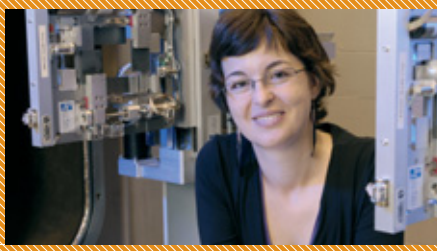
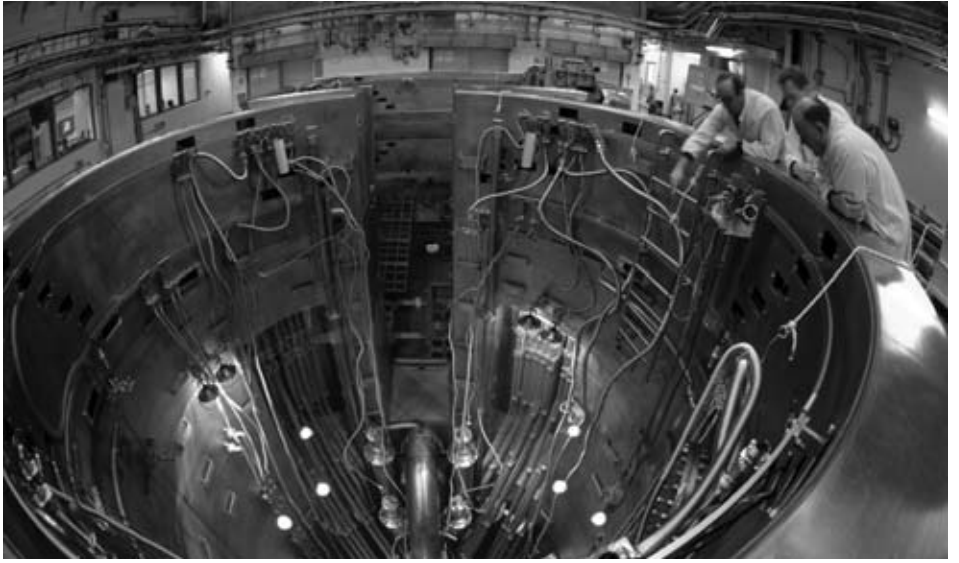
Australian Government

Nuclear-based science benefiting all Australians



Annual Report 2006-07



ANSTO scientific facilities

- 20MW OPAL MULTIPURPOSE RESEARCH REACTOR
- NEUTRON DIFFRACTION AND SCATTERING FACILITIES
- ANTARES 10MV TANDEM ACCELERATOR
- STAR 2MV TANDETRON ACCELERATOR
- ELEMENTAL ANALYSER – ISOTOPE RATIO MASS SPECTROMETER
- WATER TUNNEL FACILITY
- GAMMA IRRADIATION FACILITIES
- CERAMIC POWDER CHARACTERISATION FACILITIES
- HOT AND COLD ISOSTATIC PRESSES
- TRANSMISSION AND SCANNING ELECTRON MICROSCOPES
- SCANNING PROBE MICROSCOPE
- SCANNING LASER DILATOMETER
- NUCLEAR MAGNETIC RESONANCE SPECTROMETERS
- PLASMA IMMERSION ION IMPLANTATION FACILITIES
- SECONDARY ION MASS SPECTROMETER
- MATERIALS TESTING LABORATORY
- ORE PROCESSING AND WASTE TREATMENT FACILITIES
- RADIOANALYTICAL LABORATORIES
- RADIOPHARMACEUTICAL DEVELOPMENT FACILITIES


Australian Government
ansto
Annual Report 2006-07

Chairman's Letter

14 September 2007

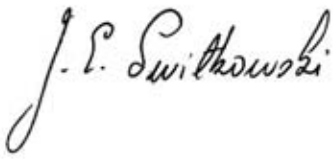
The Hon Julie Bishop MP
Minister for Education, Science and Training
Parliament House
CANBERRA ACT 2600

Dear Minister

In accordance with Section 9 of the *Commonwealth Authorities and Companies Act 1997* (*CAC Act*), I am pleased to present the Annual Report of the Australian Nuclear Science and Technology Organisation for the period 1 July 2006 to 30 June 2007.

This Annual Report includes a Report of Research and Operations, the content and preparation of which the Board is responsible for under Section 9 of the *CAC Act*.

Yours sincerely



Dr Ziggy Switkowski
Chairman

Contents

About ANSTO

The Australian Nuclear Science and Technology Organisation (ANSTO) is Australia's national nuclear research and development organisation and the centre of Australian nuclear expertise.

With approximately 950 staff, ANSTO is responsible for delivering specialised advice, scientific services and products to government, industry, academia and other research organisations. We do so through the development of new knowledge, the delivery of quality services and the provision of support for business opportunities.

ANSTO's nuclear infrastructure includes the Open Pool Australian Light-water reactor (OPAL), Australia's new $470 million research reactor, particle accelerators, radiopharmaceutical production facilities, and a range of other unique research facilities. OPAL is Australia's only operating nuclear reactor. It is used to produce radioactive products for use in medicine and industry, as a source of neutron beams for scientific research and to irradiate silicon for semiconductor applications. The High Flux Australian Reactor (HIFAR), which was Australia's first reactor, was officially shut down in January 2007 and is currently awaiting decommissioning.

ANSTO also operates the National Medical Cyclotron, an accelerator facility used to produce short-lived radioisotopes for nuclear medicine procedures.

ANSTO also manages access to overseas synchrotron facilities for Australian scientists.

ANSTO's main site is located 40 km south west of Sydney's central business district, occupies 70 hectares and is surrounded by a 1.6 km buffer zone.

The Organisation's general purpose is prescribed by the *Australian Nuclear Science and Technology Organisation Act 1987 (ANSTO Act)* and is translated into action through corporate drivers of vision, mission and strategic goals.

ANSTO's vision

ANSTO's vision is to be recognised as an international centre of excellence in nuclear science and technology for the benefit of Australia.

ANSTO's mission

Our mission is to:

- Support the development and implementation of government policies and initiatives in nuclear and related areas, domestically and internationally
- Operate nuclear science and technology based facilities, for the benefit of industry and the Australian and international research community
- Undertake research that will advance the application of nuclear science and technology
- Apply nuclear science, techniques and expertise to address Australia's environmental challenges and increase the competitiveness of Australian industry
- Manufacture and advance the use of radiopharmaceuticals which will improve the health of Australians.

Underpinning the vision and mission are ANSTO's core values:

Safety, Security and Environmental Sustainability: protecting human health, safeguarding our operations and minimising our environmental footprint

Honesty, Openness and Integrity: building trust within our organisation and with stakeholders

Innovation, Collaboration and Responsiveness: creating and embracing new ideas, promoting learning and development, recognising trends, understanding stakeholder needs and fostering cooperation and teamwork

Competence and Professionalism: maintaining high standards of expertise and delivery to internal and external customers.

These core values are fundamental in all our activities and underpin the way in which we will deliver on our strategic directions.

ANSTO's strategic directions

ANSTO's strategic directions form the basis for the organisation's research and operations:

Deliver Excellence in Nuclear Science and Technology

We will be the source of significant new discoveries, producing new knowledge, capabilities and technologies. While some of these will be applied to our own operations, others will be developed through targeted research, with the benefit distributed widely by outreach activities which encourage adoption and commercialisation.

Focus our Capabilities to Support Issues of National Importance

We will focus our facilities, activities, expertise and collaboration on areas that contribute to Australia's priorities, especially in support of its nuclear, research, industry, environmental,

About ANSTO

health, security and international relations policies.

Maximise Return on Investment in Expertise and Specialised Facilities

ANSTO will operate world-class nuclear facilities at a level of efficiency that ensures a high return on investment for the Australian Government, our customers and our collaborative partners.

Promote Understanding of the Benefits of Nuclear Science and Technology

Through effective communication and engagement with industry, research and the wider community, we will increase support for our work and encourage the further adoption of applications of nuclear science and technology.

The Hon Julie Bishop, MP, Minister for Education, Science and Training.

Responsible Minister

The responsible Minister during the reporting period was the Hon Julie Bishop MP, Minister for Education, Science and Training.

Statement of compliance

This report is written with reference to the guidelines provided for the presentation of Government documents, published by the Department of the Prime Minister and Cabinet in April 2004 (as amended) and the *Commonwealth Authorities and Companies (Report of Operations) Orders 2005*.

Management

As at 30 June 2007

Dr Ian Smith
Executive Director

Dr Ron Cameron
Chief of Operations

Dr George Collins
Chief of Research and Acting Head, Radiopharmaceuticals Research Institute

Dr Robert Robinson
Head, Bragg Institute

Prof John Dodson
Head, Institute for Environmental Research

Prof Lyndon Edwards
Head, Institute of Materials and Engineering Science

Mr Doug Cubbin
General Manager, Finance and Administration and Chief Financial Officer

Mrs Cait Maloney
General Manager, Safety and Radiation Services

Mr Con Lyras
General Manager, Technical Services and Facilities Management

Dr Greg Storr
General Manager, Reactor Operations

Mr Ian Turner
General Manager, ANSTO Radiopharmaceuticals and Industrials

Members of the Board

Dr Ziggy Switkowski

BSc (Hons), PhD, FAICD

Company director, former chief executive, scientist

Chairman 1 March 2007 - 31 December 2010

Appointed 1 January 2006

Term concludes 31 December 2010

Stood down from 6 June 2006 to 28 February 2007 to take up an appointment as Chairman of the Prime Ministerial Taskforce undertaking the Uranium Mining, Processing and Nuclear Energy Review.

Mr Michael A Eager

BE (Mining), FAusIMM

Company director, mining engineer

Deputy Chairman and Acting Chairman: 1 July 2006 - 31 December 2006

Deputy Chairman 1 March 2007 - 29 February 2008

Appointed 1 January 2002

Term concluded 31 December 2006

Reappointed 1 March 2007

Term concludes 29 February 2008

Dr Carrie (Carmel) J Hillyard

BSc (Hons), PhD, FTSE

Venture Capital Partner, CM Capital Investments, biotechnologist

Appointed 21 July 1999

Reappointed 22 July 2004

Resigned 30 June 2007

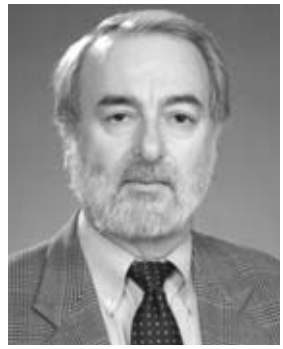
Dr Agatha van der Schaaf

MB, BS, BMedSc, FRACP

Head, Department of Nuclear Medicine, Sir Charles Gairdner Hospital

Appointed 25 July 2002

Term concludes 24 July 2007



Dr Klaus Schindhelm

BE, PhD, FIEAust

Senior Vice President, Applied Research Global, ResMed Ltd

Acting Deputy Chairman 1 January to 28 February 2007

Appointed 20 March 2003
Term concludes 19 March 2008

Dr Ian Smith

BE, PhD, FTSE, FIEAust, CPEng

Executive Director, ANSTO

Appointed 17 May 2004

Term concludes 16 May 2008

Chairman's Report

Welcome to ANSTO's Annual Report 2006-07, and my first as Chairman. It is a happy situation that my first report covers a period of new beginnings at ANSTO. ANSTO is an organisation focused on nuclear technologies and as such it is impossible to ignore the changing community attitudes to all things nuclear. The overwhelmingly positive media coverage and public comment on the opening of the OPAL reactor clearly signalled this change in attitude. With the commissioning of the OPAL reactor and the increasing interest in nuclear power as an alternative baseload energy option that contributes minimally to climate change, there is a feeling that ANSTO holds a new significance in the minds of the public as Australia's centre for expertise in nuclear science and technology.

In OPAL, Australia now has a safe and modern research reactor. OPAL was specifically designed to be a multipurpose reactor, optimised for the tasks of guaranteeing a domestic radiopharmaceutical supply of the most widely used nuclear medicines, continuing ANSTO's silicon irradiation business and having the design and neutron flux to place it in the top three research reactors in the world for scientific research. It is Australia's largest single investment in big science and the immediate over-demand for experimental time on the first two neutron scattering instruments commissioned has, to some extent, proved the scientific case for the reactor and the need for it in the scientific community.

Australia's investment in OPAL also strengthens its position internationally in areas such as nuclear technology, nuclear and radiation safety, safeguards on nuclear materials, non proliferation concerns and counter terrorism work. ANSTO has its particular focus in the region, particularly with regard to the safeguards and nuclear safety arrangements of our near neighbours.

ANSTO plays a leading role in the Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA). ANSTO recently hosted the 29th National Representatives Meeting of the RCA, chaired by ANSTO's Chief of Operations, Dr Ron Cameron. The RCA provides a framework for International Atomic Energy Agency (IAEA) Member States in Asia and the Pacific to cooperate with each other and the IAEA on peaceful applications of nuclear energy. ANSTO's role in the RCA contributes to the fulfilment of Australia's obligations under the Nuclear Non-Proliferation Treaty. For example, ANSTO has just concluded a major project under the RCA programme to improve regional capabilities to respond to radiological risks including emergencies. In a related programme, Mrs Cait Maloney, General Manager of ANSTO's Safety and Radiation Services, has taken over as Chair of the Steering Committee of the International Atomic Energy Agency's Asian Nuclear Safety Network (ANSN). The ANSN was set up to pool and share existing and new technical knowledge and practical experience to further improve the safety of nuclear installations in the Asian region.

On the nuclear technology front, in April, the Prime Minister announced the Government's commitment to Australia's participation in the Generation IV advanced nuclear research programme. Australia's participation in the Generation IV International Forum (or GIF) will be managed by ANSTO and its contribution will be focused on research relating to the properties of materials to be used in very high temperature reactors and in the use of ceramic titanate immobilisation technology (synroc) for radioactive waste immobilisation. ANSTO's existing expertise in radioactive waste management and advanced materials is expected to be a valuable contribution to this global research effort.

A number of ANSTO staff in areas such as materials and environmental science also continue to have a high profile internationally. Professor John Dodson, head of ANSTO's Institute for Environmental Research, has been appointed vice-chair of the Science Program Committee for the International Year of Planet Earth (IYPE). Professor Dodson also chairs the Climate Change Focus Group. IYPE is hosted by United Nations Educational, Scientific and Cultural Organisation (UNESCO) and the International Union of Geological Sciences.

Australia's expertise and experience in nuclear technologies primarily resides at ANSTO. As highlighted in the Uranium Mining, Processing and Nuclear Energy Review, there is a national shortage of nuclear science and technology skills. To address this, ANSTO is working to provide opportunities for students to study these fields. Recently ANSTO launched applications for its Nuclear Futures Graduate Development Program, aiming to recruit 15 Australian graduates each year beginning in 2008. The graduates will undertake a four-year program to build expertise in nuclear science and technology, applicable in such areas as health physics, radiation protection and nuclear engineering. They will spend the first two years at ANSTO, in four different areas. In the third and fourth years, many are expected

Chairman's Report

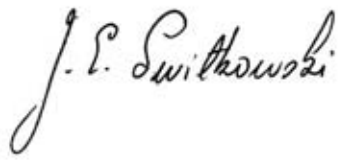
to undertake an overseas secondment for additional experience. ANSTO has already received 70 applications from science and engineering graduates interested in a career in the nuclear industry.

The Australian Institute of Nuclear Science and Engineering, of which ANSTO is a member, is meanwhile planning a school of nuclear science and technology, and a number of universities are planning new nuclear education programs with assistance from ANSTO.

The past eighteen months saw the retirement of a number of Board members, including the former Chairman, Dr Ian Blackburne, on whose watch ANSTO progressed impressively to the point of the successful completion of the OPAL project. On 30 June 2007 Dr Carrie Hillyard resigned after tenure of 8 years. Since 1 July 2007 Dr Agatha van der Schaaf's tenure of 5 years also came to an end. I would like to thank my former colleagues for their many important contributions over a critical period in ANSTO's history.

In July 2007 Mr Bill Scales and Professor Paul Greenfield joined the Board to help lift ANSTO to the next level of achievement.

On behalf of the Board I would like to congratulate ANSTO for the successes of the past year. It is timely and evidence of good planning many years ago that today ANSTO finds itself at the cutting edge of nuclear research and associated modern infrastructure and instrumentation at a time when Australia is beginning to genuinely consider nuclear power as an option to meet its increasing energy needs without increasing greenhouse gas emissions. Australia is not alone in this issue. There are 31 countries currently using nuclear power, and a further 18 considering it. As the debate about the nuclear fuel cycle unfolds in Australia, ANSTO will continue to be a source of expertise and leadership in all things nuclear.



Dr Ziggy Switkowski
Chairman

Executive Director's Report

In the previous annual report I described that year as being one of consolidation, review and progress towards future goals. I am pleased to be able to report that this year has been a year of meeting - and in many cases exceeding - those goals.

The most significant of those goals was the commissioning of the new, multipurpose OPAL research reactor. An operating licence for OPAL was issued by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) in July, and the reactor first 'went critical' on 12 August. After a period of rigorous and careful testing of all systems, OPAL reached its full power of 20MW in November. The reactor was officially opened by the Prime Minister of Australia, the Hon John Howard in April 2007, during a week of events for ANSTO staff, business, science and other stakeholders. It has been gratifying for all ANSTO staff, past and present, that have been involved in this long road towards a new, modern, safe research reactor for Australia, to see OPAL met with such a positive reception, not just by the potential industrial and scientific users, but by the Australian community.

One of the major uses of OPAL, along with radiopharmaceutical production, is in scientific research where the neutrons produced by the reactor are used to study problems in physics, chemistry, materials science and engineering, the life sciences and the earth sciences. Scientists gain access to these neutrons through ANSTO's Bragg Institute by submitting proposals that are judged by a peer review system, with those considered the best awarded time on the instruments.

Just as OPAL has been built and commissioned, the Bragg Institute too has had the goal of building and commissioning the

state of the art neutron scattering instrumentation required to take best scientific advantage of the reactor's capabilities. The first two of these instruments, the Echidna and Wombat powder diffractometers, have now been commissioned. At the end of April 2007, the first proposal round for experiments on these instruments closed. Researchers from Australia and overseas lodged around 80 proposals requesting a total of 319 beam days over the two instruments, resulting in the instruments already being in the order of 300% oversubscribed.

Moving from the new and modern OPAL to the 'old girl' that was the HIFAR reactor, another goal achieved this year was maintaining safe and reliable operation of HIFAR until her final shutdown. On 30 January 2007, the Hon Julie Bishop MP, Minister for Education, Science and Training, shut HIFAR down for the last time. After nearly 50 years of service from the reactor, the event was an emotional one for the reactor staff and the scientific researchers who in some cases had spent whole careers working with the reactor. Fortunately, their stories have been captured in a commemorative documentary celebrating the achievements of HIFAR. On 1 June, Australia's peak engineering body – Engineers Australia – officially declared HIFAR a national engineering landmark.

The steady progress I reported last year has resulted in a number of other achievements by the organisation. The on-going synroc project in the United Kingdom has received a further eighteen months of funding. This project involves an ANSTO tailor-made synroc-based glass-ceramic matrix to be used to permanently immobilise five tonnes of legacy plutonium waste residues currently stored at Sellafield in the UK. ANSTO designed the matrix specifically for the Sellafield waste, and the resulting wasteform will be suitable for long-term storage and eventual permanent disposal.

ANSTO's expertise in material testing has been rewarded with a contract to undertake a major remaining life assessment for Yallourn power station in Victoria. ANSTO spin-off companies CeramiSphere and Australian Membrane Technologies each received a grant of $80 000 from the Federal Government to support the commercialisation of their innovations. ANSTO is making a scientific contribution to a number of international groups, such as the World Meteorological Organisation's Global Atmospheric Watch program.

Last year, ANSTO signalled its potential involvement with the Australian Synchrotron. Synchrotron radiation and neutron scattering are complementary research tools and ANSTO has for many years run the Australian Synchrotron Research Programme (ASRP). This year ANSTO was successfully selected as preferred tenderer together with WorleyParsons Ltd to be the future joint operators of the Australian Synchrotron facility in Victoria.

Due to its expertise and long history in the area of nuclear technology and reactor operation, ANSTO is aware that it is well placed to provide advice in the nuclear power debate. ANSTO is working hard in the areas of communication and education, in Australian schools and the wider community, covering the range of nuclear issues including research, nuclear power, environmental aspects and radioactive waste to ensure the community has access to the information it needs to participate in debate on these issues.

Executive Director's Report

The organisation has reached a number of significant goals in the past year but, as often is the case, reaching such milestones means that the hard work is just beginning. There are still many challenges ahead for ANSTO in ensuring the OPAL reactor and associated instruments are fully utilised, in expanding ANSTO's production of and research in radiopharmaceuticals, in beginning the process of the safe dismantling and decommissioning of the HIFAR reactor, and in the operation of the Australian Synchrotron, to name just a few.

I would like to thank the ANSTO Board for their support and note my appreciation of the hard work by ANSTO staff over the last year and particularly for their tremendous enthusiasm and involvement during the period of the OPAL opening.

Ian Smith
Executive Director

A new reactor – OPAL opening

Australia's new nuclear research reactor was officially opened by the Prime Minister, John Howard on 20 April 2007.

The reactor, named OPAL, is Australia's third nuclear reactor and will allow scientists to conduct world-leading studies into understanding the structure of materials at the atomic level, ultimately for use in industry and medicine. To do this new state-of the-art neutron beam instruments, located in an adjoining building to OPAL, use the neutrons it produces to penetrate matter and produce neutron scattering patterns which are then analysed by scientists.

The information supplied by neutron scattering techniques is particularly important for engineering challenges. Applications include; gauging how long a power station's life can be lengthened by measuring stresses in components, such as turbines; analysing problems associated with blockages in oil and gas pipelines; and assisting in extracting oil and gas from reservoirs.

ANSTO will also have the capacity to increase production of radiopharmaceuticals and irradiate more silicon for the semiconductor industry.

At the opening, ANSTO Chairman, Dr Ziggy Switkowski, recognised the efforts of those who had constructed OPAL, deeming it Sydney's third icon after the Harbour Bridge and the Opera House.

The Prime Minister officially opened OPAL and, together with the Minister for Education, Science and Training, Ms Julie Bishop MP, Dr Switkowski and ANSTO Executive Director Dr Ian Smith, unveiled a commemorative plaque.

The Prime Minister acknowledged that OPAL will be one of the top three multipurpose research reactors in the world, saying "This is a wonderful day for Australian science. OPAL is a triumph for science and all those who support science. I look forward to the day when Australian scientists are revered as much as our sports people."

OPAL is a remarkable demonstration to the world of the cutting edge science capacity of Australians and is a project which ANSTO staff are justifiably proud of.

Highlights

Commercial

- ANSTO successfully selected as preferred tenderer together with ASX-listed company WorleyParsons Ltd to be the future joint operators of the Australian Synchrotron facility in Victoria
- ANSTO successfully contracted to undertake a major remaining life assessment for Yallourn power station in Victoria
- ANSTO companies CeramiSphere Pty Ltd and Australian Membrane Technologies Pty Ltd each received a grant of $80 000 from the Federal Government to support commercialisation of their innovations
- Access ANSTO developed a postgraduate asset management course with the University of Wollongong.

