveness of the internal control environment;
- reviewing the adequacy and effectiveness of arrangements established by management to ensure compliance;
- assessing the adequacy of risk management activities as they relate to specific business functions, systems, programs, projects or activities;
- reviewing the means of safeguarding physical and intangible assets;
- reviewing the reliability and integrity of financial and non-financial information; and
- appraising the economy, efficiency and effectiveness with which resources are acquired and deployed relative to the achievement of business objectives.

The Head of Internal Audit prepares strategic and annual work plans that are risk-based, and which reflect focus areas that may be highlighted by the RAC and executive management. These plans are updated, as appropriate, in line with ANSTO's dynamic business environment. The annual Internal Audit Plan is reviewed by the RAC and approved by the ANSTO Board.

Significant internal audit findings are presented to the RAC. Follow-up reviews are conducted to ensure that all internal audit recommendations are properly carried out.

In order to ensure the independence of the Internal Audit function, the Head of Internal Audit reports directly to the RAC and has unrestricted access to the RAC Chair and members, as well as to the Chair of the Board.

The Head of Internal Audit reports for administrative purposes to the Group Chief Financial Officer and has access to Board and Committee minutes and submissions.

The role, purpose, scope and authority of the Internal Audit function is set out in the Internal Audit Charter. This Charter is reviewed by the RAC and approved by the ANSTO Board.

Judicial decisions and reviews by outside bodies

There were no judicial decisions or decisions of administrative tribunals that had a significant impact on the operations of ANSTO during the financial year.

There were no specific reports issued by the Commonwealth Auditor-General, other than reports issued in relation to 2017–18 financial statements of ANSTO and its Australian based subsidiaries.

There were no reports on the operations of ANSTO by a Parliamentary Committee or the Commonwealth Ombudsman or findings by the Office of the Australian Information Commissioner during the financial year.

In June 2018 a review was conducted by a globally recognised panel of experts, following a directive issued to ANSTO by the regulator, ARPANSA. This required ANSTO to select and appoint an expert independent review team to recommend how to improve safety in the aging radiopharmaceutical production facility and related matters. The final report by the independent expert review team contains 85 recommendations in respect to ANSTO, to ARPANSA and to the Australian Government. ANSTO is managing the recommendations relevant to our operations with an associated action plan.

During the year, ANSTO's funding needs and governance arrangements were independently examined. This work has helped and is continuing to inform the deliberations of government, the board and ANSTO management in planning for the future.

Amendments to the *Australian Nuclear Science and Technology Organisation Act 1987*

There were no amendments to the ANSTO Act during the 2018-19 financial year.

Indemnities and insurance premiums for officers

ANSTO's insurance coverage with Comcover includes professional indemnity and directors' and officers' liability. Certain sections of the *PGPA Act* contain prohibitions against ANSTO giving indemnities and paying insurance premiums relating to liabilities arising from conduct involving a lack of good faith by officers.

There have been no exceptions to these provisions and no claims were made against ANSTO in respect of such liability that required a claim on ANSTO's insurer, Comcover. It should be noted that ANSTO subsidiaries are fully covered under ANSTO's overarching Comcover policies. Workers' compensation coverage is dependent on whether employees of a subsidiary are Commonwealth Government employees or employed under State labour legislation.

Nuclear liability

ANSTO is provided with insurance coverage for ionising radiation liability from Comcover for up to $50 million. The Comcover policy includes liability arising out of ANSTO's responsibility for: managing, storing and conditioning ionising radiation emitting material and waste; transporting nuclear waste and materials for disposal both within Australia and overseas; and transporting radioactive materials including radioisotopes.

For any liability which is not covered by Comcover, ANSTO has been provided with a Deed of Indemnity by the Commonwealth which commits the Commonwealth to providing an indemnity to cover any loss or liability incurred by ANSTO and ANSTO Nuclear Medicine Pty Ltd, their respective employees and contractors, which arise from a claim for injury to a person or damage to property caused by ionising radiation. The current Deed expires in April 2026.

2018-2019 financial statements

Australian National Audit Office

INDEPENDENT AUDITOR'S REPORT

To the Minister for Industry, Science and Technology

Opinion

In my opinion, the financial statements of the Australian Nuclear Science and Technology Organisation and its subsidiaries (together the 'Consolidated Entity') for the year ended 30 June 2019:

(a) comply with Australian Accounting Standards – Reduced Disclosure Requirements and the *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015*; and

(b) present fairly the financial position of the Consolidated Entity as at 30 June 2019 and its financial performance and cash flows for the year then ended.

The financial statements of the Consolidated Entity, which I have audited, comprise the following statements as at 30 June 2019 and for the year then ended:

- Statement by the Accountable Authority, Chief Executive Officer and Chief Financial Officer;
- Consolidated Statement of Comprehensive Income;
- Consolidated Statement of Financial Position;
- Consolidated Statement of Changes in Equity;
- Consolidated Statement of Cash Flows; and
- Notes to the financial statements comprising a Summary of Significant Accounting Policies and other explanatory information.

Basis for opinion

I conducted my audit in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards. My responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of my report. I am independent of the Consolidated Entity in accordance with the relevant ethical requirements for financial statement audits conducted by the Auditor-General and his delegates. These include the relevant independence requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants* (the Code) to the extent that they are not in conflict with the *Auditor-General Act 1997*. I have also fulfilled my other responsibilities in accordance with the Code. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Other information

The Accountable Authority is responsible for the other information. The other information comprises the information included in the annual report for the year ended 30 June 2019 but does not include the financial statements and my auditor's report thereon.

My opinion on the financial statements does not cover the other information and accordingly I do not express any form of assurance conclusion thereon.

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In connection with my audit of the financial statements, my responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or my knowledge obtained in the audit, or otherwise appears to be materially misstated.

If, based on the work I have performed, I conclude that there is a material misstatement of this other information, I am required to report that fact. I have nothing to report in this regard.

Accountable Authority's responsibility for the financial statements

As the Accountable Authority of the Consolidated Entity, the directors are responsible under the *Public Governance, Performance and Accountability Act 2013* (the Act) for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards – Reduced Disclosure Requirements and the rules made under the Act. The directors are also responsible for such internal control as the directors determine is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the directors are responsible for assessing the ability of the Consolidated Entity to continue as a going concern, taking into account whether the entity's operations will cease as a result of an administrative restructure or for any other reason. The directors are also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the assessment indicates that it is not appropriate.

Auditor's responsibilities for the audit of the financial Statements

My objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian National Audit Office Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial statements.

As part of an audit in accordance with the Australian National Audit Office Auditing Standards, I exercise professional judgement and maintain professional scepticism throughout the audit. I also:

- identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control;
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Consolidated Entity's internal control;
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Accountable Authority;
- conclude on the appropriateness of the Accountable Authority's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Consolidated Entity's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my auditor's report. However, future events or conditions may cause the Consolidated Entity to cease to continue as a going concern;
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation; and
- obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Consolidated Entity to express an opinion on the financial report. I am responsible for

the direction, supervision and performance of the Consolidated Entity audit. I remain solely responsible for my audit opinion.

I communicate with the Accountable Authority regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

Australian National Audit Office

Scott Sharp

Executive Director

Delegate of the Auditor-General

Canberra

15 October 2019

Statement by Accountable Authority, Chief Executive and Chief Financial Officer

In our opinion, the attached financial statements for the year ended 30 June 2019 comply with subsection 42(2) of the *Public Governance, Performance and Accountability Act 2013* (PGPA Act), and are based on properly maintained financial records as per subsection 41(2) of the PGPA Act.

In our opinion, at the date of this statement, there are reasonable grounds to believe that the Australian Nuclear Science and Technology Organisation will be able to pay its debts as and when they fall due.

Signed in accordance with a resolution of the Board of Directors.

Annabelle Bennett Accountable Authority - Chair	Shaun Jenkinson Acting Chief Executive Officer	Steve Jennaway Group Chief Financial Officer
15 October 2019	15 October 2019	15 October 2019

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Consolidated Statement of Comprehensive Income

For the year ended 30 June 2019

	Note	Budget 2019 $'000	Actual 2019 $'000	Actual 2018 $'000
NET COST OF SERVICES				
Expenses				
Employee	1.1A	156,695	155,919	141,418
Supplier	1.1B	105,154	103,872	98,488
Depreciation/amortisation	2.2A	85,591	77,545	70,865
Impairment loss	2.2A	-	147,314	61,920
Decommissioning provision expense	2.3C	-	129,908	-
Write-down of stock and fixed assets		-	739	982
Grants		2,988	4,331	3,614
Finance costs	1.1D	22,456	19,609	18,004
Foreign currency exchange losses		-	5,188	347
Total expenses		372,884	644,425	395,638
Own-source revenue				
Sales of goods and rendering of services	1.2	106,919	102,676	92,841
Interest	5.2	2,500	3,221	3,725
Grants income		9,842	16,005	8,591
Total own-source revenue		119,261	121,902	105,157
Other income				
Foreign currency exchange gains		-	498	1,919
Gains from asset sales		-	313	31
Other revenue		-	6	3,907
Total other income		-	817	5,857
Total own-source income		119,261	122,719	111,014
Net cost of services		(253,623)	(521,706)	(284,624)
Revenue from Government		214,072	214,072	198,119
Deficit for the year before income tax		(39,551)	(307,634)	(86,505)
Income tax expense	1.1E	-	(134)	(437)
Deficit for the year after income tax		(39,551)	(307,768)	(86,942)
Other comprehensive income				
Items that will not be subsequently reclassified to net cost of services				
Changes in asset revaluation reserve	2.4A	-	(53,808)	(57,192)
Items that may be subsequently reclassified to net cost of services				
Exchange differences on translation of foreign operations	2.4A	-	2	(13)
Total other comprehensive expense for the year		-	(53,806)	(57,205)
Total comprehensive deficit for the year		**(39,551)**	**(361,574)**	**(144,147)**

The above statement should be read in conjunction with the accompanying notes.

Consolidated Statement of Financial Position

As at 30 June 2019

	Note	Budget 2019 $'000	Actual 2019 $'000	Actual 2018 $'000
Assets				
Financial assets				
Cash and cash equivalents	2.1A	15,052	19,178	7,916
Trade and other receivables	2.1B	40,103	22,783	16,120
Investments	2.1C	128,602	102,099	130,282
Total financial assets		183,757	144,060	154,318
Non-financial assets				
Property, plant and equipment	2.2A	1,080,374	1,138,589	1,233,742
Intangible assets	2.2A/B	84,065	68,101	70,449
Inventories	2.2C	33,176	30,456	30,549
Deferred tax asset	1.1E	1,074	518	652
Prepayments		4,332	15,383	11,775
Total non-financial assets		1,203,021	1,253,047	1,347,167
Total assets		1,386,778	1,397,107	1,501,485
Liabilities				
Payables				
Suppliers		606	10,377	17,886
Employees	4.1	5,359	5,366	4,415
Other payables	2.3A	-	8,570	10,878
Total payables		5,965	24,313	33,179
Revenue in advance	2.3B	33,163	33,364	20,686
Provisions				
Employee provisions	4.2	38,411	45,932	44,192
Decommissioning	2.3C	355,983	613,256	387,124
Intellectual property payment	2.3C	40,771	40,312	43,188
Other provisions	2.3C	505	505	578
Total provisions		435,670	700,005	475,082
Total liabilities		474,798	757,682	528,947
Net assets		**911,980**	**639,425**	**972,538**
Equity				
Contributed equity		819,675	819,675	791,214
Reserves	2.4A	508,785	399,124	452,930
Accumulated deficit	2.4B	(416,480)	(579,374)	(271,606)
Total equity		**911,980**	**639,425**	**972,538**

The above statement should be read in conjunction with the accompanying note

Consolidated Statement of Changes in Equity

For the year ended 30 June 2019

	Accumulated deficit		Asset revaluation reserve		Other reserves		Contributed equity		Total	
	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Balance at 30 June 2017	**(184,664)**		**500,124**		**10,011**		**770,177**		**1,095,648**	
Surplus deficit for the year	(86,942)		-		-		-		(86,942)	
Other comprehensive income										
Foreign currency translation	-		-		(13)		-		(13)	
Revaluation increment	-		(57,192)		-		-		(57,192)	
Total comprehensive (deficit)/surplus for the year	(86,942)		(57,192)		(13)		-		(144,147)	
Transactions with owners										
Government equity injection	-		-		-		21,037		21,037	
Balance at 30 June 2018	**(271,606)**	**(376,929)**	**442,932**	**498,774**	**9,998**	**10,011**	**791,214**	**791,214**	**972,538**	**923,070**
Deficit for the year	(307,768)	(39,551)	-	-	-	-	-	-	(307,768)	(39,551)
Other comprehensive income										
Revaluation decrement	-	-	(53,808)	-	2	-	-	-	(53,806)	-
Total comprehensive deficit for the year	(307,768)	(39,551)	(53,808)	-	2	-	-	-	**(361,574)**	**(39,551)**
Transactions with owners										
Government equity injection	-	-	-	-	-	-	28,461	28,461	28,461	28,461
Balance at 30 June 2019	**(579,374)**	**(416,480)**	**389,124**	**498,774**	**10,000**	**10,011**	**819,675**	**819,675**	**639,425**	**911,980**

The above statement should be read in conjunction with the accompanying notes.

Consolidated Statement of Cash Flows

For the year ended 30 June 2019

	Note	Budget 2019	Actual 2019	Actual 2018
		$'000	$'000	$'000
Cash flows from operating activities				
Sales of goods and rendering of services		91,450	104,307	99,858
Grants received		17,614	24,108	24,972
Interest received		2,500	3,420	3,414
Receipts from Government		214,072	214,072	198,119
Payments to employees		(156,695)	(153,513)	(141,224)
Payments to suppliers		(109,317)	(132,816)	(124,339)
Other payments		(18,025)	-	-
Net cash from operating activities		41,599	59,578	60,800
Cash flows from investing activities				
Proceeds from sale of property, plant, equipment and intangibles		-	504	71
Proceeds from investment sales/maturity		418,509	225,909	492,793
Purchase of property, plant, equipment and intangibles		(53,171)	(64,572)	(80,442)
Purchase of investments		(430,398)	(197,725)	(496,497)
Net cash used in investing activities		(65,060)	(35,884)	(84,075)
Cash flows from financing activities				
Government equity injection		28,461	28,461	21,037
Bank charges		-	(37)	-
Net cash from financing activities		28,461	28,424	21,037
Net increase/(decrease) in cash and cash equivalents		5,000	52,118	(2,238)
Effect of exchange changes on the balance of cash and cash equivalents held in foreign currencies		-	-	-
Cash and cash equivalents at the beginning of the reporting year		10,052	7,916	10,154
Cash and cash equivalents at the end of the reporting year	2.1A	**15,052**	**60,034**	**7,916**

The above statement should be read in conjunction with the accompanying notes.

Overview

Objectives of Australian Nuclear Science and Technology Organisation

Australian Nuclear Science and Technology Organisation (ANSTO) is a not-for-profit Australian Government Corporate Commonwealth Entity. ANSTO's strategic objectives, as set out in its current Corporate Plan, are:

- Putting people first: Equipping and empowering our people to respond to the growing nuclear science and technology needs of Australia and the world;
- World class science and technology outcomes: Creating innovative solutions to complex problems and providing new insights into our world;
- Strategic management of landmark and national infrastructure: Realising opportunities, serving users and creating value;
- Nuclear expertise and advice: Providing expert, science and technology based advice and services to support Australia's nuclear policy; and
- Nuclear business and innovation: Providing services and products to our customers that benefit the broader community.

In the 2017-18 Portfolio Budget Statement ANSTO has only one outcome as reflected below:

Outcome 1: Improved knowledge, innovative capacity and healthcare through nuclear based facilities, research, training, products, services and advice to Government, industry, the education sector and the Australian population.

ANSTO's activities contributing towards the outcome are classified as departmental. Departmental activities involve the use of assets, liabilities, income and expenses controlled or incurred by ANSTO in its own right. The continued existence of ANSTO in its present form and with its present programs is dependent on Government policy and on continuing funding by Parliament for the entity's administration and programs.

Reference to ANSTO means ANSTO and its controlled entities except in notes 1.1E and 6.2.

Basis of Preparation of the Financial Statements

The financial statements are general purpose financial statements and are required by section 42 of the *Public Governance, Performance and Accountability Act 2013*.

The financial statements have been prepared:

a) having regard to the provisions of the *Australian Nuclear Science and Technology Organisation (ANSTO) Act 1987* (as amended); and
b) in accordance with:
   i. *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015* (FRR) (as amended) for reporting periods ending on or after 1 July 2017; and
   ii. Australian Accounting Standards and Interpretations – Reduced Disclosure Requirements issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period.

The financial statements have been prepared on an accrual basis and in accordance with the historical cost convention, except for certain assets and liabilities at fair value. Except where stated, no allowance is made for the effect of changing prices on the results or the financial position. Where necessary the comparative information for the preceding financial year has been reclassified to achieve consistency in disclosure with current financial year amounts.

The financial statements are presented in Australian dollars and values are rounded to the nearest thousand dollars unless otherwise specified.

The financial statements were authorised for issue by the Board of Directors on 15 October 2019.

Overview (continued)

Foreign currency

Transactions denominated in a foreign currency are converted to Australian currency at the rate of exchange prevailing at the date of the transaction. At reporting date, amounts receivable and payable in foreign currency are translated to Australian currency at the exchange rate prevailing at that date and any exchange differences are brought to account in the Statement of Comprehensive Income. ANSTO does not enter into speculative forward exchange contracts.

Principles of consolidation

The consolidated financial statements incorporate the financial statements of ANSTO and the entities it controls. Control is achieved when ANSTO has all of the following:

- power over the investee;
- is exposed, or has rights, to variable returns from its involvement with the investee; and
- the ability to use its power to affect its returns.

Consolidation of a subsidiary begins when ANSTO obtains control over the subsidiary and ceases when they lose control of the subsidiary. All intragroup assets and liabilities, equity, income, expenses and cash flows relating to transactions between members of the Group are eliminated in full on consolidation. Profit or loss and each component of other comprehensive income are attributed to the owners of the entity and to the non-controlling interests. Total comprehensive income of subsidiaries attributed to the owners of the entity and to the non-controlling interests even if this results in the non-controlling interests having a deficit balance. Changes in the Group's ownership interests in subsidiaries that do not result in the Group losing control over the subsidiaries are accounted for as equity transactions. The carrying amounts of the Group's interests and the non-controlling interests are adjusted to reflect the changes in their relative interests in the subsidiaries. Any difference between the amount by which the non-controlling interests are adjusted and the fair value of the consideration paid or received is recognised directly in equity and attributed to ANSTO.

Significant accounting judgements and estimates

In the process of applying the accounting policies listed in this note, the judgements made that have the most significant impact on the amounts recorded in the financial statements are:

- The fair value of property, plant and equipment and their useful lives;
- Decommissioning provision; and
- Recoverable amount of the intangible asset relating to intellectual property and fair value of the associated liability.

Apart from these assumptions and estimates no other accounting assumptions or estimates have been identified that have a significant risk of causing a material adjustment to carrying amounts of assets and liabilities within the next accounting period.

Overview (continued)

Adoption of new Australian Accounting Standard requirements

No accounting standard has been adopted earlier than the application date as stated in the standard.

At the date of authorisation of the financial statements, the Standards and Interpretations listed below were on issue but not yet effective. These new or revised standards will be adopted and their implementation are not expected to have a material financial impact on the entity in future reporting periods, though they will require enhanced disclosure.

Standard/Interpretation	Effective for annual reporting periods beginning on or after	Expected to be initially applied in the financial year ending
AASB 15 'Revenue from Contracts with Customers and AASB 2014-5 'Amendments to Australian Accounting Standards arising from AASB 15'	1 January 2019	30 June 2020
AASB 16 'Leases'	1 January 2019	30 June 2020

Capital commitments

Capital commitments are capital expenditure contracted for at the reporting date, but not recognised as liabilities.

1. Financial Performance

This section details the financial performance of ANSTO.

1.1 Expenses

1.1A Employee

	2019	2018
	$'000	$'000
Wages and salaries	117,970	106,588
Superannuation	21,589	21,228
Leave and other entitlements	15,040	12,887
Separation and redundancies	1,320	715
Total employee expenses	**155,919**	**141,418**

Accounting Policy

Liabilities for 'short-term employee benefits' (as defined in AASB 119 *Employee Benefits*) and termination benefits expected within twelve months of the end of reporting period are measured at their nominal amounts.

Other long-term employee benefits are measured as the total net present value of the defined benefit obligation at the end of the reporting period minus the fair value at the end of the reporting period of plan assets (if any) out of which the obligations are to be settled directly.