Community

- ANSTO made a significant contribution to the Uranium Mining, Processing and Nuclear Energy Review. The organisation's chairman, Dr Ziggy Switkowski, stood aside from the Board to chair the Review
- A road show was undertaken at universities around Australia for ANSTO's new, four-year Nuclear Futures Graduate Development Program. Some 70 applications were received
- ANSTO published physics work books for students and teachers with information and activities tailored to the NSW Higher School Certificate to accompany their visits to ANSTO
- A new OPAL visitor centre was launched complete with interactive models of the reactor and a plasma TV with a live link to view the reactor pool
- A documentary to commemorate the achievements of Australia's first nuclear reactor, HIFAR, was launched at the Powerhouse Museum
- Two community discussions were held to hear from members of the local community and provide information about ANSTO's operations and science. One focussed on HIFAR decommissioning and included a presentation by Dr Kevin Langley, who is involved in the decommissioning of nuclear facilities in Harwell, UK
- Market research was undertaken to assess community understanding and perceptions about ANSTO. This builds on similar research conducted in 2004 and shows that since that time, community understanding about ANSTO's research and operations has improved and perceptions about ANSTO are generally more positive
- 120 Physics and Chemistry teachers from all over NSW attended professional development at ANSTO on the nuclear science component of the NSW HSC syllabus.

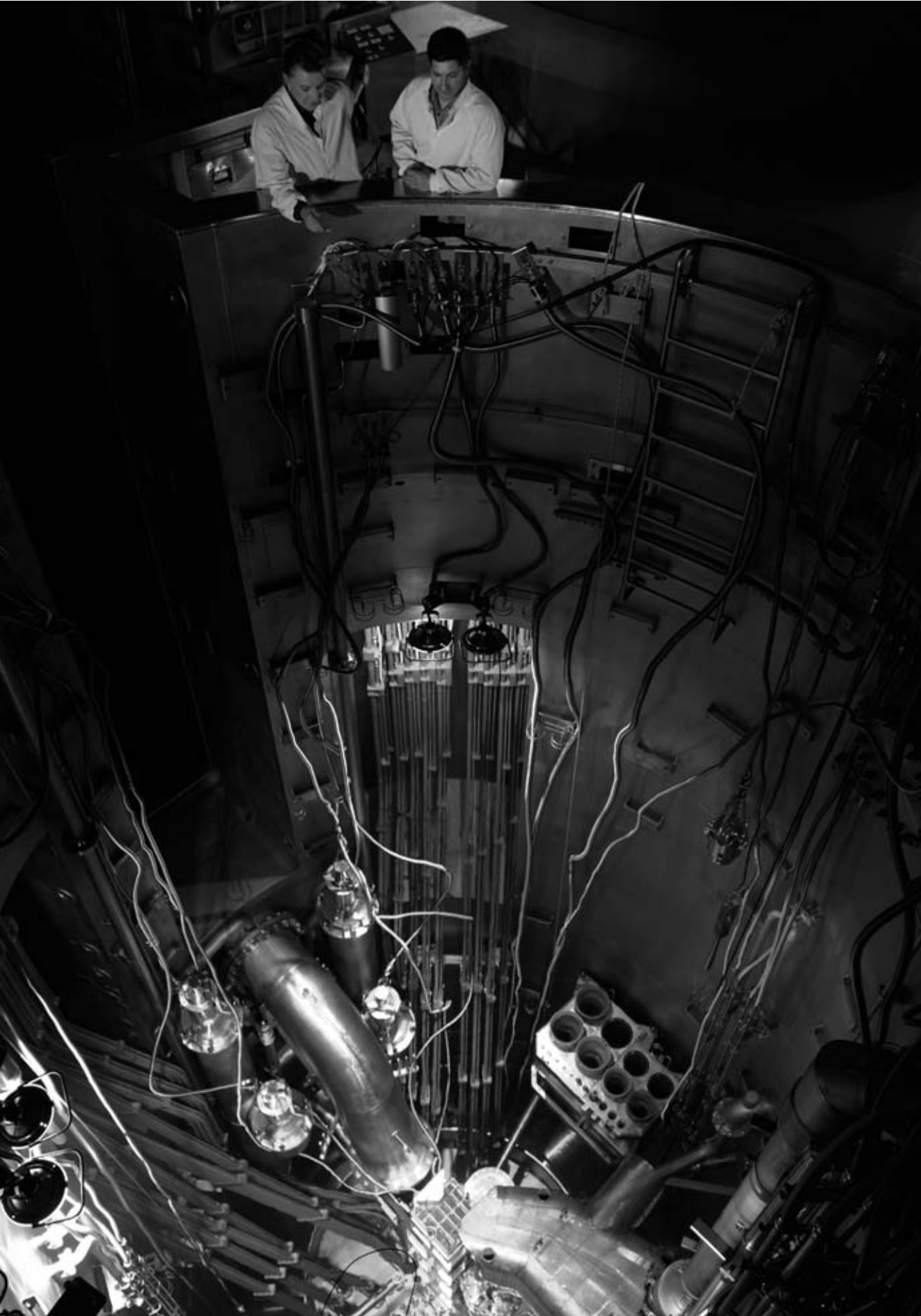
Research

- The first proposal round for neutron-beam experiments at OPAL on the ECHIDNA and WOMBAT powder diffractometers closed with a total of 77 beam-time proposals from Australia and overseas, for a requested total of 319 beam days over the two instruments, resulting in the instruments being in the order of 300% oversubscribed
- ANSTO received funding of $3.3 million for a National Deuteration Facility as part of the National Collaborative Research Infrastructure Strategy
- The first students were chosen for ANSTO's joint post-graduate scholarships with the University of Sydney
- The first projects began under the ANSTO-University of Melbourne Collaborative Research Support Scheme

- ANSTO appointed new heads for its Institute for Environmental Research and Institute for Materials and Engineering Science
- A new collaborative monitoring program for natural atmospheric radionuclides was established by ANSTO scientists at the international atmospheric baseline station in China, as a contribution to the World Meteorological Organisation's Global Atmospheric Watch program
- ANSTO's revolutionary membrane bioreactor that operates as waste treatment technology, won the award for best invention of the week on ABC's *New Inventors*
- ANSTO launched its Senior Research Fellowships and Distinguished Researcher Fellowships, as part of its initiatives to further increase the excellence of research in the organisation
- The Minister for Education, Science and Training, the Hon Julie Bishop, approved ANSTO's research performance assessment report. The assessment was undertaken during 2005-06 in line with the objectives of the Research Quality Framework
- ANSTO patented a new method for isotope ratio mass spectrometry
- An article in *Nature Research Highlights* based in part on research conducted by an ANSTO scientist showed that the East Antarctic Ice Sheet has been stable for thousands of years but is threatened by rising sea levels
- ANSTO was officially proclaimed a Collaborating Centre for neutron beam science by the IAEA.

Operations

- The pinnacle of ANSTO's achievements for the year was the official opening of the new $470 million OPAL research reactor by the Prime Minister of Australia, the Hon John Howard MP
- The HIFAR reactor operated for the last time on 30 January 2007 when the shutdown was initiated by the Hon Julie Bishop MP, Minister for Education, Science and Training
- ANSTO signed Memoranda of Understanding with the Defence, Science and Technology Organisation, the Australian Federal Police and the NSW Fire Brigade
- Dr Ron Cameron was elected chair of the IAEA Regional Cooperative Agreement among the 17 IAEA member states in our region
- New policy proposals for ANSTO Radiopharmaceuticals and Industrials automation, super-compaction of waste and extra OPAL operating costs were approved in the May 2007 budget.



Report of Research and Operations

Introduction–Operations

The past year has been an exciting one for ANSTO with the culmination of a decade of planning being realised with the completion of commissioning and official opening of Australia's new nuclear reactor. Named OPAL – Open Pool Australian Light water reactor – this Argentinean designed reactor will be a world class multi-purpose research reactor.

The Prime Minister, the Hon John Howard together with the Minister for Education, Science and Training, the Hon Julie Bishop, officially opened OPAL on April 20 as the highlight of a week involving guests from across academia, politics, science, business and the community.

The $470 million reactor development project was completed within budget. The opening was a major achievement for all of the personnel who have been involved in the many stages of the delivery of the facility.

The successful completion of OPAL and the accompanying neutron beam facilities means that Australia now has a multi-purpose nuclear reactor that is expected to be in the top three research reactors worldwide. In addition to the research benefits, it will enable a four-fold increase in the production of radiopharmaceuticals and a doubling of the capacity to irradiate silicon used in semi-conductor production.

The reactor replacement process commenced in September 1997, and has included an Environmental Impact Study, three nuclear safety licence approvals, two Senate inquiries and approval by the Public Works Committee.

The full operation of OPAL comes soon after the permanent closure of HIFAR, Australia's first nuclear reactor, which was switched off in January 2007, after almost 50 years of service to the Australian community. Following the shutdown, all spent fuel and cooling water has

Report of Research and Operations

been removed. Planning is underway for final decommissioning and removal in about 10 years time, subject to ARPANSA approval.

ANSTO made a significant submission to the Uranium Mining Processing and Nuclear Energy review, commissioned by the Federal Government. It has also participated with other government agencies this year in an Inter-departmental committee to follow-up the recommendations of various enquiries into the possible establishment of nuclear power in Australia.

ANSTO has continued to represent Australia through the International Atomic Energy Agency. Australia holds one of only 13 permanent seats on the IAEA board of governors, which is largely dependant on Australia being the operator of a nuclear reactor, and is able to use this position to strongly support non-proliferation objectives and promote safety and security, especially in the region. ANSTO's Chief of Operations became the Chair of IAEA's Regional Cooperative Agreement that includes 17 member States in our region.

ANSTO continued active programs of community interaction and communication which this year included the OPAL reactor opening in addition to our charter to informing the community of the beneficial applications of nuclear science and technology.

Operationally, ANSTO has focused this year on maintaining high standards of safe and secure operation of all our facilities and to manage nuclear materials and waste consistent with all regulatory and international objectives.

Managing Australia's Core Nuclear Facilities

Commissioning a new reactor

In July 2006 an operating licence was issued for the OPAL reactor by ARPANSA and ANSTO moved quickly after this time to 'hot' commission OPAL. Hot commissioning started with a final integration test of all the reactor systems to check for functionality and was followed by the introduction of nuclear fuel into the facility. Individual fuel assemblies were loaded one at a time into the reactor core, and a series of careful measurements were undertaken as the reactor control rods were extracted. On Saturday 12 August 2006 at 11.30 pm OPAL was declared 'critical' for the first time at a power level of about three milliwatts.

After this, many tests were performed at powers up to around 300 kilowatts to prove the nuclear safety of the reactor. The measurements from these tests showed the reactor was constructed to the described design, and consequently that nuclear safety parameters are consistent with the calculated values contained in the Safety Analysis Report (SAR). After ARPANSA reviewed the results from this commissioning stage, approval was received to take the reactor to higher powers, and in November 2006 OPAL reached its full power of 20 megawatts.

The commissioning process has given ANSTO an opportunity to work through a number of modifications as well to plan to repair a minor leak between two cooling systems, which will take place before the end of 2007. During the commissioning period OPAL was successfully operated at full power since none of the issues were of safety significance.

Since April 2007 the Cold Neutron Source has operated with good reliability and cold neutron measurements have been undertaken at a

Report of Research and Operations

number of neutron beam instruments. In May 2007 the final commissioning report was delivered to ARPANSA, and this milestone effectively completes commissioning of OPAL.

Closure of an old reactor

When the Hon Julie Bishop MP, Minister for Education, Science and Training, initiated the final shutdown of HIFAR, ANSTO current and former staff farewelled 'the old girl' at a special closing ceremony. During its lifetime, HIFAR supplied millions of patient doses of nuclear medicines to Australia, New Zealand and Asia, and allowed cutting-edge nuclear science to take place. More than 700 refereed publications resulted from the scientific work done at HIFAR. The high levels of reliability and safety seen from HIFAR over many years were maintained during its last months of operation, and in the final three months of operation, the reliability level was 100%.

Since January, the nuclear fuel has been removed from the reactor core and subsequently all used fuel was removed to storage facilities outside the Reactor Containment Building. All the heavy water coolant has been removed from the reactor systems, and in early June 2007, 24 hour operator shift manning concluded.

Plans are now being developed for the period of possession and control prior to the final decommissioning of HIFAR. In June, HIFAR was recognised as a National Engineering Landmark.

Reducing waste

International best practice in the nuclear industry encourages the minimisation of waste by providing a clear distinction between radioactive waste that requires special processing and treatment, and waste that is not classified as radioactive under IAEA guidelines. Virtually everything is radioactive to some extent and is therefore suitable for 'free release'. In line with these international guidelines and with stringent Australian regulations, ANSTO's Waste Operations Section implemented a streamlined, quality assured system for assessing and disposing of such 'free release' waste.

In its reactor operations and radioisotope production and research activities, ANSTO generates a wide range of wastes with varying levels of radioactivity. Prior to processing, storing or disposing of this waste, ANSTO applies a rigorous waste certification and release control system which assesses radionuclide activity in waste material against the 'free release' limits defined in Australian and international regulations.

A three stage assessment approach to waste characterisation and release control has reinforced the integrity of ANSTO's waste management system by ensuring that any waste released for unrestricted disposal is consistent with all regulatory requirements and international best practice. Since the system has been implemented, we have been able to significantly reduce the amount of non-radioactive waste stored on site.

Managing Australia's Core Nuclear Facilities

Spent fuel successfully shipped to the US

ANSTO's largest ever shipment of spent fuel elements to the US set sail in December 2006 and arrived safely in January 2007. Logistically this was the most complex shipment the organisation has undertaken. The methodology, standards and practices employed by ANSTO personnel were praised by US Department of Energy staff.

This was the eighth overseas shipment of spent fuel since the HIFAR reactor commenced operation in 1958. In that time, ANSTO has safely shipped a total of 2142 spent fuel elements to the US, Scotland and France. The spent fuel returned to Scotland and France will be reprocessed to remove the re-usable parts of the spent fuel and the remaining waste fraction will be returned to Australia as intermediate level waste. Spent fuel that has been shipped to the US will remain in the US and no waste will be returned to Australia.

The 2006 shipment comprised 330 spent fuel elements, including some from the smaller MOATA research reactor (a low-power physics and training reactor shut down in 1995). Comprehensive inspection and preparation procedures were carried out over a 12-month period from August 2005 to August 2006. The shipment process consisted of transporting the loaded spent fuel casks (placed inside shipping containers) to the wharf and loading them onto a designated and licensed cargo ship bound for the US. The overall shipment was conducted with strict attention to proven safety procedures and protocol used successfully in previous shipments.

This latest shipment involved an innovative new loading process. Of the 330 spent fuel elements, 210 were loaded into five US certified and designed shipment casks which use a dry loading system, the first time such a system has been employed by ANSTO.

The remaining 120 spent fuel elements were loaded into two casks of German design, each with a capacity for 60 spent fuel elements. All of the 330 spent fuel elements were loaded under water, which provided the primary radiation shielding source for the loading operation.

Improvements to Facility Management at ANSTO

The extensive range of facilities that can be seen at ANSTO today began life in 1953 when the initial development of the site commenced. Over the subsequent 54 years the range of facilities on site has developed to meet the needs of the organisation to the stage that the current facilities accommodate up to 1000 personnel in 83 buildings. In recent times ANSTO has added the most significant facility since the construction of the initial HIFAR research reactor, the OPAL research reactor.

The proper management of the facilities at ANSTO is of fundamental importance to the organisation. It is recognised that an efficient facility management process will minimise the total life cost of the facilities whilst maximising the support offered to the strategic goals of ANSTO.

Over recent years structured facility management has become a recognised and required process practiced by organisations

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that expend resources on people, their work environment, and the ways they work.

In keeping with the development of the facility management industry, ANSTO undertook a review of how facilities were being managed and introduced changes and initiatives to ensure that the best industry standards are being implemented within the organisation.

Some of the initiatives have already been implemented and include the expansion of the ANSTO Engineering division to become the Technical Services and Facility Management division. This Facilities Manager role has been designed to place the division as the 'landlord' of the site and to be responsible for the efficient management, development, and maintenance and decommissioning of all facilities.

A detailed ten year Asset Management Plan is underway to be completed by the end of 2007. This document will detail the facility needs of the organisation for the next decade. Once completed this plan will be reviewed and updated on an annual basis.

Some of the goals of the Asset Management Plan include facilitating increased public access and usage of the site and hence supporting the reality of ANSTO as a safe and environmentally friendly user of nuclear technology. Landscaping will be predominantly Australian native flora and the buildings will be designed to project an image of a modern 'hi-tech' research and commercial organisation. Underlying management focus will be maintained on conservation of resources and minimising energy and water usage.

HIFAR Final Shift

It was an historic day for ANSTO and Australia as the first nuclear reactor in Australia was officially closed on 30 January 2007 after almost 50 years of operation. The five men who operated HIFAR on its last day, John Wernej, Vahan Papazian, Kenneth Baker, Ray Mobbs and their supervisor Pertti Sirkka pictured below from left to right, participated in one of the most memorable and nostalgic days of ANSTO's history.

Providing Expert Scientific and Technical Services

Andrew Parkinson works at ANSTO as a forensic chemist in the Forensic and Nuclear Security group of the Counter-Terrorism Research project. His research investigates the effects of radiation exposure on critical trace evidence such as fingerprints, DNA, fibres and paint chips. He also develops procedures for the decontamination of radiologically contaminated trace evidence, and evaluating post-incident radiological decontamination products and technologies. Andrew's research will equip forensic and counter-terrorism agencies with the knowledge they need to work effectively at a radiological crime scene.

Representing Australia Overseas

For many years ANSTO has played a leading role in the Regional Cooperative Agreement (RCA) for Asia and the Pacific. This is a major treaty-level mechanism that fosters regional cooperation in the use of nuclear science and technology to address development issues in agriculture, health, environment, and other fields.

This year ANSTO has continued to support Australia's obligations under the RCA Treaty by sharing its skills and technical expertise with Member States and by encouraging the further development of peaceful nuclear cooperation in the Asia Pacific region. This cooperation also contributes towards our obligations and duties under the Nuclear Non-proliferation Treaty.

ANSTO staff have just concluded a major three-year project under the RCA programme to improve regional capabilities to respond to radiological risks, including radiological emergencies and aquatic environmental risks.

The Australian Government approved over $1.4 million in funding to support the project. The project was managed by ANSTO and the technical activities were implemented through the International Atomic Energy Agency Technical Cooperation Department.

ANSTO staff provided training and instruction to RCA scientists in three separate technical areas. Firstly, Radiological Risk Assessment sought to develop Member States' capacity to model the consequences of scenarios in which an accidental radiological release has occurred. Secondly, Radiological Emergency Response aimed to enhance Member States' capacity to respond to radiological emergencies. Finally, Radiological Pollution Assessment in Coastal Aquatic Environments had the goal of developing Member States' capacity to assess, plan and respond to radiological as well as non-radiological pollution in coastal aquatic environments.

As well as fulfilling Australia's obligations under the Regional Cooperative Agreement and

making a positive contribution to the improvement of the region's radiological safety capabilities, this project also advanced ANSTO's own scientific standing in Asia and the Pacific and with the IAEA.

Commonwealth Radioactive Waste Management Facility

ANSTO has been providing technical advice to the Department of Education Science and Training (DEST) in support of the development of a concept design for the proposed Commonwealth Radioactive Waste Management Facility.

The waste facility is being planned to provide a centralised storage of Commonwealth low and intermediate radioactive solid waste. The proposed facility will allow for low level solid waste to be buried just below the surface or placed above ground in an engineered store. Intermediate level solid waste, which requires shielding due to higher levels of radioactivity, will be placed in an above ground storage for up to 100 years, pending consideration of future management options.

A number of sites have are under consideration. Any ongoing role for ANSTO in the detailed design, construction and/or operation of such a facility is yet to be decided.

Security and safeguards

In accordance with international agreements and stringent national laws and regulations, ANSTO is required to protect all its nuclear material and facilities from security threats and to ensure that all nuclear material in Australia is used exclusively for peaceful purposes. *Australia's Nuclear Non-proliferation (Safeguards) Act 1987* authorises the Minister for Foreign Affairs – or the Minister's delegate, the Director of Safeguards – to issue permits to ANSTO to possess, use and transport nuclear material and to operate nuclear facilities on condition that appropriate physical protection measures and safeguards are in place.

Australia has been a party to the International Treaty on the Non-Proliferation of Nuclear Weapons since 1974. Under this Treaty, IAEA inspectors have permission to verify that all nuclear material in this country is used exclusively for peaceful purposes. To facilitate this is ANSTO's responsibility.

For this purpose ANSTO has a Nuclear Materials Accountancy and Control (NMAC) system for the nuclear materials it holds, and regular inspections are conducted by both the Australian Safeguards and Non-Proliferation Office (ASNO) and the International Atomic Energy Agency. In 2007, ANSTO reviewed its NMAC system in order to develop a more efficient and effective safeguards system, compatible with international and national safeguards obligations and requirements as well as ANSTO's own business and operations objectives. The review provided an objective assessment of credible safeguards threats and measures to mitigate these threats. The review also compared ANSTO's safeguards operations with international best practice, with favourable results. The review was extremely timely in light of HIFAR's shutdown and the commissioning of OPAL.

Security measures

Protection of nuclear material and facilities from security threats is an obligation under the International Convention on the Physical Protection of Nuclear Material.

Providing Expert Scientific and Technical Services

To this end, the ANSTO site is guarded 24 hours, 7 days a week, by the Australian Federal Police (AFP), who have a counter-terrorism Advanced First Response plan in place. In addition, under National Counter-Terrorism Plan arrangements between the Federal and State Governments, the AFP can call on the NSW Police for assistance.

ANSTO has also recently completed a new main entrance, designed in consultation with ASIO, the Australian Bomb Data Centre and the nuclear regulators, ASNO and ARPANSA. The new entrance enhances the overall security of the site in response to the changes in recent years in the security situation internationally. These security arrangements have been carefully designed to ensure that they do not compromise ANSTO's attractiveness as a centre of research excellence: high-level security for the OPAL reactor building itself is combined with ease of access to the neutron beam facilities for national and international researchers.

Radiological Decontamination Project

In the event of a radiological dispersion device - or dirty bomb - incident, authorities will have the complex task of removing the radiological contamination from the surrounding area, to ensure the safety of the returning public. However, the area should also be returned as much as possible to its state before the incident, to reduce any psychological and socio-economic impact on the community. This mix of imperatives will require a number of materials and techniques.

ANSTO has experimented with five different surfaces (concrete, paving, Colorbond™ steel, mild steel and asphalt) contaminated with a variety of commonly found radioactive materials. These surfaces were then systematically decontaminated using a range of low impact and innovative techniques commonly found on the commercial market. Their ease of use and decontamination effectiveness was reported.

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The findings of this research will assist emergency management organisations, such as fire brigade Hazardous Materials (HAZMAT) teams and environment protection agencies, to prepare guidelines to decontaminate environments contaminated with dispersed radioactive material.

ANSTO plans to further develop decontamination procedures for forensic evidence that has been radiologically contaminated. This will enhance the nation's forensic counter terrorism capabilities.

Border Security: X-ray Technology Trial

The University of Canberra and ANSTO have together provided expertise and scientific oversight for trials evaluating how well air cargo X-ray imaging equipment can detect contained explosive materials. The results will help improve Government policy related to air cargo screening for explosive devices.

The study is funded by the Australian Government and managed by the Department of Transport and Regional Services. The project team includes experts from the Australian Customs Service, ANSTO, the University of Canberra, the Australian Bomb Data Centre (part of the Australian Federal Police), the Department of Prime Minister and Cabinet, airports and X-ray equipment suppliers.

The study was motivated by the fact that there is no historic standard for the screening of air cargo by X-ray imaging devices and very little data on the effectiveness of both current and new equipment in operational environments. The study is examining current methods, new techniques at the cutting edge of technology and promising techniques in development or near commercial reality. All equipment in use – ranging from systems that can examine luggage size to those that examine maritime containers – will be examined, as well as new computerised tomography (CT) developments.

National Interest and Capabilities Enhancement

While all ANSTO's research projects address issues of national importance, the organisation has one specific research theme that focuses on counter-terrorism issues, as well as the capabilities ANSTO will need in the future. In this work, ANSTO is building on its strengths in nuclear forensics and detector systems, primarily through interaction with end users, including Customs and the Australian Federal Police, and with agencies such as the Defence Science and Technology Organisation. This research also supports ANSTO's relationship with the International Atomic Energy Agency in the Asia Pacific region.

Counter Terrorism Research Project

The objective of this project is to utilise and strengthen ANSTO's ability to contribute to the *Safeguarding Australia* national research priority and to develop stronger links and collaborations with other national and international government agencies and universities in the area of counter-terrorism. This project primarily contributes to the *Protecting Australia from Terrorism and Crime* National Research Priority goal.

Introduction–Research

Zaynab Aly is a research chemist working on the identification of different manufacturers' chemical and isotopic signatures of bullets, cartridge cases and hand swabs from bullets. She is applying a range of techniques for materials characterisation that ANSTO uses in its own research and offers as services to customers. Like many ANSTO staff, Zaynab works on a number of research projects. She has also been working on geopolymer wasteforms as possible candidates for the immobilisation of intermediate and low level radioactive waste

It was a landmark year for ANSTO research in 2006-07 due to a number of factors. There were significant developments in research facilities; evolution of the research portfolio; key collaborations were formed; more technologies were commercialised; significant training and education programs were conducted; and there were changes in ANSTO's research leadership.

The key development in ANSTO's research facilities was the commissioning of the OPAL reactor and its state-of-the art neutron beam instruments. This facility has opened up exciting opportunities for researchers around Australia. Its world-class quality puts Australian researchers at a new international competitive advantage. The new instruments will also open up areas of research in biology, materials science and engineering, which are set to benefit many areas of Australia's economy and society in years to come.

One example of this increase in capability is research that will use the improved neutron scattering facilities to 'see' hydrogen and the contrasts between different hydrogen isotopes. This will allow scientists to look more closely at how hydrogen behaves under different conditions expanding research in areas such as drug design. During the year ANSTO received the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS) funding to establish a National Deuteration Facility to support this kind of research.

The successful development of the neutron beam instruments is testimony to the quality of the researchers, engineers and technical staff in the Bragg Institute. The new OPAL facility has attracted top class researchers from around the world, including some expatriate Australian scientists who have been enticed home. The skills that they have brought with

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them have greatly enriched the Australian research base. Most of these scientists are also experts in X-ray scattering, so their presence here in Australia has also contributed to the development of the Australian Synchrotron in Melbourne and its potential user base.

In terms of commercialisation, this year saw two new companies established to take ANSTO research to market. ANSTO is determined to push its innovations through the development pipeline to deliver benefits to the nation.

CeramiSphere is commercialising a patented ANSTO technology that provides encapsulation and controlled release of active molecules from nano-spheres which are so small they can be injected into the bloodstream. They have many potential applications, including drug delivery, cosmeceuticals and speciality chemicals. At present, while CeramiSphere is a fully-owned ANSTO subsidiary, it is collaborating closely with partners that offer routes to specific markets.

Australian Membrane Technologies (AMT) is commercialising a nano-particulate membrane bioreactor, patented by ANSTO, which provides an efficient oxidation and biomass retention system for waste water treatment. It is more cost effective than existing technologies, highly effective in recovering solids and bacteria, and has potential for domestic and small-scale industrial use as well as use in large municipal treatment plants.

Both these technologies were developed in ANSTO's Institute for Materials and Engineering Science. CeramiSphere's technology builds on capabilities that ANSTO had already developed in nanotechnology, which in turn was a product of its long history of research in ceramic wasteforms. This illustrates the surprising outcomes that can emerge from research over extended periods of time. AMT's technology also evolved from sol-gel chemistry developed for ANSTO's nuclear wasteform research.

There are two more examples of capturing outcomes of research. The first was the Australian Pipeline Industry Association's release of ANSTO's Pipestrain software. This software was designed to analyse the stresses and strains on pipes in the gas industry and was developed by the Cooperative Research Centre (CRC) for Welded Structures. ANSTO was a member of this CRC, which recently concluded. The second was a joint venture with Connell Wagner which resulted in the development of software to analyse and model the cost and scheduling of major power station infrastructure shutdowns and maintenance which was initiated on the same CRC.

Significant steps were also made in the commercialisation of synroc and our minerals capabilities, as discussed in the materials research section and the ANSTO Minerals business unit, respectively.

In research training, ANSTO has embarked on a number of initiatives in recent years, and 2006-07 saw the first fruit from two of the most exciting ones. The first five projects began under our Collaborative Research Support Scheme with the University of Melbourne, and the first candidates were selected under a jointly funded postgraduate scheme with the University of Sydney.

The collaborations with the University of Melbourne addressed diverse topics such as light metals, materials for advanced nuclear

fuel cycles, polymers, counter-terrorism and 'molecular machines'.

The first postgraduate students supported through the University of Sydney scheme will undertake research in membranes, molecular and microbial biosciences, hydrogen storage, heavy-metal oxides and thin film biosurfaces.

Postdoctoral fellowships are one of the most significant stages of researcher training, and ANSTO has greatly expanded its postdoctoral program in recent years. It now has 45 postdoctoral positions, of which 18 are jointly funded with other organisations and therefore highly collaborative.

Meanwhile ANSTO has awarded its first Senior Research Fellowships, to Klaus-Dieter Liss from the Bragg Institute and Katerina Zavitsanou from the Radiopharmaceutical Research Institute. Their research is outlined on pages 37 and 46.

ANSTO is increasingly using joint positions and secondments to increase its research productivity and impact, and to enable other organisations to better appreciate the potential applications of nuclear techniques. The collaborations with Sydney and Melbourne universities are examples of this in action, as is the secondment of an ANSTO staff member during the year to the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

ANSTO has also extended its collaborations with CSIRO in its Food Science project, discussed on page 36, and through involvement with CSIRO's Wealth from Oceans and Energy Transformed National Research Flagships.

Change in research leadership started in January 2007 when Professor John Dodson, previously at Brunel University and the University of Western Australia, joined ANSTO as its new Head of the Institute for Environmental Research. In the same month, Professor Lyndon Edwards from the Open University in the UK commenced as the new Head of the Institute of Materials and Engineering Science.

Plans for 2007-08

Three of ANSTO's five research themes will be adjusted in 2007-08 to reflect the evolution of our research portfolio. As a result, the five themes will be:

- Isotopes in the Environment
- Health and Radiation Science
- Nuclear Materials Engineering
- National Interest and Capability Enhancement
- Neutron and X-ray Scattering

The first four of these themes align with the four National Research Priorities (NRPs) while the fifth represents the development of an underlying capability which supports research across the NRPs.

The Institute for Environmental Research will focus on applying the capabilities it has developed over the past few years to a major regional study of the interaction of water availability, climate variability and human impacts.

ANSTO is also committed to significant growth of its Radiopharmaceutical Research Institute, particularly in the use of radiotracers to better understand the fundamentals of disease and in

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support of clinically-driven research involving radiopharmaceuticals.

Substantial overarching changes occurred in Nuclear Materials Engineering as a result of a Restructuring and Reconfiguration process in what is now called the Institute of Materials and Engineering Science. This is based on three programs, namely Advanced Nuclear Systems, Nuclear Solutions and Structural Integrity.

The decision of the Australian Government to seek membership of the Generation IV International Forum, which is working on the next generation of nuclear power systems, provides some very challenging opportunities for materials research. This research will also be applicable to high temperature coal-fired power plants and fusion energy systems.

Meanwhile the Bragg Institute will be focusing on the commissioning of its new neutron beam instruments and we look forward to seeing the first research outputs from these instruments. It certainly will be an exciting year for Australian science with research also commencing at the Australian Synchrotron.

Acquiring and Utilising Nuclear Knowledge

Amparo Lopez Rubio, one of the Bragg Institute team, joined ANSTO in May 2006, after completing a PhD in Food Science and Technology at the Polytechnical University of Valencia, Spain. Her research applies scattering techniques to the study of food structures, with the aim of correlating them with the functional properties of the products. Within the Food Science project, she has been mainly involved in understanding resistant starch, a fraction of starch which is not digested in human's small intestines and is associated with health benefits such as weight regulation and prevention of colorectal cancer.

Neutron and X-ray Science

Introduction

ANSTO's application of neutron scattering and X-ray science has always been well recognised internationally and the new OPAL facilities are set to place Australia as a world leader in these fields. ANSTO scientists use neutron scattering and X-ray science in a diverse range of areas such as polymers, pharmaceutical products, food science, biology, oxides, magnetism, earth sciences and engineering problems such as welds and stresses.

Neutrons and X-rays are complementary tools for investigating atomic and molecular structures and the properties of matter. Neutrons interact with the nucleus of an atom whereas X-rays interact with the electron cloud surrounding the nucleus of an atom. They are both used to solve complex research and industrial problems.

List of Projects

- Neutron Scattering–Science/Research Project
  Bragg Institute staff support and collaborate with neutron beam instruments users from within ANSTO and the wider research community. Staff also maintain their expertise and reputations through their own research, conducted within this project. The range of research and the number of people using the instruments is anticipated to rise in 2007-08 as new instruments come on line. This project contributes primarily to the *Breakthrough Science* National Research Priority goal.
- Food Science Project
  Neutron and X-ray science techniques and expertise are being used to investigate fundamental and industrial issues facing food science, such as storage and processing. As mentioned on page 36 this project

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incorporates a major collaboration with CSIRO. This is a new area of exciting research for ANSTO and contributes to the *Ageing Well, Ageing Productively* NRP goal.

- Characterisation of Biomolecules Project
  Understanding the make-up of biomolecules is another key area of new research for ANSTO. This research has implications in a variety of areas in medicine and industry. The project contributes to the *Frontier Technologies* NRP goal.
- Nanostructural Engineering Project
  ANSTO has been developing a comprehensive strategic technology platform, based on sol-gel processing, atomic layer deposition and plasma processing. Neutron scattering has been probing materials at the nano level to help develop new applications in protective and adaptive coatings for abrasion/corrosion resistance, coatings in photovoltaics and biotechnology and engineered polymer systems. Nanostructural Engineering primarily contributed to the *Advanced Materials* NRP goal and collaborates strongly with industry and targeted research organisations such as the CRC for Polymers.
- Neutrons for Engineering Project
  Neutrons can be used to provide answers to engineering problems such as residual-stress and cracks. The project has also supported the new residual stress instrument being built for OPAL. This project has close collaboration with industrial researchers and primarily contributes to the *Frontier Technologies* and *Advanced Materials* NRP priority goals.

OPAL 'Menagerie'

During 2006-07 five new neutron beam instruments entered commissioning, producing the first neutron scattering patterns from the OPAL reactor. By the end of 2007 the Bragg Institute will begin operating a scientific user service at the OPAL neutron beam facility. By 2008 this service will include seven neutron beam instruments, each designed to provide different types of information. The instruments are named after Australian native animals and together comprise a menagerie of exceptional scientific quality with uniquely Australian identities.

The initial menagerie comprises the following:

- **Echidna** is a high resolution powder diffractometer, specialising in determination of crystal structure in complex materials such as ceramics, minerals and advanced materials with potential applications in electronic devices.
- **Koala** is a neutron Laue diffractometer which specialises in rapid determination of crystal structure in single crystals of complex chemicals and in characterisation of the role of hydrogenous molecules in biological systems.
- **Kowari** provides a powerful method for assessing thermomechanical and residual stress in industrial components, such as turbine blades and in welded structures, at the atomic level.
- **Platypus** is a neutron reflectometer that examines surface and interfacial structures in solids and liquids such as membranes, surfactants and complex layered compounds for microelectronics applications.

Acquiring and Utilising Nuclear Knowledge

- **Quokka**, a small angle neutron scattering instrument, characterises structures from 1 nanometre to 1 micrometre in size in polymers, proteins and various porous media. This instrument uses the new cold neutron source on OPAL.
- **Taipan**, a thermal neutron three-axis spectrometer, measures atomic, molecular excitations, such as vibrations, librations and magnetic exchange interactions in exotic magnetic and superconducting materials.
- **Wombat**, a high intensity powder diffractometer, specialises in time-resolved atomic structure determination and looks at how structures change over time or under certain conditions, chemical reactions and kinetic studies.

At the end of 2009 there will be two more additions to the menagerie:

- **Pelican**, a time-of flight, polarised neutron spectrometer, and
- **Sika**, a cold neutron three-axis spectrometer, which is funded by the National Science Council of Taiwan.

These two instruments will extend the capability of instruments at ANSTO to more subtle, lower energy dynamic interactions and expand the understanding of the behaviour of exotic magnetic and superconducting materials.

The entire menagerie was designed to meet the highest standards of performance, safety, reliability and user-friendliness. For the last seven years a multidisciplinary team of over 60 staff from many parts of ANSTO have contributed to the design, construction and assembly of these instruments.

The first two instruments fully commissioned were **Echidna** and **Wombat** and they have demonstrated performance far in excess of their predecessors at HIFAR. They look certain to be competitive with the best of their type in the world. Subject to regulator approval ANSTO is planning to commence user experiments in early 2007-08. Commissioning of **Koala**, **Kowari** and **Platypus** began in the

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first half of 2007. Initial safety assessment of **Kowari** and **Platypus** is proceeding well, so ANSTO anticipates moving quickly to performance demonstration and application for their operating licences. **Koala**'s safety commissioning was smooth, but some technical difficulties interrupted commissioning in the first half of 2007.

Quokka and **Taipan** will reach the commissioning phase in late 2007. All going well, they will be ready for experiments early in 2008.

Case study

Food Science

Nuclear techniques such as small-angle neutron and X-ray scattering offer unique insights into the structure of food products and ingredients, enabling significant improvements in food safety, quality and nutrition so as to improve health and reduce disease. With these and associated techniques, ANSTO scientists can create and 'watch' real-time simulations of the structural changes that proteins, polymers and other food components undergo as they are being processed or digested, all at the scale of a micron (one-millionth of a metre) down to a nanometre (about 10 atoms wide).

In July 2006 ANSTO launched its Food Science project, in collaboration with Food Science Australia, the University of Queensland and CSIRO's Food Futures Flagship. This project aims to conduct research of national significance for the improvement of food processing techniques and nutrition.

One of the first studies investigated the health benefits of certain starches. Starches occur naturally in wheat, potato and rice and are used in many processed food products. Although most starch is digested in the small intestine, broken down by enzymes called amylases in a process called hydrolysis, a small amount, known as 'resistant starch', is indigestible. This undigested starch passes to the large intestine where it is converted by colonic bacteria into short-chain fatty acids. It is these fatty acids that are believed to be a key to improved gut health and the prevention of diseases such as colorectal cancer and Type II diabetes. In short, scientists hypothesise that if you can increase the percentage of resistant starch in food products, you will increase the amount of short-chain fatty acids in the colon and thereby improve health.

Of particular interest are resistant starches known as RSIII. These are found in processed starches, which form the bulk of starch in most people's diets. ANSTO scientists developed simulations, using samples of maize starch, to compare what happened to it when digested with amylase enzymes and without. The results showed that the hydrolytic action of the amylase enzymes reorganises the starch's molecular structure, making it more crystalline and therefore resistant to digestion. What this reveals is that RSIII-type resistant starch is not present in natural starches, but it formed by the enzymes during the digestion process itself. The perceptions of RSIII among food scientists and in the food industry should change as a result of this research, especially in terms of the use of processed starches in food products.

Acquiring and Utilising Nuclear Knowledge

Klaus-Dieter Liss, from the Bragg Institute, joined ANSTO in May 2004, coming to Australia from Europe. His expertise is in diffraction techniques using neutron and synchrotron radiation. He led the construction of the **Echidna** OPAL neutron beam instrument before he was awarded one of ANSTO's first Senior Research Fellowships. In his fellowship project, he will examine what happens in metals under thermo-mechanical processes. Better understanding of the physics of materials under manufacturing or application conditions will allow the development of lighter, more resistant and longer lasting products.

Case study

Extreme conditions metals

Demand is set to increase for industrial and consumer equipment that is lighter, thinner, stronger, longer lasting and better able to perform in extreme conditions, such as high pressure and temperature or exposure to radiation. Metals used in such equipment will have to be engineered with extraordinary precision. This means understanding in minute detail the physical and chemical behaviour of metals while they are undergoing thermomechanical industrial processing (for example, how a property like hardness slowly changes), or what happens when a device in operation, such as a spinning turbine blade, is subject to high temperature and mechanical stress.

Conventional analytical techniques can assess a metal only after it has been rapidly cooled to room temperature, but the structure of metals at high temperature and room temperature are very different. Using neutron and synchrotron radiation techniques, however, transformations in the metal's atomic and microstructures (its phase composition, grain correlations, texture, grain size and so on) can be studied *in situ* – that is, *while* the metal is being heated, processed or subjected to operational stress.

This year ANSTO awarded a Senior Research Fellowship to Dr Klaus-Dieter Liss, an expert in diffraction methods, to run a project studying deformation processes in metals, particularly under extreme conditions. Dr Liss is recognised internationally for his groundbreaking work, in collaboration with European and Australian universities, in using synchrotron powder diffraction methods to conduct *in situ* investigations of the behaviour of the phase composition of titanium

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aluminide (a light-weight alloy with great potential for high-temperature applications in the transportation and aerospace industries) as it was heated up to 1400°C.

Dr Liss and his team started their new project in May 2007. Their investigations of metal deformation will have spin-off benefits for ANSTO research in materials for the nuclear power cycle and steels for supercritical power plants. The project team is keen to establish themselves as world leaders in their field, and with ANSTO's credentials in diffraction techniques and materials science together with the new neutron powder diffractometers – Wombat and Echidna– at the OPAL reactor, there is every chance they shall.

Acquiring and Utilising Nuclear Knowledge

John Dodson was appointed the Head of the Institute for Environmental Research in early 2007 and is passionate about making a difference by helping to alleviate Australia's water crisis and provide greater understanding on the effects of climate change through science. John spent most of his working life teaching and carrying out research in universities in Christchurch, Sydney, Perth and London before taking up his current position. With research currently being carried out in Australia, China and Pacific Islands, his vision is to apply ANSTO's considerable expertise to address significant environmental issues in climate change, water sustainability and human impact on environmental systems.

Isotopes in earth systems

Introduction

The Institute for Environmental Research uses isotope tracing techniques to understand patterns of air current movement through the atmosphere; the age, recharge, evaporation and movement of water in aquifers; the uptake and sites of deposition of chemical elements in plant systems; how food chains work; and the origins of air pollutants. The Institute also uses isotopes to estimate the age of materials and surfaces to investigate climate changes, human impacts and landscape development.

ANSTO has some of the most sensitive instruments for such research in the world, in specially designed laboratories and staffed by trained specialists who measure isotopes in earth systems. These are fundamental for developing an understanding of how complex environmental and biological systems function, and these understandings underpin what we need to know in managing environmental systems and developing policies for the sustainable use of water and biological resources.

List of Projects

- **Cosmogenic Climate Archives of the Southern Hemisphere (CcASH) Project**
  This project identifies, collects, measures and analyses unique records of climate change in the Southern Hemisphere using nuclear-based techniques and cosmogenic radionuclides. The research can deliver geo-chronological frameworks, a better understanding of environmental change, landscape evolution of the Australian continent and processes of climate variability in the past. CcaSH primarily contributes to the *Responding to Climate Change and Variability* NRP goal.

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- Isotopic Tracers in Atmospheric Transport (IsoTrans) Project
  Using novel applications of ANSTO nuclear techniques and (radio)isotopic tracers, this project aims to produce advanced representations of surface-atmosphere exchanges and mixing for better predictions of diurnal and seasonal cycles of pollution and water resources in major cities, river basins and ecosystems. IsoTrans primarily contributes to the *Responding to Climate Change and Variability* and *Water–a Critical Resource* NRP goals.

- Isotopes for Water Project
  In this project, ANSTO scientists undertake isotopic water studies focussed on both water supply (the amount of water) and water quality (its value to the community). The goal is to increase stakeholder belief in the benefits of isotopic science for the management and improvement of water resources in Australia and ultimately assist in the effective management of water in Australia. This project primarily contributes to the *Water–a Critical Resource* NRP goal.

- ATLAS - ANSTO Technologies, Leaders in Analytical Science
  ATLAS supports environmental research by providing analytical expertise and by operating and developing ANSTO's analytical capabilities. ATLAS provides trace element, radioisotope and stable isotope analyses to a wide range of researchers both within ANSTO and to external clients. One notable success of the project was the proof-of-principle for two new methods of mass spectrometry achieved by ANSTO scientists. This project primarily contributes to the *Reducing and Capturing Emissions in Transport and Energy Generation* NRP goal.

- Radwaste Science
  Within this project, ANSTO scientists provide the technical knowledge needed to underpin the case for radioactive waste facilities, including aspects of wasteform durability, facility design, modelling and performance assessment. In addition, the project provides a focus for ongoing ANSTO research relating to the environmental impact of nuclear operations, focusing on radioactive waste, radionuclide migration and impacts on the environment. This project primarily contributes to the *Transforming Existing Industries* NRP goal.

- Accelerator Science
  This multifaceted ANSTO project has two main objectives. Firstly, it aims to drive accelerator-based research, particularly related to heavy ion microspectroscopy; ion beam induced charge effects in semiconductor nuclear detection systems; nuclear methods in transboundary air pollution studies; heavy metal accumulation mechanisms in plants; and nuclear reaction analysis of multilayers, interfaces and thin film microelectronic devices. Secondly, the project aims to provide safe, efficient and effective operation and scientific enhancement of ANSTO's mass spectrometry and ion beam analysis capabilities, facilities and expertise for use by ANSTO, universities, CSIRO, local and state governments, industry and international organisations. This project contributes to diverse NRP goals, including the *Reducing and Capturing Emissions in Transport and Energy Generation* and *Protecting Australia from Terrorism and Crime.*

Acquiring and Utilising Nuclear Knowledge

Suzanne Hollins, a member of the Institute for Environmental Research, joined ANSTO in 2001 having completed a PhD in environmental physics at James Cook University. She leads the *Isotopes for Water* project, which uses isotopic tracers and techniques to improve effective management of water resources and aquatic ecosystems. Through strategic collaborations and the transfer of research outcomes into improved management practices, ANSTO is helping ensure the protection, conservation and sustainable development of these valuable natural resources.

Case Study

Isotopic Atmospheric Tracers

Most people know that air pollution created in one city or country can travel vast distances and affect other cities and countries. Using nuclear techniques, ANSTO scientists have developed a new way to determine not only what caused the pollution, but also where in the world it came from.

Past research conducted by ANSTO scientists developed ways to use accelerator technology to determine whether fine particles suspended in the air were produced by man-made combustion sources (such as cars, industrial plants and mining) or by natural sources such as soil and sea spray. By measuring the naturally occurring radioactive trace gas radon, the geographic origins of the pollution can now also be determined.

Having completed its involvement in the Aerosol Characterisation Experiment in East Asia (ACE-Asia), tracking the movement of fine particle pollution on an international scale, ANSTO is focusing its pollution research on its home town of Sydney, which can suffer from high pollution levels.

The IsoTrans project has commissioned a network of detectors for monitoring radon, co-located with ANSTO fine particle pollution samplers, at four locations in and near Sydney. With nodes at Lucas Heights, Wollongong, Richmond and Muswellbrook, the network is contributing high quality data to ANSTO investigations of atmospheric pollution in urban and industrial areas.