Leave

The provision for employee entitlements encompasses annual leave and long service leave that ANSTO has a present obligation to pay resulting from employee services provided up to reporting date. The leave liabilities are calculated on the basis of employees' remuneration at the estimated salary rates that will be applied when leave is taken, including employer superannuation contribution rates to the extent that the leave is likely to be taken during service rather than paid out on termination.

The Enterprise Agreement provides under the heading General Leave for an employee entitlement which combines sick leave, 'carer's leave and leave for 'other' prescribed purposes. No provision has been made for general leave as all such leave is 'non-vesting'.

The estimate of the present value of the liability takes into account attrition rates and pay increases through promotion and inflation.

Separation and redundancy

Provision is made for separation and redundancy benefit payments. ANSTO recognises a provision for termination when it has developed a detailed formal plan for the termination and has informed those employees affected that it will carry out the termination.

Superannuation

ANSTO's staff are members of the Commonwealth Superannuation Scheme (CSS) and the Public Sector Superannuation Scheme (PSS) or the PSS accumulation plan (PSSap), or other superannuation funds held outside of the Australian Government that provide retirement, death and disability benefits to employees. The CSS and PSS are defined benefit schemes for the Australian Government. The PSSap is a defined contribution scheme.

The liability for defined benefits is recognised in the financial statements of the Australian Government and is settled by the Australian Government in due course. This liability is reported in the Department of Finance's administered schedules and notes.

ANSTO makes employer contributions to the employees' superannuation scheme at rates determined by an actuary to be sufficient to meet the current cost to the Government. ANSTO accounts for contributions as if they are contributions to defined contribution plans.

1. Financial Performance (continued)

1.1A Employee (continued)

The staff of the subsidiaries are members of various defined contribution schemes and receive the Superannuation Contribution Charge.

The liability for superannuation recognised as at 30 June represents outstanding contributions for the final fortnight of the year.

1.1B Suppliers

	2019	2018
	$'000	$'000
Goods from external entities	21,348	32,481
Services from related entities	17,761	16,682
Workers compensation premiums-related entities	725	800
Services from external entities	64,038	48,525
Total supplier expenses	**103,872**	**98,488**

Commitments for minimum lease payments in relation to non-cancellable operating leases are payable as follows:		
One year or less	137	137
From one to five years	548	685
Over five years	81	81
Total operating lease commitments	**766**	**903**

1.1C Write-down of assets

Financial assets:		
Write-down of receivables	-	8
Non-financial assets:		
Materials - write off obsolete stock	49	931
Property, plant and equipment write-down	690	-
Intangibles write-down	-	43
Total write-down of assets expenses	**739**	**982**

1.1D Finance costs

Unwinding of discount on decommissioning	19,609	18,004
Total finance costs	**19,609**	**18,004**

1. Financial Performance (continued)

1.1E Income tax expense

	2019	2018
	$'000	$'000
Prima facie tax on results of taxable subsidiaries	44,428	546
Over provision in respect of prior years	(29)	-
Deferred tax asset not booked/written-off	(44,596)	(1,043)
Impact of origination and reversal of temporary differences	(133)	77
Effect of non-deductible items	196	(17)
Total income tax expense	**(134)**	**(437)**

ANSTO is exempt from income tax. Unbooked deferred tax assets in relation to un-recouped tax losses including timing difference in ANSTO Inc., is $718,299 (2018: $681,483) and ANSTO Nuclear Medicine Pty Ltd (ANM) is $45,159,363 (2018: $921,458). The total deferred tax assets recognised as at 30 June 2019 in relation to controlled entities are: $518,188 (2018: $651,864), from PETTECH Solutions Pty Ltd at $518,188 (2018: $651,864) and ANM at $nil (2018: $nil).

Accounting Policy

ANSTO is exempt from all forms of Australian taxation except fringe benefits tax (FBT) and the goods and services tax (GST). ANSTO is not exempt from any foreign taxation laws relative to its overseas operations.

Revenues, expenses and assets are recognised net of GST except:

- where the amount of GST incurred is not recoverable from the Australian Taxation Office; and
- for receivables and payables.

Subsidiaries

ANSTO's subsidiaries are subject to normal taxation.

ANSTO Inc. is a USA company and is subject to US tax laws. No deferred tax asset has been recognised at 30 June 2019 (2018: nil) in relation to ANSTO Inc. as the directors do not believe it is probable that sufficient profits will be generated to utilise the tax losses.

No deferred tax asset has been recognised at 30 June 2019 (2018: $562,024) in relation to ANM as the directors do not believe it is probable that sufficient profits will be generated to utilise the tax losses in a reasonable time frame.

In respect of the subsidiaries, current tax assets and liabilities for the current and prior periods are measured at the amount expected to be recovered from or paid to the taxation authorities based on the current period's taxable income. The tax rates and tax laws used to compute the amount are those that are enacted or substantively enacted by reporting date.

Deferred income tax is provided on all temporary differences at reporting date between the tax bases of assets and liabilities and their carrying amounts for financial reporting purposes.

The PETTECH directors believe it is probable that sufficient profits will be generated to utilise the tax losses available.

1. Financial Performance (continued)

1.1E Income tax benefit (continued)

Deferred income tax liabilities are recognised for all taxable temporary differences except:

- when the deferred income tax liability arises from the initial recognition of goodwill or of an asset or liability in a transaction that is not a business combination and that, at the time of the transaction, affects neither the accounting profit nor taxable profit or loss; or

- when the taxable temporary difference is associated with investments in subsidiaries, associates or interests in joint ventures, and the timing of the reversal of the temporary difference can be controlled and it is probable that the temporary difference will not reverse in the foreseeable future.

Deferred income tax assets are recognised for all deductible temporary differences, carry forward of unused tax credits and unused tax losses, to the extent that it is probable that taxable profit will be available against which the deductible temporary differences and the carry forward of unused tax credits and unused tax losses can be utilised, except:

- when the deferred income tax asset relating to the deductible temporary difference arises from the initial recognition of an asset or liability in a transaction that is not a business combination and, at the time of the transaction, affects neither the accounting profit nor taxable profit or loss; or

- when the deductible temporary difference is associated with investments in subsidiaries, associates or interests in joint ventures, in which case a deferred tax asset is only recognised to the extent that it is probable that the temporary difference will reverse in the foreseeable future and taxable profit will be available against which the temporary difference can be utilised.

Unrecognised deferred income tax assets are reassessed at each reporting date and are recognised to the extent that it has become probable that future taxable profit will allow the deferred tax asset to be recovered.

Deferred income tax assets and liabilities are measured at the tax rates that are expected to apply to the year when the asset is realised or the liability is settled, based on tax rates (and tax laws) that have been enacted or substantively enacted at reporting date. Deferred tax assets and deferred tax liabilities are offset only if a legally enforceable right exists to set off current tax assets against current tax liabilities and the deferred tax assets and liabilities relate to the same taxable entity and the same taxation authority.

1. Financial Performance (continued)

1.2 Revenue

1.2 Sales of goods and rendering of services

	2019	2018
	$'000	$'000
Sales of goods		
Radioisotope sales	64,235	66,122
Total sales of goods	**64,235**	**66,122**
Rendering of services		
Service & contract research	23,953	15,245
Silicon irradiation	7,771	5,574
CSIRO site support	753	1,216
Training courses	306	277
Land management	5,658	4,407
Total rendering of services	**38,441**	**26,719**
Total sales of goods and rendering of services	**102,676**	**92,841**

Accounting Policy
Funding received or receivable from the Department of Industry, Innovation and Science (DIIS) (appropriated to ANSTO as a Corporate Commonwealth Entity payment item for payment to ANSTO) is recognised as Revenue from Government when the entity gains control of the funding unless it is in the nature of an equity injection, such amounts are recognised directly in contributed equity in the year received.

Operating revenue from sale of goods and rendering of services
Revenue from the sale of goods and rendering of services is recognised when:

- The risks and rewards of ownership have been transferred to the buyer;
- ANSTO retains no managerial involvement nor effective control over the goods;
- The revenue, stage of completion and transaction costs incurred can be reliably measured; and
- It is probable that the economic benefits associated with the transaction will flow to ANSTO.

Receivables for goods and services are recognised at the nominal amounts due less any impairment allowance. Collectability of debts is reviewed at reporting date. Allowance is made when collectability of the debt is no longer probable.

Grant revenue
Government grants and funding are recognised when ANSTO obtains control over the contribution. There are two types of grants being reciprocal grants and non-reciprocal grants.

For reciprocal grants, this is recognised in profit or loss on a systematic basis over the periods in which ANSTO recognises as expenses the related costs for which the grants are intended to compensate. Where the grants also include funds that relate to future related costs for which the grants are intended to compensate, this portion is recognised as revenue in advance.

For non-reciprocal grants, ANSTO is deemed to have assumed control when the grant is receivable or received. Government grants that are receivable as compensation for expenses or losses already incurred or for the purpose of giving immediate financial support to ANSTO with future related costs are recognised in profit or loss in the period in which they become receivable. Conditional grants may be reciprocal or non-reciprocal depending on the terms of the grant.

1. Financial Performance (continued)

1.2 Sales of goods and rendering of services (continued)

Resources received free of charge
Resources received free of charge are recognised as revenue when and only when a fair value can be reliably determined and the services would have been purchased if they had not been donated. Use of those resources is recognised as an expense.

Resources received free of charge are recorded as either revenue or gains depending on their nature i.e. whether they have been generated in the course of the ordinary activities of ANSTO.

Contributions of assets at no cost or for nominal consideration are recognised as gains at their fair value when the asset qualifies for recognition.

2. Financial Position

This section details the financial position of ANSTO.

2.1 Financial assets

2.1A Cash and cash equivalents

Accounting Policy

Cash is recognised at its nominal amount. Cash and cash equivalents include:

- Cash on hand; and
- Demand deposits in bank accounts with an original maturity of 3 months or less that are readily convertible to known amounts of cash and subject to insignificant risk of changes in value.

2.1B Trade and other receivables

	2019	2018
	$'000	$'000
Goods and services		
Related entities	716	894
External entities	16,600	12,321
Trade receivables	**17,316**	**13,215**
Less impairment allowance	-	-
Net receivables for goods and services	**17,316**	**13,215**
Other receivables		
Interest accrued	595	795
GST receivable from the Australian Tax Office	856	869
Other	4,016	1,241
Total other receivables	**5,467**	**2,905**
Total net trade and other receivables	**22,783**	**16,120**

Trade and other receivables are expected to be received within 12 months.

Net receivables are aged as follows:

Overdue but not impaired:		
Less than 31 days	15,881	15,410
31 to 60 days	383	136
61 to 90 days	461	165
More than 90 days	591	409
Total net trade and other receivables	**17,316**	**16,120**

2. Financial Position (continued)

2.1C Investments

		2019	2018
		$'000	$'000
Term Deposits – held to maturity		101,886	130,187
Southern Radioisotopes Alliance Inc.	2.1D	-	-
Clarity Pharmaceuticals Pty Ltd	2.1E	213	95
Total investments		**102,099**	**130,282**

2.1D Investment in joint venture

Name	Place of incorporation	%	2019 $	2018 $
Southern Radioisotopes Alliance Inc.	USA	100	625	625
Total investment in joint venture			**625**	**625**

Investment is USD 600 (2018: USD 600). This company has yet to commence trading.

2.1E Investment – other

Name	Place of incorporation	%	$	$
Clarity Pharmaceuticals Pty Ltd	Australia	2.4	213,241	95,144
Total investment – other			**213,241**	**95,144**

Clarity Pharmaceuticals Pty Ltd. was incorporated in New South Wales, Australia on 17 September 2010. The current shareholding is 147,352 shares (2018: 135,087).

2. Financial Position (continued)

2.2 Non-financial assets

2.2A Property, plant and equipment and intangible assets

Movement summary 2018-19 for all consolidated assets irrespective of valuation basis.

	Land	Buildings	Plant and equipment	Intellectual property	Software	Other intangibles	Assets under construction	Total
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Gross value as at 30 June 2018	115,688	188,922	1,035,708	51,210	26,141	950	166,984	**1,585,603**
Opening balance AUC reclassification	-	(25,717)	(84,733)	-	-	-	110,450	**-**
Additions - new assets	-	-	830	-	-	-	84,505	**85,336**
Additions - decommissioning	-	43,228	-	-	-	-	-	**43,228**
Transfers/reclassifications	-	43,988	117,393	-	1,453	4,736	(176,369)	**(8,799)**
Assets written-off	-	-	(880)	-	(15)	-	-	**(895)**
Disposals	-	-	(693)	-	-	-	-	**(693)**
Gross value as at 30 June 2019	**115,688**	**250,421**	**1,067,626**	**51,210**	**27,579**	**5,686**	**185,570**	**1,703,780**
Accumulated depreciation/amortisation and impairment losses 1 July 2018	-	28,911	199,504	20,874	2,392	870	28,861	**281,412**
Transfers/reclassifications	-	-	(8,784)	-	(15)	-	-	**(8,799)**
Depreciation/amortisation	-	6,922	66,430	42	2,912	1,239	-	**77,545**
Impairment loss	-	97,289	50,025	-	-	-	-	**147,314**
Assets written-off	-	-	(190)	-	-	-	-	**(190)**
Disposals	-	-	(192)	-	-	-	-	**(192)**
Accumulated depreciation/amortisation and impairment losses 30 June 2019	**-**	**133,122**	**306,793**	**20,916**	**5,289**	**2,109**	**28,861**	**497,090**
Net book value as at 30 June 2019	**115,688**	**117,299**	**760,833**	**30,294**	**22,290**	**3,577**	**156,709**	**1,206,690**
Property, plant and equipment	**115,688**	**117,299**	**760,833**	**-**	**-**	**-**	**144,769**	**1,138,589**
Intangibles	**-**	**-**	**-**	**30,294**	**22,290**	**3,577**	**11,940**	**68,101**

No intangible assets are expected to be disposed of within the next 12 months.

2. Financial Position (continued)

2.2A Property, plant and equipment and intangible assets (continued)

Accounting Policy

Asset recognition threshold

Items of buildings, infrastructure, plant and equipment and major facilities are recorded at cost of acquisition and depreciated as outlined below. Items of plant and equipment with a cost of less than $5,000 (2018: $5,000) are expensed in the year of acquisition (other than where they form part a group of similar items which are significant in total).

The initial cost of an asset includes an estimate of the cost of dismantling and removing the item and restoring the site on which it is located at the end of its useful life. This is particularly relevant to 'make good' or decommissioning provisions on buildings, infrastructure, plant and equipment and major facilities, taken up by ANSTO where there exists an obligation to restore the property to its original condition. These costs are included in the value of the asset it relates to with a corresponding provision for the 'make good' or decommissioning taken up.

Any changes to the initial decommissioning cost attributable to adjustments to the consumer price index (CPI) and discount rate at 30 June each year will be reflected as an adjustment to the provision for decommissioning and asset revaluation reserve.

The cost of assets constructed by the entity includes the cost of materials, direct labour and an appropriate proportion of fixed and variable overheads.

Revaluations

Following initial recognition at cost, buildings, infrastructure, plant and equipment and major facilities are carried at fair value less accumulated depreciation and accumulated impairment losses. Valuations are conducted with sufficient frequency to ensure that the carrying amounts of assets do not differ materially from the assets' fair values as at reporting date. The regularity of independent valuations depends upon the volatility of movements in market values for the relevant assets. Independent valuers are generally used to conduct these scheduled revaluations. Revaluation increases or decreases arise from differences between an asset's carrying value and fair value.

Qualified parties, independent of ANSTO carried out the 30 June 2017 valuations. The independent valuations undertaken effective 30 June 2017 were performed by PP&E Valuations Pty Ltd in relation to the assets at ANSTO's Clayton site and Australian Valuation Solutions for the assets at ANSTO's Lucas Heights and Camperdown sites.

Revaluation adjustments are made on a class basis. Any revaluation increment is credited to equity under the heading of asset revaluation reserve except to the extent that it reverses a previous revaluation decrement of the same asset class that was previously recognised through profit and loss. Revaluation decrements for a class of assets are recognised directly through profit and loss except to the extent that they reverse a previous revaluation increment for that class.

Any accumulated depreciation as at the revaluation date is eliminated against the gross carrying amount of the asset and the asset restated to the revalued amount except for assets relating to decommissioning that are not subjected to revaluation.

Depreciation

Items of buildings, infrastructure, plant and equipment and major facilities, but excluding freehold land, are depreciated over their estimated useful lives to ANSTO using the straight-line method.

The depreciation rates (useful lives), residual values and methods are reviewed during each reporting date and necessary adjustments are recognised in the current, or current and future reporting periods, as appropriate.

2. Financial Position (continued)

2.2A Property, plant and equipment and intangible assets (continued)

Depreciation and amortisation rates applying to each class of depreciable asset are based on the following useful lives:

	2019	2018
Buildings on freehold land	**5 to 40 years**	5 to 50 years
Plant and equipment	**2 to 30 years**	2 to 30 years
Infrastructure	**20 years**	20 years
Landmark, national and major research facilities	**5 to 40 years**	5 to 40 years

Impairment
All assets were assessed for indications of impairment at 30 June 2019. Where indications of impairment exist, the asset's recoverable amount is estimated and an impairment adjustment made if the asset's recoverable amount is less than its carrying amount.

The recoverable amount of an asset is the higher of its fair value less costs to sell and its value in use. Value in use is the present value of the future cash flows expected to be derived from the asset. Where the future economic benefit of an asset is not primarily dependent on the asset's ability to generate future cash flows, and the asset would be replaced if the entity were deprived of the asset, its value in use is taken to be its depreciated replacement cost.

Derecognition
An item of property, plant and equipment is derecognised upon disposal or when no further future economic benefits are expected from its use or disposal.

2.2B Intangibles

The useful lives of intangible assets are assessed as either finite or indefinite.

Intangible assets with finite lives are amortised over the useful economic life and assessed for impairment whenever there is an indication that the intangible asset may be impaired. Intangible assets with indefinite useful lives are not amortised, but are tested for impairment annually, either individually or at the cash-generating unit level.

Software
Items of software are recorded at cost and amortised as outlined below. Items with a cost of less than $5,000 (2018 $5,000) are expensed in the year of acquisition. Software and licences are reported at cost. There is no material internal software development, though there are significant internal capitalised costs involved in the implementation of purchased software.

Intellectual property
ANSTO and NTP Radioisotopes (SOC) Limited (NTP) signed the Intellectual Property (IP) Licence Agreement on 15 May 2012 for the provision of NTP's IP to ANSTO to enable ANSTO to build a new Mo-99 manufacturing plant at Lucas Heights.

Under the terms of the IP Agreement NTP granted to ANSTO an exclusive, irrevocable, perpetual licence to use, exploit, reproduce and modify the current IP and the future IP.

ANSTO originally recognised the IP right conveyed, at fair value, as an intangible asset with an indefinite life and a financial liability for the future payments required in relation to the asset. This IP is recognised as its initial fair value less impairment, $30,294,000 (2018: $30,336,000).

2. Financial Position (continued)

2.2A Property, plant and equipment and intangible assets (continued)

Amortisation
Intangibles are amortised over their estimated useful lives to ANSTO using the straight line method.

Amortisation rates applying to intangibles are as follows:

	2019	2018
Purchased software	**2 to 10 years**	2 to 7 years
Licences	**3 years**	3 years
Intellectual property	**Indefinite life**	Indefinite life

Impairment
All intangible assets were assessed for impairment at 30 June 2019. Where indications of impairment exist, the asset's recoverable amount is estimated and an impairment adjustment made if the asset's recoverable amount is less than its carrying amount.

Patents
Due to the uncertain commercial value of patents and because benefits extending beyond one accounting period cannot be assured, the costs associated with the development and registration of patents are expensed in the year in which they are incurred, unless recoverability is assured beyond any reasonable doubt. At 30 June 2019 there were 196 patents (2018: 192) registered to ANSTO and no associated costs are recognised as an asset (2018: nil).

2.2C Inventories

	2019	2018
	$'000	$'000
Raw materials and stores – not held for resale		
Stores – at cost	23,957	24,110
Cobalt-60 sources – at net realisable value	86	86
Reactor fuel and heavy water – at average purchase price	2,700	2,701
	26,743	26,897
Work in progress - at cost	2,222	2,295
Finished goods - at cost	1,491	1,357
Total inventories	**30,456**	**30,549**
Inventories expected to be realised within		
No more than 12 months	27,672	27,762
More than 12 months	2,784	2,787
Total inventories	**30,456**	**30,549**

Accounting Policy
Inventories held for sale are valued at the lower of cost and net realisable value. Costs incurred in bringing each item of inventory to its present location and condition, are assigned as follows:

- Raw material and stores (with the exception of reactor fuel) - purchase cost on a first-in first-out basis;
- Reactor fuel - average purchase price; and
- Finished goods and work-in-progress - cost of direct materials and labour plus attributable costs that can be allocated on a reasonable basis.

2. Financial Position (continued)

2.2D Commitments

	2019	2018
	$'000	$'000
Infrastructure, plant and equipment	50,234	82,094
Fuel element purchase	8,455	9,227
Mo-99 plate purchase	13,128	10,482
Total commitments	**71,817**	**101,803**
One year or less	58,055	62,635
From one to five years	13,762	39,168
Total commitments	**71,817**	**101,803**

2.3 Liabilities

2.3A Other payables

	2019	2018
	$'000	$'000
Final monies on construction contract	20	10,134
Other payables	8,550	744
Total other payables	**8,570**	**10,878**
Other payables expected to be settled within		
No more than 12 months	8,570	10,878
Total other payables	**8,570**	**10,878**

Accounting Policy

Financial liabilities are classified other financial liabilities and are recognised and derecognised upon trade date.

Other financial liabilities, including borrowings, are initially measured at fair value, net of transaction costs. These liabilities are subsequently measured at amortised cost using the effective interest method, with interest expense recognised on an effective interest basis.

Supplier and other payables are recognised at amortised cost. Liabilities are recognised to the extent that the goods or services have been received (and irrespective of having been invoiced).

2. Financial Position (continued)

2.3B Revenue in advance

	2019	2018
	$'000	$'000
Grant Monies Rec'd in Advance - Current	30,789	18,355
Revenue Received In Advance - Goods and Services	2,575	2,331
Total revenue in advance	**33,364**	**20,686**
Other payables expected to be settled within		
No more than 12 months	12,863	11,458
More than 12 months	20,501	9,228
Total revenue in advance	**33,364**	**20,686**

Accounting Policy

Grants and revenue are not recognised in the profit or loss until ANSTO obtains control over the contribution. Until such time that control over the contribution is obtained, the funds received are recognised as revenue in advance.

2.3C Provisions

		2019	2018
		$'000	$'000
Decommissioning	(a)	613,256	387,124
Intellectual property payment	(b)	40,312	43,188
Other provisions		505	578
Total provisions		**654,073**	**430,890**
Provisions expected to be settled within			
No more than 12 months		17,776	33,813
More than 12 months		636,297	397,077
Total provisions		**654,073**	**430,890**

(a) This provision includes decommissioning costs relating to property, plant and equipment, and infrastructure and local and overseas legacy waste and current OPAL waste disposition.

An external company, Project Time & Cost LLC (PT&C), was engaged during the year to provide a report on the cost of decommissioning facilities at ANSTO's Lucas Heights campus. The estimate provided by PT&C has an expected accuracy range between +50% and -30%. ANSTO has applied the point estimate from the PT&C report in their calculation of the decommission provision which has resulted in an increase in the decommissioning provision of $183.7 million. The impact of this increase has been recognised in the Statement of Comprehensive Income ($129.9 million) with the remaining difference recognised against the Asset Revaluation Reserve ($53.8 million).

(b) The provision of intellectual property relates to the future payments required in relation to the intellectual property asset (Notes 2.2A and 2.2B). The liability is derived from calculating the estimated commission to be paid to NTP based on expected future sales and then discounted back at 4.28% (2018: 5.35%).

2. Financial Position (continued)

2.3C Provisions (continued)

Provisions movement reconciliation

	Decommissioning	Intellectual Property Payment	Other claims
	$'000	$'000	$'000
Carrying amount 30 June 2017	**313,421**	**51,152**	**10,352**
Addition to/(reversal of) provision	1,914	-	(9,774)
Amounts used	(1,953)	(6,537)	-
Change in accounting estimate	55,842	(1,531)	-
Unwinding discount	17,900	104	-
Carrying amount 30 June 2018	**387,124**	**43,188**	**578**
Addition to provision	47,893	-	-
Amounts used	(24,973)	(7,781)	(73)
Change in accounting estimate	183,753	4,755	-
Unwinding discount	19,459	150	-
Carrying amount 30 June 2019	**613,256**	**40,312**	**505**

2. Financial Position (continued)

2.4 Reserves

2.4A Reserves

		2019	2018
		$'000	$'000
Asset revaluation	(a)		
Opening balance		442,932	500,124
Revaluation - realisation		(53,808)	(1,350)
Revaluation – decommissioning		-	(55,842)
Asset Revaluation Reserve		**389,124**	**442,932**
Other reserves			
OPAL depreciation	(b)	**9,061**	**9,061**
Intermediate low level waste (ILLW) return	(c)	**616**	**616**
Foreign currency reserve			
Opening balance		321	334
Movement		2	(13)
Closing balance	(d)	**323**	**321**
Other reserves		**10,000**	**9,998**
Total Reserves		**399,124**	**452,930**

(a) Asset revaluation
This reserve represents the revaluation of property, plant and equipment.

(b) OPAL depreciation reserve
This reserve represents unused funding for OPAL depreciation. This was due to a delay in final commissioning of OPAL.

(c) Intermediate low level waste (ILLW) return
This reserve relates to unspent appropriation for ILLW return.

(d) Foreign currency reserve
This reserve relates to foreign currency translation at reporting date.

2.4B Accumulated deficit

	2019	2018
	$'000	$'000
Opening balance	(271,606)	(184,664)
Deficit for the year	(307,768)	(86,942)
Closing balance	**(579,374)**	**(271,606)**

3. Funding

This section identifies ANSTO's funding structure.

3.1 Government funding

	2019	2018
	$'000	$'000
Revenue from Government	214,072	198,119
Government equity injection	28,461	21,037
Total government funding	**242,533**	**219,156**

Appropriations are made to the Department of Industry, Innovation and Science and then paid to ANSTO. ANSTO does not receive any Departmental Capital Budget.

4. People and relationships

This section describes a range of employment and post-employment benefits provided to our people and our relationships with key people.

4.1 Employee payables

	2019	2018
	$'000	$'000
Accrued salaries and wages	1,183	945
Incentives	4,184	3,470
Total employee payables	**5,366**	**4,415**

4.2 Employee provisions

	2019	2018
	$'000	$'000
Annual leave	37,700	13,426
Long service leave	8,232	30,766
Total employee provisions	**45,932**	**44,192**
Employee provisions expected to be settled within		
No more than 12 months	38,507	36,952
More than 12 months	7,425	7,240
Total employee provisions	**45,932**	**44,192**

4. People and relationships (continued)

4.3 Key management personnel remuneration

Key management personnel (KMP) are those persons having authority and responsibility for planning, directing and controlling the activities of ANSTO, directly or indirectly, including any director (whether executive or otherwise) of ANSTO. ANSTO has determined the KMP to be the ANSTO Portfolio Minister, the Board and the Executive Leadership Team. KMP remuneration is reported in the table below:

	2019	2018
	$'000	$'000
Short-term employee benefits:		
Salary	3,581	3,560
Performance bonuses	599	-
Other	11	2
Total short-term employee benefits	**4,191**	**3,562**
Post-employment benefits:		
Superannuation	372	357
Total post-employment benefits	**372**	**357**
Other long-term benefits:		
Long-service leave	60	97
Other	283	364
Total other long-term benefits	**343**	**461**
Termination benefits	**216**	**-**
Total key management personnel remuneration	**5,122**	**4,380**

The total number of KMP included is 15.37 (2018: 16.25). Represented by 6.68 non-executive board members (pro-rated) (2018: 7.71) and 8.69 full time equivalent (FTE) (2018: 8.54 FTE) members of the ANSTO Executive Leadership Team. The above key management personnel remuneration excludes the remuneration and other benefits of the Portfolio Minister. The Portfolio Minister's remuneration and other benefits are set by the Remuneration Tribunal and are not paid by the entity.

4.4 Related party transactions

ANSTO is an Australian Government controlled entity. Related parties to this entity are the Key Management Personnel, the Commonwealth cabinet and other Australian Government entities.

Significant transactions with related parties or entities that they are associated with can include:

- the payments and receipt of grants; and
- purchases of goods and services

Giving consideration to relationships with related parties, their associated entities, and transactions entered into during the reporting period by ANSTO, it has been determined that there are no related party transactions to be separately disclosed.

5. Managing Uncertainties

This section analyses how ANSTO manages the financial risks within its operating environment.

5.1 Contingent assets and liabilities

Contingent assets and contingent liabilities are not recognised in the statement of financial position but are reported in the notes. They may arise from uncertainty as to the existence of a liability or asset or represent an asset or liability in respect of which the amount cannot be reliably measured. Contingent assets are disclosed when settlement is probable but not virtually certain and contingent liabilities are disclosed when settlement is greater than remote.

Unquantifiable Contingencies

At 2019, ANSTO still has the likelihood of claims in relation to asbestos related diseases. It is not possible to estimate the amounts of any eventual payments that may be required in relation to these claims. Such claims however are, covered by the Department of Finance provision dealing with asbestos related claims against any Commonwealth Authorities including ANSTO in the event of any litigation or claim for compensation.

5.2 Financial instruments

a) Categories of financial instruments

	Note	Carrying amount 2019	Fair Value 2019	Carrying amount 2018	Fair Value 2018
Financial assets		**$'000**	**$'000**	**$'000**	**$'000**
Loans and receivables					
Cash and cash equivalents	2.1A	19,178	19,178	7,916	7,916
Receivables for goods and services	2.1B	17,316	17,316	13,215	13,215
Interest accrued	2.1B	595	595	795	795
Other	2.1B	4,016	4,016	1,241	1,241
Investments held to maturity	2.1C	101,886	101,886	130,187	130,187
Investments	2.1C	213	213	95	95
Total financial assets (recognised)		**143,204**	**143,204**	**153,449**	**153,449**
Total financial liabilities					
Amortised cost					
Suppliers		10,377	10,377	17,886	17,886
Employees	4	5,366	5,366	4,415	4,415
Other payables	2.3A	8,570	8,570	10,878	10,878
Revenue in advance	2.3B	33,364	33,364	20,686	20,686
Total financial liabilities (recognised)		**57,677**	**57,677**	**53,865**	**53,865**

5. Managing Uncertainties (continued)

5.2 Financial instruments (continued)

Interest revenue from financial assets

	2019	2018
	$'000	$'000
Loans and receivables		
Cash and cash equivalents	486	163
Investment held to maturity	2,735	3,562
Net income from financial assets	**3,221**	**3,725**

Interest revenue
Interest revenue is recognised using the effective interest method as set out in AASB 139 *Financial Instruments: Recognition and Measurement*.

b) Net expenses from financial liabilities

There were no expenses from financial liabilities for 2019 (2018: $nil).

Financial assets
The net fair values of cash, deposits on call and non-interest-bearing monetary financial assets are in accord with their carrying amounts. Loans receivable are carried at cost, which is above their net fair value, because it is intended to hold them to maturity.

Financial liabilities
The net fair values for trade creditors and grants received in advance, all of which are short-term in nature, are in accord with their carrying amounts.

Accounting Policy

ANSTO classifies its financial assets in the following categories:

- Financial assets at fair value through profit or loss;
- Held-to-maturity investments; and
- Loans and receivables.

The classification depends on the nature and purpose of the financial assets and is determined at the time of initial recognition. Financial assets are recognised and derecognised upon trade date.

Effective interest method
The effective interest method is a method of calculating the amortised cost of a financial asset or a financial liability and of allocating interest income over the relevant period. The effective interest rate is the rate that discounts estimated future cash receipts through the expected life of the financial asset, or, where appropriate, a shorter period.

Income is recognised on an effective interest rate basis except for financial assets at fair value through profit or loss.

5. Managing Uncertainties (continued)

5.2 Financial instruments (continued)

Financial assets at fair value through profit or loss
Financial assets are classified as financial assets at fair value through profit or loss where the financial assets have been acquired principally for the purpose of selling in the near future. Assets in this category are classified as current assets.

Financial assets at fair value through profit or loss are stated at fair value, with any resultant gain or loss recognised in the profit or loss. The net gain or loss recognised in the profit or loss incorporates any interest earned on the financial assets.

Where a reliable fair value cannot be established for unlisted investments in equity instruments, cost is used less impairment if applicable.

Held-to-maturity investments
Non-derivative financial assets with fixed or determinable payments and fixed maturity dates that the group has the positive intent and ability to hold to maturity are classified as held-to-maturity investments. Held-to-maturity investments are recorded at amortised cost using the effective interest method less impairment, with revenue recognised on an effective yield basis.

Loans and receivables
Trade receivables, loans and other receivables that have fixed or determinable payments that are not quoted in an active market are classified as 'loans and receivables'. Loans and receivables are measured at amortised cost using the effective interest method less impairment. Interest is recognised by applying the effective interest rate.

Impairment of financial assets
Financial assets are assessed for impairment at each reporting date.

- Financial assets held at amortised cost - If there is objective evidence that an impairment loss has been incurred for loans and receivables or held to maturity investments held at amortised cost, the amount of the loss is measured as the difference between the asset's carrying amount and the present value of estimated future cash flows discounted at the asset's original effective interest rate. The carrying amount is reduced by way of an allowance account. The loss is recognised in the Statement of Comprehensive Income.

- Financial assets held at cost - If there is objective evidence that an impairment loss has been incurred the amount of the impairment loss is the difference between the carrying amount of the asset and the present value of the estimated future cash flows discounted at the current market rate for similar assets. The net fair values of cash, deposits on call and non-interest-bearing monetary financial assets are in accord with their carrying amounts. Loans receivable are carried at cost, which is above their net fair value, because it is intended to hold them to maturity.

Financial liabilities
Financial liabilities are classified other financial liabilities and are recognised and derecognised upon trade date.

Other financial liabilities
Other financial liabilities, including borrowings, are initially measured at fair value, net of transaction costs. These liabilities are subsequently measured at amortised cost using the effective interest method, with interest expense recognised on an effective interest basis.

Supplier and other payables are recognised at amortised cost. Liabilities are recognised to the extent that the goods or services have been received (and irrespective of having been invoiced).

5. Managing Uncertainties (continued)

5.3 Fair value measurement

The following tables provide an analysis of assets and liabilities that are measured at fair value. The different levels of the fair value hierarchy are defined below.

Level 1: Quoted prices (unadjusted) in active markets for identical assets or liabilities that the entity can access at measurement date.
Level 2: Inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly.
Level 3: Unobservable inputs for the asset or liability.

Non-financial assets	Category	Fair value 2019 $'000	Fair value 2018 $'000	Valuation technique[1]	Inputs used[1]
Land	**3**	**115,688**	115,688	Market approach	Adjusted market transactions (zoning, access, existing use, size, topography, location)
Buildings	**2**	**4,579**	4,579	Market approach	Adjusted market transactions
	3	**112,720**	155,432	Depreciated replacement cost (DRC)	Replacement cost of a new/consumed economic benefit/ obsolescence of asset
Infrastructure, plant and equipment	**2**	**3,410**	3,410	Market approach	Adjusted market transactions
	3	**757,423**	954,633	Depreciated replacement cost (DRC)	Replacement cost of a new/consumed economic benefit/ obsolescence of asset

1. The valuation techniques and inputs used in 2019 and 2018 are consistent.

The highest and best use of all non-financial assets is the same as their current use.

Accounting Policy

For assets that are recognised in the financial statements at fair value on a recurring basis, the determination is made whether transfers have occurred between levels in the hierarchy by re-assessing categorisation (based on the lowest level input that is significant to the fair value measurement as a whole) at the end of each reporting period.

Recurring and non-recurring Level 3 fair value measurements - valuation processes

The Australian Valuation Solutions (AVS) undertook a comprehensive valuation of all non-financial assets located at the Lucas Heights and Camperdown campuses effective 30 June 2017. PP&E Valuations undertook a comprehensive valuation of all non-financial assets located at the Clayton campus effective 30 June 2017. The entity tests the procedures of the valuation model as an internal management review at least once every 12 months (Valuations are conducted with sufficient frequency to ensure that the carrying amounts of assets do not differ materially from the assets' fair values as at reporting date). If a particular asset class experiences significant and volatile changes in fair value (i.e. where indicators suggest that the value of the class has changed materially since the previous reporting period), that class is subject to specific valuation in the reporting period, regardless of the timing of the last specific valuation.

5. Managing Uncertainties (continued)

5.3 Fair value measurement (continued)

Land, Infrastructure, Plant and Equipment
Assets that do not transact with enough frequency or transparency to develop objective opinions of value from observable market evidence have been measured utilising the depreciated replacement cost (DRC) approach. Under the DRC approach, the estimated cost to replace the asset is calculated and then adjusted to take into account its consumed economic benefit/asset obsolescence (accumulated depreciation). Consumed economic benefit/asset obsolescence has been determined based on professional judgment regarding physical, economic and external obsolescence factors relevant to the asset under consideration.

Assets are recorded at cost on acquisition except as stated below. The cost of acquisition includes the fair value of assets transferred in exchange and liabilities undertaken. Financial assets are initially measured at their fair value plus transaction costs where appropriate.

Assets acquired at no cost, or for nominal consideration, are initially recognised as assets and revenues at their fair value at the date of acquisition, unless acquired as a consequence of restructuring of administrative arrangements. In the latter case, assets are initially recognised as contributions by owners at the amounts at which they were recognised in the transferor's accounts immediately prior to the restructuring.

6. Other information

6.1 Deed of indemnity

A Deed of Indemnity between the Commonwealth Government, ANSTO and ANSTO Nuclear Medicine Pty Ltd (ANM), under which the government has formally agreed to indemnify ANSTO and ANSTO Officers, and ANM and ANM Officers, from any loss or liability arising from claims caused by ionising radiation, was signed by the Minister for Industry, Innovation and Science in April 2016. It will remain in place until April 2026.

6.2 Information relating to ANSTO (the parent entity)

	2019	2018
	$'000	$'000
Financial assets	161,353	170,525
Non-financial assets	1,225,683	1,226,892
Total assets	1,387,036	1,397,417
Payables	13,543	33,327
Provisions	655,187	473,537
Revenue in advance	33,363	20,686
Total liabilities	702,093	527,550
Net assets	**684,943**	**869,867**
Contributed equity	819,675	791,214
Asset revaluation reserve	388,232	442,077
Other reserves	9,677	9,677
Accumulated deficit	(532,641)	(373,101)
Total equity	**684,943**	**869,867**
Deficit of the parent entity	**(159,540)**	**(200,402)**
Other comprehensive expense of the parent entity	**(53,845)**	**(55,842)**
Total comprehensive expense of the parent entity	**(213,385)**	**(256,244)**

The lease commitments shown in note 1.1B only relate to ANSTO.

	Interest rate	Maturity date	2019	2018
			$	$
$15 million unsecured loan facility from ANSTO to ANM	CommSec Variable Rate 6.28% (2018: 6.38%)	31.12.20	8,322,377	3,259,798
Total unsecured loan from ANSTO to ANM			**8,322,377**	**3,259,798**
Interest on unsecured loan facility			**332,040**	**163,112**

6. Other information (continued)

6.2 Information relating to ANSTO (the parent entity) (continued)

There are transactions between ANSTO and its subsidiaries for purchases and sales or goods and services. These transactions are on normal commercial terms and conditions no more favourable than those available to other parties.

Investment in subsidiaries

The current carrying value of ANSTO's subsidiaries at 2019 are set out below. Unless otherwise stated, share capital consists solely of ordinary shares that are held directly by ANSTO, and the proportion of ownership interests held equals the voting rights held by the group. The country of incorporation is also their principal place of business.

Name	Place of incorporation	2019 %	2019 $	2018 $
PETTECH Solutions Pty Ltd (a)	Australia	100	2,965,588	2,965,588
ANSTO Inc. (b)	USA	100	-	-
ANSTO Nuclear Medicine Pty Ltd (c)	Australia	99.9	13,938,100	13,938,100
Australian Synchrotron Holding Company Pty Ltd (d)	Australia	100	-	-
Total investment in subsidiaries			**16,903,688**	**16,903,688**

(a) ANSTO continues to own 100% of PETTECH Solutions Pty Ltd. To 2 January, when its business was sold, its principal activities were manufacturing, sale and distribution of FluoroDeoxyGlucose (FDG) and Fluorine 18 (F18) for use in the Australian market. Subsequent to the sale of the business, PETTECH's primary activity is the ownership of infrastructure for the manufacture of FDG.

(b) ANSTO continues to own 100% of ANSTO Inc. its principal activity is to promote the commercialisation of ANSTO Technology in the USA. For the financial year ended 30 June 2018 the financial statements were audited by Wipfli LLC.