Radon provides information on the recent history of the air-stream, which the project team is using to help trace the origins of man-made and natural airborne pollutants arriving at the network nodes. The combination of

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radon analysis, which tracks the pollution's origins, together with ANSTO's accelerator analysis, which determines whether the pollution is natural or manmade, gives more accurate understanding to scientists. The results are combined with advanced meteorological analyses using sophisticated multivariate statistical analysis techniques to reconstruct regional patterns of pollution emissions on seasonal and inter-annual timescales.

Datasets collected during ACE-Asia have been used to test the new combined technique, and it has been confirmed this year that the method delivers atmospheric pollution source information that is more comprehensive than provided by previously available, non-nuclear methods. The challenge now is to apply this novel methodology to the new Sydney network in order to produce unique atmospheric composition profiles for urban and industrial areas that are affecting a high proportion of the Australian population.

Case Study

Retreating East Antarctic Ice Sheet

The East Antarctic Ice Sheet – the world's single largest mass of ice – is 3000 km across and up to 4 km deep at the South Pole. If it were to melt, sea levels would rise by 60 metres. Even if only 10% of it melted due to global warming, the consequences would be catastrophic.

ANSTO scientists have been part of a multinational team which has used ANSTO's sensitive particle accelerator dating equipment to test traditional theories. The degree of melt following the last ice age 20 000 years ago is a guide to how much it may melt with global warming.

The research team collected rock samples from various mountainous Antarctic locations. Cosmogenic exposure age dating indicated when the rocks were deposited by glaciers. This data, combined with the altitude at which the sample was obtained, enabled calculation of how thick the Antarctic ice sheet was at that time.

The results were surprising and showed that the ice sheet has not changed for 7000 years. Its latitudinal extent today is similar to what it was at the end of the last ice age. It had previously been believed that the ice shelf had extended 200 km further north.

600 km inland the ice sheet was stable and started reducing about 5000 years after the ice age. This suggests that coastal parts of the Antarctic ice sheet will respond to warming quicker than predicted. The bulk of the ice sheet, however, aided by colder air over Antarctica, will be more resistant to global warming than previously expected.

Overall, initial signs of rising sea levels can be expected to come from the retreat of the smaller and more unstable West Antarctic and Greenland ice sheets, glacier melting and thermal expansion of the oceans, rather than from a reduction in the Antarctic ice sheet.

Case Study

Metal-eating plants

Most plants wither and die when their soil becomes contaminated by toxic metals, but

Acquiring and Utilising Nuclear Knowledge

there is a small group of plants which can absorb high levels of arsenic, cobalt, lead, zinc and other typically poisonous heavy metals without harm. These plants are known as metal 'hyper-accumulators', and their tolerance for toxicity can be put to good use. Because, in effect, they 'extract' toxic metals from the soil, they offer a low-cost, eco-friendly way to clean up and rejuvenate contaminated agricultural land and industrial sites. Scientists are also experimenting with using these plants for 'phyto-mining': that is, *harvesting* the metals they have absorbed. For both these reasons, there is a great deal of scientific interest in learning more about how they manage to grow in contaminated soils and accumulate such high concentrations of normally toxic metals.

It is generally believed that hyper-accumulating plants adapted to metal-contaminated soils over hundreds of thousands of years, perhaps because in such harsh environments there was less competition from other plant species. The secret of their success lies in their root system, which detoxifies concentrations of metal as they enter the plant, converting them into less harmful compounds. The plant then transports these compounds above ground into the stem and leaves where they are stored.

Researchers at ANSTO are investigating the biological mechanisms that prevent the metal from affecting the plant's main functions and trying to discover where precisely the metal is being accumulated on a cellular and even sub-cellular level. To do this, they are using the

heavy ion microprobe on ANSTO's Australian National Tandem for Applied Research (ANTARES) particle accelerator to produce high resolution X-ray images of plant tissues at a scale of a few microns (a micron is one millionth of a metre). These X-ray images, which are in effect 'maps', have revealed that metals may accumulate in the epidermal region around the outside of the stem, in the vascular bundles inside the stem itself, around the vascular bundles in the leaf and in the leaf's abaxial surface.

The goal of this research is to identify how to manipulate and optimise the processes that enable hyperaccumulation. It may be possible, for example, to create more efficient hyperaccumulators, to transform other, faster-growing plant species into hyperaccumulators (most existing hyperaccumulators grow very slowly), or to produce plants that can accumulate other toxic materials.

Case Study

ANSTO digs deep for water cause

The effective management of water resources is a critical issue in Australia. We are all being urged to 'save water', and federal, state and local governments are developing strategies to deal with the nationwide shortage. Scientists at ANSTO have developed a way to ensure effective management of one of the most valuable resources for the current crisis – groundwater.

The NSW Government released a 25-year Metropolitan Water Plan for Sydney in late 2004. There is an enormous amount of water in the Sydney Basin (the area from Newcastle to Jervis Bay and west to Lithgow), but it lies deep in aquifers in the sandstone. Although some of it is already used for drinking and irrigation, there is a potential for a great deal more to be made available.

ANSTO's role is to ensure that this valuable resource is not over-exploited and is managed effectively. Crucial to effective management is knowing how quickly an aquifer is replenished, or 'recharged', and a clue to this is the groundwater's age. 'Young' groundwater indicates the recharge is rapid and derives primarily from rainfall. 'Old' groundwater indicates the recharge is slow, so usage has to be managed with particular care. By analysing the carbon-14 in dissolved carbon dioxide and the tritium radioisotopes in groundwater samples, ANSTO scientists are able to date whether the water is 'young' or 'old'.

In one preliminary study (in conjunction with the NSW Department of Natural Resources) in the Kulnura-Mangrove Mountain region on the NSW Central Coast, ANSTO scientists estimated that some groundwater could be as old as five thousand years, considerably older than previous studies had indicated. The research is yet to be completed but indicates the importance of this technique in determining the sustainability of these aquifers, and that a close eye will have to be kept on their usage. Age dating of Sydney Basin groundwater carried out at ANSTO provides water managers with an independent tool to assess groundwater resources, advancing research on sandstone aquifers. The technique is not only applicable to the sandstone aquifers in the Sydney Basin, but can also be used in many other groundwater systems and ANSTO is expanding its application across Australia.

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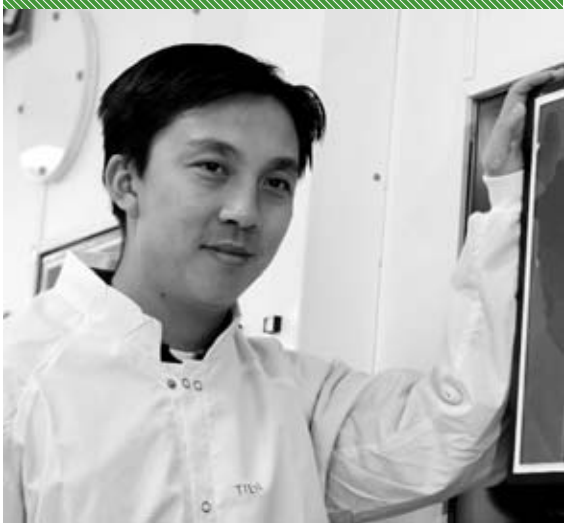

Tien Pham joined ANSTO in early 2003 and is working on the synthesis and evaluation of novel molecules for their potential for disease diagnosis and therapeutic purposes. He is developing ligands that target the sigma receptor and the peripheral benzodiazepine receptor, which are known to be over-expressed in certain cancers and are implicated in neurodegenerative diseases. By developing a more specific radioligand for a target receptor, clinicians can hone in on the location of cancer or make more accurate assessment of the neurodegenerative disease state. They can then assign the most appropriate therapy, potentially saving time, money and patient stress by eliminating the use of unnecessary treatment.

Improving health using nuclear medicine

Introduction

ANSTO's radiopharmaceutical research aims to improve understanding of disease progress, improve diagnosis and develop new treatments for diseases such as cancer, Alzheimer's and Parkinson. The Radiopharmaceutical Research Institute (RRI) employs its strengths in medicinal, synthetic and unique radiopharmaceutical chemistry to underpin the discovery, development and evaluation of novel radiopharmaceuticals and radiopharmaceutical processes. The institute works closely with Australian medical research institutes.

List of Projects

- Development of Radiopharmaceuticals for Imaging Cancer Project
  In this project, ANSTO scientists develop radiopharmaceuticals for imaging specific properties of cancer.
- Radioisotope Target and Process Development Project
  This project develops efficient processes for the production, separation and purification of radionuclides that can be used in radiopharmaceuticals for disease treatment and diagnosis.
- Molecular Imaging Project
  Researchers in this project are developing novel imaging techniques as well as providing molecular imaging research services for other ANSTO projects and external research bodies.

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- **Development of Radiopharmaceuticals for Imaging Neurodegeneration Project**
  In this project ANSTO is developing radiopharmaceuticals for imaging neurodegenerative diseases such as Multiple Sclerosis, Alzheimer's and Parkinson Disease and stroke.
- **CRC for Molecular Imaging Development Project**
  The objective of this collaborative research program is to develop radiopharmaceuticals for imaging fundamental disease processes and expand the clinical utility and availability of radiotracers and nuclear medicine imaging to the medical community.
- **Radiation Dosimetry for Proton and Synchrotron X-ray Therapy Project**
  This project has two objectives. First, it aims to address the need of radiation oncologists for knowledge and tools to help with emerging new modalities of radiation therapy. Second, it aims to expand applications of solid state micro and minidosimetric technologies for applications in radiation protection (terrestrial, aviation and space).

All the above projects primarily contribute to the *Ageing Well, Ageing Productively* NRP goal.

Case Study

Understanding drug-induced psychosis

Cannabinoids are potent substances that the body produces naturally to help control mental and physical processes. Cannabinoids are also absorbed into the body when a person uses substances derived from the cannabis (or marijuana) plant, in which case they produce intoxication and other effects. The most extreme effect is to trigger psychosis. This is known to happen in vulnerable individuals, most often during adolescence or young adulthood. Despite many targeted studies over the last decade, the connection between the use of these substances and the onset of psychosis is still not well understood.

ANSTO and the Schizophrenia Research Institute are collaborating in investigating the brain mechanisms underlying the onset of drug-induced psychosis. More information about these mechanisms could lead to the development of treatments to neutralise or reduce any psychosis-causing effects of such drug abuse. It could also shed light on the brain functions whose disturbances result in the disorganised thinking, attention deficit, and memory and language problems that characterise psychotic disorders such as schizophrenia.

A link between schizophrenia and cannabinoids has already been found in post-mortem studies. People with schizophrenia have abnormalities in their endo-cannabinoid system (the system that produces the body's own cannabinoids). This suggests that the body's endo-cannabinoid system might be a good target for new pharmacological approaches to understanding and treating drug-induced psychosis.

In light of this evidence, Katerina Zavitsanou, one of ANSTO's Senior Research Fellows, is attempting to simulate and examine the chronic effects of cannabinoids on cellular elements in the brains of rats. Future studies will examine how cannabinoids affect animals made vulnerable to developing psychotic-like

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Katerina Zavitsanou joined ANSTO in 2004 as a neuroscientist and was awarded one of ANSTO's first Senior Research Fellowships in December 2006. She leads a research program which uses neuroimaging models on rodents to investigate the brain mechanisms affected by substance abuse and psychosis. Katerina has also been involved in extensive schizophrenia research which focused on the investigation of neurochemical abnormalities in the brains of post mortem schizophrenia patients. Understanding of such abnormalities could lead to better diagnosis and treatment of the disease.

behaviour. Together these studies could indicate new pharmacological directions for treating both cannabis dependence and psychosis.

Initial research involves using *in vitro* (outside the body) techniques to identify the elements in brain cells that cannabinoids 'target' and to understand, by administering cannabinoids to the rodents, how the density and functionality of these cellular elements are modified or impaired. The way these cellular targets change over time can subsequently be tracked in the rodents *in vivo* (in a living body) using non-invasive neuro-imaging techniques. To 'see' what's happening to the cells, scientists inject the animal with radiolabelled tracers (radiopharmaceuticals) that attach themselves to the target cells and emit signals, providing information that can be read using ANSTO's molecular imaging Single Photon Emission Computed Tomogrpahy (SPECT) and Positron Emission Tomography (PET) cameras.

By enabling very tightly controlled studies of the 'real time' effects of cannabinoid drugs in living animal subjects, these cutting-edge techniques offer an exciting opportunity to use ANSTO's small animal imaging facilities to investigate brain-related disorders.

Case Study

Radiopharmaceutical receptors show the way

A RRI team is developing sophisticated new radiopharmaceuticals to locate cancer cells and tissue affected by neurodegenerative diseases and to 'map' their growth and proliferation.

In general terms, radiopharmaceuticals offer precisely-targeted but non-invasive techniques for producing images of what's happening in the body at the cellular level. Radiolabels are incorporated onto small molecules, which are

then injected into the blood and travel through the body. When they attach to the cells under investigation the radiolabels emit signals that can be used to provide images of cells that are diseased or abnormal.

The new radiopharmaceuticals under development target a family of receptors known as 'sigma receptors'. These are proteins found in many cells of the central nervous system – cells that interact with psychotropic drugs, opiates and psycho-stimulants. Currently we know of two receptor subtypes, 'sigma-1' and 'sigma-2', that also appear in high densities in a number of neuronal and non-neuronal tumour cell lines. Furthermore, there is evidence that sigma-2 receptors are implicated in the proliferation of cells as well as the regulation of apoptotic processes.

The RRI has developed several molecules (ligands) that target the sigma receptor through a kind of 'natural affinity'. The molecules have been radiolabelled with the isotopes iodine-123 and fluorine-18 and evaluated *in vivo* using one of ANSTO's SPECT imaging system cameras. Preliminary studies involving mixed sigma-1 and sigma-2 ligands have demonstrated uptake in melanoma and breast tumour models, so show strong potential for further research. Recently the RRI team developed novel selective ligands labelled with the fluorine-18 isotope for PET imaging, which specifically target the sigma-2 receptor. The biological evaluation of these is in progress.

The development of these novel ligands as PET/SPECT imaging agents could vastly contribute to understanding of biochemical pathways as well as provide new and more precise tools to assess tumour growth and proliferation in patients. In the coming months, the most promising sigma-1 and sigma-2 radiopharmaceuticals will be evaluated in models of cancer and neurodegeneration and their potential for imaging these diseases assessed. Successful candidates will be progressed to preclinical studies in partnership with organisations such as The Peter MacCallum Cancer Centre in Melbourne and the Brain and Mind Institute at Sydney University.

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Lyndon Edwards, the Head of ANSTO's renamed Institute of Materials and Engineering Science has research interests in structural integrity and materials engineering and has worked for over 20 years with the aerospace, automobile and nuclear power industries, using advanced scientific techniques to develop solutions to engineering problems. He holds a chair in Structural Integrity at the UK's Open University and is a leading proponent of engineering stress measurement using neutron diffraction.

Applying nuclear science to advance the understanding of materials

Introduction

ANSTO's materials research covers both the scientific and technological demands involved in running a nuclear reactor as well as the development of innovative materials, materials processing techniques and characterisation capabilities.

With a multidisciplinary team of ceramicists, metallurgists, physicists, chemists, engineers and earth scientists, ANSTO's nuclear expertise and facilities have been used for projects such as the design and construction of new radiation detectors, to improve the structural integrity of safety-critical structures and the longevity of welded structures such as OPAL, and to develop safe methods for the long-term storage of radioactive wastes.

Looking forward, the Institute's advanced nuclear systems teams are exploring how ANSTO might develop new materials to improve the safety and performance of 'next generation' nuclear power plants. This could include novel alloys better able to withstand the high temperatures and extreme conditions produced by Generation IV power reactors.

List of projects

- Nuclear Component Integrity Project
  This project contributes to the safe and efficient operation of ANSTO's existing and future nuclear plant. Researchers involved also develop an understanding of the fabrication methods, behaviour under irradiation and post-irradiation examination of reactor fuels.

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- Application of new materials technology Project
  This commercially-oriented project tailors ANSTO's intellectual property created within other materials engineering projects to meet the needs of external customers.
- Tools for Engineering Asset Management Project
  The objective of this project is to assist the sustainability and competitiveness of Australian industry; and to showcase ANSTO's capabilities by applying relevant research resources to solve problems identified by Australian industry.
- Advanced Materials for Environment and Energy Applications Project
  Researchers in this project develop radioisotope separations technologies based on inorganic and composite organic-inorganic materials and explore these materials for applications in wider energy and environment areas.
- Atomic Scale Processes in Nuclear Materials and Minerals Project
  Under this project, ANSTO researchers aim to understand atomic scale processes and structure-property relationships in advanced ceramic oxide materials (such as synroc-based wasteforms) and their mineral analogues, in order to develop new nuclear materials and predictive models for their behaviour.
- Nuclear Waste Form Development Project
  This project aims to perform research and development to commercially exploit ANSTO's innovative ceramics and glass-ceramics, such as synroc, to help solve the global problem of radioactive waste immobilisation.

All the above projects primarily contribute to the *Advanced Materials* NRP goal.

Case Study

Does antimatter matter?

ANSTO is engaged in partnerships with leading research teams in Australia to develop advanced materials for applications in industry, medicine and the environment. Key to developing the next generation of 'designer' materials is nanotechnology. This involves manipulating materials at the molecular level by controlling the position of the atoms – like making things out of Lego™ but on a scale 10 000 times smaller than the length of your little finger nail!

As a member of the Centre of Excellence for Antimatter-Matter Studies, ANSTO scientists are investigating the relationship between the molecular structure of materials and their functionality in order to optimise how the next generation of nano-materials is engineered. To do this they use positrons, the 'antimatter' of electrons (similar to electrons but with the opposite charge and spin). Positrons allow scientists to probe inside a material and investigate the tiny spaces ('nano-pores') that can form. Nano-pores are critical to the design of new materials because they act as protective bubbles and can be used to hold and store chemical and other substances. For example, they can convey therapeutic drugs such as radiopharmaceuticals through the body, intact and unharmed, until they reach their target destination where they can be 'unloaded' or activated.

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Suzanne Smith leads the research program on Nuclear Interactions with Matter at ANSTO. This program aims to establish the relationship between molecular structure and function of novel materials using nuclear probes. It is the first research program in the world to bring together atomic and molecular experimental and theoretical physicists, materials scientists, chemists and biologists to explore the interaction of positrons with matter. The team is applying positron science to advance materials engineering and medical imaging and therapy.

Positrons are excellent probes because when fired into a material, they become trapped in nano-pores. They bounce around inside these pores until they find an electron. The longer they bounce around, the bigger the pore. Positrons can tell us how large they are, where they are and how many there are – information which is important for designing materials with specific molecular architecture.

There is very complex and difficult-to-detect interaction between nano-pores and the chemicals they are designed to store. To monitor these molecular interactions, ANSTO scientists create radioactive mimics (or nuclear probes) that are extremely sensitive - comparable to detecting a droplet of a chemical in a swimming pool. The nuclear probes are used to see if the nano-material can be engineered to accommodate that chemical.

Already nanotechnology is used to make semiconductors, suntan lotions, cosmetics and other products. But by investigating the 'nano-porosity' of materials such as polymers, ceramics and wool powders, ANSTO scientists aim to develop even more sophisticated materials that store radioactive and other hazardous wastes; separate and release metal ions, drugs and other chemicals; and adapt 'intelligently' to their environments.

Case Study

Nuclear waste technology delivers high performance answers

What do ceramic armour, titanium golf clubs, light weight knee implants and high strength windows for spacecraft have in common? They are high performance engineered materials created using a materials processing technique called hot isostatic pressing (HIP).

ANSTO has one of the few facilities in the world able to produce these denser, more

reliable and longer lasting materials on an industrial pilot scale using the HIP process. This innovative thermal treatment uses high temperature and pressure to evenly compress components, to remove defects and pores from component castings and improve bonding between the materials. The resulting structures have improved strength and durability.

HIPing also allows for the creation of a new generation of alloys not readily available through traditional melting methods. Combinations of materials such as ceramics and metals can be alloyed together to form new light-weight orthopaedic products.

ANSTO's expertise in HIP technology has nuclear origins. For more than 25 years, ANSTO scientists have been developing ceramic and glass-ceramic waste forms to lock up nuclear waste. Waste forms need to hold a high concentration of waste with high durability and enough flexibility to accommodate process and waste variations.

ANSTO's synroc (synthetic rock) waste forms mimic titanate minerals that have immobilised naturally-occurring radionuclides such as thorium and uranium in the Earth's crust for billions of years. Produced using HIPing, ANSTO's titanate ceramics incorporate the waste within the crystal structure of the rock.

In short, HIPing can lock up nuclear waste and can also be applied in customised high-performance components for the medical device, automotive, sporting, mining, semiconductor, space and defence industries.

Educating and training the Australian Community

Susan Pearce, and **Anna Paradowska** (pictured) are two of the last postgraduate research students to use ANSTO's original HIFAR reactor. Both doing PhDs in mechanical engineering, they received support from AINSE to make regular visits to ANSTO's neutron beam facilities. Susan (Adelaide University) and Anna (Monash) were independently researching the residual stresses that occur in metals as a result of high-temperature welding repairs. Using 'TAS', the Triple Axis Spectrometer, they applied neutron diffraction techniques to investigate how particular welding techniques stress, or deform, the atomic planes of a metal structure, either weakening or strengthening it. These nuclear techniques are the most accurate way to assess the structural integrity of metal components in power plants and aircraft, for example, where metals are exposed to high pressures, extreme temperatures or corrosive environments.

Australian Institute of Nuclear Science and Engineering (AINSE)

Located on ANSTO's Lucas Heights site, the Australian Institute of Nuclear Science and Engineering Incorporated is a not-for-profit association of 39 universities and GNS Science in partnership with ANSTO. Thirty-six of the universities are in Australia and three are in New Zealand. AINSE was established by the Commonwealth Government in 1958 and has three full-time staff.

AINSE's mission is to advance research, education and training in nuclear science and engineering and related fields within Australasia by being, in particular, the key link between universities, ANSTO and other member organisations and major nuclear science and associated facilities. The mission is supported by four strategic goals, to be achieved by the end of 2008, as follows.

1. Members will have access to major nuclear and related research facilities in Australia and some overseas facilities through AINSE.
2. Research performance of our scientific outcomes will have increased substantially.
3. All universities in Australasia, some sections of the CSIRO, many major museums, many non-teaching hospitals and a significant proportion of the scientific institutes in Australasia will be members of AINSE.
4. AINSE will have expanded its existing set of excellent scientific networks.

AINSE operates on a calendar year basis with a 2006 income of $5.3 million. This report covers the period 1 January to 31 December 2006.

Core business

AINSE uses its funds primarily to provide access to nuclear and other facilities at ANSTO and to AINSE-supported facilities. In 2006, it

supported 211 university projects and provided supplements to 57 postgraduate research students, with a total value of $2.2million. The projects have applications in many fields where nuclear science and technology can provide unique insights, including cultural heritage, advanced technology, manufacturing, mining, agriculture, medicine and environmental protection. Over the course of the year 466 papers, 215 of which appeared in refereed journals, and 64 theses were published as a result of AINSE-supported research.

AINSE ran four conferences during the year: a Radiation Conference in April; Neutron Scattering Symposium in December; the NUPP (Nuclear and Particle Physics) and Plasma Conferences in December were part of the AIP (Australian Institute of Physics) Biennial Congress; and the ITER (International Thermonuclear Experimental Reactor) Forum in October 2006.

AINSE awarded International Travel Scholarships to nine post-graduate students to assist them in presenting their AINSE-supported research at international conferences. The ninth AINSE Winter School took place in July 2006 with the program being judged an outstanding success. AINSE offered a scholarship to each of the 39 member universities to enable a nominated third-year student to participate.

Additional projects

AINSE acts as a peak body on behalf of its member organisations in applying for and administering major research infrastructure grants. An application to the Australian Research Council Linkage Infrastructure and Equipment Fund was successful for 2006. The grant of $240 000 for access to the UK facility ISIS, the world's most powerful pulsed-neutron source, was supplemented by $126 250 from universities, $25 000 from ANSTO and $8 750 from AINSE. Nineteen experiments were accepted for a total of 48 days on the facility and, based on that research, 29 papers were published.

Australian Synchrotron Research Program (ASRP)

The Australian Synchrotron Research Program gives Australian researchers access to state-of-the-art synchrotron radiation research capabilities at three overseas synchrotron light source facilities:

- the Australian National Beamline Facility at the Photon Factory, Tsukuba Science City, Japan
- the Advanced Photon Source at the Argonne National Laboratory in Chicago, USA; and
- the National Synchrotron Radiation Research Centre in Hsinchu, Taiwan.

Synchrotron radiation based techniques are vital to a wide range of research fields: physics, chemistry, materials science, structural biology, polymer research, environmental science and geophysics. The ASRP's facilities are open to any scientist working at an Australian research institution, including government and industry research laboratories. Access is on the basis of scientific merit via a peer-reviewed proposal system, and includes travel and subsistence funding for successful applicants. The ASRP stations scientific staff at each overseas facility to assist visiting Australian research teams.

Educating and training the Australian Community

The ASRP is funded by the Australian Federal Government's Major National Research Facilities program until June 2007, and has received additional funding from NCRIS to continue the program until December 2008. ANSTO has managed the program since its inception in 1996. The success of the program can be seen in the broad range of Australian research organisations, universities and state governments that have partnered with the Victorian and New Zealand Governments as foundation investors in the Australian Synchrotron.

The Australian synchrotron user community has grown steadily since the ASRP was established. The ASRP currently supports visits to these overseas synchrotron facilities by about 190 Australian research teams a year, and serves a total user community of more than 500. Scientists from 24 universities, four government laboratories including ANSTO and five CRCs regularly use ASRP beamlines.

Synchrotron research

A highlight for 2006 was the establishment of the Asia-Oceania Forum for Synchrotron Radiation Research (AOFSRR), with the ASRP as one of nine foundation organisations. The goal of the forum is to foster cooperation and collaboration between the user communities and synchrotron facilities of the region. The first annual AOFSRR workshop was held at the KEK laboratory, Tsukuba Japan, in November 2006.

In addition to acting as the ASRP's managing agent, ANSTO is a significant user of its facilities. In the last year 20 projects led be ANSTO scientists from the Environment, Materials and Engineering Science and Bragg Institutes were awarded beamtime on the ASRP's overseas beamlines. Projects included the study of metal uptake by hyper-accumulating plants, structure studies of functional surface films and novel oxide materials, studies of nano-structures, and investigations of novel polymers.

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The ASRP administers a postdoctoral fellowship program funded by subscriptions from its member organisations. Dr Naveen Bhatia, who is studying hyper- accumulation of metals in certain plants, was an ASRP fellow based in the Environment Institute until January 2007.

ASRP member organisations

Australian National University, Curtin University of Technology, Monash University, University of Canberra, University of Melbourne, University of Newcastle, University of NSW, University of Queensland, University of South Australia, University of Sydney, University of Western Australia, CSIRO, and the state governments of NSW and Victoria.

Access to Major Research Facilities Programme

ANSTO has operated the Access to Major Research Facilities Programme since 1990, when it was established by the Australian Government. The term 'major research facilities' refers to large facilities not available in Australia, such as synchrotron radiation sources, high flux neutron beam sources, high energy physics facilities and astronomical facilities. For Australian science to remain at the cutting edge, and for Australia to benefit from developments in technology, our scientists must have access to these facilities.

The International Science Linkages (ISL) programme, which is a part of the Federal Government's Innovation Statement: Backing Australia's Ability - Building Our Future through Science and Innovation, provided funding of $704 000 for the 2006-07 financial year.

The program objectives are to provide financial support to Australian researchers from industry, private and public research organisations and universities so that they can:

- travel to major international research facilities not available in Australia
- attend strategic planning meetings essential to Australia's participation in projects that require the use of major international research facilities not available in Australia.

There are two unique demands that must be met for access to major facilities and which underlie the current program:

- Access to the facilities is highly competitive and scientists often receive very short notice that their application has been successful. It is therefore vital that the program has a fast turnaround time.
- In many cases, use of these facilities is complex. Consequently, postgraduate students and technicians are often involved in running experiments. Our program provides for multiple personnel to visit the facilities.

During the 2006-07 financial year the program funded 95 teams to perform experiments using facilities in the USA, Europe and Asia. Although no preference is given to our own research, 12 ANSTO teams received funding to visit overseas neutron scattering, synchrotron and accelerator facilities.

The programme is highly appreciated by Australian researchers and has recently been extended for three years.

Education Program

ANSTO has always actively sought community involvement and education opportunities. Over the last year the education program developed to further benefit science students, science

Educating and training the Australian Community

teachers, government initiatives and the general community.

As well as offering general public site tours, ANSTO also offers customised site tours for senior science classes. These tours tailor the information delivered to NSW HSC syllabus outcomes for physics and chemistry. The education officers involved each received professional training so that they know exactly what's on the syllabus and how to educate visiting students on their subject matter. Work books were also developed to act as an additional resource material for teachers. A number of other publications were also created, copyright free, to supplement the curriculum.

ANSTO has also benefited the teaching community by holding four professional development days for teachers. Over 120 teachers attended from all over NSW, from as far west as Broken Hill, as far south as Albury and as far north as Armidale. These professional development days sought to educate teachers on the applications of nuclear physics and chemistry in the workplace as well as showing teachers parts of the ANSTO site most relevant to the syllabus.

ANSTO's Careers in Science initiative, which was backed by the CSIRO, Australian Institute of Marine Science (IMS), Defence Science and Technology Organisation (DSTO), New South Wales Ministry for Science and Medical Research (OFMR), followed a Federal Government National Schools Strategy which identified the need for greater promotion of careers in science. The plan aims to encourage more school students to pursue careers in science through the publication of educational resources, site tours and a special website www.careersinscience.gov.au Further to these publications, one ANSTO staff member made interactive presentations in local schools to encourage students to take on science in years 11 and 12.

ANSTO also held two community forums over the year whereby the general community was invited to an open discussion of issues of importance to ANSTO and the community.

Report of Research and Operations

Providing Nuclear Health Solutions to Australians

Saving lives using Nuclear medicine

ANSTO Radiopharmaceuticals and Industrials (ARI) is the commercial nuclear medicine arm of ANSTO. It is the primary supplier of radiopharmaceuticals in Australia.

By improving the diagnosis and treatment of infection, cancer and heart disease, nuclear medicine is helping to save lives in Australia and around the world. Each year, around 500 000 Australians benefit from nuclear medical procedures that use radioisotopes from ARI.

Eighty per cent of ARI's radiopharmaceuticals are produced at the OPAL research reactor. ARI also manufactures radiopharmaceuticals at the National Medical Cyclotron in Camperdown. From its base in Sydney, ARI supplies around 200 public and private nuclear medicine centres in Australia as well as exporting radiopharmaceuticals to Asian, New Zealand, US and European markets.

Nuclear medicine involves using small amounts of radiation to diagnose and treat disease conditions such as cancer, heart disease, thyroid disorders and bone fractures. The radiation comes from radiopharmaceuticals that travel through the human body to the area under investigation. These tailor-made compounds contain radioisotopes – atoms which spontaneously produce specific amounts of radiation that can be used to diagnose and treat a wide range of human diseases and injuries.

Nuclear medicine is safe because radiopharmaceuticals only emit tiny quantities of radiation. Radiopharmaceuticals rapidly lose their radioactivity and are quickly eliminated from the body by normal body processes. As radiopharmaceuticals have a limited shelf life, they must be produced close to where they are used and transported without delay.

Report of Research and Operations

ANSTO has more than 40 years experience in the production and development of radioisotopes for medical, industrial and environmental applications. Radiopharmaceutical production processes and facilities at OPAL are currently being automated and upgraded to significantly increase the quality, quantity and range of ARI's radioisotope products and services.

Seeing inside the body

Nuclear imaging techniques are used to 'see' diseased or inflamed tissues and organs inside the body. Radioisotopes are chosen to suit the body organ or physiological process being studied. The most commonly used diagnostic radiopharmaceutical, technetium-99m, is used to diagnose various heart, kidney, lung, liver and thyroid conditions and some bone cancers. iodine-123 is used to diagnose various thyroid, adrenal, lung and bone conditions. thallium-201 is used to diagnose heart conditions and gallium-67 is used for tumour and infection imaging. Nuclear imaging is particularly useful in the early diagnosis of cancer and is helping to increase cancer survival rates.

Using radiopharmaceuticals to treat disease

Radiopharmaceuticals are also used in therapy and palliative care. For example, ARI supplies Australian company Sirtex Medical with yttrium-90 for its SIR-Spheres®, which are used to treat liver cancer. An Australian innovation, the yttrium-90 micro-spheres are injected into the bloodstream and travel to the liver, where they selectively irradiate the tumours. The micro-spheres are sold in Australia, the USA, Europe and throughout Asia. Worldwide, more than 800 000 new cases of primary or secondary liver cancer are diagnosed each year, with life expectancies varying from months to years.

ARI also produces Quadramet™ (samarium-153) for alleviating pain from breast and prostate cancers that have spread to the bones. iodine-123 is used to treat thyroid cancers. iridium-192 is used in internal radiotherapy, while phosphorus-32 is used by physicians to treat polycythaemia vera (a chronic disease characterised by an increase in the number of red blood cells and blood volume).

Radioisotopes for industry and science

ANSTO produces a range of radioisotopes for use by industry and in scientific research. For example, radioisotopes produced by ANSTO are used to safely and reliably test the integrity of power station turbine blades, pipeline welds, aerospace structural components, railway tracks, bridges and heavy mining equipment. Other uses include checking the density of the rock on which bridges and roads are to be built, measuring the extent of subterranean oil resources, gauging refinery tank levels and assessing mineral flow on conveyor belts. iridium-192 is the most commonly used industrial radioisotope in Australia.

Environmental applications of radioisotopes include using technetium-99 to trace the movement of water and pollutants in bays and harbours.

Commercially Applying Nuclear Science

Tony Taylor works in Australian Membrane Technologies Pty. Ltd., which is a subsidiary of ANSTO formed to commercialise Tony's invention: the nano-particulate membrane bioreactor. This invention is a hybrid organ that assembles cells (bacteri, fungi) into a simple lung composed of gills. The invention is extremely efficient and economical for treating sewage, making antibiotics, foods, enzymes and many other applications. Tony's career has also included work on fossills in a Martian meteorite, exploring the possibilities that there was once life on Mars. He has also had extensive media coverage for his invention and is now recognized as a leading researcher in Astrobiology and Biotechnology.

Commercial Services to Industry

Access ANSTO is the commercial interface for industry to access ANSTO's nuclear science expertise, technology and unique research capabilities. This valuable portal provides companies and organisations with a single point of entry and a comprehensive view of the depth of specialist services and diversity of research undertaken at ANSTO, the many benefits of working with ANSTO, and how to utilise its renowned science and technology.

A new web portal specifically for business/industry audiences, launched by Access ANSTO provides external customers with easy access to all of ANSTO's:

- Specialised technical services
- Contract and collaborative research capabilities
- Technology transfer opportunities
- Radiation safety training.

During the past year Access ANSTO has been instrumental in assisting commercial partners to exploit a wide range of new opportunities, which support the strategic directions of ANSTO and will lead to increasing new strategic partnerships with industry. We have seen a continued strong interaction with industry, with external services, training, and contract research revenue of $11 773 000, an increase of 10% over the previous year with an average project value of $7 200.

Some of the industry projects Access ANSTO has supported include:

- Successful tendering with Australian Stock Exchange listed WorleyParsons Ltd to operate the Australian Synchrotron facility in Melbourne
- Participation in the clean-up of legacy waste at Nexia's Sellafield site in the UK using synroc ANSTO technology
- Establishment of a long-term strategic

Report of Research and Operations

partnership between a major international mining company and ANSTO Minerals for ongoing contract research and development work

- Successful tendering between industry partners and our radiation safety services for radioactive classification and remediation of contaminated sites in Australia
- Undertaking a major remaining life assessment for Yallourn power station, VIC
- Development of a postgraduate asset management course with the University of Wollongong
- Cold crucible technology – demonstration and scaleability of technology to a commercial level
- Successful licencing of proprietary analytical software for understanding pipestrain for the gas industry and software to improve economic analysis of maintenance shutdowns in the power industry
- ANSTO Inc. is currently arranging to undertake a 'proof-of-concept' demonstration for the US Department of Energy in relation to ANSTO's synroc technology through the use of Hot Isostatic Pressing (HIP). This demonstration will highlight the ability of the synroc technology to successfully encapsulate various forms of nuclear waste and reduce their storage needed significantly through the use of the HIP technology
- ANSTO recently committed $10 million to construct and operate a new state-of-the-art Positron Emission Tomography (PET) nuclear medicine production facility. ANSTO has linked with global medical operator Siemens to supply PET products to the Australian medical market utilising the Siemens PETNET system. The initial facility will include a dual PET facility in Sydney, NSW and be capable of producing PET isotopes for the superior imaging and diagnosis of cancer and other medical conditions
- ANSTO has developed a software product to assist companies undertaking initial assessments and ongoing monitoring of environmental risk assessments on their sites to enable them to determine how to efficiently manage their operations. ANSTO has licensed Australian based group, Hearn Scientific to distribute this product.

Strategic Partnering

A key approach adopted in our commercialisation model is the creation of strategic partnerships with a variety of large and small to medium enterprises. This holistic approach to commercialisation means we are able to add value to industry partners by:

- Utilising unique scientific instruments and equipment maintained at ANSTO
- Identifying and exploiting research capabilities through collaborative partnerships, analytical skills, and expertise of researchers
- Engaging with industry in strategic partnerships through the provision of research, joint ventures and Intellectual Property transfer.

Technology Transfer

ANSTO is committed to the transfer of its technology and adoption by industry of the outcomes of its significant discovery research programmes.

Commercially Applying Nuclear Science

The Sulfide Solutions acid mine drainage and associated environmental mining consulting business was successfully transferred to the international consulting engineering group SRK Consulting Australasia Pty Ltd, generating ongoing royalty payments for future use of the ANSTO developed SULFIDOX software.

Three wholly owned companies established their operations during the year as a prelude to future technology transfer to industry.

CeramiSphere Pty Ltd has developed an exciting new encapsulation and controlled release technology platform. Potential market applications include; controlled release of specialty chemicals such as biocides and pesticides for use in paints and coatings, delivery of drugs, and active ingredients in personal care and cosmetic products. The company is currently undertaking paid proof-of-concept projects for industry in the areas of biocide and surface protection for a leading international building products company and anti-tampering for an international pharmaceutical company.

Australian Membrane Technologies (AMT) was incorporated to develop and market products using its proprietary Nanoparticulate Membrane Bioreactor (NMB) technology for sewerage, wastewater treatment, bioenergy and biopharmaceutical market applications. Proof-of-concept trials as a precursor to licence

Report of Research and Operations

agreements are being conducted with companies in the building products, biodiesel, biogas and biopharmaceutical industries.

ANSTO Inc commenced operations in the US to represent ANSTO's nuclear waste management technologies. The main focus is to actively participate in the US Department of Energy waste management assessment process, where synrocANSTO is one of the four short-listed technologies for the clean-up of high level waste.

CeramiSphere and AMT were successful in applying for Commercialising Emerging Technologies (COMET) grants to fund the preparation of detailed strategic plans, information memorandums and strategic patent protection advice.

New Project Development

The ANSTO Innovation Forum supports inventors with the development of their innovative ideas through the 'proof of concept' phase and supports the transition through to industry-ready products. Access ANSTO has supported the project development of:

- Cryptates – A universal ligand for binding to specific sites, particularly useful in the targeting of cancer. ANSTO is currently partnering with several world renowned medical centres for the application of this 'linker' technology on neuroblastoma, diabetes, breast cancer and apoptosis. Currently the technology is being arranged to be licenced to a number of groups
- Peripheral – type Benzodiazepine Receptor (PBR) – Early stage targeting of stroke and Alzheimer's disease and some cancers. Initial selection of a lead compound has been finalised as part of *in vivo* testing and further toxicity tests are currently being undertaken. This will then lead to clinical trials being progressed with industry partners.

ANSTO Minerals

In a world concerned with global warming and future energy supplies for growing economies, the interest in nuclear power and uranium has grown significantly. Over the last year, this has resulted in ANSTO Minerals expanding its laboratory facilities and people resources to meet the increased demand from companies seeking to expand existing facilities or bring new uranium mines into production.

ANSTO Minerals is a mining industry consultancy that has specialised knowledge of uranium ore processing. The group has a 25 year track record of providing practical solutions and innovative technology in ways that deliver financial and environmental benefits to the mining industry. Consulting and sponsored, collaborative and contract research is carried out in:

- Uranium ore processing and extraction;
- Control of naturally occurring radioactive materials (NORM) in the minerals industry; and
- Process development in hydrometallurgical processes.

Australia has the largest reserves of uranium in the world and is the world's second largest uranium (yellow cake) producer. ANSTO Minerals has strong on-going relationships with all of Australia's uranium producers, and has worked with these companies since start-up. The recent rapid rise in the uranium price has

resulted in a flurry of expansion, and exploration and feasibility studies. ANSTO Minerals is working on several new development projects for mines in Australia and overseas.

In addition, there is a growing awareness of radioactivity in other, non-uranium mineral products. This has been driven by stricter regulations and the threat of legal liability over exposure to NORM. ANSTO Minerals is involved in the development of such resources by providing consulting and process development services, with specialist advice and expertise relating to radionuclide deportment.

Commercial Activities

Revenue from the provision of consultancy and R&D services has almost doubled from $2.3 million in 2005-06 to $4 million in 2006-07. Over the year, ANSTO Minerals carried out a wide spectrum of projects for more than 20 clients, with the major fraction of the revenue received from half a dozen key clients. An increasing proportion of revenue has come from project work carried out at the pilot plant scale and at mine sites. Interaction with industry has increased, resulting in significant travel both within Australia and overseas, with several new players appearing on the scene.

Research

The primary objective of ANSTO Minerals research is to develop technologies that will increase the competitiveness and environmental sustainability of operations in the uranium mining sectors and industries affected by NORM.

The current research focus in uranium processing has been in the following areas:

- the application of resin-in-pulp (RIP) technology to uranium extraction. RIP can produce considerable savings by eliminating a large expensive solid/liquid separation step;
- the development of uranium separation technologies, such as solvent extraction and ion exchange, which will tolerate the presence of chloride. This is of particular interest to Australian uranium operations in arid areas where high quality water is in short supply; and
- the identification of gaps in knowledge that are inhibiting a balanced assessment of the development potential of Australia's uranium deposits. This project is the subject of co-operative research between ANSTO Minerals, CSIRO and Geoscience Australia under the CSIRO Minerals Down Under (MDU) flagship.

ANSTO Minerals keeps abreast of the regulatory requirements for the handling and processing of minerals containing radioactivity by close co-operation with ARPANSA and state regulators and through participation in IAEA committees.

Report of Governance and Performance

Safety Arrangements and Environmental Performance

Athena Prib joined Safety and Radiation Services at the start of 2005 as a Radiation Safety Training Facilitator. Her job involves designing, co-ordinating and teaching radiation safety courses to a wide range of participants from emergency services, government organisations (such as CSIRO, Australian Customs and Defence), universities, research facilities and hospitals, and industries such as mining, construction, oil and petroleum. Running courses on radiation safety improves awareness of radiation and safety in the work place and helps dispel some of the myths about radiation.

An assesment of ANSTO's performance concluded that ANSTO's performance was efficient and effective in producing its principal outputs and outcomes.

Environmental Protection

ANSTO is committed to operating in a manner that protects the environment and is consistent with Australian and international standards. Environmental awareness is promoted throughout the organisation and ANSTO strives for continual improvement in environmental performance.[1]

Environmental management system

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. This standard requires that environmental risks and legal requirements are understood and managed, an appropriate measurement and review system is in operation, and that there is an organisational commitment to continual improvement. In addition all parts of our environmental monitoring program operate within a quality system certified to the ISO 9001:2000 standard for Quality Management Systems.

Environmental performance

Accurate measurements with independent verification

ANSTO's environmental monitoring program includes measurements of radioactivity and some key non-radioactive materials in air and liquid emissions and in samples of air, surface- and ground-waters, sediment and biota from the local environment. General environmental radiation is also monitored and local weather patterns reported. Many monitoring capabilities are checked and independently verified.

[1] This section constitutes ANSTO's report on its performance in relation to ecologically sustainable development and environmental matters as required under Section 516A of the *Environment Protection and Biodiversity Conservation Act 1999*.

Report of Governance and Performance

Environmental monitoring in 2006-07 has confirmed that ANSTO's releases of radioactive material into the environment continue to be at very low levels.

Airborne doses low

The levels of radioactivity released in air are too low to be directly measured away from the site. Computer modelling is therefore used to translate measurements into theoretical radiation doses to people at various distances from the site. The outcome of this modelling estimated that the maximum potential public dose derived from ANSTO in 2006-07 was 0.0020 mSv. This corresponds to less than 0.2 per cent of the 1.0 mSv annual limit for members of the public established by ARPANSA.

For the closest neighbours, ANSTO's activities added less than 0.15 per cent to the average 1.5 mSv dose received by Australians from natural background radiation. During the year, the modern OPAL research reactor was opened and the nearly 50 year-old HIFAR research reactor was closed. These historic events have significantly reduced the contribution made by ANSTO's nuclear reactor to the already tiny potential public dose of radioactivity from airborne emissions.

Liquid effluent discharges within limits

Effluent discharged from ANSTO into the sewer complied with all limits for radioactive discharges, in accordance with the Trade Waste Agreement with Sydney Water. Compliance with these limits ensures that water at the Cronulla sewage treatment plant meets World Health Organisation drinking water standards for radioactivity. During the year a review was initiated with Sydney Water of the Trade Waste Agreement limiting concentrations for non-radioactive materials, such as ammonia, zinc and total dissolved solids. The aim of the review is to provide assurance that ANSTO's discharges remain within authorised limits and pose no threat to the environment.

Good water quality

ANSTO regularly monitors stormwater leaving the site, as well as sampling the nearby Woronora River. Results show that tritium concentrations remained below a level considered acceptable in Australian drinking water. Gross alpha and beta measurements were also below the levels required for stormwater/surface waters, following the *NSW Protection of the Environment Operations Act 1997*. In fact, more than 95 per cent of measurements were below the stricter screening levels from the Australian Drinking Water Guidelines (ADWG). ANSTO's stormwater does not contribute to public water supply, but referring to the ADWG provides a useful context for understanding our data. Monitoring of groundwater at the Lucas Heights site showed no detectable ANSTO-produced radionuclides apart from very low levels of tritium.

Detailed reporting

The results and findings from our environmental monitoring program are available to the public in the annual report series *Environmental and Effluent Monitoring at ANSTO Sites*, and summarised in ANSTO's Corporate and Social Responsibility report available through the website.