(c) ANSTO owns 100% of the B class and C class shares on issue of ANM. The B class shares, 101 are not entitled to any dividends but do have operational control. The C class shares, 110,300,000 were issued as consideration for the Mo-99 manufacturing facility. There was one A class share issued to the Minister of Industry, Innovation and Science on behalf of the Commonwealth. The A class share is entitled to dividends. ANM's principal activities are to own and operate the new Molybdenum 99 (Mo-99) and Synroc Waste Treatment facilities. The Mo-99 facility became operational on 25 May and is currently operating under a restricted licence. It is expected to be fully operational in 2019-20. At 30 June 2019 ANSTO's investment in ANM was impaired by $96.3M (2018: $96.3M).
ANSTO has undertaken to not call on ANM to pay for the operational readiness capital costs or the 2nd dissolution hot cell, when complete, or for services rendered until the production facility is undertaking production runs specifically for export, including the costs of investigating and resolving the mechanical failure, and when ANM has sufficient incremental cash flows to pay these costs, as agreed by both parties. This will be no earlier than 12 months from the date of signing the ANM FY19 financial statements.
The Mo-99 manufacturing become operational on 25 May 2019, however on 21 June 2019, the production experienced an event which resulted in a restricted licence limiting production to two production runs, meeting domestic demand.

(d) On 1 July 2016 ANSTO was transferred the remaining 97.6% of the shares in the Australian Synchrotron Holding Company Pty Ltd (ASHCo) for no consideration. ASHCo owns the Australian Synchrotron. The net assets of ASHCo were transferred to ANSTO on 30 November 2017. The company was deregistered on 12 June 2019.

6. Other information (continued)

6.3 Events after reporting date

During the reporting period, an independent review of ANSTO was commenced. The initial response resulted in the Budget measure 'Strengthening the Australian Nuclear Science and Technology Organisation'.

6.4 Budgetary reports and explanations of major variances

The following tables provide a comparison between the 2018–19 Portfolio Budget Statements (PBS) budget and the final financial outcome in the 2018–19 financial statements. The Budget is not audited and does not reflect additional budget estimates provided in the 2018–19 Portfolio Additional Estimates Statements (PAES) or the revised budget provided as part of the 2019–20 Portfolio Budget Statements (PBS). However, major changes in budget have been explained as part of the variance analysis where relevant.

The ANSTO PBS does not include ANSTO Nuclear Medicine Pty Ltd (ANM), the $168.8M nuclear medicine initiative, as it is a Public Non-Financial Corporation (PNFC) but does contain ANSTO's other controlled entities. PNFC's do not form part of the General Government Sector (GGS) and are outside of the scope of AASB 1055 *Budgetary Reporting*. ANM is included in the Actual figures as it is controlled by ANSTO.

A budget has not been provided for in the PBS, for non-cash items such as asset revaluations, foreign exchange and sale/impairment of asset adjustments. Unless the variance is considered to be 'major', no explanation has been provided.

Explanation of major variances

Event impacting financial statements	Affected consolidated statements and line items
The ANM project is reported differently in the budget compared to the actual figures. ANM is a subsidiary of ANSTO, it is consolidated into the financial statements and the costs associated with the construction of the ANM facilities are reflected in property, plant and equipment net of impairment, $28.9M (2018: $28.9M). However, for budget purposes ANM does not form part of the Portfolio Budget Statements and is reflected as an investment. As at 30 June 2019 the value of the ANM Mo-99 production facility is $18.6M (2018: $110.5M). ANM become operational on 24 May 2019 transferring the production of Mo-99 from ANSTO to ANM. The facility becoming operational required the recognition of the provision for decommissioning, $43.2M.	**Statement of Comprehensive Income:** Depreciation/amortisation and impairment losses Sale of goods and rendering of services **Statement of Financial Position:** Investments Property, plant and equipment Decommissioning provision
On 28 June 2019 ANSTO received the first tranche, $6.5M of a $12.5M five year unconditional grant from the NSW Government for ANSTO's innovation precinct.	**Statement of Comprehensive Income:** Grant income **Statement of Financial Position:** Cash and cash equivalents

6. Other information (continued)

Event impacting financial statements	Affected consolidated statements and line items
Up to the commencement of ANM's operations in May 2019, ANSTO production and sales of Mo-99 increased to mitigate global demand.	**Statement of Comprehensive Income:** Sales of goods and rendering of services revenue Supplier expenses **Statement of Financial Position:** Provision - Intellectual property payment **Statement of Cash Flows:** Sales of goods and rendering of services Payments to suppliers
ANSTO manages its cash through the use of term deposits. The term of each deposit is dependent on the cash needs of the business and the interest rates prevailing at the time. Changes in either the cash needs or the interest rates impact on the number of times a deposit is 'rolled' in the period. The 2018-19 PBS was completed in April 2018.	**Statement of Cash Flows:** Proceeds from investment sales/maturities Purchase of investments
Each year at 30 June ANSTO assesses its obligation to decommission facilities on its campuses. In accordance with the Australian Accounting Standards, the provision is assessed for the timing of payments, anticipated costs, discount, exchange and inflation rates. Timing of payments has been impacted by the inability of ANSTO to fund planned decommissioning works as scheduled. An external company, Project Time & Cost LLC (PT&C), was engaged during the year to provide a report on the cost of decommissioning facilities at ANSTO's Lucas Heights campus. The estimate provided by PT&C has an expected accuracy range between +50% and -30%. ANSTO has applied the point estimate from the PT&C report in their calculation of the decommission provision. The 2018-19 PBS was completed in April 2018.	**Statement of Comprehensive Income:** Finance costs Changes in asset revaluation reserve **Statement of Financial Position:** Provision – Decommissioning Reserves
On 22 June 2018, ANSTO experienced a mechanical issue with a conveyer belt in the production facility manufacturing technetium-99m (Tc-99m) generators. ANSTO has been importing Tc-99m generators from the USA since the issue was identified. The fault has been fixed and quality control tests finalised. A controlled start-up process that incorporates full equipment checks is in place after which production will ramp up. Full production is scheduled for early September 2018, with generator imports remaining in place until full production is achieved. The cost of importation is approximately $1 million per week. The 2018-19 PBS was completed in April 2018.	**Statement of Cash Flows:** Payments to suppliers
The 2018-19 PBS showed payments for decommissioning activities as other payments these payments are shown as payments to suppliers in the 2019 actual figures.	**Statement of Cash Flows:** Payments to suppliers
In April 2018 when the 2018-19 PBS was completed ANSTO's anticipated ASL was 1,303 this decreased to 1,275 for FY19 in the 2019-20 PBS. The lower staffing levels were partially offset by increased use of contractors, particularly to deal with a backlog of repairs and maintenance work on ANSTO's aging infrastructure.	**Statement of Comprehensive Income:** Employee expenses Supplier expenses **Statement of Cash Flows:** Payment to employees Payment to suppliers

APPENDIX 1

Equality of employment opportunity

ANSTO strives to embrace and champion diversity within and outside our organisation and welcomes the contributions of our staff, customers, stakeholders and the public in helping us achieve that goal.

We endeavour to create a culture of inclusion, where our diversity of thought and differing perspectives are a source of organisational agility, resilience and renewal. We provide empowering and effective work-based policies which support the individual needs of our employees, including flexible work practices, health and well-being and family-friendly programs.

Our inclusive culture enables us to attract and retain the best talent to work with us in achieving meaningful goals.

Our commitment to equal opportunity employment stems from ANSTO's business case for Diversity and Inclusion – it's not a tack-on, it's a fundamental strategy for delivering on our organisational objectives and realising the value of our immensely talented workforce. The case for creating an inclusive workplace culture can be summarised by three key messages.

Goals, targets and accountability

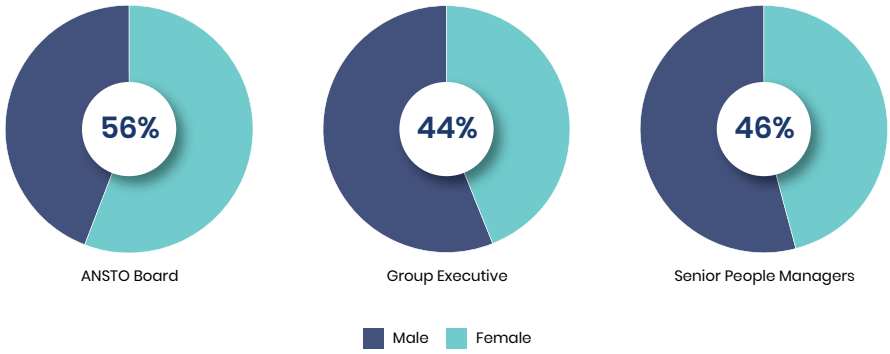
ANSTO aims to achieve equitable representation across the organisation by 2030, and we are actively working on increasing the diversity of candidates in the talent pipeline. Research shows that diverse teams perform better on measures tied to our strategic success. Therefore, we aim to have all leadership teams made up of a minimum of 40 per cent males and 40 per cent females by 2020.

ANSTO is accountable to staff, stakeholders and the community when it comes to addressing the diversity of our workforce. We track our progress on our representation targets transparently both internally and externally. Current statistics on gender representation overall and by pay (band) level are available publicly on ANSTO's website, and they clearly show we have some way to go to meeting our 2030 target. All staff may also access meaningful data about our progress towards targets through a set of detailed dashboards on our intranet.

Since setting leadership representation KPI's, ANSTO now meets our target at the Board, Executive and Senior People Manager (organisational) cohort level. We continue to work on this on a divisional level.

Equality of employment opportunity for 2018–19

Description	Employees (full-time equivalent)		% of Total		% change 2019/18	Average Salary		% change 2019/18
Financial Year	**2019**	**2018**	**2019**	**2018**		**2019**	**2018**	
Female	359.4	352.9	29.2%	28.5%	1.9%	$96,051	$92,642	3.7%
Male	872.3	886.5	70.8%	71.5%	-1.6%	$109,293	$107,949	1.2%
Total	1,231.7	1,239.4	100.0%	100.0%	-0.6%	$105,261	$103,411	1.8%
Workforce Diversity								
People with diabilities	6	6	0.5%	0.5%	0.0%	$107,630	$105,331	2.2%
Aboriginal and Torres Strait Islanders	6	6	0.5%	0.5%	0.0%	$92,054	$95,952	-4.1%
Non-English-speaking background	204	204	16.6%	16.5%	0.0%	$111,570	$110,524	0.9%



In December 2018, ANSTO was awarded an Athena SWAN Bronze Institution Award for our progress and commitments to addressing diversity and inclusion (see more detail on page 8). Our CEO, Dr Adi Paterson, is also a Male Champion of Change and works with other STEM CEOs to champion equity and address inclusion in a meaningful, accountable and results-driven way. ANSTO continues to play an active role in the Women in STEM Decadal Plan, developed by the Australian Academy of Science in collaboration with the Australian Academy of Technology and Engineering.

Taking steps towards the ANSTO of the future

ANSTO strives to improve both the diversity of our workplace and the inclusivity of our culture. We are engaging with subject matter experts to deliver training programs that improve our inclusive leadership and mentoring programs with a focus on diversity and inclusion which will result in sustainable and measurable change.

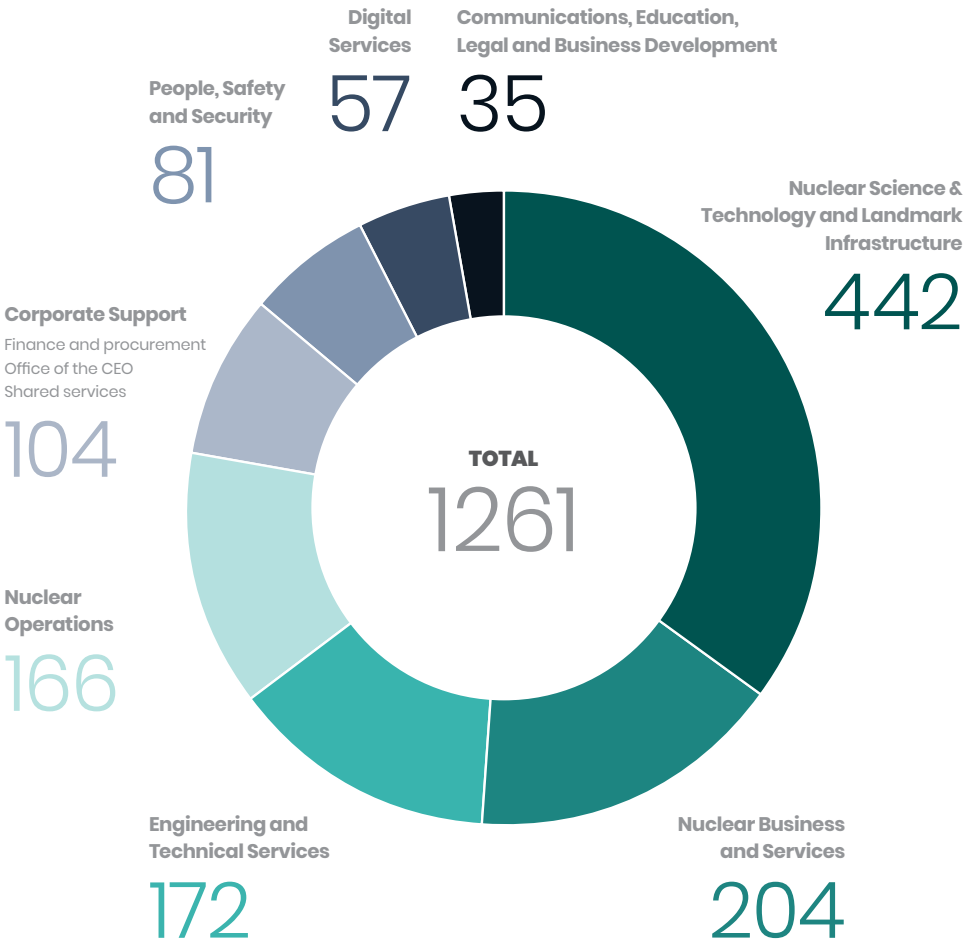
We work on a range of change programs over the short and long term to bring forth meaningful changes today and tomorrow – from making everyday changes to our work environment that improve employees' experience, to educating and engaging with young people to invest in the future of STEM talent.

Growing STEM talent, building the pipeline

At ANSTO, we are committed to fostering the next generation of STEM talent, and are recognised globally for our work in nuclear science education and outreach. See page 46-47 for more information.

Further down the pipeline, we have a range of Early Careers programs including apprenticeships, traineeships, internships for undergraduates and our Graduate Program. We are increasing our affiliations with a number of universities to enhance the diversity of our early career pipeline.

Our staff



This chart represents ANSTO's headcount, or number of individuals that worked within the organisation, as of 30 June 2019.

All ongoing employees – Current reporting period (2018-2019)

	Male			Female			Total
	Full Time	Part Time	*Total Male*	Full Time	Part Time	*Total Female*	
NSW	707	13	*720*	263	69	*332*	*1052*
Vic	92	1	*93*	19	4	*23*	*116*
Overseas	1	-	*1*	-	-	-	*1*
Total	800	14	*814*	282	73	*355*	*1169*

All non-ongoing employees – Current reporting period (2018-2019)

	Male			Female			Total
	Full Time	Part Time	*Total Male*	Full Time	Part Time	*Total Female*	
NSW	50	2	*52*	23	2	*25*	*77*
Vic	11	0	*11*	3	1	*4*	*15*
Total	61	2	*63*	26	3	*29*	*92*

All ongoing employees – Previous reporting period (2017-2018)

	Male			Female			Total
	Full Time	Part Time	*Total Male*	Full Time	Part Time	*Total Female*	
NSW	720	8	*728*	249	66	*315*	*1043*
Vic	97	1	*98*	21	5	*26*	*124*
ACT		1	*1*				*1*
Overseas	-	-	-	1	-	*1*	*1*
Total	817	10	*827*	271	71	*342*	*1169*

All non-ongoing employees – Previous reporting period (2017-2018)

	Male			Female			Total
	Full Time	Part Time	*Total Male*	Full Time	Part Time	*Total Female*	
NSW	58	1	*59*	30	1	*31*	*90*
Vic	4	-	*4*	2	-	*2*	*6*
Total	62	1	*63*	32	1	*33*	*96*

Remuneration Report

Introduction

The categories of officials, employees of ANSTO, covered by the disclosures are:

- Key Management Personnel (KMP) - members of the Board and the Executive Leadership team disclosure in Table 1
- Senior executives: employees who are assigned General Manager or equivalent roles and delegations, disclosed in Table 2
- Other highly paid staff: employees with total remuneration $220,000 or greater not disclosed in Table 1 or 2, disclosed in Table 3.

Remuneration policies and practices

The remuneration of the ANSTO Board is in accordance with the Remuneration Tribunal (Remuneration and Allowances for Holders of Part-time Public Office) Determination 2019.

The remuneration parameters of the Chief Executive Officer are determined by the Australian Government Remuneration Tribunal. The ANSTO Remuneration and Nominations Committee assist the Board in fulfilling its responsibilities with regard to overall remuneration policy and strategy, performance and remuneration of the CEO.

Members of the Executive Leadership Team are on individual contracts which are based on market rates at the time of employment. The remuneration reflects qualifications, experience and levels of responsibility for each role. They also participate in the ANSTO Executive Incentive Plan. This plan was developed in conjunction with an external organisation. It contains a mixture of short-term and long-term incentives. Achievement of these incentives relies on achievement of group and individual key performance indicators (KPIs). The Remuneration and Nominations Committee oversees the approach to performance and remuneration of the Executive Leadership Team.

Senior executive and high paid positions are remunerated either in accordance with either the Enterprise Agreements or individual contracts. Each role has a Position Description detailing the roles, responsibilities, reporting lines, delegations and qualifications required. The role is subject to the Mercer rating system and is benchmarked to ensure the appropriateness of remuneration. The Enterprise Agreement sets out the remuneration and entitlements of employees. Remuneration is benchmarked annually for those employees on Individual Contracts; where the individual contract is silent the clauses of the Enterprise Agreement will apply.

Senior executives are eligible to participate in an annual bonus system linked to the achievement of their KPIs. Other highly paid officers may, depending on performance, be eligible for participation in the performance increments as detailed in the Enterprise Agreement or their contracts. Recommendations for incentive payments are made by line managers and ultimate approval is by the Executive Leadership Team.

Remuneration governance arrangements

The operations of the Remuneration and Nominations Committee for the year are detailed in the Corporate Governance Statement. Internally their operations are supported by the CEO and the Group Executive, People, Culture, Safety and Security.

Table 1 – KMP

		Short Term Benefits			Post Employment Benefits	Other Long Term Benefits		Termination Benefits	Total Remuneration[1]
Name	Position Title	Base Salary $	Bonus $	Other Benefits $	Super Contributions $	Long Service Leave $	Other Long Term Benefits $	$	$
Mr Jim McDowell	Board Chair to 31 August 2018	17,222	-	327	1,708	-	-	-	19,257
The Hon Annabelle Bennett, AC SC	Board Chair from 25 March 2019	27,537	-	-	-	-	-	-	27,537
Ms Penny Dobson	Deputy Board Chair and RAC Member 1 July to 31 August 2018 and from 25 March 2019. Acting Board Chair from 1 September 2018 to 24 March 2019.	94,419	-	1,862	8,948	-	-	-	105,228
Ms Carol Holley	Board Member and RAC Chair	66,102	-	685	6,275	-	-	-	73,062
Dr Gordon de Brouwer, PSM	Board and RAC Member from 4 April 2019	14,331	-	-	-	-	-	-	14,331
Emeritus Prof Stephen Buckman, AM	Board and RAC Member	58,085	-	1,430	8,944	-	-	-	68,459
Prof Brigid Heywood	Board and RAC Member	58,085	-	2,731	8,944	-	-	-	69,760
Prof Andrew Scott, AM	Board and RAC Member	58,085	-	2,206	5,517	-	-	-	65,809
Prof Margaret Sheil, AO	Board and RAC Member	58,093	-	1,739	8,945	-	-	-	68,776
Dr Adi Paterson	Chief Executive Officer and Board Member	498,520	106,080	-	25,000	9,704	-		639,304
Mr Peter Arambatzis	Group Executive, Business Operations Systems and Group Chief Financial Officer to 8 February 2019	368,006	-	-	36,221	6,528	2,850	216,189	629,793
Ms Pamela Naidoo-Ameglio	Group Executive, Nuclear Operations	277,233	59,631	-	51,192	4,266	16,615	-	408,937
Mr Michael Beckett	Group Executive, Special Projects, Part-time, 80%	206,793	42,396	-	25,809	(10,752)	31,188	-	295,433
Mr Robert Blissett	Group Executive, People, Culture, Safety and Security	354,412	74,292	-	31,554	12,565	56,010	-	528,833
Mr Shaun Jenkinson	Group Executive, Transformation and Engagement	351,054	73,872	-	25,000	8,213	57,308	-	515,447
Mr Con Lyras	Group Executive, Maintenance and Engineering and Chief Engineer	287,944	56,880	-	21,316	10,322	42,945	-	419,406
Ms Marianne Morton	Chief Information and Digital Officer joined the Group Executive on 20 March 2019	78,993	57,000	-	6,636	3,642	14,250	-	160,522
Dr Simone Richter	Group Executive, Nuclear Science & Technology, and Landmark Infrastructure	278,902	65,772	-	53,997	5,621	34,748	-	439,039
Ms Jayne Senior	Group Executive, Customer Advocacy and Value Chain	286,687	60,000	-	27,198	5,040	27,223	-	406,148
ANSTO KMP		**3,440,501**	**595,923**	**10,980**	**353,202**	**55,148**	**283,137**	**216,189**	**4,955,081**
Subsidiary KMP disclosures		140,320	2,746	-	19,015	4,948	-	-	167,029
TOTAL Consolidated KMP - Financial Statements Note 4.3		**3,580,822**	**598,670**	**10,980**	**372,217**	**60,096**	**283,137**	**216,189**	**5,122,110**

Notes:

1. Remuneration is reflected on an accruals basis not a cash basis and has not been annualised.
2. Other long term benefits reflect long term incentives.
3. The negative figure in long service leave represents the leave being used during the year.

Table 2 – Senior Executives

		Short Term Benefits			Post Employment Benefits	Other Long Term Benefits		Termination Benefits	Total Remuneration[1]
Total Remuneration Bands	Number of Senior Executives[2]	Base Salary $	Bonus $	Other Benefits $	Super Contributions $	Long Service Leave $	Other Long Term Benefits $	$	$
$0-$219,999	6	159,564	2,386	-	18,437	(12,205)	-	-	168,182
$220,000-$244,999	1	158,927	43,616	-	30,052	6,501	-	-	239,097
$245,000-$269,999	1	201,875	13,043	-	37,127	5,773	-	-	257,819
$270,000-$294,999	3	230,061	20,375	-	28,740	10,358	-	-	289,534
$295,000-$319,999	4	210,853	49,405	-	37,664	6,742	-	-	304,663
$320,000-$344,999	1	239,666	42,013	-	41,798	5,275	-	-	328,752
$345,000-$369,999	1	263,024	40,706	-	44,789	8,322	-	-	356,840
	17								

Notes:
1. Remuneration is reflected on an accruals basis not a cash basis.
2. Remuneration has only been included for the period the employee is a senior executive.
3. The negative figure in long service leave represents the leave being used during the year.

Table 3 – Other Highly Paid Officers

		Short Term Benefits			Post Employment Benefits	Other Long Term Benefits		Termination Benefits	Total Remuneration[1]
Total Remuneration Bands	Number of Highly Paid Officers	Base Salary $	Bonus $	Other Benefits $	Super Contributions $	Long Service Leave $	Other Long Term Benefits $	$	$
$220,000-$244,999	12	190,033	5,604	125	29,566	5,624	-	-	230,952
$245,000-$269,999	8	192,087	18,723	-	30,452	12,388	-	-	253,651
$270,000-$294,999	6	221,858	24,543	-	29,075	4,879	-	-	280,355
$320,000-$344,999	1	229,757	56,949	-	24,076	9,320	-	-	320,103
$345,000-$369,999	1	263,317	53,742	-	24,700	9,768	-	-	351,526
$420,000-$444,999	1	304,335	(8,929)	-	33,735	8,046	-	96,059	433,246
	29								

Notes:
1. Remuneration is reflected on an accruals basis not a cash basis and has not been annualised.
2. The negative figure in the bonus column represents the accrual from 2017-18 being more than was paid in 2018-19.

Employee support, culture and inclusion

Our goal is to create a workplace where employees thrive and feel like they belong, by supporting, empowering and valuing their individual skills. Our current programs and progress on this ambition are outlined below.

ANSTO is committed to providing a flexible, supportive and diverse working environment to enable everyone to work towards their planned career goals, and encouraging employees to live a balanced lifestyle that combines work, family and community responsibilities. Eighty per cent of staff state that their work arrangements meet their need for flexibility.

Flexible arrangements can take a number of different forms and can be temporary or permanent depending on the nature of the requirement, the work done by the staff member and what can be reasonably accommodated by the business area.

ANSTO encourages managers and employees to work together – utilising the wide variety of options available to meet the flexible needs of the employee and the business, which include, but are not limited to:

- Flexible working hours
- Flex/Managed Time (time off in lieu)
- Working from home
- Job sharing
- Part time
- Compressed hours
- Averaging of hours
- Purchased leave
- Unpaid leave
- Transition to retirement
- Individual flexibility arrangement (IFA).

In line with our environmental sustainability measures, ANSTO has invested significantly in technology which supports a seamless work experience from any location, with improvements in technology supporting working from home and virtual meeting capabilities.

Career management

At ANSTO, we have begun a journey to create a culture that encourages proactive and deliberate career management; a culture that invests in employee's careers to enable informed career decisions and encourage individual accountability for career growth. We want to actively facilitate a learning journey designed to help our employees develop new capabilities and knowledge that both align with business objectives and provide long-term career growth opportunities.

The Career Management System will provide a suite of tools and training for employees, managers and leaders to support each stage of the career development model. The system will deliver self-assessment and diagnostic resources to assist staff and managers with greater self-awareness and understanding of personal strengths. This in turn will fuel richer conversations related to career planning and development opportunties.

Managers will be supported through specific training to build their capability as career coaches to better facilitate the career discovery journey and change process with their staff.

The CMS will provide staff with the opportunity to realise the various career options they could leverage. This will create better staff engagement and career movements within the organisation.

Privacy

ANSTO is committed to protecting personal information in accordance with the *Privacy Act 1988* (Cth) *(Privacy Act)* and the Australian Privacy Principles (APPs). The privacy function sits within PCSS and a Privacy Officer and a Privacy Champion have been appointed as required by the *Privacy (Australian Government Agencies – Governance) APP Code 2017*.

The aim of this function is to enhance existing privacy capability within ANSTO, build greater transparency in information handling practices, ensure legislative compliance and foster a culture of respect for privacy and the value of personal information. To achieve this aim, ANSTO has a documented privacy management plan which identifies specific, measurable privacy goals and targets and sets out how ANSTO will meet its compliance obligations under the APPs. ANSTO has appointed both a Privacy Champion and Privacy Officer to ensure our aims are given the required priority and oversight.

ANSTO also conducts privacy impact assessments for all high privacy risk projects, regularly reviews and updates its privacy practices, procedures and systems to ensure their currency and adequacy for the purposes of compliance with the APPs, monitors compliance with its privacy practices, procedures and systems and ANSTO is actively enhancing internal privacy capability including by providing appropriate privacy education and training to all staff who have access to personal information.

Parenting career phase

For staff members who are or become parents, ANSTO is committed to ensuring that our staff are supported during the parenting phase of their careers.

We see this phase as a valuable period of skill development, and are committed to supporting and partnering with employees during this period. Ways that we do this include, but are not limited to:

- Generous maternity/parental paid and unpaid leave
- Flexible working options
- On-site childcare centre at Lucas Heights
- Family room
- Three weeks of sick/carers leave per year
- The Parenting Toolkit to assist managers and employees plan this career phase, and
- Seamless backfill replacements for staff going on parental/maternity leave.

ANSTO supports staff members providing care to others, with flexible work arrangements and leave available to all those balancing work and caring responsibilities.

Phased retirement

ANSTO recognises the knowledge, skills and expertise held by mature-age employees, and the contribution they can make to the organisation. We therefore offer a range of phased retirement options, including mentoring, community involvement and flexible working arrangements to assist employees transition into retirement.

Supporting employees in periods of difficulty

ANSTO is committed to ensuring all employees feel safe and supported in our workplace. Any employee at risk of, or experiencing, domestic and family violence should feel comfortable seeking support from ANSTO and the Employee Assistance Program.

ANSTO:

- provides affected employees with a safe space, support networks and leave entitlements when dealing with domestic or family violence,
- promotes flexible work practices at all levels in the organisation to support employees with family or other caring responsibilities and create an equal opportunity environment, and
- provides information on support services and options for managers, colleagues and individuals that may be affected by, or are at risk of being affected, on how to respond effectively and assist with minimising the impacts of the violence as much as possible.

Our commitment in this area is underpinned by ANSTO's Domestic and Family Violence Policy.

Healthy minds, healthy bodies and occupational rehabilitation

ANSTO continues to provide a campus physiotherapy service as part of early intervention for injury management and return to work programs, as well as a fully functioning Occupational Health Centre with a registered nurse and fully functioning treatment room (Monday to Friday). The Occupational Health Centre is audited annually through the 9001 and 45001 WHS audit process. ANSTO's performance in the area of occupational rehabilitation (RMS) continues to be strong as demonstrated with the continued adherence to the RMS and Compensation Act of 1988 and the ongoing commitment to ensuring the timely access to appropriately qualified experts that strive to achieve great outcomes for ANSTO personnel during times of illness or injury. The effectiveness of the RMS continues to be the focus of the ANSTO Senior executive and delegates who continue to demonstrate a strong commitment to providing personnel with an effective program that promotes the timely access to best practice evidence-based medical services, that aligns with the principles of natural justice and regard for the individual.

ANSTO has a number of programs and facilities that support mental and physical health including:

- Annual flu vaccines
- Women's and men's Health Screening Program
- Bowel screening programs
- Lunchtime sporting activities
- Flexible work arrangements
- Running Club
- Toastmasters
- Social Club
- Quit smoking support
- Employee and Manager Support Program with psychologists (EAP service)
- KPMG Fair Call Hotline
- Mindfulness seminars and tools.

Disability

ANSTO is committed to creating a workplace where different abilities are recognised, valued and celebrated. We care about providing a workplace where people with physical disability or neuro-divergences, carers of people with a disability, and people experiencing and managing mental health issues are supported to thrive.

ANSTO assists people with disabilities by providing workplace modifications or reasonable adjustments to help them perform their job, including:

- changing when, where and how work is performed
- ergonomic or specialist equipment, and
- physical changes to access (accessibility parking permits and spaces).

All new buildings and areas being renovated at ANSTO must comply with the relevant disability legislations, and we have ongoing improvements to the accessibility of our campuses including widening footpaths and equipping meeting rooms (above 100m2) with hearing loops.

In the event that a workplace design has excluded facilities for people with disabilities or the work environment is unsafe for people with disabilities to fulfil their duties, ANSTO reviews whether the work environment can be modified. ANSTO's policies and procedures align with the requirements of the *Equal Employment Opportunity (Commonwealth Authorities) Act 1987* and *Disability Discrimination Act 1992*, intended to ensure employees with disabilities working at ANSTO and applicants for recruitment who have a disability are not discriminated against. ANSTO also has procedures and support in place to handle complaints and grievances which may be raised by employees and visitors.

Indigenous acknowledgment

ANSTO acknowledges the traditional owners of the lands of each of our campuses and the unique cultural significance of the area in the past, today and into the future. In recognition of this connection, ANSTO is enhancing activities to connect with the local and broader Australian Indigenous communities. ANSTO is in the process of developing a Reconciliation Action Plan.

Meditation and multi-faith prayer space

ANSTO's Lucas Heights campus has two dedicated spaces that can be used for mediation and prayer, including a meeting room and silent room. This facility is intended to provide staff with quiet and peaceful rooms. Rooms for private reflection, meditation and prayer are also available to our staff working at ANSTO's Clayton campus.

These spaces accommodate all religious affiliations and denominations, and are part of ANSTO's ongoing commitment to provide facilitates that enable balance between personal, work and faith-based commitments.

LGBTQI+ support

Our LGBTI Staff Network's mission is to provide support, networking and advocacy to gender diverse and same-sex attracted people at ANSTO. Our network provides visibility to gender diversity and LGBTQI+ issues, and support and advocacy for those encountering difficulties in the workplace. They provide important input into ANSTO policies and procedures on gender diversity and LGBTQI+ issues.

Individuals in our network work are role models and mentors, and outreach to LGBTQI+ youth in STEM.

APPENDIX 2

Functions and powers of the organisation under the *ANSTO Act 1987*

In September 2017, the Australian Parliament passed legislation amending ANSTO's governing legislation, the *Australian Nuclear Science and Technology Organisation Act 1987 (ANSTO Act)*. The amendments came into force on 19 September 2017.

The amendments (in sections 3 and 5) provide greater flexibility to ANSTO in its activities, including the use of its property, facilities and resources for science, technology, innovation and training purposes.

This includes enabling the establishment of an Innovation Precinct at ANSTO's Lucas Heights campus, and the potential establishment of similar precincts in association with other ANSTO campuses.

More broadly, the amendments facilitate enhanced collaboration between industry, universities and ANSTO across all its campuses. The amendments also update and expand the constitutional references in the *ANSTO Act* to better reflect ANSTO's current and proposed activities (the repeal of subsection 5(5) and insertion of section 6A).

The amendments are highlighted in blue italics below.

Section 3: Interpretation

"scientific research, innovation and training" includes the following, whether or not related to nuclear science and nuclear technology:

(a) any activities in the fields of natural or applied science (including engineering and technology) for the extension or application of knowledge;

(b) any activities that involve innovation or high levels of technical risk for the purposes of creating new or improved materials, products, devices or processes;

(c) the education and training of persons in matters related to activities mentioned in paragraph (a) or (b).

Section 5: Functions of Organisation

(1) The functions of the Organisation are:

- **(a)** to undertake research and development in relation to:
  - **(i)** nuclear science and nuclear technology; and
  - **(ia)** the application and use of nuclear science and nuclear technology; and
  - **(ii)** the production and use of radioisotopes, and the use of isotopic techniques and nuclear radiation, for medicine, science, industry, commerce and agriculture; and
  - **(iii)** such other matters as the Minister directs; and
- **(b)** to encourage and facilitate the application and use of the results of such research and development; and

(ba) to condition, manage and store radioactive materials and radioactive waste, arising from:

- **(i)** the Organisation's activities (including the production of radioactive materials for other persons); or
- **(ii)** the activities of companies in which the Organisation holds a controlling interest (including the production of radioactive materials for other persons); or
- **(iii)** the use by other persons of radioactive materials produced by the Organisation or such companies; or
- **(iv)** the activities of other persons who are specified in the regulations; and

(bb) to condition, manage and store radioactive materials and radioactive waste generated, possessed or controlled by the Commonwealth or a Commonwealth entity; and

(bc) to condition, manage and store radioactive materials and radioactive waste at the request of:

- **(i)** a law enforcement agency; or
- **(ii)** a Commonwealth, State or Territory agency responsible for the management of emergencies or disasters;

including, but not limited to, radioactive materials or radioactive waste involved in, or arising out of, a radiological incident or a radiological emergency; and

(bd) to condition, manage and store radioactive waste that has been, or is to be, sent to Australia under contractual arrangements relating to the conditioning or reprocessing of ANSTO spent nuclear fuel; and

(c) to produce, acquire, provide and sell goods, and to provide services, that are:

- **(i)** in connection with the production and use of radioisotopes, and the use of isotopic techniques and nuclear radiation, for medicine, science, industry, commerce and agriculture; or
- **(ia)** in connection with the conditioning, management and storage of radioactive materials or radioactive waste; or
- **(ib)** in connection with nuclear science and nuclear technology; or
- **(ic)** in connection with the application and use of nuclear science and nuclear technology; or
- **(ii)** otherwise in connection with matters related to its activities; and

(d) to act as a means of liaison between Australia and other countries in matters related to its activities; and

(e) to provide advice on aspects of:

- **(i)** nuclear science and nuclear technology; and
- **(ii)** the application and use of nuclear science and nuclear technology; and
- **(iii)** other matters related to its activities; and

(ea) to make available to other persons, *whether or not on a commercial basis*, the knowledge, expertise, equipment, facilities, resources and property of the Organisation by:

(i) providing training and management expertise; or

(ii) selling or leasing equipment; or

(iii) leasing land, buildings and facilities; or

(iv) taking any other action that the Organisation thinks appropriate; and

Note: See also subsection (4A) of this section and subsection 6(3).

(f) to co-operate with appropriate authorities of the Commonwealth, the States and the Territories, and with other organisations and institutions in Australia or elsewhere, in matters related to its activities; and

(g) to publish scientific and technical reports, periodicals and papers on matters related to its activities; and

(h) to collect and sell or distribute, as appropriate, information and advice on matters related to its activities; and

(j) to arrange for training, and the establishment and award of scientific research studentships and fellowships, in matters related to its activities; and

(k) to make grants in aid of research into matters related to its activities; and

(m) to make arrangements with universities and other educational research institutions, professional bodies and other persons for the conduct of research or of other activities in matters related to its activities.

(1A) A regulation made for the purposes of subparagraph (1)(ba)(iv) must not have the effect of authorising the premises on which the Lucas Heights Research Laboratories are situated to become a national nuclear waste repository.

(1B) In subsection (1A):

"national nuclear waste repository" means a site chosen by the Commonwealth, after the commencement of this subsection, for the storage of nuclear waste with a view to it never being moved to another site.

(1C) Without limiting paragraph 5(1)(bb):

(a) radioactive materials and radioactive waste generated by a Commonwealth contractor under a contract between the Commonwealth contractor and the Commonwealth or a Commonwealth entity are taken to be generated by the Commonwealth or the Commonwealth entity, as the case requires; and

(b) radioactive materials and radioactive waste possessed or controlled by a Commonwealth contractor under a contract between the Commonwealth contractor and the Commonwealth or a Commonwealth entity are taken to be possessed or controlled by the Commonwealth or the Commonwealth entity, as the case requires.

(2) The Organisation shall not undertake research or development into the design or production of nuclear weapons or other nuclear explosive devices.

(3) In undertaking its functions, the Organisation is to have regard to:

(a) the Commonwealth Government's national science, technology and energy policy objectives; and

(b) the Commonwealth Government's commercialisation objectives for public research institutions.

(4) The Minister shall not give a direction under subparagraph (1)(a)(iii) to the Organisation to undertake research or development in relation to a matter unless the Minister is satisfied that research or development by the Organisation in relation to that matter would be an effective use of the staff of the Organisation, and would not duplicate unnecessarily any activity being carried on, or proposed to be carried on, by any other agency or authority of the Commonwealth.

(4A) Without limiting paragraph (1)(ea), the Organisation may perform its function under that paragraph for the purposes of scientific research, innovation and training.

Section 6: General powers of Organisation

(1) Subject to this Act, the Organisation has power to do all things necessary or convenient to be done for or in connection with the performance of its functions and, in particular, has power:

(a) to enter into contracts;

(b) to acquire, hold and dispose of real or personal property;

(c) to occupy, use and control any land or building owned or held under lease by the Commonwealth and made available for the purposes of the Organisation;

(d) to erect buildings and structures and carry out works;

(e) to form, or participate in the formation of, a company or partnership;

(f) to appoint agents and attorneys, and to act as an agent for other persons;

(g) to engage persons to perform services for the Organisation;

(h) to design, produce, construct and operate equipment and facilities; and

(j) to do anything incidental to any of its powers.

(2) The powers of the Organisation may be exercised within or outside Australia.

(3) To avoid doubt, the Organisation has the power to construct buildings and facilities for the sole purpose of performing the function referred to in paragraph 5(1)(ea).

Subsection 5(5) has been repealed and replaced with:

Section 6A Constitutional limits

(1) *The Organisation may perform its functions only:*

- ***(a)*** *for purposes relating to activities that are peculiarly adapted to the government of a nation and cannot otherwise be carried on for the benefit of the nation; or*
- ***(b)*** *for purposes relating to trade and commerce:*
  - ***(i)*** *between Australia and places outside Australia; or*
  - ***(ii)*** *among the States; or*
  - ***(iii)*** *within a Territory, between a State and a Territory or between 2 Territories; or*
- ***(c)*** *for purposes relating to postal, telegraphic, telephonic or other like services; or*
- ***(d)*** *for purposes relating to the security or defence of Australia; or*
- ***(e)*** *for purposes relating to astronomical and meteorological observations; or*
- ***(f)*** *for purposes relating to statistics; or*
- ***(g)*** *for purposes relating to weights and measures; or*
- ***(h)*** *for purposes relating to copyrights, patents of inventions and designs, and trade marks; or*
- ***(i)*** *for purposes relating to the provision of medical and dental services; or*
- ***(j)*** *for purposes related to external affairs, including:*
  - ***(i)*** *giving effect to any international agreement to which Australia is a party; and*
  - ***(ii)*** *addressing matters of international concern; and*
  - ***(iii)*** *by way of the performance of its functions in a place outside Australia; or*
- ***(k)*** *for purposes relating to the relations of the Commonwealth with the islands of the Pacific; or*
- ***(l)*** *in, or for purposes relating to, a Territory; or*
- ***(m)*** *in, or for purposes relating to, a Commonwealth place (within the meaning of the Commonwealth Places (Application of Laws) Act 1970); or*
- ***(n)*** *for purposes relating to matters incidental to the execution of any of the legislative powers of the Parliament or the executive power of the Commonwealth.*

(2) *A term used in subsection (1) and the Constitution has the same meaning in that subsection as it has in the Constitution.*

APPENDIX 3

Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act), section 516A

Environmental protection

ANSTO undertakes education, research and innovation to enhance scientific understanding of the environment and to provide solutions for a sustainable planet.