ANSTO also reports annually to the Department of Environment and Water Reources about any activities that fall under

Safety Arrangements and Environmental Performance

John Geldeard joined ANSTO's Safety and Radiation Services in 2001 as an Active Handler working on loading and unloading radioactive targets from HIFAR to be processed for use in industry and medical fields. Four months later he joined the Fuel Management Team and has since completed three highly complex spent fuel shipments: two to France and one to the USA. He also assists the Waste Operations Team in reducing waste from the ANSTO site.

the National Environmental Protection Measures. Overall, ANSTO commits significant resources to effectively monitor, manage and report on its environmental impacts and responsibilities.

Ecologically sustainable development (ESD)

ANSTO's commitment to environmental protection and sustainability principles is embedded at the highest level. The organisation has defined strategic directions which inform its social, economic and environmental core values. These priorities 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. Specific local arrangements and objectives for protecting human health, safeguarding our operations and minimising our environmental footprint derive from these overarching documents. The measures adopted to achieve our environmental commitments are documented in environmental management plans that underpin ANSTO's Environmental Management System.

ANSTO activities that contribute to ESD include our research into the significant environmental issues of dryland salinity, water management, climate variability and purification of waste water. This research enhances scientific knowledge and improves environmental outcomes. Our active support of nuclear non-proliferation and the development of nuclear safeguards also accords with ESD principles.

Finally, ANSTO's commitment to ecologically sustainable development means that special emphasis is placed on reducing the Organisation's environmental footprint by minimising waste production, and the consumption of resources such as paper,

Report of Governance and Performance

electricity and water. 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.

Safety arrangements

ANSTO is committed to ensuring a safe and healthy environment for employees, visitors, contractors and the external community. All ANSTO activities are governed by a 'safety first' philosophy that means work is planned and will only be performed if it is judged to be safe.

Safety and environmental principles, values and commitments are set out in the ANSTO Health, Safety and Environment Policy which is supported by a framework of documents that constitutes our safety management system. Key elements of the safety system are:

- documented requirements and guidance,
- formal review and approval of potentially hazardous work,
- auditing and evaluation of safety performance
- communication of safety issues and performance to workers and the community.

During the reporting period, the ANSTO safety documentation was completely updated and preliminary steps were taken to integrate with ANSTO's environmental protection system.

Accidents and incidents

An important part of ANSTO's safety management system is the capturing of information on all safety-related events including accidents and 'near misses'. This ensures the proper investigation of all such events and the implementation of safety improvements. It also gives us data to drive improvements in ANSTO's safety performance. One key indicator of safety performance is the number of incidents that are reported to regulators (Comcare and ARPANSA).

In 2006-07 ANSTO informed Comcare of 14 notifiable incidents. Four of these were serious personal injury (or possible serious injury), nine were dangerous occurrences and one was an incapacity (notified when the staff member is absent for 30 days or more). Comcare investigated one reported incident and their report concluded that ANSTO did not breach duty of care under section16 (1) of the *Occupational Health and Safety (Commonwealth Employment) Act 1991*. All but one of these incidents were conventional health and safety issues (i.e. muscle strains and sprains).

All incidents were investigated and improvements made to work practices as a result.

Measuring radiation by the dose

Everyone is exposed to ionising radiation from natural sources. People may also be exposed to radiation from non-natural sources, including medical procedures such as X rays. The effect of radiation on our body is called dose and is measured in sieverts (Sv). Typical doses of radiation are so small that they are usually expressed in units of one thousandth of a sievert, known as a millisievert (mSv). According to the most recent data from ARPANSA, the average dose an Australian receives from natural background radiation

Safety Arrangements and Environmental Performance

Table 1: Effective dose

	2002-03	2003-04	2004-05	2005-06*	2006-07
Maximum effective dose mSv	9.7	9.8	10.2	10.2	9.4
Average effective dose mSv	0.8	0.8	0.8	0.8	0.6
Collective effective dose man-mSv	684	692	697	690	545

*The 2005-06 values do not include an outlier dose value of 65.9 mSv

Table 2: Distribution of individual effective dose

dose ranges (mSv)	2002-03	2003-04	2004-05	2005-06	2006-07
0 to 2	756	824	807	751	926
2 to 5	80	82	66	61	41
5 to 10	23	18	20	28	13
10 to 15	0	0	1	1	0
> 15	0	0	0	1	0

(excluding medical sources) is 1.5 mSv per year. Federal and State regulations require that a member of the public should receive no more than 1 mSv per year from radiation sources other than background radiation and medical procedures. The regulatory limit for radiation workers is 20 mSv per year, averaged over five years, with no more than 50 mSv in any one year.

ANSTO's workers are routinely monitored for exposure to radiation. Monitoring results for 2006-07 show that the radiation doses received by ANSTO workers remain significantly below regulatory limits.

Table 1 shows the maximum, average and collective effective doses for the past five years. Table 2 shows the distribution of individual effective doses over the same period. The graph in Figure 1 compares maximum and average effective doses. Regulations give annual dose limits for radiation workers for the whole body (effective dose), for the skin (shallow dose) and for extremities such as hands or feet. The dose limits are:

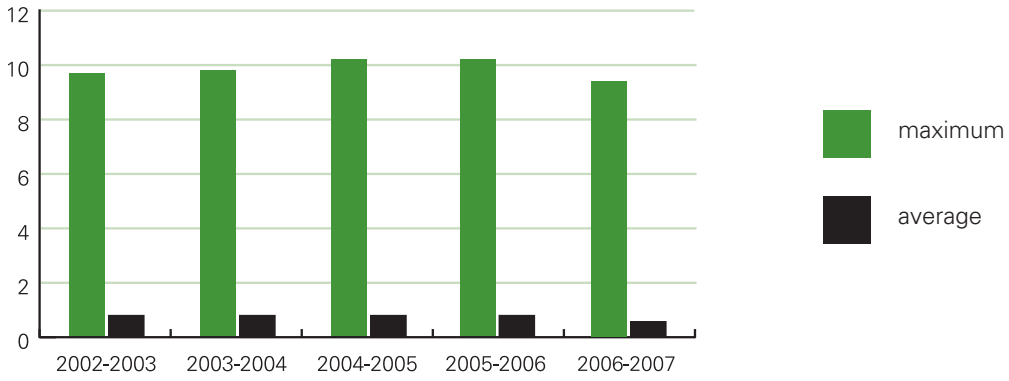
- whole body 20 mSv, averaged over five years
- shallow (skin) 500 mSv
- extremities 500 mSv.

Emergency preparedness and responses

ANSTO and emergency services organisations jointly maintain a 24-hour emergency response capability to deal with incidents at Lucas Heights. The Response Plan for Accidents and Incidents describes how an emergency

Report of Governance and Performance

Figure 1: Comparison of the maximum and average annual effective doses



response will be coordinated and identifies who is responsible for which actions. Each organisation has standing procedures detailing each individual response. NSW emergency services manage responses to emergencies with potential significant offsite radiological consequences at state-level according to the Lucas Heights Emergency Sub Plan. There is also a district-level Lucas Heights Emergency Evacuation Sub Plan supporting these arrangements. In the event of an emergency, ANSTO staff would give technical assistance and practical support to emergency service organisations.

ANSTO maintains a close working relationship with emergency service organisations through the Local Liaison Working Party. The working party includes ANSTO specialists and representatives of emergency service organisations, local government, and support organisations, including NSW Health. ARPANSA is an observer. As a result of a memorandum of understanding established between ANSTO and the NSW Fire Brigade during the year, there are improved descriptions of all major fire hazards on the ANSTO site.

An ongoing program of emergency training and evacuation drills is in place for all of site. Staff in each work area undergo training in the local emergency response protocols and are familiarised with the appropriate muster points. This training is supplemented with evacuation drills that are run with the respective Building Wardens.

ANSTO staff continued to run the Radiological Awareness Program for local emergency service organisations and functional groups in cooperation with ARPANSA. Specific radiological training is also provided to the NSW Fire Brigade members as part of their HAZMAT training.

Performance Against Strategic Objectives

The Australian Government funds ANSTO in three separate tranches, or outcomes, to:

1. acquire new nuclear based infrastructure, that is, the construction and commissioning of OPAL
2. arrange for the reprocessing or disposition of spent HIFAR fuel
3. deliver valued, nuclear-related scientific services and products.

The first two outcomes are funded in accordance with specific Government decisions. The third outcome is subject to a Quadrennium Funding Agreement (QFA) between the Minister for Finance and Administration, the Minister for Education, Science and Training, and ANSTO. Funding on a quadrennial basis provides a more stable financial environment and a realistic timeframe in which to plan for and deliver outputs and outcomes.

The following performance report covers all three outcomes and reports against outputs identified in ANSTO's section of the 2006-07 Department of Education, Science and Training Portfolio Budget Statement.

Outcome 1 – Nuclear based infrastructure

Objective

The replacement research reactor is operational and providing improved core nuclear facilities for medical, industrial and R&D (Research and Development) applications during 2006.

Indicators	Performance
Level of compliance with project plan and achievement of specific milestones:	
• On time	The replacement research reactor, OPAL, finished commissioning in 2006-7
• On budget	Replacement research reactor project milestones have been achieved within budget

Contributions of Outputs to Outcome

ANSTO's specific output relates directly to client supervision of the design, construction and performance testing of the outcome in the form of an operational replacement research reactor together with neutron beam instrumentation.

Indicators	Performance
Operating Licence achievement (June 2006)	• Achieved 14 July 2006
First criticality achieved	• Achieved 12 August 2006
Full Power	• 3 November 2006
First radioisotope delivery	• 19 April 2007
Cold neutron source commissioned	• April 2007

Outcome 2 – Disposition of Spent Fuel

Objective

Removal of spent fuel from the ANSTO site in line with stringent safety arrangements and community expectations.

Indicators	Performance
Safety procedures adhered to fully and shipment is: • On time • On budget	• 8th Shipment has been completed to schedule and within budget parameters

Output 2.1

Indicators	Performance
• Schedule for ninth shipment is completed	• Planning for the ninth shipment scheduled for 2009 is on track and meeting budget and time parameters.

Performance Against Strategic Objectives

Outcome 3 – Science and Technology Solutions

Output 3.1

Management of core nuclear facilities providing Australia with nuclear capability and credibility from which socio-economic benefits flow to Australia, the R&D community and industry.

Indicators	Performance	
	2005-06	**2006-07**
• Research beamline usage – percentage of all available days, across all instruments[i]	71%	**66%**
• Research reactor availability – percentage of actual hours at power as a proportion of total hours planned to be at power[ii]	99%	**97.8%**
• Accelerator usage – percentage of all available days, excluding maintenance, for tandem accelerators[iii]	91%	**77%**

Output 3.2

Expert scientific and technical services for and on behalf of Government, in support of Australia's national and international strategic and nuclear policy objectives.

Indicators	Performance	
	2005-06	**2006-07**
• Leadership role in national and international forums and networked organisations – number of such roles[iv]	35	**37**
• Person-years by staff on projects that have as a primary objective providing advice to Government	14[v]	**13.5**

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Output 3.3

The acquisition of knowledge, through research and its utilisation, through innovation, to advance the beneficial applications of nuclear science and technology to problems of environmental, medical, social and industrial importance.

Indicators	Performance	
	2005-06	**2006-07**
• Publication and conference papers		
- Books, chapters & monographs	2	**6**
- Journal articles	172	**350**
- Conference papers/abstracts	269	**289**
Total	443	**645**
• Number of research collaborations	251	**153**
• New inventions per year		
- Invention disclosures	16	**10**
- Provisional patent filing	4	**2**

Output 3.4

Science and technology services to industry and the Australian research and development community, including training of students in nuclear science and technology and its applications.

Indicators	Performance	
	2005-06	**2006-07**
• Number of postgraduates and undergraduates supervised	195	**143**
• External earnings from services and contract research	$10 435 044	**$11 545 249**
• External earnings from training courses[vi]	$251 000	**$201 000**

Performance Against Strategic Objectives

Output 3.5

Regular production and sale of radiopharmaceuticals and radioisotopes for medical and industrial applications and other services through designated business units.

Indicators	Performance	
	2005-06	**2006-07**
• Radioisotope sales (total)	$20 951 576	**$19 795 007**
• Export sales	$5 042 638	**$4 788 530**
• Radiopharmaceutical doses to patients – potential doses[vii]	$2 201 145	**$1 975 077**

Output 3.6

The exploitation of ANSTO's intellectual property and physical assets.

Indicators	Performance	
	2005-06	**2006-07**
• Intellectual property being commercialised – inventions and designs with active commercialisation plans	36	**18**
• External earnings from land management and CSIRO site support	$3 809 136	**$3 737 081**

i Reduction in beamline usage is due to a gradual decrease in research using the HIFAR instruments, which were shut down at the end of 2006. Staff effort was transferred to the installation of the new instruments at OPAL

ii Results for reactor availability reflects HIFAR availability to the end of 2006.

iii The indicator is for usage of Small Tandem for Applied Research (STAR) and ANTARES, with 13% allowed for maintenance. Difference in usage reflects the increased maintenance cycle for ANTARES and a 251 work day cycle

iv Leadership constitutes a level of responsibility above general membership and participation. Organisations include IAEA, Forum for Nuclear Cooperation in Asia (FNCA), Regional Cooperative Agreement (RCA), Organisation for Economic Cooperation and Development (OECD) and Nuclear Energy Agency (NEA). Committees including International Scientific Societies and International conference organising bodies, CRCs, ARC centres and networks, industry bodies

v* Note: The method of calculating this figure has change from last year (ANSTO Annual Report 2005-6). The change in the method for determining the data has resulted in an increase from 11 reported in 2005-6 to 14.6 and a comparable figure of 13.5 in 2006-7. The increase is due to the inclusion of 30% of our Counter Terrorism Research work; 25% of our Chief of Operations and CEO; and inclusion of work related to Nuclear Powered Warships

vi This figure includes Safety Training. The figure is low compared to previous years due to an increase in Safety Consultancy and the movement of resources to cater for the consultancy demand. The training income in other areas such as IAEA work is fairly consistent, and the variation in income appears to be due to the increase in consultancy work in Safety.

vii Potential doses to patients based on radioactivity of the five main ARI products, as measured at the point of despatch to nuclear medicine centres in Australia. These five main products are a Technetium-99m Generator, thallium-201, gallium-67 and the medical iodine products iodine-131 and iodine-123. The estimate takes account of transport times, rates of radioactive decay and average dose quantities per patient but not the centres' hours of operation and usages, patient characteristics or the organs imaged. The indicator only covers distribution in Australia, not exports.

Report of Governance and Performance

Corporate Governance

Barry Munns commenced as ANSTO's Chief Internal Auditor in May 2006. The scope of the Internal Audit team encompasses all areas of ANSTO, with an emphasis on providing independent assurance to both the Board and Chief Executive Officer on the efficiency, effectiveness and security of ANSTO's business operations, corporate governance, risk management, corruption prevention, and compliance processes.

Compliance

ANSTO is subject to the provisions of various Commonwealth Acts, Regulations made under these various Acts and Commonwealth Awards.

The principal Acts are:

- *Australian Nuclear Science and Technology Organisation Act 1987*
- *Australian Radiation Protection and Nuclear Safety Act 1998*
- *Commonwealth Authorities and Companies Act 1997*
- *Nuclear Non-proliferation (Safeguards) Act 1987*
- *Occupational Health and Safety (Commonwealth Employment) Act 1991*

Other relevant Acts include:

- *A New Tax System (Goods and Services Tax) Act 1999*
- *Archives Act 1983*
- *Auditor-General Act 1997*
- *Australian Radiation Protection and Nuclear Safety (Licence Charges) Act 1998*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Equal Employment Opportunity (Commonwealth Authorities) Act 1987*
- *Freedom of Information Act 1982*
- *Lands Acquisition Act 1989*
- *Legislative Instruments Act 2003*
- *Long Service Leave (Commonwealth Employees) Act 1976*
- *Maternity Leave (Commonwealth Employees) Act 1987*
- *Privacy Act 1988*
- *Racial Discrimination Act 1975*

Report of Governance and Performance

- *Safety, Rehabilitation and Compensation Act 1988*
- *Sex Discrimination Act 1984*
- *Superannuation Act 1976*
- *Superannuation Act 1990*
- *Superannuation Guarantee (Administration) Act 1992*
- *Superannuation (Productivity Benefit) Act 1988*
- *Therapeutic Goods Act 1989*
- *Workplace Relations Act 1996*

The principal Award is the Australian Nuclear Science and Technology Organisation (General) Award 1990.

ANSTO has put in place policies and procedures to deliver compliance with the above Acts and Regulations made thereunder, and with the above Award.

ANSTO Act –amendments

1. Amendments to section 5 of the Act

During the financial year, Section 5 of the ANSTO Act was amended to allow ANSTO to condition, manage and store some radioactive material and radioactive waste other than that which may arise directly from ANSTO's activities. As the pre-eminent expert body on radioactive materials and radioactive waste technology in Australia, with the facilities and trained personnel for managing radioactive material and waste, it is the Government's intention that ANSTO be able to fully participate in the management of radioactive material and waste in the possession or under the control of any Commonwealth entity.

The amendment also ensures that ANSTO is able to provide effective assistance to State and Territory jurisdictions, if asked, in ensuring public health and safety in the event of an incident, including a terrorist or criminal incident, involving radiological material. Authority to accept and manage radioactive material arising from a terrorist incident is an important component of Australia's counter-terrorism response.

Thirdly, spent nuclear fuel from ANSTO's reactors is sent overseas under contractual arrangements for reprocessing to convert it into an intermediate level waste form suitable for long-term storage and eventual disposal in Australia. Australian spent fuel may be combined with spent nuclear fuel from many sources and processed in bulk campaigns. Accordingly, the amendment clarifies ANSTO's authority to condition, manage and store the material returned to Australia as a result of the contractual arrangements entered into for this purpose.

More detail about these amendments can be found in the Explanatory Memorandum for the Bill, at http://www.comlaw.gov.au/ComLaw/Legislation/Bills1.nsf/0/69292790960BF6EFCA25714800285B07/$file/06019em.pdf The amendments came into force on 6 December 2006.

2. Amendments to governance parts of the Act

The Governance Review Implementation (Science Research Agencies) Bill 2007 (the Bill) was introduced into Parliament on 28 March 2007 and received Royal Assent on 21 June 2007. It seeks to improve the corporate governance of three statutory authorities in the Education, Science and Training portfolio - the

Corporate Governance

Australian Institute of Marine Science (AIMS), the Australian Nuclear Science and Technology Organisation (ANSTO) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The Bill is part of a broader exercise within the Australian Government to improve transparency and consistency in relation to governance arrangements for statutory authorities and office holders in response to the Government's endorsement of the recommendations of the Review of the Corporate Governance of Statutory Authorities and Office Holders (the Uhrig Review). The amendments to the ANSTO Act contained in the Bill will take effect on Proclamation.

Currently Section 9 of the *Australian Nuclear Science and Technology Organisation Act 1987* (the ANSTO Act) provides for a Board consisting of the Executive Director and "not fewer than 2 nor more than 6 other members". The ANSTO Act will be amended to reflect Uhrig Review recommendations for best practice regarding governance by a board by specifying that the Board will consist of 6-9 members including the Executive Director. Consistent with the amendments to be made to the governance of AIMS and CSIRO, the legislative requirement for Ministerial approval of contracts above a prescribed value (currently $5 million) will be removed by repealing section 31 of the ANSTO Act. This will be replaced by a requirement, set out in the Minister's Statement of Expectations, that the Minister is notified in advance of ANSTO entering into significant contracts. This is consistent with the provisions in section 15 of the *CAC Act.*

For consistency with commercial practice, the title of the chief executive of ANSTO will be changed to "Chief Executive Officer" rather than the current 'Executive Director', wherever occurring in the ANSTO Act.

More detail about these amendments can be found in the Explanatory Memorandum for the Bill, at http://parlinfoweb.aph.gov.au/piweb/Repository/Legis/ems/Linked/28030700.pdf.

The functions of the Board

A Board established under Section 8 of the *Australian Nuclear Science and Technology Organisation Act 1987* governs ANSTO.

The general functions of the Board, as set out in Section 10 of 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.

In particular, it has responsibility for:

- approval of organisational strategy and the annual business plan and budget
- monitoring financial performance
- monitoring managerial performance
- ensuring that the significant risks facing the organisation have been identified, and that appropriate control, monitoring and reporting mechanisms are in place.

The *Commonwealth Authorities and Companies Act* requires the Board to comply with certain accountability and corporate governance principles, including:

- the maintenance of an Audit Committee
- specific financial and reporting provisions

Report of Governance and Performance

- disclosure of all Board members' personal interests
- provision of indemnities and indemnity insurance in certain circumstances.

All *CAC Act* requirements are currently being met.

Processes are in place for performance assessment of both the Board and its Audit Committee and individual members thereof.

The Board has established an Audit Committee and a Remuneration Committee. All matters considered by those Committees are submitted to the Board for information and, where appropriate, ratification. Details of the Audit Committee and the Remuneration Committee are provided below. The Board is also supported in its role by other committees or mechanisms relating to safety and environmental management and to management of the research portfolio. These are also described below.

Board Charter

ANSTO has an established Board Charter, setting out the respective rights and responsibilities, functions and powers of Board members and ANSTO executives. It is made available internally on the ANSTO internet site.

Board membership

During the 2006-07 financial year, the Board comprised five non-executive members, drawn from the broader community, who are not involved in the day-to-day running of the organisation, and an Executive Director. The Executive Director, who is appointed by the Board, cannot be the Chair. The non-executive members are appointed by the Governor-General for specified periods. The dates of appointment and tenure of Board members are set out in the financial statements. Other positions held, including other directorships, are disclosed in the Board information section of this Annual Report.

Section 19 of the ANSTO Act provides that the Executive Director shall manage the affairs of the organisation, subject to the directions of, and in accordance with, policies determined by the Board. Senior management attend Board meetings as required to report on matters relevant to their individual areas of responsibility.

Each member brings complementary skills and experience to the Board. Its members during the 2006-07 financial year had experience in areas that included industry, information and communication technology, mining, scientific research, medicine and the commercialisation of research.

The Board meets regularly in accordance with a formally approved timetable and agenda. Board members receive regular papers from management on financial and business performance and specific papers on a range of issues relevant to the organisation.

Seven Board meetings were held during the 2006-07 financial year. Details of the number of Board meetings attended by each member during the period in which each member held office during the financial year are shown over.

Board remuneration and allowances

The remuneration and allowances of members of the Board, including the Executive Director, are determined by the Remuneration Tribunal.

Corporate Governance

Meetings – Board

Member	Eligible to attend	Attended
Dr Ziggy Switkowski[i] (Chair)	3	3
Mr Michael A Eager (Deputy Chair)	6	6
Dr Ian Smith (Executive Director)	7	7
Dr Carmel J Hillyard	7	6
Dr Agatha A van der Schaaf	7	7
Dr Klaus H Schindhelm	7	7

i Stood down from 6 June 2006 to 28 February 2007 to take up an appointment as Chairman of the Prime Ministerial Taskforce undertaking the Uranium Mining, Processing and Nuclear Energy Review.

Remuneration of Board members is disclosed in the Financial Statements.

Disclosure of interests of Board Members

Sections 27F-27K of the *CAC Act* provides for the disclosure of material personal interests in a matter that is being considered by the Board, and prohibits participation, deliberation and decision making by any member on such matters. All these requirements were met during the year.

Board member access to independent professional advice

The Board has established procedures by which members, in the interests of their duties, may seek independent professional advice at ANSTO's expense. In brief, members must first seek permission from the ANSTO Chairman.