ANSTO's commitment to environmental protection and sustainability principles is defined in its Corporate strategic plans, Environmental Policy and Organisational core values – and in its new Logo. We are committed to effective stewardship, the sustainability of our operations and to responsibly interact with the local ecology and biosphere, and to protect it. We minimise our environmental footprint through continuing to apply the principles of Ecologically Sustainable Development (ESD) and by the prevention, minimisation and control of pollution.

These values are integral to ANSTO's Business Management System – the framework that defines how business is conducted to deliver outcomes to our customers and stakeholders in a safe, consistent and environmentally responsible manner. Objectives and targets for safe, secure and sustainable operations are implemented through documented operational and business plans at all levels of the organisation.

Environmental protection is mandated when planning and undertaking major capital works and any proposed activities which may fall under the *EPBC Act* are assessed for referral to the Department of the Environment and Energy. Proposals for new (or modifications to existing) facilities or activities also undergo a rigorous internal safety, regulatory and environmental assurance process.

Environmental awareness is promoted throughout the organisation via inductions, the staff intranet, training and communication programs.

Environmental and quality management systems

To provide assurance that ANSTO is maintaining sound environmental protection practices, we maintain an environmental management system (EMS) that is certified to the International Standard ISO 14001 for all three sites, including the ANSTO Nuclear Medicine facility which became operational in 2019. This standard requires that:

- the environmental context of the organisation and its operations is defined;
- its environmental impacts and compliance obligations are identified, with the risks managed and mitigated;
- an effective measurement and review system is in operation; and
- there is organisational commitment to continual improvement.

Our extensive environmental monitoring program also operates within a quality framework that is certified to the ISO 9001 standard for Quality Management Systems.

The ANSTO Environmental Management System (EMS) Strategy FY14-FY19 was evaluated against a new suite of key performance indicators, targets and action plans and a revised EMS strategy is being developed for FY20 onwards which will place further emphasis on the United Nations Sustainable Development Goals. The Executive Committee for Workplace Health & Safety and Environment supports the implementation of this strategy and provides oversight of the environmental management system.

Environmental performance

ANSTO aims to reduce its environmental footprint by minimising the generation of waste, monitoring the consumption of resources such as hydrocarbon fuels, paper, electricity and water, and by recycling consumables. We also monitor and annually report our carbon footprint through the National Greenhouse and Energy Reporting (NGER) Scheme and participate in the Sustainability Advantage Program run by the NSW Office of Environment and Heritage for which we were recently awarded a silver partnership award. A program to assess the biodiversity within ANSTO's Lucas Heights Bushland Perimeter has continued to deliver improvements in the eradication of invasive weed species.

The performance indicators in **Table 5** incorporate all three campuses where practicable. The electricity data shows that over the past four years ANSTO's total electricity consumption has slightly increased. Whilst ANSTO continues to look for electricity savings as per the program introduced in FY17, expanded infrastructure and hotter than normal summers are expected to impact electrical consumption. Examples of where ANSTO invests in renewable energy include pathway and streetlights using standalone integrated solar PV/battery storage systems and solar hot water and electricity.

Table 5. Environmental performance indicators for ANSTO sites

Resource Usage	Units	FY 2016	FY 2017	FY 2018	FY 2019	Change on previous year
Electricity	GWh	67.2	66.6	67.2	68.5	+1.9%
Water	m3	315,694	320,369	318,438	323,898	+1.7%
Passenger vehicle petrol and diesel	L/100km	8.98	8.65	8.26	8.20	-0.73%
Waste Water [1]						
Wastewater discharged to sewer	m3	89,235	103,024	75,916	76,711	+1.0%
Landfill and Recycled Waste [1]						
Waste sent to landfill	tonnes	226	237	259	308.7	+19%
Recycled cardboard + paper	tonnes	22.3	85.5	114	130.5	+14.5%
Recycled co-mingled containers	tonnes	5.9	16.7	18.2	20.5	+12.6%
Other recycled streams [2]	tonnes	19.8	12.9	24.8	31.5	+27%
Landfill diversion rate	%	17.5	33.2	37.7	37.1	-0.6%

Notes: 1. Data for the Lucas Heights site only (includes tenants).
2. Other recycling streams include batteries, ferrous and non-ferrous metal, gardening and e-waste.

In FY19 the Lucas Heights campus eceived only 726 mm of rainfall, which is lower than the thirty year average. In addition there were higher than average temperatures over summer and as a result, a significant level of irrigation was required across the campus. This was partly offset by utilising the rainwater capture system and communications to staff highlighting the ongoing need to use water efficiently.

ANSTO's landfill diversion rate has remained constant with 37% of waste being diverted from landfill. The ~19% increase in the total amount of waste to landfill is attributed to construction activity. ANSTO continues to recycle ferrous metals, garden waste, concrete, batteries, toner cartridges, mobile phones and redundant computer equipment. Many business units within ANSTO have set up recycling stations for alternative reuse/recyclable waste streams such as soft plastics, coffee grounds and compostable food scraps. This will continue to be a focus for new environmental strategies.

During FY2019 the amount of paper consumed increased by 18%. The causes for this are being investigated further however it may be due to more accurate reporting following the introduction of new printers that record paper use. The recycled paper content of print stock has increased to over 20%.

Environmental monitoring program

ANSTO conducts an extensive effluent and environmental monitoring program that measures radioactivity in authorised emissions to air and liquid effluent discharges to the sewer; and in samples of air, surface water, ground water, sediment and biota from the local environment. Local environmental radiation and weather conditions are reported online via the ANSTO webpage.

Results of environmental monitoring in 2018-2019 demonstrate that ANSTO's authorised releases of radioactive material to the air and sewer continue to be effectively controlled, complied with regulatory limits and had minimal impact on humans, wildlife or the environment.

Good water quality

Stormwater runoff from the Lucas Heights site does not contribute to any public drinking water supply, however ANSTO regularly monitors radioactivity in stormwater leaving the site, as well as sampling the nearby Woronora River. Results show that concentrations of tritium in water in the local environment have decreased since the HIFAR reactor closed in 2007, and are well below the level considered safe for drinking water by the World Health Organisation. Gross alpha and beta measurements were below the radiological levels set for surface waters under the previous NSW *Protection of the Environment Operations Act 1997*. In fact, the majority of results were below the screening level of 0.5 Bq/L for alpha and beta radioactivity set out in the Australian Drinking Water Guidelines.

An extensive network of shallow and deep groundwater wells is designed to monitor potential sources of contamination to groundwater, water quality and groundwater movement. Groundwater from the Lucas Heights site contains only naturally-occurring radionuclides and low levels of tritium. Groundwater near underground fuel storage tanks is analysed for petroleum hydrocarbons to check for evidence of leaks from tanks, however no leaks have been detected to date.

Authorised discharges within limits

Liquid effluent discharged from ANSTO sites into the sewer system complied with the acceptable limits for trade wastewater set by the Sydney Water Corporation. Compliance with these limits, together with effluent dilution studies, ensures that ANSTO's liquid effluent meets World Health Organisation drinking water standards for radioactivity at the Cronulla wastewater treatment plant.

Air ventilated from laboratories and facilities that handle radioactive materials is treated and/or filtered prior to discharge and continuously monitored. ARPANSA sets limits for airborne radioactive discharges from licensed ANSTO facilities and all airborne emissions were within the annual operating compliance limits.

Detailed reporting

Reports on airborne and liquid effluent discharges are submitted to the relevant regulatory authorities on a quarterly basis. Details of our environmental monitoring program are on the ANSTO website and the results and findings are available on request. In addition, ANSTO reports real-time environmental radiation dose-rates recorded in the nearby suburb of Engadine via the ANSTO webpage. The weather data for Lucas Heights are also available on ANSTO's website and published by the Bureau of Meteorology on the Lucas Heights Weather Observations page.

ANSTO reports annually to the Energy Efficiency in Government Operations (EEGO) and National Greenhouse and Energy Reporting (NGER) programs; both of these reports are available on the ANSTO website.

All staff are encouraged to report early and often on any potential or actual safety and environmental incidents. All incidents are subsequently investigated, actioned and mitigation controls evaluated for effectiveness via ANSTO's reporting system.

Safe waste management

ANSTO has maintained safe and effective management of its radioactive wastes for many years. There is minimal environmental impact from the storage of solid radioactive waste since there are no ongoing emissions or energy requirements, apart from the packaging process and building footprint. One of the waste minimisation strategies involves concentration of intermediate level liquid waste using a drum dryer; the electricity consumption of this is offset by the reduction of packaging, handling and storage space required.

Liquid wastewater comprising mainly sewage with some trade waste is tested for compliance with limits for radioactivity before being discharged to the sewer. Concentration limits for non-radioactive materials such as ammonia, zinc and total dissolved solids were also met. Sydney Water conducts independent testing of ANSTO's liquid effluent discharges and the Trade Waste Agreement is periodically reviewed to provide assurance that ANSTO's discharges are fully characterised, remain within authorised limits and pose no threat to the environment. Effluent from the Sutherland Shire undergoes tertiary treatment at the Cronulla wastewater treatment plant and is ultimately discharged to the ocean at Potter Point. Analyses of marine biota (fish, seaweed and barnacles) from Potter Point confirmed that wastewater from ANSTO has a negligible effect on the local marine environment.

ANSTO continues to support a national approach to safe waste management, including the establishment of a National Radioactive Waste Management Facility (NRWMF).

Little Forest Legacy Site

ANSTO is responsible for the Little Forest Legacy Site (LFLS) located within the 1.6km buffer zone. This site, formerly known as the Little Forest Burial Ground (LFBG), was used by the Australian Atomic Energy Commission and other government agencies during the 1960's to dispose of waste containing low levels of radioactivity and non-radioactive beryllium oxide, in a series of shallow trenches. There has been ongoing monitoring, maintenance and management of the site since 1966 including routine air, soil and groundwater testing, results of which are publicly available and confirm that the site is being safely managed.

The site is subject to a licence issued by ARPANSA and is managed by ANSTO on behalf of the Government. ANSTO has established a steering committee for the ongoing management of LFLS and continues to conduct detailed scientific studies of the site, in order to investigate options for the final disposition of the radioactive material and to ensure the continued safe management of the site.

Dose levels low

Environmental gamma radiation levels are continuously measured by thermoluminescent dosimeters at the Lucas Heights site and averaged 1.36 mSv/yr for 2018-19. The environmental dose recorded in surrounding suburbs and at the Cronulla wastewater treatment plant were also at normal background levels with an average of 1.21 mSv/yr (the national average natural background radiation dose is 1.5 mSv/yr).

Studies carried out of ANSTO's liquid effluent discharges to sewer have confirmed that the radiological risk to humans (working at the Cronulla wastewater treatment plant or swimming in the sea near the Potter Point ocean outfall) is negligible.

Computer modelling is used to estimate the potential radiation dose to people from airborne emissions at the Lucas Heights site. The model inputs include the quarterly stack emission results, local weather data and conservative assumptions about environmental exposure pathways. The maximum potential dose to local residents from ANSTO's airborne emissions in 2018-19 was calculated to be 0.0027 millisievert (mSv). This is less than 0.3 per cent of the annual public dose limit of 1 mSv established by ARPANSA.

Maximum Annual Effective Dose from Airborne Emissions at 1.6 km

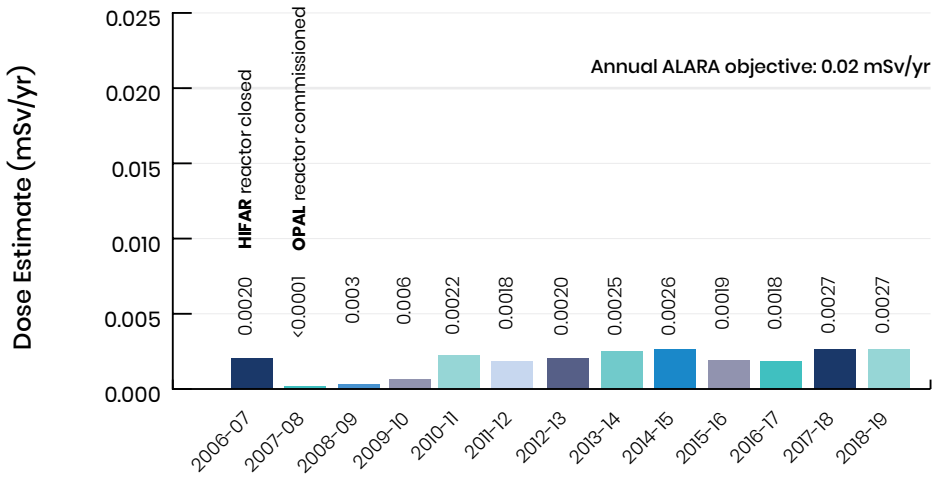


Figure 1: Maximum estimated annual effective dose from LHSTC airborne discharges at the boundary of ANSTO's 1.6 km buffer zone, July 2006 to June 2019.

Doses from ANSTO's airborne emissions in 2018-2019 also remained well below the 0.02 mSv 'as low as reasonably achievable' (ALARA) performance objective despite increased production of beneficial medical isotopes (see **Figure 1**). For its closest neighbours, ANSTO's activities added less than 0.2 per cent to the 1.5 mSv dose that every Australian receives from natural background radiation each year, as shown in **Figure 2**.

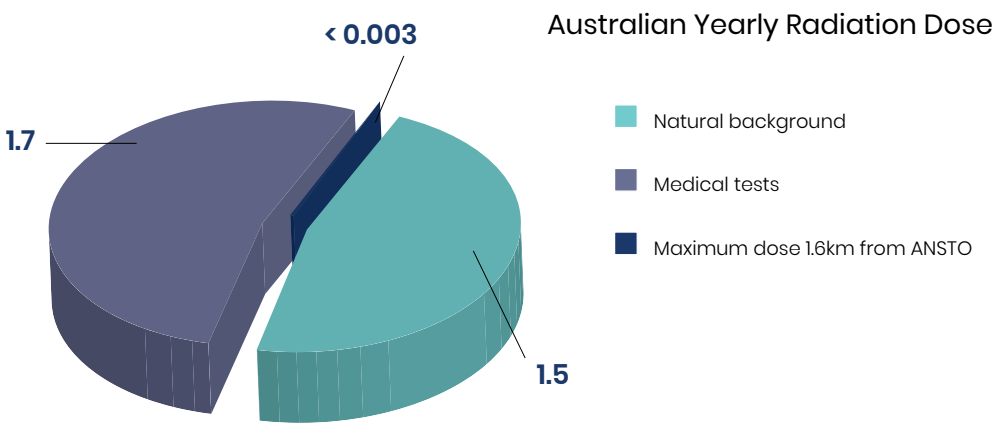


Figure 2: The average annual dose received by Australians from various sources compared to the maximum potential airborne dose to ANSTO's nearest residents in 2018-2019.

*Source: ARPANSA Fact Sheet http://www.arpansa.gov.au/pubs/factsheets/IonisingRadiationandHealth.pdf

Radiological protection of wildlife

A screening assessment was performed in 2018 to investigate the potential dose rates received by local wildlife from radiological effluent releases associated with operations at the Lucas Heights site, including expected releases from the ANM Mo-99 production facility.

The assessment applied the methodology laid out in ARPANSA Guide: *Radiation Protection of the Environment*, which is consistent with current international best practice approaches. Dose assessments were performed for a range of terrestrial and marine organisms using conservative radioactivity concentrations for the air and water exposure pathways (determined from routine stack monitoring of airborne emissions and liquid effluent releases to sewer).

Even using a very conservative approach, the potential dose rates to all organisms were below the lowest benchmark for potential harmful effects (10 µGy/hr). These results were consistent with previous studies that concluded no significant impacts to wildlife from ANSTO's operations.

Managing the ANSTO bushland perimeter

ANSTO manages a section of land with an area over ~450 ha within the 1.6 km buffer zone centred on the existing HIFAR reactor in accordance with the ANSTO Bushland Perimeter Plan of Management, updated in 2018. This area comprises the Lucas Heights Science and Technology Centre, a number of legacy waste disposal sites and ~350 ha of undeveloped native bushland and riparian zones. A qualitative review of the biodiversity potential of the ANSTO Bushland Perimeter assessed 110 sample sites against benchmark criteria for the different vegetation communities, such as native species diversity and density, connectivity, soil exposure and weediness. The results of this assessment are being used to prioritise management actions including: revegetation and rehabilitation works, stormwater system upgrades, and weed management programs. This assessment will form the baseline for future assessments utilising the same benchmark criteria to evaluate improvement programs and any ongoing impact of ANSTO's operations on the surrounding environment.

The area has numerous bush walking trails, and is actively managed through a program of regular inspections, maintenance, culling of feral animals and weed reduction programs. An ANSTO staff bush care group has been meeting monthly for a number of years to target high risk locations. The work of this group has seen the eradication of noxious weed species such as Crofton Weed, Cotton Bush, African Love Grass and Cassia from over two hectares of riparian vegetation within the ANSTO Perimeter Bushland. ANSTO also engages with the local Dharawal Indigenous Group to identify and protect areas of cultural importance within the ANSTO Bushland Perimeter.

A significant bushfire occurred within ANSTO's Bushland Perimeter in April 2018, resulting in 200 ha of bushland being burnt. ANSTO is monitoring the progress of vegetation regrowth and any weed infestations and will respond according to best practice. Annual hazard reduction burns are planned in consultation with NSW Rural Fire Services.

Referrals under the EPBC Act

Within this reporting period ANSTO did not submit any new referrals under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Construction activities for the expansion of the solid low-level waste facility and the ANSTO Nuclear Medicine Mo-99 production facility at the Lucas Heights site were completed, and construction of the Synroc Waste Treatment Facility commenced.

Regular independent inspections have been undertaken throughout the projects to evaluate conformity with the environmental commitments made by ANSTO in the referrals.

Mitigating environmental impacts

ANSTO encourages staff to cycle, carpool or take public transport to get to work and to walk rather than drive around the site. ANSTO provides staff with a carpooling website and regular shuttle-bus services to and from the local railway station. Numerous paths, tracks, bike racks, lockers and shower facilities are available for use by the avid walker/cyclist.

The ANSTO online 'swap shop' continues to provide a forum for staff to pass on unwanted goods. From furniture to chemicals to analytical equipment, by exchanging useful products staff can help save time, money and the environment by reducing waste going to landfill. The online Equipment Database tool also allows staff to share resources and knowledge whilst minimising the procurement of new equipment.

ANSTO's chemical management system enables staff in different business areas to share and track chemical resources, which will reduce the need to procure new chemicals. ANSTO is also utilising the system to better determine its reporting requirements under the National Pollution Inventory and to improve the identification and control of environmentally hazardous chemicals.

In line with ANSTO's focus on digitisation, new IT systems and solutions including digital authorisations continue the transition to a paperless office which reduces power and paper consumption. Many functions such as budgeting, business planning, procurement, maintenance, recruitment, on-boarding, training and waste transfers are now managed through online user interfaces.

ANSTO has adopted an integrated approach to planning and decision-making across the business, to optimise the management of all that we do. By managing its people, resources, and infrastructure more effectively, ANSTO aims to increase productivity thereby enhancing the environmental sustainability of our operations.

Accordance with ecologically sustainable development (ESD) principles

Ecologically sustainable development (ESD) is embedded into ANSTO's core values. The ANSTO Building Code (ABC) provides the minimum standard that new facilities at ANSTO must conform with. Within the ABC, the principles of ESD are mandated through the requirement for all new and refurbished buildings to have an independent ESD consultant involved in the design, achieve a target minimum 4.5 star NABERS rating and comply with the requirements for the Energy Efficiency in Government Operations (EEGO) Policy. Furthermore, minimum standards for the efficient use of water in offices and laboratories, installation of rainwater tanks, re-use of waste water and sub-metering are enforced through the ABC.

ANSTO has integrated environmental protection into management processes by requiring project/construction environmental management plans (P/CEMP) at the project planning phase. All capital projects such as construction of buildings, infrastructure and support facilities must have P/CEMP in place to prevent environmental impacts such as soil erosion, dust, noise and discharges to stormwater. Independent oversight of these projects includes the approval of P/CEMPs, ad-hoc inspections and formal audits.

ANSTO is also moving to more sustainable procurement practices.

Other ANSTO activities that contribute to improved social, environmental and economic outcomes include our research into significant environmental issues such as air quality, soil erosion, water resource management, wetland health, biodiversity, food provenance, climate variability and global warming impacts such as rising sea levels and temperatures on marine ecosystems.