Report of operations

Section 9, Schedule 1 of the *CAC Act* requires that the Organisation's Annual Report include a report of operations. *The Commonwealth Authorities and Companies (Report of Operations) Orders 2005* set out the requirements for such a report. In this Annual Report this is called a Report of Research and Operations. The format and content of the 2006-07 Annual Report, including the financial statements, addresses these requirements in general, and Appendix 6 sets out details of compliance with the particular requirements of these Orders.

The Board reports that:

- ANSTO's mission and strategic directions are being actioned
- Actual performance is reported against approved performance indicators
- Pursuant to Section 15 of the *CAC Act*, ANSTO notified the Minister:
    - o in December 2006 that the ANSTO Board has decided on the incorporation of two subsidiary companies, Australian

Report of Governance and Performance

Membrane Technologies Pty Limited and CeramiSphere Pty Limited; and

- o in June 2007 that the ANSTO Board has decided on the incorporation of a further subsidiary company PETNET Australia Pty Ltd.

- There have been no other significant changes in ANSTO's state of affairs or principal activities during the year
- ANSTO has continued to manage both the risks and opportunities it faces.

The Board reports that, in the opinion of senior management and the Board, at the time of making this report, adequate cash resources are, and will continue to be, available to cover ANSTO's requirement for working capital, to pay existing debts, and meet obligations during the next financial year.

The Board states that a risk oversight and management policy and supporting processes are in place and that adequate systems are in place to ensure compliance with this policy.

Health, safety and environmental protection

The Board places primary importance on the safe performance of all ANSTO activities. The monitoring of health, safety and environmental protection in general, and compliance with relevant legislation in particular, is designated as a responsibility of the whole Board. ANSTO's Health, Safety and Environment Policy clearly sets out the organisation's commitment to verifiable implementation of best practices in safety and environmental protection.

The Board attaches priority to the directions and recommendations on safety made by external regulators such as the Australian Radiation Protection and Nuclear Safety Agency and Comcare. All operation of nuclear facilities and work involving radioactive materials at ANSTO is conducted in compliance with licences issued under the *ARPANS Act 1998*.

The ANSTO Health, Safety and Environment Committee advises the Executive Director on the effectiveness and compliance of ANSTO's performance in the areas of health, safety and environmental management. During 2006-07, the ANSTO safety system was updated to emphasise the integration of focus on health, safety and environmental protection. The new ANSTO Occupational Health, Safety and Environment (OHSE) protection system includes documented procedures and guidance; reviews of higher risk activities by the Safety Assessment Committee and audits of system implementation and OHSE regulatory compliance. The Board receives regular reports on these issues, and in 2006-07 has encouraged strengthened management focus in these areas.

Audit Committee

The Audit Committee, a formal sub-committee of the Board, comprised during the year Mr M A Eager (Chair), Dr K Schindhelm and a member external to ANSTO, Mr W Wilton. Mr Wilton is a Chartered Accountant. The ANSTO Chairman is an ex officio member of the Committee. The Executive Director, the Board Secretary, the Chief Financial Officer, representatives of the Australian National Audit

Office and the Chief Internal Auditor attend all meetings or relevant parts of all meetings by invitation. Others attend meetings, as appropriate, at the invitation of the Committee.

In accordance with good practice, all Board members receive copies of Audit Committee papers and meeting minutes, and can attend Committee meetings as a right. This Committee was established by the Board under a formal written Charter to oversee the organisation's risk management policies, practices and controls in relation to financial and commercial activities, including the financial reporting process, legislative and regulatory conformance, corporate governance and asset protection. Its Charter extends to the review of safety and environmental systems and performance. The Charter is made available internally on the ANSTO intranet site. The Committee also reviews summaries of the internal and external audit work schedules and reports. Additionally, in accordance with the provisions of the *CAC Act*, the Committee is responsible for assisting Board members to fulfil their specific responsibilities under that Act.

The Committee has unlimited access to both the internal and external auditors and to senior management.

The Committee scrutinises the annual financial statements of ANSTO and considers the appropriateness of accounting practices reflected therein. It receives a signed recommendation from the Chief Financial Officer, and the Executive Director, as to the veracity of the financial statements signed by the Board.

Five Audit Committee meetings were held during the financial year. Details of the number of Committee meetings held and attended during the period in which each member held office during the financial year are provided in the table below.

The Committee generally meets quarterly. It is the first of two formal sub-committees of the Board.

Remuneration Committee

The Remuneration Committee, a formal subcommittee of the Board, comprised during the year Dr Z Switkowski (Chair), and Mr M A Eager. The Executive Director, the Board Secretary and the Chief Financial Officer attend all meetings or relevant parts of all meetings by invitation. Others attend meetings, as appropriate, at the invitation of the Committee. In accordance with better practice, all Board members receive meeting minutes, and can attend Committee meetings as a right.

This Committee was established by the Board under a formal written Charter to oversee:

Meetings – Audit Committee

Member	Eligible to attend	Attended
Mr Michael A Eager (Chair)	4	4
Dr Klaus Schindhelm (Member)	5	4
Mr Warren Wilton (External Member)	5	5

Dr Klaus Schindhelm acted as the Chairman of the Audit Committee for the February 2007 meeting.

- The overall remuneration policy and strategy for the organisation
- The remuneration policies for the Executive Director
- The compliance of remuneration policies and practices with statutory and regulatory requirements.

The Charter is made available internally on the ANSTO intranet site.

One Remuneration Committee meeting was held during the financial year. Details of the number of Committee meetings held and attended during the financial year are provided in the table above. It is the second of two formal sub-committees of the Board.

Technical Advisory Committee

The Technical Advisory Committee (TAC), formally established in accordance with a Board decision, comprises four members, all of whom are external to ANSTO. Members are chosen on the basis of internationally recognised scientific expertise and experience. The current members (as at 30 June 2007) of the Committee are Dr Roy Green, Emeritus Professor Peter Robinson, Dr Dan Shochat, and Professor William Stirling. Dr Shochat's term concluded on 30 June 2007.

This Committee operates under written terms of reference and was established by the ANSTO Board to advise it on the quality and relevance of the portfolio of research projects being undertaken at ANSTO. The terms of reference are made available internally on the ANSTO internet site.

Specifically the TAC provides an expert overview of research and addresses the following matters:

- To provide strategic advice to the Board concerning the research project portfolio
- To provide the Board with an overview of the quality of research within ANSTO's portfolio
- To advise on any matters affecting the quality of research outputs

The Committee was formally constituted in October 1996 and is required to meet at least once per year. It met once during the 2006-07 financial year and presented a formal report to the Board.

Induction and continuing professional development of ANSTO executives

Processes are in place for induction and ongoing education to inform executives of their responsibilities and rights. New executives have access to appropriate induction documents and processes (including those relating to safety and security) and to ANSTO officers. Development needs are identified

Meetings – Remuneration Committee

Member	Eligible to attend	Attended
Dr Ziggy Switkowski (Member)	1	1
Mr Michael A Eager (Member)	1	1

through an annual multi-rater feedback process (360 Degree Assessment) against the Executive Capability Framework. Individual Development Plans are implemented on the basis of this process to provide continuing professional development for ANSTO Executives to meet their professional and career development needs. Development opportunities include Executive Coaching and Mentoring, Executive Development Programmes (DSTO); Australian Public Service (APS) Executive Development Programmes; Business School Programmes; and Targeted Capability Programmes to meet specific needs.

Performance review for ANSTO executives

During the 2006-07 financial year performance reviews were conducted of the Executive Director, the Chief of Operations, the Chief of Research and the Chief Financial Officer and those reporting directly to them. Information on the performance review system is made available internally on the ANSTO internet site.

This review included the conducting of a 360 degree feedback process on all members of the senior Management Team and the implementation of development plans.

Risk management

The Board recognises that developing and implementing ANSTO's strategies requires careful assessment and balancing of both risk and opportunity.

The Board is charged with the responsibility of ensuring that appropriate policies are in place to cover identified risks, and management is required to develop appropriate procedures to manage these risks.

The Board has endorsed a risk management framework introduced by management in 1997 and continually refined. As part of this framework, ANSTO's Internal Audit function undertakes a systematic program of risk assessments designed to identify, evaluate and prioritise high and significant risks, utilising a methodology consistent with the Australian Risk Management Standard AS/NZS - 4360/2004. The Audit Committee and the Australian National Audit Office (ANAO) receive summaries of all risk assessment reports.

ANSTO's risk management policy provides that it is the responsibility of the operational management of ANSTO to develop and implement risk mitigation strategies. The overall risk framework is actively applied in ANSTO's operations and to new initiatives in particular. Project risk management remains a significant area of focus in particular capital works projects.

In appropriate circumstances, insurance is used as a method to transfer the financial impact of risk.

The Board, supported by the Audit Committee, oversees the development and operation of business continuity planning and other emerging risk issues.

The ANSTO risk management policy is made available internally on the ANSTO internet site.

Ethical standards

ANSTO's ethics policy is set out in a document entitled *Code of Ethics – A Code for ANSTO Staff*. The Code provides a reference point for ethical behaviour and applies to members of the Board, management and all staff. The Code sets out the standards for ethical behaviour

and conduct and provides guidance by defining the expected values and standards of workplace behaviour and performance.

Fraud control

The organisation has an established fraud control policy and plan, in line with the *Fraud Control Policy of the Commonwealth* and guidelines set out by the Attorney General's Department, Criminal Justice Division.

External audit

Under Section 8 of the *CAC Act* the Commonwealth Auditor-General, through the ANAO, is the external auditor for ANSTO.

The ANAO, as a matter of policy, provides only audit services to ANSTO.

The Audit Committee reviews the ANAO audit plan and reports and meets with ANAO representatives prior to recommending to the Board that the annual financial statements be accepted and the Statement by Directors signed.

Internal audit

The ANSTO Internal Audit function has a dual reporting line to the Audit Committee and the Executive Director. Its responsibility is to provide an independent, risk-based review function, as set out in a formal Charter periodically reviewed by the Audit Committee and endorsed by the Board. The Audit Committee approves the annual Internal Audit plan and receives regular reports on progress against that plan.

Internal control

The Board is responsible for ensuring that appropriate policies and internal controls are in place and operating.

Compliance and review are monitored through the Audit Committee and the Internal Audit function.

Service Charter

ANSTO's Service Charter sets out a statement of what ANSTO does and the standards of product and service that customers, stakeholders and the community can expect from the organisation.

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 reporting year.

There were no specific reports issued by the Commonwealth Auditor-General, other than that issued in relation to the 2006-07 financial statements.

There were no reports on the operations of ANSTO by a Parliamentary Committee or the Commonwealth Ombudsman during the reporting year.

Ministerial directions

There were no ministerial directions to ANSTO made under either the *ANSTO Act* or the *CAC Act* during the reporting year.

Indemnities and insurance premiums for officers

ANSTO's insurance coverage includes professional indemnity and directors' and officers' liability. Certain sections of the *CAC 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.

Nuclear safeguards

ANSTO undertakes continuing observation of and compliance with strict national and international safeguards guidelines and requirements established by the International Atomic Energy Agency and the national safeguards regulator, the Australian Safeguards and Non-Proliferation Office.

IAEA and ASNO inspectors carried out inspections of ANSTO's nuclear material and a full Physical Inventory Verification in June 2006. During each of the inspections the IAEA inspectors requested short notice inspection and were granted complementary access. The results of inspections were satisfactory. The IAEA inspections were supplemented by ASNO's regular audits of ANSTO's nuclear material accounting and physical protection systems.

ANSTO is strengthening its nuclear safeguards further by putting greater emphasis on each individual nuclear material Authorised Officer's responsibility and accountability for the nuclear material in the division or institute's custody.

During 2006-07, ANSTO demonstrated, through ongoing implementation of safeguards, its commitment to the fulfilment of its obligations under both the *Nuclear Non-Proliferation (Safeguards) Act* and Australia's Agreement with the IAEA.

Business continuity planning

Continuity of ANSTO business is a critical issue that has been considered and planned for by the Board, the Executive Director and senior management. Many services delivered by ANSTO are critical to the economic and social well-being of our society. A failure to deliver these could have significant consequences for those concerned. As a result, ANSTO regularly reviews all aspects of its business continuity management to ensure a constant state of readiness. In 2006-07 ANSTO's crisis management plan was updated.

Corporate social responsibility (CSR)

In 2006-07, ANSTO continued to demonstrate its commitment to corporate social responsibility by publishing its fourth CSR report. This annual report focuses on the ways ANSTO responds to environmental, safety and social issues that affect staff, customers, the Australian community and key stakeholders. Highlights of this year's report included research that will deliver significant benefits to Australians by providing a simple technique for cleaning waste water, a discussion of some safety challenges that ANSTO is addressing, and steps that have been taken to reduce ANSTO's environmental footprint.

Financial Statements

Independent Audit Report

Australian National Audit Office

To the Minister for Education, Science and Training

Scope

I have audited the accompanying financial statements of the Australian Nuclear Science and Technology Organisation (ANSTO) for the year ended 30 June 2007. The financial statements comprise; a statement by directors and chief financial officer; income statement; balance sheet; statement of changes in equity; statement of cash flows; schedules of commitments and contingencies; a summary of significant accounting policies, and other explanatory notes.

The Responsibility of the Board for the Financial Statements

The members of the Board are responsible for the preparation and fair presentation of the financial statements in accordance with Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997* and Australian Accounting Standards (including Australian Accounting Interpretations). This responsibility includes establishing and maintaining internal controls relevant to the preparation and fair presentation of the financial statements that are free from material misstatement, whether due to fraud or error; selecting and applying appropriate accounting policies; and making accounting estimates that are reasonable in the circumstances.

Auditor's Responsibility

My responsibility is to express an opinion on the financial statements based on our audit. Our audit has been conducted in accordance with Australian National Audit Office Auditing Standards, which incorporate Australian Auditing Standards. These Auditing Standards require that we comply with relevant ethical requirements relating to auditing engagements and plan and perform the audit to obtain reasonable assurance whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in financial statements. The procedures selected depend on the auditor's judgement, including the assessment of the risks of material misstatements of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to ANSTO's preparation and fair presentation of the financial statements 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 ANSTO's internal control. An audit also includes evaluation the appropriateness of accounting policies used and the reasonableness of accounting estimates made by the Board, as well as evaluation the overall presentation of the financial statements.

I believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for my audit opinion.

Independence

In conducting the audit, we have followed the independence requirements of the Australian National Audit Office, which incorporate the ethical requirements of the Australian accounting profession.

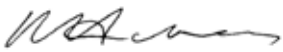
Audit Opinion

In my opinion, the financial statements of the Australian Nuclear Science and Technology Organisation:

a) have been prepared in accordance with the Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997*, and Australian Accounting Standards (including Australian Accounting Interpretations); and

b) give a true and fair view of the matters required by the Finance Minister's Orders, including ANSTO's financial position as at 30 June 2007 and of its financial performance and its cash flows for the year then ended.

Australian National Audit Office



P Hinchey
Senior Director
Delegate of the Auditor-General

Sydney
16 August 2007

PO Box A456 Sydney South NSW 1235
130 Elizabeth Street
SYDNEY NSW
Phone (02) 9367 7100 Fax (02) 9367 7102

Statement by Directors and Chief Financial Officer

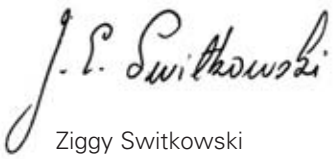
Australian Government

Australian Nuclear Science and Technology Organisation

In our opinion, the attached financial statements for the year ended 30 June 2007 have been prepared based on properly maintained financial records and give a true and fair view of the matters required by the Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997*.

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

This statement is made in accordance with a resolution of the members of the Board.



Ziggy Switkowski
Chairman

16 August 2007
Sydney

Ian O Smith
Executive Director

16 August 2007
Sydney

Douglas Cubbin
Chief Financial Officer

16 August 2007
Sydney

Income Statement
for the year ended 30 June 2007

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
INCOME			
Revenue			
Revenue from Government	5A	141 578	117 568
Goods and services	5B	39 586	38 427
Grants	5C	775	272
Interest	5D	5 306	5 384
Total Revenue		187 245	161 651
Gains			
Net gains from sale of assets	5E	898	109
Net foreign exchange gains - non speculative	5F	18	6
Other	5G	2 968	-
Total Gains		3 884	115
TOTAL INCOME		191 129	161 766
EXPENSES			
Employees	6A	73 430	61 704
Suppliers	6B	74 826	49 332
Depreciation and amortisation	6C	47 783	52 107
Write down and impairment of assets	6D	2 010	2 176
Grants	6E	3 301	2 549
Finance costs	6F	9 186	8 897
TOTAL EXPENSES		210 536	176 765
OPERATING LOSS	(a)	(19 407)	(14 999)

(a) The operating loss is after bringing to account $23.44M (2006: $23.86M) expenses associated with decommissioning for which no funding has been received.

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

Balance Sheet
as at 30 June 2007

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
ASSETS			
Financial assets			
Cash	7A, 22	3 477	11 338
Receivables	7B, 22	11 242	7 465
Investments	7C, 22	84 103	87 140
Total financial assets		98 822	105 943
Non-financial assets			
Land and buildings	8A	178 112	184 124
Infrastructure, plant and equipment and major facilities	8B	704 155	665 006
Inventories	8C	6 008	4 691
Intangibles	8D	776	2 054
Other	8E	2 025	4 470
Total non-financial assets		891 076	860 345
Total assets		989 898	966 288
LIABILITIES			
Payables			
Suppliers	9E, 22	6 984	9 354
Grants	9F, 22	43	293
Other	9G, 22	2 466	687
Total payables		9 493	10 334
Interest bearing liabilities			
Other	9A, 22	2 938	2 770
Total interest bearing liabilities		2 938	2 770
Provisions			
Employees	9B	24 653	23 246
Decommissioning costs	9C	223 963	183 596
Other	9D	2 503	2 661
Total provisions		251 119	209 503
Total liabilities		263 550	222 607
NET ASSETS		726 348	743 681

Balance Sheet
as at 30 June 2007

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
EQUITY	10		
Contributed equity		413 856	413 856
Reserves		255 025	270 672
Retained surpluses		57 467	59 153
Total equity		726 348	743 681
Current assets		98 083	109 233
Non-current assets		891 815	857 055
Current liabilities		36 554	37 229
Non-current liabilities		226 996	185 378

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

Statement of changes in equity for the year ended 30 June 2007

	Retained Surpluses		Asset Revaluation Reserve		Other Reserves		Contributed Equity/Capital		Total Equity	
	2007 $'000	2006 $'000	**2007 $'000**	2006 $'000	**2007 $'000**	2006 $'000	**2007 $'000**	2006 $'000	**2007 $'000**	2006 $'000
Opening balance Balance carried forward from previous period	**59 153**	54 052	**252 562**	255 918	**18 110**	38 210	**413 856**	393 369	**743 681**	741 549
Income and Expenses										
Revaluation adjustment	-	-	**2 074**	(3 356)	-	-	-	-	**(2 074)**	(3 356)
Subtotal income and expenses recognised directly in equity	-	-	**(2 074)**	(3 356)	-	-	-	-	**(2 074)**	(3 356)
Net Operating Results	**(19 407)**	(14 999)	-	-	-	-	-	-	**(19 407)**	(14 999)
Total income and expenses	**(19 407)**	(14 999)	**(2 074)**	(3 356)	-	-	-	-	**(17 333)**	(18 355)
Contributions by Owners										
Appropriation (equity injection)	-	-	-	-	-	-	-	20 487	-	20 487
Sub total Transactions with Owners	-	-	-	-	-	-	-	20 487	-	20 487
Transfers between equity components (Note 10)	**17 721**	20 100	**(24 871)**	-	**7 150**	(20 100)	-	-	-	-
Closing balance at 30 June	**57 467**	59 153	**229 765**	252 562	**25 260**	18 110	**413 856**	413 856	**726 348**	743 681

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

Statement of Cash Flows
for the year ended 30 June 2007

	Notes	FINANCIAL YEAR 2007 $'000 Inflows (Outflows)	2006 $'000 Inflows (Outflows)
OPERATING ACTIVITIES			
Cash received			
Goods and services		34 273	35 815
Interest		5 352	5 466
Net GST received from Australian Taxation Office		13 214	11 601
Appropriations		141 578	117 568
Total cash received		194 417	170 450
Cash used			
Employees		(72 023)	(59 746)
Suppliers		(90 659)	(59 344)
Total cash used		(162 682)	(119 090)
Net cash from operating activities	11	31 735	51 360
INVESTING ACTIVITIES			
Cash received			
Proceeds from sales of property, plant and equipment		1 480	323
Proceeds from sales/maturity of investments		15 857	14 000
Total cash received		17 337	14 323
Cash used			
Purchase of property, plant and equipment		(43 059)	(83 725)
Loans to related parties		(1 054)	-
Purchase of investments		(12 820)	(24 833)
Total cash used		(56 933)	(108 558)
Net cash used by investing activities		(39 596)	(94 235)

Statement of Cash Flows
for the year ended 30 June 2007

	Notes	FINANCIAL YEAR **2007 $'000** Inflows (Outflows)	FINANCIAL YEAR 2006 $'000 Inflows (Outflows)
FINANCING ACTIVITIES			
Cash received			
Appropriation - contributed equity		-	49 287
Total cash received		-	49 287
Net cash from financing activities		-	49 287
Net increase/(decrease) in cash held		(7 861)	6 412
Cash at 1 July		11 338	4 926
Cash at 30 June	7A	3 477	11 338

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

Schedule of Commitments as at 30 June 2007

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
BY TYPE			
CAPITAL COMMITMENTS			
Infrastructure, plant and equipment		6 647	8 067
Fuel elements purchase		3 806	6 141
Total capital commitments		10 453	14 208
By maturity			
Capital commitments payable			
One year or less		10 453	12 280
From one to five years		-	1 928
		10 453	14 208
OTHER COMMITMENTS			
Replacement Research Reactor Project (OPAL)	(b)	5 297	14 000
Disposition of spent fuel	(a)	32 497	46 079
Operating lease	(c)	2 411	2 548
Total other commitments		40 205	62 627
Total commitments payable		50 658	76 835
Other commitments receivable			
Replacement Research Reactor Project (OPAL)	(b)	-	2 552
Disposition of spent fuel	(a)	34 271	46 079
GST recoverable from Australian Taxation Office		950	1 292
Total other commitments receivable		35 221	49 923
Net other commitments		4 984	12 704
By maturity - other commitments (OPAL)			
One year or less		5 297	11 448
By maturity - operating lease - minimum payments			
One year or less		137	137
From one to five years		685	685
Over five years		1 589	1 726
		2 411	2 548

Schedule of Commitments
as at 30 June 2007

Note:

(a) In 1997-1998 the Government determined to provide $98.953 million in 2007 dollars ($86.4 million in 1997 dollars) to remove spent fuel rods from the Lucas Heights Science and Technology Centre and meet the costs of reprocessing offshore. An amount of $64.682 million has been drawn down. The amount of $32.497 million is not included in the commitment by maturity figures as the commitment payable is more than fully offset by the commitment receivable. As the timing of the spent fuel shipment for 2007 was delayed additional rods were shipped and the costs were higher than initially anticipated. As a result the appropriation was not sufficient to cover costs. The funding shortfall will be received in the 2007-2008 financial year.

(b) A contract was executed on 13 July 2000 between ANSTO and INVAP SE for the design, construction and commissioning of a replacement research reactor at Lucas Heights. The net amount of $5.297 million (2006: $11.448 million) is included in the commitment by maturity.

(c) ANSTO has a twenty five year lease contract with Central Sydney Area Health Services with an annual rental payable of $137,000. The annual rental is subject to review every three years.

The timing of the other commitments payable is matched to the receipt of other commitments receivable.