ANSTO's support of nuclear non-proliferation ideals and the development of nuclear safeguards also accords with ESD principles. We contribute to the global non-proliferation agenda through the Global Initiative to Combat Nuclear Terrorism and collaborate with bodies such as the International Atomic Energy Agency and the Comprehensive Test Ban Treaty Organisation.

Finally, ANSTO's commitment to environmental protection means that special emphasis is placed on reducing our environmental footprint by minimising waste and the consumption of resources and by recycling consumables. Our scientific research provides practical, science-based advice to inform decision makers, creating opportunities to conserve resources and sustain our fragile environment. It also ensures that we manage our past and current waste in a manner that protects human health and the environment, now and in the future.

APPENDIX 4

Work Health and Safety Act 2011

High reliability – Safety at ANSTO

ANSTO provides a safe and healthy workplace for all workers and other persons under its control, through planned strategies to prevent death, work-related injury and ill health. We are each responsible for our own safety, that of our colleagues and of the public.

Through core values, ANSTO's senior leadership is committed to delivering excellence in our Work, Health and Safety (WHS) performance. ANSTO remains committed to our overriding safety goal of 'zero tolerance for harm to anybody, anywhere, anytime.' Leadership in WHS is an important aspect in achieving continuous improvement in WHS. The Executive Work, Health and Safety and Environment (WHSE) Committee includes various members of the ANSTO's Group Executive as well as ANSTO's Chief Nuclear Officer. The committee provides continued leadership and oversight by monitoring site-wide risks and learning from incidents that had the potential of a major impact to people, plant/equipment and environment and by endorsing key safety related projects and initiatives.

ANSTO continued to explore the integration of complementary functions and the sharing of key information during 2018-2019. A High Reliability group has been formed which brings together the High Reliability support function, Radiation Protection Services (RPS), Work Health and Safety (WHS) and Emergency Management (EM) groups. A General Manager High Reliability has been appointed. This role will lead the operation and management of the group in delivering enhanced safety and emergency capability and engagement which supports the organisation in achieving the strategic plan. The team leads the organisation to achieve true 'high reliability' in a complex hazardous environment that operates safely without catastrophic events.

ANSTO's operations cover a diverse range of activities and geographic locations with interfaces to the environment, our workers, stakeholders, visitors and the community in general. The nuclear and medical nature of our organisation necessitates a more holistic view of the application of safety rather than the conventional focus required of work health and safety alone. The hierarchy of safety responsibility at ANSTO is shown in **Figure 3**.

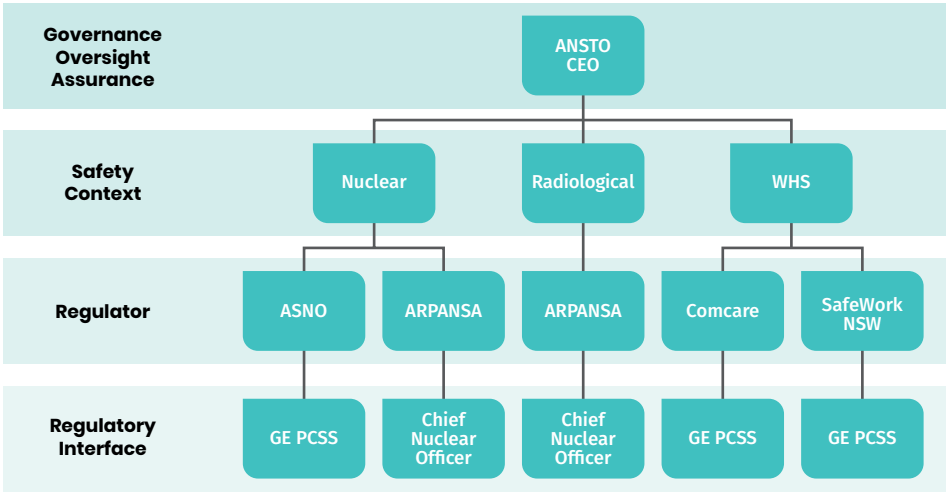


Figure 3: Hierarchy of safety responsibility and regulatory interface

Work Health and Safety (Work Health and Safety Act 2011)

Strategy

During 2018-2019 the Executive WHSE Committee endorsed the ANSTO Work Health and Safety Strategy 2018-2022 outlining four key objectives:

1. Our workers will be value driven, prepared, trained, aware and engaged;
2. Our workplaces will be managed on a risk informed basis, fit for purpose, reviewed, maintained, compliant and cover all areas where our people work;
3. Our systems, processes and initiatives will be integrated and of high integrity, enabling, informing, measurement based and validated;
4. Our stakeholders will be engaged to improve WHS performance.

To achieve these objectives a number of actions have been identified and are being monitored by the Executive WHSE Committee.

Occupational hygiene

Occupational hygiene focuses on the risk management of occupational health hazards in the workplace by measuring exposure and designing and implementing control strategies to prevent ill health to workers.

The occupational hygiene monitoring program assesses exposure risks to current and legacy hazards including chemical, biological and physical agents in line with the legislative requirements. The program was expanded with exposure risk reviews being completed for many of ANSTO's tasks including decommissioning activities. This function provides support across ANSTO operations and projects by characterising and assessing the risks of these hazards.

The Health & Wellbeing Centre and Occupational Hygiene have been working closely to ensure ANSTO's health assessment activities are risk based and fit for purpose. As part of ensuring that our people are equipped with equipment that is fit for purpose ANSTO has introduced fit testing programs for respiratory and hearing protection equipment.

The hazards register continues to be a communication tool that lists known hazards, building information and corporate knowledge.

Key WHS achievements

The key WHS achievements for FY19 for the organisation are listed below.

1. Accreditation of all ANSTO campuses (NSW and Victoria) to ISO 45001 - Occupational Health and Safety Management Systems.
2. Reviewed and published the ANSTO Work Health and Safety Management System in consultation with staff, to produce a documentary framework designed to allow for the unique nature of risks associated with ANSTO operations, providing flexibility while maintaining compliance with ANSTO's legal requirements. (See **Figure 4**).

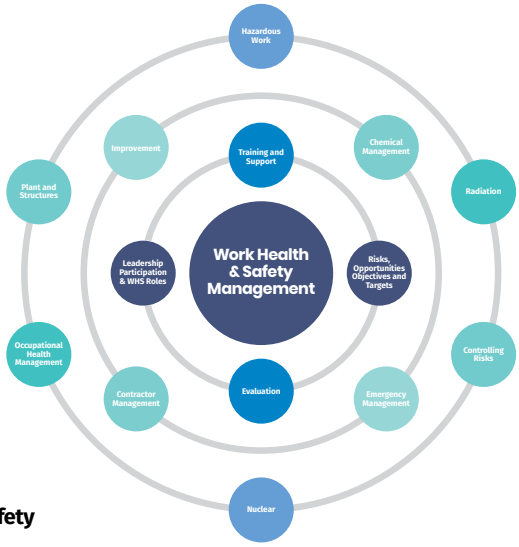


Figure 4: ANSTO Atom of Safety

3. Confirmation through review that ANSTO's asbestos disposal management system and record was compliant with legal requirements.
4. Enhanced training of ANSTO Occupational Health Nurse in workplace mental health and wellbeing, including formal training in mental health first aid.
5. Health and safety support an integral part of ANSTO major projects to achieve project delivery.

Safety awareness

All workers are continually engaged and informed through a risk based WHS focus program combined with safety alerts. Targeted safety topics included: strengthen safety in your area, be well at work, manage chemicals safely, beat the heat, vehicles safety, situational awareness and be safe with radiation. WHS alerts are used to provide information on emerging issues and lessons learnt relating to health and safety from inside and outside the organisation. Key WHS alerts during 2018–2019 included: safe use of pyrophoric substances, crystalline silica, recent Mo-99 incidents and potential high skin doses from radiation contamination.

In Australia, October is National Safe Work Month, a time for organisations to make their commitment to improving safety and health in their workplace. The theme of this year's program was developing and sustaining a psychologically healthy and safe work environment. Activities that were run at ANSTO sites included recognition of workplace safety champions, health promotion seminars, healthy morning or afternoon teas and engagement of consultant psychologists to provide information sessions and training.

Health and wellbeing of our people

The ANSTO Occupational Health & Wellbeing Centre provided advice, services and a comprehensive health program to workers throughout the 2018-2019 financial year. The Centre is staffed by two Occupational Health Nurses and a Rehabilitation Case Manager supported by a contracted Physiotherapist and Occupational Physician. The health programs included men's and women's health, influenza vaccinations, travel and work immunization, workplace conditioning programs, and ergonomic and work station assessments. The Occupational Health & Wellbeing Centre is a central point of support for all aspects of workers' health.

The early intervention strategies implemented by the ANSTO Health Centre continue to support the timely return of workers to pre-injury duties and keep workers engaged with ANSTO during the treatment and rehabilitation processes. The program focuses on providing early assessment and treatment to reduce the consequences of all injuries regardless of an accepted worker's compensation claim. This has proved successful in meeting ANSTO's goal of returning workers to normal duties, as productive team members as soon as possible. The ANSTO rehabilitation program continues to be compliant with the requirements of the *Safety, Rehabilitation and Compensation (SRC) Act* demonstrating effective procedures and programs are in place. The extension of the physiotherapy service has seen workers availing themselves of the service, allowing them to be productive members of ANSTO's workforce.

Workers' compensation

The ANSTO premium is dependent on the aggregate premium pool (the total premium to be charged across all Commonwealth agencies) and ANSTO's claim performance. ANSTO premiums are summarised in **Table 6**.

Table 6: ANSTO Workers' Compensation Premiums

Financial Year	ANSTO Premium
FY16/17	$826,655
FY 17/18	$736,528
FY 18/19	$574,523
FY 19/20*	$1,017,560

**The main drivers for this increase were an increase in the costs of claims (specifically in FY18) and an applied penalty. The penalty was an adjustment to ANSTO's contribution to the prior year's premium pool. The FY18 claims will continue to impact ANSTO's premium rate for a further three premium calculations.*

Regulator engagement

The main Safety Regulator that ANSTO engages with for WHS Oversight is Comcare.

ANSTO continued to work closely with Comcare during 2018–2019, with Comcare representatives visiting ANSTO campuses, gaining additional insights into ANSTO. These visits gave ANSTO insight into best practice activities and allowed us to gain a better understanding of the role of the regulator. This resulted in improved work health and safety outcomes for the business and key projects. Comcare continued to provide support, information and guidance regarding WHS legislative requirements to ANSTO's WHS team.

ANSTO is required to report incidents to Comcare under the section 35 of the *WHS Act*. This section defines a notifiable incident as:

- the death of a person, or
- the serious injury or illness of a person, or
- a dangerous incident.

During 2018-2019 nine dangerous incidents were reported to Comcare outlined in **Table 7**.

Table 7: Summary of incidents notified to Comcare.

Month of Incident	Description
October 2018	***Dangerous Incident:*** Electrical: Minor electric shock during work on light fittings.
December 2018	***Dangerous Incident:*** Electrical: Contact with a live cable during drilling operation.
February 2019	***Dangerous Incident:*** Projectile ejected from vessel: Small quartz vessel became pressurised, ejecting the quartz end cap that shattered on floor.
March 2019	***Dangerous Incident:*** Chemical Hazard: Workers splashed with sodium hydroxide.
March 2019	***Dangerous Incident:*** Dropped Load: Equipment on two wheel dolly over balanced and fell.
March 2019	***Dangerous Incident:*** Electrical: Mild electric shock received during fault finding during electrical maintenance.
April 2019	***Dangerous Incident:*** Electrical: contact with live cable during decommissioning activities.
May 2019	***Dangerous Incident:*** Electrical: charging of incorrect battery.
June 2019	***Dangerous Incident:*** Radiation Exposure: personal contamination to one staff member, direct exposure to contaminated pot of two staff members.

Training

ANSTO offers training in a range of work, health and safety related subjects to all workers. WHS training courses aim to provide the necessary information, instruction and skills to workers to assist them in meeting their legislative responsibility and to undertake work without risk to themselves, others and the workplace.

Incidents

The ANSTO Incident Management System consolidates all incidents and any associated actions into one location. The system has allowed for improved trending and data analysis for safety-related incidents which has supported evidence-based decision making. The ANSTO investigation process ensures the appropriate response and controls have been adopted in each case.

Workers are encouraged to report all incidents following ANSTO's 'No Blame – Full disclosure' principle. ANSTO continues to promote the reporting of all incident types. Refer to **Table 8**. The upward trend in reports indicates a strong reporting culture.

Table 8: Number of incidents (safety, operational and environmental) reported per year

Year	Number of Incidents
FY12	761
FY13	795
FY14	952
FY15	1,128
FY16	938
FY17	933
FY18	1,296
FY19	1,278

The ANSTO Incident Management System continues to provide enhanced analysis and trending of incidents including classification systems that identifies the types of incidents and clarification of the definition of an 'Opportunity for Improvement'.

The majority of incidents reported continue to be Opportunities for Improvements (OFIs), a key measure of ANSTO's reporting culture. In 2018-2019, 73 per cent of safety incidents were OFIs compared to 71 per cent (2017-2018), 80 per cent (2016-2017) and 82.5 per cent (2015-2016).

ANSTO staff are encouraged to report all types of incidents, with 40 per cent of incidents being near hits/misses or hazards/observations. All safety incidents are allocated an actual and potential impact rating. The potential impact rating identifies the 'worst case scenario' of the incident. The majority of reported safety incidents had a potential impact rating of low significance or minor.

The high reporting rate, especially of OFI and low significant/minor incidents highlights an ongoing positive reporting culture.

Lost shift and lost time injuries

Lost Shift Injury Frequency Rate (LSIFR) and Lost Time Injury Frequency Rate (LTIFR) are a safety performance measure at ANSTO that are used to separate serious injuries (LTI) from less serious injuries (LSI). (Refer **Table 9)**.

Table 9: Lost Shift and Time Injury Frequency Rates

Year	LSIFR	LTIFR
FY15	2.9	2.9
FY16	1.0	0.5
FY17	4.2	0.9
FY18	1.4	3.2
FY19	2.3	0.9

In 2018-2019 five Lost Shift Injuries and two Lost Time Injuries were recorded. Lost Shift injuries are injuries where workers required less than five days off work; Lost Time injuries are injuries that required five or more days off work. The early intervention program managed by the ANSTO Health and Wellbeing Centre aims to minimise the time taken off for work related injuries and allows workers to return to work as early as possible. The data in **Table 9**, indicates a downward trend in LTIFR's primarily due to early intervention. But in some cases, due to the injury this is not possible and extended time off work is taken. Refer to **Figure 5**.

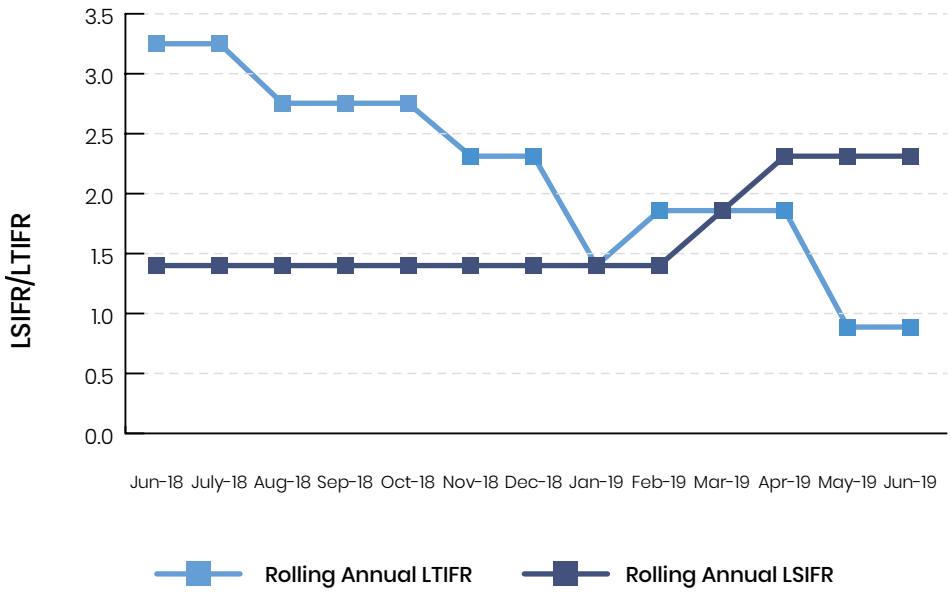


Figure 5: Rolling Annual Lost Shift/Time Injury Frequency Rate

Independent Safety Review of the ANSTO Health Approach to Occupational Radiation Safety and Operational Procedures

In June 2018 a review was conducted by a globally recognised panel of experts, following a directive issued to ANSTO by the regulator, ARPANSA. This required ANSTO to select and appoint an expert independent review team to recommend how to improve safety in the ageing radiopharmaceutical production facility and related matters. The panel was led by David Jones, who has extensive experience in management and production of safety cases and assessment for nuclear facilities in the UK and Europe. Other panel members included:

- Professor Andrew Hopkins – Expert in Human and Organisational Factors
- Dr Lynn Williams – Expert in Safety Culture and Organisational Baseline
- Dr Peta Miller – Expert in Human Factors
- Brent Rogers – Expert in Radiological Protection

The final report by the independent expert review team contains 85 recommendations in respect to ANSTO, to ARPANSA and to the Australian Government. ANSTO is managing the recommendations relevant to our operations with an associated action plan.

Emergency management

Emergency management is part of the business resilience framework that allows ANSTO to respond to disruptive incidents in a cohesive manner that is consistent with organisational objectives. ANSTO's Emergency Operations are responsible for the management, coordination, preparation, resourcing and overall operational response for all ANSTO incidents and emergencies.

The New South Wales (NSW) Government Lucas Heights Emergency Sub Plan has been updated with input from ANSTO. This plan is a sub-plan of the NSW State Emergency Management Plan and provides detailed arrangements for NSW emergency services to respond to advice that there is a loss of control with the potential for or actual release of radioactive material from the Lucas Heights Science and Technology Centre.

ANSTO is working to align and implement the requirements of the International Atomic Energy Agency (IAEA) Safety Standards Series No. GSR Part 7, *Preparedness and Response for a Nuclear or Radiological Emergency* (2015) and other related international guidance. The implementation of this plan has been monitored by ARPANSA as part of routine regulatory oversight.

Radiation safety

(Australian Radiation Protection and Nuclear Safety Regulations 2018)

Everyone in the world is exposed to ionising radiation from natural sources. People may also be exposed to radiation from non-natural sources, including nuclear medicine procedures for diagnosis and treatment of certain illnesses. Personal radiation exposure ('dose') is measured in sieverts (Sv), however, typical annual exposures are so small that they are usually expressed in units of one thousandth of a sievert, known as a millisievert (mSv).

Strategy

The ANSTO Radiation Protection Strategic Plan is used to strengthen ANSTO's high-performance culture. The four objectives of the plan are:

1. Improve radiation safety culture
2. Reduce radiological safety risks
3. Ensure continued regulatory compliance
4. Generate continuous improvement in radiological protection.

Continuous improvement

ANSTO supports Nuclear Powered Warship visits to Australian ports under the Commonwealth Plan for Nuclear Powered Warship visits (OPSMAN 1) by acting as the Leader Radiation Monitoring Group and are the Commonwealth operational representative during a visit. ANSTO also advises the State or Territory on emergency responses during a radiological or nuclear emergency associated with the visit.

Occupational exposures

According to the most recent data from ARPANSA, the average effective dose an Australian receives from natural background radiation (excluding medical sources) is 1.5 mSv per year. Federal, State and Territory regulations require that a member of the public should receive no more than 1 mSv effective dose per year from radiation sources in addition to background radiation and medical procedures.

The regulatory annual limits for radiation workers (Occupationally Exposed Persons) are:

- 20 mSv effective whole body dose (averaged over five years, with no more than 50 mSv in any one year);
- 20 mSv equivalent lens of the eye dose (averaged over five years, with no more than 50 mSv in any one year);
- 500 mSv equivalent dose to the skin;
- 500 mSv equivalent dose to the (hands and feet).

This is derived from recommendations made by the International Commission on Radiological Protection (ICRP 103) that have specified three basic principles for radiation protection, which are applied at ANSTO. These principles are:

1. Justification of a Practice – All exposures to ionising radiation shall have a positive net benefit.
2. Optimisation of Protection – All exposures shall be as low as reasonably achievable (ALARA), taking into account economic and societal factors..
3. Dose Limitation – All exposures from planned exposure situations shall be less than the relevant statutory limit.

Limits are insufficient in themselves to ensure the best achievable protection under the prevailing circumstances, and both the optimisation of protection and the limitation of doses and risks to individuals are necessary to achieve the highest standards of safety.

The radiation exposure of ANSTO's workers, who are routinely engaged in working with ionising radiation, is monitored by our specialist dosimetry service, with records of exposures maintained.

Monitoring results for calendar year 2018 show that radiation doses received by ANSTO workers remain significantly below regulatory limits. In 2018 the average effective dose across all ANSTO workers was 0.4 mSv. **(Table 10)**. (This is equivalent to receiving two chest x-rays[1] or flying from Melbourne to London and back three times.[2] It is also about 20% of the average background radiation exposure received just from living in Australia).

[1] https://www.iaea.org/Publications/Factsheets/English/radlife
[2] https://www.arpansa.gov.au/understanding-radiation/radiation-sources/more-radiation-sources/flying-and-health

Table 10: Effective whole body dose

ALL STAFF	Calendar Year				
Effective Dose	**2014**	**2015**	**2016**	**2017**	**2018**
Max. Individual Dose (mSv)	6.44	5.3	5.4	5.2	5.8
Average Dose All ANSTO Workers (mSv)	0.5	0.5	0.5	0.5	0.4
Collective Effective (Person-mSv)	447	463	529	546	369

Table 11 shows the distribution of individual effective doses over the same period. The graph in **Figure 6** compares maximum effective dose to a single worker and the average effective dose across all relevant ANSTO workers.

Table 11: Distribution of individual effective dose

ALL STAFF	Calendar Year				
Effective Dose Range	**2014**	**2015**	**2016**	**2017**	**2018**
0 to <1mSv	894	890	902	918	949
1 to <2 mSv	47	59	78	71	38
2 to <5 mSv	21	23	19	27	18
5 to 7 mSv	4	1	3	2	4
>7 mSv	0	0	0	0	0

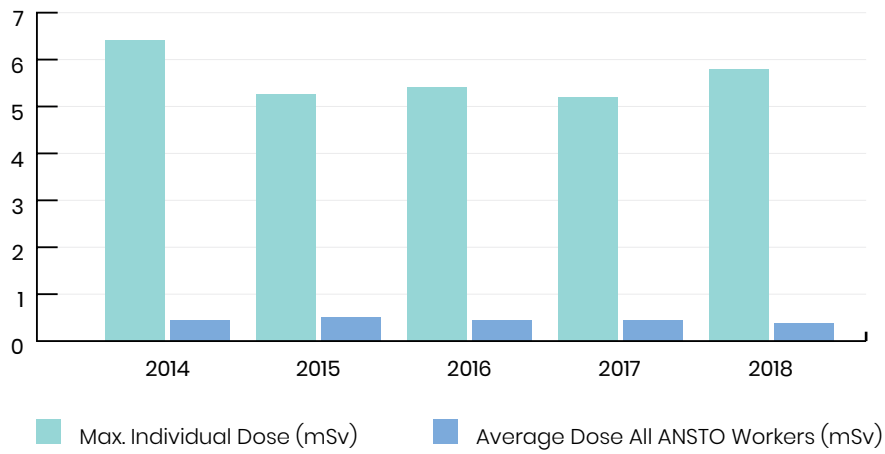


Figure 6: Comparison of maximum and average effective doses.

Extremity exposure

The exposure to the hands of ANSTO workers is routinely measured for those operations that require workers to have their hands closer to sources of radiation, such as during radiopharmaceutical product testing. Generally, the radiation exposures to the hands are very low compared to the applicable dose limit of 500mSv. With the exception of three workers, the maximum extremity dose to ANSTO operators in 2018 and year to date 2019 was 82 mSv (i.e. approximately 16.5 per cent of the dose limit) with more than 98 per cent of workers' extremity exposures being below 50 mSv. The exceptions were caused by an accidental exposure due to Mo-99 contamination. Significant radioactive contamination was transferred to the surface of a shielding pot and operators were exposed locally to the hands when they wiped the pot surfaces. The estimated dose to the hands from this exposure has initially indicated that three operators have exceeded the annual dose limit of 500mSv, but received less than the threshold for tissue reactions, such as reddening of the skin.

Regulator engagement

The main regulator ANSTO engages with for radiation and nuclear safety is ARPANSA.

ANSTO is required to report accidents under section 58 of the *Australian Radiation Protection and Nuclear Safety Regulations 2018*. An accident is any occurrence, associated with controlled apparatus, controlled materials or a controlled facility, which results in, or has the potential to result in, exposure to radiation, such as to cause injury, damage or harm to any person or the environment. During 2018-2019 one accident was reported to ARPANSA. This was Radiation Exposure: personal contamination to one staff and direct exposure to contaminated pot of two staff. Additionally, ANSTO was found in breach of its licences on six occasions. Refer to **Table 12.**

Table 12: Summary of ANSTO breaches

Facility	Breach
ANSTO Health	Failure to comply with the requirements of an Operating Limits Condition
ANSTO Camperdown Campus	Failure to review and update plans and arrangements every three years
ANSTO Camperdown Campus	Failure to comply with requirements of ARPANS 1999 Regulation 51 to seek approval from ARPANSA for a change significant to safety
Little Forest Legacy Site	Failure to comply with ARPANS 1999 Regulation 51 to seek approval from ARPANSA for a change significant to safety
Materials Fabrication Bay	Failure to comply with ARPANS Regulation 2018 section 64 to report changes to a facility without significant safety implications within three months of the change being made
ANSTO Camperdown Campus	Failure to comply with requirements of Regulation 51 to seek approval from ARPANSA for a change significant to safety

APPENDIX 5

Freedom of Information Act 1982, section 8

The Freedom of Information Act 1982 (FOI Act) provides the public with a general right of access to documents held by Australian Government agencies, by requiring agencies, such as ANSTO, to publish the information and provide a right of access to the documents.

This general right is limited by exceptions to protect essential public interests, including the privacy of individuals and the business affairs of those who give information to the agency.

In the reporting year to 30 June 2019, ANSTO received seventeen requests for information under section 15 of the *FOI Act*.

ANSTO is required to publish information to the public as part of the Information Publication Scheme (IPS).

The IPS is designed to promote open and transparent communication of government information.

Set out below is the information required to be published by ANSTO under Part II of the *FOI Act*.

1. ANSTO's Agency Plan

ANSTO's Information Publication Scheme plan is currently available on the ANSTO website at:
https://www.ansto.gov.au/access-to-information

2. Details of the structure of the Agency's organisation

An organisational chart detailing the structure of ANSTO can be found on ANSTO's website at:
https://www.ansto.gov.au/governance.

3. Details of ANSTO's functions, including its decision-making powers and other powers affecting members of the public

Information in relation to ANSTO's powers and functions can be found at pages 126-130 of this report. Information about ANSTO's purpose and Values, Board Composition, Corporate Plan and Service Charters can be found on ANSTO's website at:
https://www.ansto.gov.au/governance

4. Details of officer appointments at ANSTO

Details of officer appointments can be found at page <to be added during indexing> of this report and a link to this information can also be found on ANSTO's website at:
https://www.ansto.gov.au/governance

5. ANSTO's Annual Reports

A link to this annual report and annual reports of previous years can be found on ANSTO's website at:
https://www.ansto.gov.au/corporate-publications

6. Details of arrangements for members of the public to comment on specific policy proposals for which ANSTO is responsible

ANSTO regularly communicates with its stakeholders, which includes the local community and councils, relevant federal ministers and other government-related personnel, both state and federal, to ensure that they are kept up-to-date about what is happening at ANSTO. The community is kept informed of ANSTO's operations via the website, which publishes news updates such as media releases. A link to this information can be found on ANSTO's website at:
https://www.ansto.gov.au/governance

7. Information which ANSTO routinely gives access to in response to requests for access under the FOI Act (excluding documents exempt from production under the FOI Act)

During 2018-2019 there was no requested documentation falling within this category.

8. ANSTO's FOI Disclosure Log

The FOI Disclosure Log lists information which has been released in response to a FOI access request. The disclosure log requirement does not apply to:

- personal information about any person if publication of that information would be 'unreasonable';
- information about the business, commercial, financial or professional affairs of any person if publication of that information would be 'unreasonable';
- other information covered by a determination made by the Australian Information Commissioner if publication of that information would be 'unreasonable';
- any information if it is not reasonably practicable to publish the information because of the extent of modification that would need to be made to delete the information listed in the above dot points.

A link to ANSTO's disclosure log can be found on ANSTO's website at:
https://www.ansto.gov.au/access-to-information

9. Information held by ANSTO which is provided to Parliament

A link to the information which ANSTO provides to Parliament can be found on ANSTO's website at:
https://www.ansto.gov.au/access-to-information

10. Contact details of ANSTO officers who can be contacted about access to information or documents under the FOI Act

Direct enquiries in relation to FOI process to the:

Mail:
FOI Coordinator
ANSTO
Locked Bag 2001
Kirrawee DC NSW 2232

Email:
foi@ansto.gov.au

Telephone:
+61 2 9717 3111

(request to be directed to the FOI Coordinator)

These contact details can be found on ANSTO's website.

11. Operational information required under section 8 of the FOI Act, that is, information held by ANSTO to assist in the performance or exercise of ANSTO's functions or powers in making decisions or recommendations affecting members of the public.

ANSTO has a range of publications, reports and information available for the public, including our annual reports, information on safety, research reports, educational books and leaflets, and DVDs.

ANSTO also provides access to a searchable database of all of ANSTO's science publications, as well as an online archive for older publications.

APPENDIX 6

Index of compliance with reporting guidelines

Index of compliance with reporting guidelines under various Acts, Regulations and Orders applicable to ANSTO as a Commonwealth authority.

ANSTO Act 1987

Functions and Powers **126– 130**

Public Governance, Performance and Accountability Act 2013 (PGPA Act)

Annual Report (section 46) **i- 165**

The accountable authority of the entity must prepare and give an annual report to the entity's responsible Minister, for presentation to the Parliament, on the entity's activities during the period, by 15 October; or the end of any further period granted under subsection 34C(5) of the *Acts Interpretation Act 1901*. The annual report must comply with any requirements prescribed by the PGPA Rule. (Section 46)

Annual performance statements (Section 39 – (1) and (2)) **18–19**

Includes a copy of the annual performance statements in the entity's annual report that is tabled in the Parliament.

The annual performance statements must:

a. provide information about the entity's performance in achieving its purposes; and

b. comply with any requirements prescribed by the rules (Section 39 – (1) and (2))

Financial statements (sections 42 and 43) **74–112**

Includes a copy of the annual financial statements and the Auditor-General's report must be included in the Commonwealth entity's annual report that is tabled in the Parliament.

The annual financial statements and the audit report must comply, and must state whether, in the accountable authority's and the Auditor-General's opinion respectively whether, they:

a. comply with the accounting standards and any other requirements prescribed by the rules; and

b. present fairly the entity's financial position, financial performance and cash flows.

If the financial statements do not comply, the accountable authority of the entity must add the information and explanations required to present fairly those matters.

Similarly for the audit report, the Auditor-General must state the reasons, quantify the financial effect and state the amount if possible. (Sections 42 and 43)

Public Governance, Performance and Accountability Amendment (Corporate Commonwealth Entity Annual Reporting) Rule 2016

Section 17BB **i**

The annual report must be approved and signed by the accountable authority, and include details of how and when approval was given. It must state that the accountable authority is responsible for preparing and delivering the annual report in accordance with the section 46 of the PGPA Act.

Section 17BC **i,18**

The annual report complies with the guidelines for presenting documents to the Parliament.

Section 17BD **i–165**

The annual report uses plain English and clear design.

Section 17BE (a)–(b) **18 ,64, 126 – 130**

The annual report must specify the entity's enabling legislation, including a summary of the entity's objects and functions and the purposes of the entity as included in the entity's corporate plan.

Section 17BE (c) **3**

The responsible Minister is specified.

Section 17BE (d)–(f) **64 – 65**

The annual report provides details of:

- any direction issued by any Minister under an Act or instrument during the period
- any government policy orders that applied to the entity under section 22 of the PGPA Act
- particulars of non-compliance with any of the above directions or orders.

Section 17BE (g) **18– 19**

The annual report must include the annual performance statements for the entity for the period in accordance with paragraph 39(1)(b) of the Act and section 16F of this rule.

Section 17BE (h)–(i) **64 – 65**

The annual report must include a statement of any significant issue reported to the responsible Minister under paragraph 19(1)(e) of the Act that relates to non-compliance with the finance law in relation to the entity. If such a statement is included, the annual report must include an outline of the action that has been taken to remedy non-compliance.

Index of compliance with reporting guidelines

Section 17BE (j) **60 – 61, 66 – 67**

Information about directors is provided, including names, qualifications, experience, attendance at Board meetings and whether the director is an executive or non-executive member.

Section 17BE (k)–(l) **59, 64, 110, 165, 115–117**

The annual report must include an outline of the:

- organisational structure of the entity (including subsidiaries);
- statistics on the number of employees of the entity, at the end of that and the previous reporting period, for full and part-time employees, gender, location; and location of major activities and facilities of the entity.

Section 17BE (m) **67 – 70**

The annual report must include information on the main corporate governance practices used by the entity, including, for example, details of:

- board committees and their main responsibilities;
- education and performance review processes for the accountable authority; and
- ethics and risk management policies.

Section 17BE (n)–(o) **66**

The annual report discloses the decision-making process undertaken by the accountable authority for making a decision if:

- the decision is to approve the entity paying for a good or service from another Commonwealth entity or a company, or providing a grant to another Commonwealth entity or a company;
- the entity, and the other Commonwealth entity or the company, are related entities;
- the value of the transaction, or if there is more than one transaction, the aggregate value of those transactions, is more than $10 000 (inclusive of GST);

If the annual report includes any of the above information:

- if there is only one transaction—the value of the transaction must be included;
- if there is more than one transaction—the number of transactions and the aggregate of value of the transactions must be included.

Section 17BE (p) **64 – 65, 72**

The annual report details any key activities and changes that affected the operations or structure, which may include:

- significant events, such as forming or participating in the formation of a company, partnership etc.;
- operational and financial results;
- key changes to its status of affairs or principal activities;
- amendments to enabling legislation or any other legislation directly relevant to its operation.

Section 17BE (q)–(r) **72**

The annual report includes particulars of:

- judicial reviews and decisions of tribunals that have had or may have a significant effect on its operations;
- reports about the authority made by the Auditor-General (other than one made under section 43 of the PGPA Act), a Parliamentary committee, the Commonwealth Ombudsman, or the Office of the Australian Information Commissioner.

Section 17BE (s) **111 – 112**

The annual report includes an explanation if information is missing from a subsidiary that is required to be included in the annual report and states the effect of not having the information in the annual report.

Section 17BE (t) **73**

The annual report includes details of any indemnity that applied during the period given to an officer against a liability, including premiums paid, or agreed to be paid, for insurance against the officer's liability for legal costs.

Section 17BE(ta) **119 – 121**

The annual report must include information about executive remuneration in accordance with Subdivision C of Part 2-3 of the PGPA Rule.

Section 17BE (u) **152 – 157**

The annual report provides an index of annual report requirements identifying where relevant information can be found in the annual report.

Index of compliance with reporting guidelines

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Science assets and staff

Communication with my Office and the Department

Acronyms

AANMS	Australasian Association of Nuclear Medicine Specialists
AC	Companion of the Order of Australia
ACAS	Australian Collaboration for Accelerator Science
ACNS	Australian Centre for Neutron Scattering
AINSE	Australian Institute of Nuclear Science and Engineering
AM	Order of Australia Award
AMS	Accelerator mass spectroscopy
ANAO	Australian National Audit Office
ANSTO	Australian Nuclear Science and Technology Organisation
ANM	ANSTO Nuclear Medicine
ANU	Australian National University
ANZSRC	Australian and New Zealand Standard Research Classification
ANZSNM	Australian and New Zealand Society of Nuclear Medicine
AO	Officer of the Order of Australia
AOFSRR	Asia Oceania Forum for Synchrotron Radiation Research
ARC	Australian Research Council
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ARPES	Angle Resolved Photoelectron Spectroscopy
ASRS	Automated Storage and Handling System
ATSE	Australian Academy of Technological Sciences and Engineering
CAS	Centre for Accelerator Science
CCI	Children's Cancer Institute
CEO	Chief Executive Officer
CERN	European Organization for Nuclear Research
CKDu	Chronic kidney disease of unknown aetiology
CNES	French Space Agency
CRC	Cooperative Research Centre
CRDC	Cotton Research Development Corporation
CST	Concentrated Solar Thermal
DMTC	Defence Materials Technology Centre
DST	Defence Science and Technology
EBSD	Electron Back-Scatter Diffraction
EPA	Environment Protection Agency
FLEET	Future Low Energy Electronics

FNCA	Forum for Nuclear Cooperation in Asia
FOI	Freedom of Information Act 1982
GIF	Generation IV International Forum
GMP	Good Manufacturing Practice
HIFAR	High Flux Australian Reactor
HRND	High-Resolution Neutron Diffraction
HZB	Helmholtz-Zentrum Berlin
IAEA	International Atomic Energy Agency
IDN	International Decommissioning Network
ILW	Intermediate level waste
IMBL	Imaging and medical beamline
INLEX	International Expert Group on Nuclear Liability
INSERM	French National Institute of Health and Medical Research
ISSP	Institute of Solid State Physics (University of Tokyo)
J-PARC	Japan Proton Accelerator Research Complex
JAEA	Japan Atomic Energy Agency
LET	Linear energy transfer
LEU	Low enriched uranium
LGBTIQA+	Lesbian, gay, bisexual, transgender, intersex, queer/questioning, asexual and other terms (such as non-binary and pansexual)
LLSW	Low Level Solid Waste
LMI	Lantheus Medical Imaging
Lu-177	Lutetium-177
Mo-99	Molybdenum-99
MOU	Memorandum of Understanding
MRT	Microbeam radiation therapy
MSR	Molten salt reactor
MX	Macromolecular crystallography beamline
MX2	Micro Crystallography beamline
NACC	Nuclear Agencies Consultative Committee
NCEPT	Neutron Capture Enhanced Particle Therapy
NCRIS	National Collaborative Research Infrastructure Strategy
NCT	neutron capture therapy
NDF	National Deuteration Facility
NEA	Nuclear Energy Agency

NESA	NSW Education Standards Authority
NIRS	National Institute for Radiological Sciences
NMI	National Measurement Institute
NORM	Managing naturally occurring radioactivity
NRWMF	National Radioactive Waste Management Facility
NST	Nuclear Science and Technology
NTD	Neutron transmutation doping
OECD	Organisation for Economic Co-operation and Development
OH	Hydroxyl radical
OPAL	Open Pool Australian Light-water
PET	Positron emission tomography
PGPA	Public Governance, Performance and Accountability Act 2013
PSM	Public Service Medal
QST	National Institutes for Quantum and Radiological Science and Technology
RAINS	Rural Alliance in Nuclear Scintigraphy
RAM	Research Agencies Meeting
RCA	Regional Collaborative Agreement
SAGE	Science in Australia Gender Equity
SAGNA	Standing Advisory Group on Nuclear Applications
SAXS	Small angle X-ray scattering
SAXS/WAXS	Small and wide angle X-ray scattering
SC	Senior Counsel
SINAP	Shanghai Institute of Applied Physics
SPECT	Single-photon emission computed tomography
STA	Science and Technology Australia
STEM	Science, technology, engineering and mathematics
STM	Scanning tunneling microscopy
Tc-99m	Technetium-99m
TES	Thermal Energy Storage
TGA	Therapeutic Goods Administration
UNSW	University of New South Wales
UoW	University of Wollongong
WiN	Women in Nuclear
XPS	X-ray photoelectron spectroscopy

Index

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T + 43 1 5067 4119

Public information

ANSTO produces regular updates on its science and technology, has available a range of publications and conducts free tours of its Lucas Heights campus. For bookings or information call +61 2 9717 3111 or email **enquiries@ansto.gov.au**

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Cover images

Clockwise from top left:

On average, more than one in two Australians will benefit from the nuclear medicines that originate from ANSTO in their lifetime.

The OPAL Virtual Reality experience was launched in August 2018, and tens of thousands of students and members of the general public have enjoyed this experience either online or at ANSTO's many outreach events.

ANSTO researcher, Karyn Wilde is a microbiologist in the National Deuteration Facility (NDF). The NDF is the only facility of its type in the Southern Hemisphere.

ANSTO's David Garton at Cape Grimm in Tasmania, where ANSTO is monitoring the air for two air pollution studies.

The OPAL multi-purpose reactor reflector vessel is positioned at the bottom of a 13-metre-deep pool of light water. The open pool design makes it easy to see and manipulate items inside the reactor pool.

Australian Government

ANSTO

Locations

Lucas Heights | Camperdown | Clayton

www.ansto.gov.au

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