The amounts reported as commitments payable includes GST where relevant. Recoveries due from the Australian Taxation Office in relation to commitments payable are disclosed as commitments receivable.

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

Schedule of Contingencies
as at 30 June 2007

	FINANCIAL YEAR	
	2007 **$'000**	2006 $'000
Contingent Liabilities		
Guarantee (a)	-	15
Total Contingent Liabilities	-	15

Note:

(a) The amount reported as contingent liabilities referred to a three (3) year security bond in favour of Energy Australia. This bond expired on 30 June 2006.

(b) ANSTO still has the likelihood of a claim in relation to asbestos related diseases, this however is covered by the Department of Finance and Administration provision dealing with asbestos related claims against any authorities including ANSTO in the event of any litigation or claim for compensation.

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

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

1 Economic dependency

Australian Nuclear Science & Technology Organisation (ANSTO) is dependent on appropriations from the Parliament of the Commonwealth Government for its continued existence and ability to carry out its normal activities.

2 Summary of significant accounting policies

(a) Basis of preparation of the Financial Report

The financial statements are required by clause 1(b) of Schedule 1 to the *Commonwealth Authorities and Companies Act 1997* (*CAC Act*) and are a General Purpose Financial Report.

They have been prepared:

i. having regard to the provisions of the *Australian Nuclear Science and Technology Organisation (ANSTO) Act 1987* (as amended)

ii. in accordance with:

- Finance Minister's Orders (FMOs) *for reporting periods ending on or after 1 July 2006;*
- Australian Accounting Standards and Interpretations issued by the Australian Accounting Standards Board that apply for the reporting period.

The financial report has been prepared on an accruals basis and is in accordance with the historical cost convention, except for certain assets at fair value. Except where stated, no allowance is made for the effect of changing prices on the results or the financial position.

Unless an alternative treatment is specifically required by an Accounting Standard or the FMOs, assets and liabilities are recognised in the Balance Sheet when and only when it is probable that future economic benefits will flow to the Entity and the amounts of the assets or liabilities can be reliably measured. However, Assets and liabilities arising under agreements equally proportionately unperformed are not recognised unless required by an Accounting Standard. Liabilities and assets that are unrecognised are reported in the Schedule of Commitments and the Schedule of Contingencies.

Unless alternative treatment is specifically required by an Accounting Standard, revenues and expenses are recognised in the Income Statement when and only when

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

the flow, consumption or loss of economic benefits has occurred and can be reliably measured.

(b) Significant Accounting Judgements and Estimates

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

- The fair value of land and buildings has been taken to be the market value of similar properties as determined by an independent valuer. In some instances, ANSTO's buildings are purpose built and may in fact realise more or less in the market

No 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.

(c) Statement of Compliance

Australian Accounting Standards require a statement of compliance with International Financial Reporting Standards (IFRS) to be made where the financial report complies with these standards. Some Australian equivalents to IFRS and other Australian Accounting Standards contain requirements specific to not-for-profit entities that are inconsistent with IFRS requirements. ANSTO is a not-for-profit entity and has applied these requirements, so while this financial report complies with Australian Accounting Standards including Australian Equivalents to International Financial Reporting Standards (AEIFRS) it cannot make this statement.

(d) Adoption of new Australian Accounting Standard requirements

No accounting standard has been adopted earlier than the effective date in the current period.

ANSTO is required to disclose Australian Accounting Standards and Interpretations which have been issued but are not yet effective that have not been early adopted by ANSTO. There are no such standards that have resulted in a change to ANSTO's accounting policies or that have affected the amounts reported in the current or prior periods or are estimated to have a financial affect in future reporting periods.

Other effective requirement changes

The following amendments, revised standards or interpretations have become effective but have had no financial impact or do not apply to the operations of ANSTO.

Amendments:

- 2005-1 Amendments to Australian Accounting Standards [AASBs 1, 101, 124]
- 2005-6 Amendments to Australian Accounting Standards [AASB 3]
- 2006-1 Amendments to Australian Accounting Standards [AASB 121]
- 2006-3 Amendments to Australian Accounting Standards [AASB 1045]
- Restriction of the fair value option under AASB139
- Reimbursement rights
- Financial guarantee contracts

Interpretations:

- UIG 4 Determining whether an Arrangement contains a Lease
- UIG 5 Rights to Interests arising from Decommissioning, Restoration and Environmental Rehabilitation Funds
- UIG 7 Applying the Restatement Approach under AASB 129 Financial Reporting in Hyperinflationary Economies
- UIG 8 Scope of AASB 2
- UIG 9 Reassessment of Embedded Derivatives

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

Future Australian Accounting Standard requirements

The following new standards, amendments to standards or interpretations have been issued by the Australian Accounting Standards Board (AASB) but are effective for future reporting periods. It is estimated that the impact of adopting these pronouncements when effective will have no material financial impact on future reporting periods.

Financial instrument disclosure

AASB 7 Financial Instruments: Disclosures is effective for reporting periods beginning on or after 1 January 2007 (the 2007-08 financial year) and amends the disclosure requirements for financial instruments. In general AASB 7 requires greater disclosure than that presently. Associated with the introduction of AASB 7 a number of accounting standards were amended to reference the new standard or remove the present disclosure requirements through 2005-10 Amendments to Australian Accounting Standards [AASB 132, AASB 101, AASB 114, AASB 117, AASB 133, AASB 139, AASB 1, AASB 4, AASB 1023 & AASB 1038]. These changes have no financial impact but will effect the disclosure presented in future financial reports.

Other

The following standards and interpretations have been issued but are not applicable to the operations of ANSTO.

- AASB 1049 Financial Reporting of General Government Sectors by Governments
- UIG 10 Interim Financial Reporting and Impairment

(e) Reporting by outcomes

A comparison of current and prior years' figures by outcome as specified in the Appropriation Acts relevant to ANSTO, is presented in Note 4.

(f) Revenue recognition

Parliamentary appropriations

From 1 July 1999, the Commonwealth Budget has been prepared under an accruals framework. Under this framework, Parliament appropriates money to ANSTO as revenue appropriations and as equity injections (refer Notes 5A and 10).

Revenue from Government - Output Appropriations

Revenues from Government are revenues for the core activities of ANSTO and are recognised at the full amount appropriated for departmental outputs as revenue of the year of appropriation, adjusted by all applicable current year formal additions and reductions listed at Clause 2A.13 of the FMOs. Any undrawn appropriation at the end of financial year is recognised as Appropriation Receivable in accordance with Clause 2A.10 of the FMOs.

Equity injections

Amount of appropriations which are designated as 'equity injections' are recognised directly in Contributed Equity in full as appropriated by the Parliament (refer Note 10).

Operating revenue from goods and services

Operating revenue from independent sources comprises revenue earned from the provision of products, or services, to entities outside ANSTO. Revenue is recognised when the goods are provided, or when the fee in respect of the services provided is receivable.

Receivables for goods and services are recognised at the nominal amounts due less any provision for doubtful debts. Collectibility of debts is reviewed at balance date. Provision is made when collectibility of the debt is no longer probable.

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

Revenue received in advance

Revenue received in advance is initially brought to account as "unearned revenue" and subsequently recognised as revenue when earned.

Contract revenue

Revenue from the rendering of a service is recognised by reference to the stage of completion of each contract. The stage of completion is determined by reference to the proportion that the completed physical contract work bears to the estimated total physical contract work.

Interest revenue

Interest revenue is recognised as the interest is received or is entitled to be received.

Revenue from sale of assets

Revenue is recognised when control of the asset has passed to the buyer.

Core operations

All material revenues described in this note are revenues relating to the core operating activities of ANSTO. Details of revenue amounts are given in Note 5.

Resources Received Free of Charge

Resources received free of charge are recognised as gains 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.

(g) Employee benefits

Benefits

Liabilities for services rendered by employees are recognised at the reporting date to the extent that they have not been settled.

Liabilities for wages and salaries and annual leave are measured at their nominal amounts. Other employees benefits expected to be settled within 12 months of their reporting date are also measured at their nominal amounts.

The provision for the employee entitlements encompasses annual leave and long service leave that ANSTO has a present obligation to pay resulting from employee services provided up to balance date. The leave liabilities are calculated on the basis of employees' remuneration, 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 estimate of the present value of the liability takes into account attrition rates and pay increases through promotion and inflation.

The nominal amount is calculated with regard to the rates expected to be paid on settlement of the liability. The current Enterprise Agreement pay rates applicable on 1 January 2008 are considered in the calculation. The financial effect of this was an additional accrual of $0.557 million (2006: $0.876 million).

General leave

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 and the average general leave taken by employees is less than the annual entitlement.

(h) Superannuation

The Australian Nuclear Science and Technology Organisation contributes to the Commonwealth Superannuation (CSS) and the Public Sector (PSS) superannuation

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

schemes or PSS accumulation plan (PSSap) which provide retirement, death and disability benefits to employees. The CSS and PSS are defined benefit schemes for the Commonwealth while the PSSap is a defined contribution scheme. Contributions to the schemes are at rates calculated to cover existing and emerging obligations. Current contribution rates in 2007 were 11.2% (2006 10.1%) of salary (PSS), 23.8% (2006 22.5%) of salary (CSS), and 15.4% (2006 15.4%) of salary (PSSap). An additional 3% is contributed to the respective funds for employer productivity benefits. The majority of staff are covered by PSS or CSS. For those staff who do not contribute to either of these two schemes, ANSTO contributes 9% of salary to the Australian Government Employees Superannuation Trust fund or to the fund nominated by the employee. Additional employer contributions are made to nominated complying funds on behalf of several term employees at a rate of 9% where the employee chooses not to make a personal contribution, or 11% where the employee chooses also to contribute. Contributions during the year are detailed in Note 6A. No liability is shown for superannuation in the Balance Sheet as the employer contributions fully extinguish the accruing liability which is assumed by the Commonwealth.

(i) Leases

Operating leases are expensed on a basis which is representative of the pattern of benefits derived from the leased assets.

(j) Cash

For the purposes of the Statement of Cash Flows, cash includes short term deposits held in a bank, cash on hand and cash equivalents. Cash is recognised at its nominal amount.

(k) Financial instruments

Accounting policies for financial instruments are stated at Note 22.

(l) Bad and doubtful debts

Bad debts are written off during the period in which they are identified. Provision for doubtful debts is made when collection of the debt is judged to be less rather than more likely.

(m) Buildings, infrastructure, plant and equipment and major facilities

Acquisition

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 $3 000 are expensed in the year of acquisition.

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. This is particularly relevant to 'make good' provisions in property leases 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' taken up.

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

Basis of valuation

AASB 116 Property, Plant and Equipment allows entities to measure each class of assets covered by that Standard at either cost or fair value (revaluation method). FMO's policy 3A.1.1, requires entities to use fair value. Fair value is market value unless there is no or limited market based evidence of fair value. In such cases fair value is estimated using depreciated replacement cost.

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

Land, buildings, plant and equipment are carried at fair value, and will be valued every five years such that the carrying amount of each asset is not materially different, at reporting date, from its fair value.

- Freehold land was revalued at 30 June 2007
- Buildings on freehold land were revalued at 30 June 2007
- Plant and equipment were revalued at 30 June 2007
- Infrastructure was revalued at 30 June 2007
- The major national facility, HIFAR reactor including instrumentation was written off following its closure during the year. The cost of de-commissioning HIFAR over an extended period remains in the accounts.
- Other national and major facilities were revalued at 30 June 2007.

FMOs allows progressive revaluation of a class of non-financial assets over more than one reporting period, provided that the requirements of AASB 116 and this Policy are met. All asset classes should be subject to formal revaluations once every five (5) years.

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.

All valuations are carried out by qualified parties, independent of ANSTO.

The valuation of land, buildings, infrastructure, plant and equipment including national and other major facilities were performed by independent valuers of the Australian Valuation Office (AVO), Mr. Frank Andreatta and Mr. Simon O'Leary (registered Valuer Nos. 2388 and 1128 respectively) at 30 June 2007, based on the asset list at 28 February 2007.

Assets acquired and/or ready for use after 28 February 2007 are recognised at cost.

Certain assets (Note 8B) are valued at Board Valuation.

Depreciation and amortisation

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

Depreciation and amortisation rates applying to each class of depreciable asset are based on the following useful lives (see table on previous page).

The depreciation rates (useful lives) of ANSTO's property, plant and equipment

Depreciation and amortisation rates	2007	2006
Buildings on freehold land	5 to 50 years	5 to 40 years
Plant and equipment	2 to 30 years	2 to 30 years
Infrastructure	20 years	20 years
National and major facilities	5 to 40 years	5 to 30 years

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

Amortisation rates	2007	2006
Purchased software	2 - 7 years	2 - 7 years
Licences	3 years	3 years

have been reviewed during the year and found to be appropriate.

The aggregate amount of depreciation allocated for each class of asset during the reporting period is disclosed in Note 6C.

Impairment

All assets were assessed for impairment at 30 June 2007. 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.

(n) Inventories

Stores are valued at purchase cost on a first-in-first-out basis. Provision is made for obsolete inventory and diminution in value.

Inventories of Cobalt-60 and enriched, natural and depleted uranium are valued on the basis of net realisable value.

Stocks of reactor fuel are valued at average purchase price.

Heavy water is valued at net realisable value.

Finished goods and work in progress are valued at cost of direct materials and labour plus attributable costs that are capable of being allocated on a reasonable basis.

(o) Intangibles

Software

Items of software are recorded at cost and amortised as outlined below. Items with a cost of less than $3,000 are expensed in the year of acquisition.

There is no material internal software development.

Software and licences are reported at deemed cost.

Amortisation

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

Amortisation rates applying to intangibles are shown in the table above.

The amortisation rates (useful lives) of ANSTO's software and licences have been reviewed during the year and found to be appropriate.

The aggregate amount of amortisation allocated for each class of asset during the reporting period is disclosed in Note 6C.

Impairment

All assets were assessed for impairment at 30 June 2007. 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

(p) Patents

Due to the uncertain commercial value of patents, trademarks, designs and applications, 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 2007 there were 136 patents, trademarks, design and applications (99 at 30 June 2006) registered to ANSTO and no associated costs are recognised as an asset (nil at 30 June 2006).

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

(q) 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 balance 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 Income Statement.

(r) Taxation

ANSTO is exempt from all forms of taxation in Australia except fringe benefits tax and the goods and services tax (GST).

ANSTO is not subject to exemption 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.

(s) Assets received free of charge

The acquisition of property, plant and equipment free of charge or for a nominal amount, is recognised at fair value.

(t) Principles of consolidation

ANSTO has a number of subsidiaries (refer Note 7D). As the transactions and assets in these subsidiaries are not material, consolidated accounts have not been prepared.

(u) Comparatives

Where necessary, comparative information for the preceding financial year has been reclassified to achieve consistency in disclosure with current financial year amounts and other disclosures.

(v) Rounding

Amounts are rounded to the nearest one thousand dollars except in relation to:

- remuneration of members of the Board
- remuneration of executives
- remuneration of auditors
- financial information about the subsidiary companies and their balances

3 Events subsequent to reporting date

On 6 July, ANSTO announced the creation of its new subsidiary, PETNET. This subsidiary is wholly owned and will invest $10M in the construction of a new nuclear medicine production facility, consisting of two state of-the-art cyclotrons at its Lucas Heights site. PETNET is a franchise purchased from Siemens Medical Solutions.

On 27 July, ANSTO announced Australia's new nuclear reactor, OPAL is to undergo an extended shutdown to address issues identified during its initial operations phase over the past eleven months. ANSTO will be undertaking a series of tests to fully determine the cause of these issues. This event may impact ANSTO's financial performance in the succeeding financial year. The extent of this impact will be mitigated by the pursuit of warranty and insurance claims.

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

4 Segment and outcomes reporting

Reporting by segments

ANSTO operates in a single industry within Australia, namely in the nuclear scientific research industry.

Reporting by outcomes:

ANSTO has three outcomes and each have one output.
Outcome 1: Replacement Research Reactor Project (OPAL)
Outcome 2: Disposal of spent fuel
Outcome 3: Core business: science and technology

Major Classes of Departmental Revenues and Expenses by Output Groups and Output

	Outcome 1		Outcome 2		Outcome 3		Total	
	Output 1		Output 2		Output 3			
	2007 $'000	2006 $'000	**2007 $'000**	2006 $'000	**2007 $'000**	2006 $'000	**2007 $'000**	2006 $'000
Operating revenues								
Revenue from Government			**11 846**	316	**129 732**	117 252	**141 578**	117 568
Sale of goods and services					**39 586**	38 427	**39 586**	38 427
Interest					**5 306**	5 384	**5 306**	5 384
Net gain from sale of assets					**898**	109	**898**	109
Other					**3 761**	278	**3 761**	278
Total operating revenues	-	-	**11 846**	316	**179 283**	161 450	**191 129**	161 766
Operating expenses								
Employees			**260**	316	**73 100**	61 388	**73 360**	61 704
Suppliers			**13 360**	864	**61 536**	48 468	**74 896**	49 332
Depreciation and amortisation					**47 783**	52 107	**47 783**	52 107
Finance costs					**3 301**	8 897	**3 301**	8 897
Write-down and impairment of assets					**2 010**	2 176	**2 010**	2 176
Other					**9 186**	2 549	**9 186**	2 549
Total operating expenses	-	-	**13 620**	1 180	**196 916**	175 585	**210 536**	176 765

Note:
The net costs include intra-government costs that would be eliminated in calculating the actual Budget outcome.

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

5 Income

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
5A. Revenues from Government			
Appropriation for outputs		141 578	117 568
5B. Goods and services			
Radioisotope sales		19 795	20 952
Services and contract research		10 307	5 829
Silicon irradiation		2 922	4 606
CSIRO site support		1 089	1 276
Training courses		201	251
Land management		2 648	2 540
Australian Synchrotron Research Project		1 367	1 423
AINSE interactions		1 257	1 550
Total sales of goods and services	5H	39 586	38 427
5C. Grants		775	272
5D. Interest		5 306	5 384
Total Revenue		187 245	161 651
5E. Net gain from sale of assets			
Infrastructure, plant and equipment:			
Revenue from sale of assets		1 339	264
Net book value of assets sold		(441)	(155)
Net gain from disposal of infrastructure, plant and equipment		898	109
5F. Net foreign exchange gains - non speculative		18	6
5G. Other revenue			
Other		2 968	-
Total other revenue		2 968	-
Total Gains		3 884	115
Total Income		191 129	161 766

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

5 Income (continued)

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
5H. Sales of goods and services			
Goods		19 795	20 952
Services		19 791	17 475
Total sales of goods and services	5B	39 586	38 427
Provision of goods to:			
External entities		19 795	20 952
Total sales of goods		19 795	20 952
Rendering of services to:			
Related entities		3 781	2 188
External entities		16 010	15 287
Total rendering of services		19 791	17 475

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

6 Expenses

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
6A. Employee expenses:			
Salaries		56 534	46 023
Superannuation		9 450	7 771
Annual leave		5 311	5 194
Long service leave		1 669	2 418
Separation and redundancy		466	298
Total employee expenses		73 430	61 704
6B. Supplier expenses:			
Goods from external entities		26 861	14 226
Services from related entities		9 341	8 226
Workers compensation premiums		416	463
Services from external entities		37 941	25 964
Operating lease rentals		267	453
Total supplier expenses		74 826	49 332
6C. Depreciation and amortisation			
Depreciation of property, plant and equipment (a)	8B	46 003	50 198
Amortisation of intangible assets - licence	8D	3	4
Amortisation of intangible assets - software	8D	1 777	1 905
Total depreciation and amortisation		47 783	52 107
6D. Writedown of assets			
Financial assets:			
Provision for doubtful debt		(1)	18
Receivables for goods and services		-	1
Foreign exchange loss - non speculative			19
- realised		68	-
- unrealised		14	-

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

6 Operating expenses (continued)

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
	Non financial assets:		
	Materials - Write off obsolete stock	1 559	812
	Loss from sale of assets	321	223
	Fixed Assets Revaluation Writedown/Impairment	49	1 057
	Nuclear material stock devaluation	-	46
	Total writedown of assets	2 010	2 176
6E.	Grants	3 301	2 549
6F.	Finance costs		
	Unwinding of discount on Decommissioning Costs	9 020	8 740
	Interest	166	157
	Total finance costs	9 186	8 897
	Total operating expenses	210 536	176 765
(a)	Depreciation of property, plant and equipment:		
	The aggregate amounts of depreciation expensed during the reporting period for each depreciable class of property, plant and equipment are as follows:		
	Buildings on freehold land	11 320	11 076
	Plant and equipment	24 288	28 071
	Infrastructure	3 668	3 255
	National and major facilities	6 727	7 796
	Total allocated	46 003	50 198

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

7 Financial assets

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
7A. Cash			
Cash at bank and on hand for operating needs		3 477	11 338
Total cash		3 477	11 338
7B. Receivables			
Goods and services			
- other parties		6 706	5 561
- related parties		924	-
	(a)	7 630	5 561
Less provision for doubtful debts		82	83
		7 548	5 478
Interest accrued		58	104
Other		1 879	25
Loans to related parties	7D	1 054	-
GST receivable		703	1 858
Total receivables (net)		11 242	7 465
(a) Goods and services (trade debtors)			
Age analysis of trade debtors			
Current		7 178	4 342
Overdue:			
Less than 30 days		206	552
30 to 60 days; and		42	412
60 to 90 days		46	33
More than 90 days		158	222
		7 630	5 561
7C. Investments			
Bank accepted bills		79 103	82 140
Investment in the Australian Synchrotron Project		5 000	5 000
Total investments		84 103	87 140

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

7 Financial assets (continued)

FINANCIAL YEAR

7D. Investment in subsidiaries

The details of the subsidiaries of ANSTO are:

Name	Place of Incorporation	% Owned	Investment		Loan Receivable	
			2007 $	2006 $	**2007 $**	2006 $
CeramiSphere Pty Limited	Australia	100%	**2**	-	**516 000**	-
Australian Membrane Technologies Pty Limited	Australia	100%	**2**	-	**200 000**	-
ANSTO Inc.	Delaware U.S.A.	100%	**-**	-	**337 917**	-
			4	-	**1 053 917**	-

ANSTO Inc. was incorporated in Delaware, USA on 27 October 1999. At 30 June 2007, US$100 (2006: US$100) of capital has been invested in this wholly owned subsidiary. This investment has been written off in prior periods.

In November 2004, the Board decided to utilise ANSTO Inc to promote the commercialisation of ANSTO technology in the USA.

The ANSTO Inc. loan is denominated in US dollars, $US281,349 (2006: $NIL).

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

8 Non-financial assets

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
8A. Land and buildings			
Land - at independent valuation - 30 June 2004 (fair value)	(a), (c)	-	82 027
Land - at independent valuation - 30 June 2007 (fair value)	(b), (c)	78 700	-
		78 700	82 027
Buildings - at cost		22 087	41 056
Less accumulated depreciation		5 991	5 533
		16 096	35 523
Buildings - at independent valuation - 30 June 2004 (fair value)	(a), (c)	-	80 206
Less accumulated depreciation	(a), (c)	-	13 632
		-	66 574
Buildings - at independent valuation - 30 June 2007 (fair value)	(b), (c)	83 316	-
		83 316	-
Total buildings		99 412	102 097
Total land and buildings		178 112	184 124
8B. Infrastructure, plant, equipment and major facilities			
(i) Plant and equipment			
Plant and equipment - at cost		147 747	176 492
Less accumulated depreciation		38 807	33 280
		108 940	143 212
Plant and equipment - at independent valuation - 30 June 2004 (fair value)	(a), (c)	-	71 888
Less accumulated depreciation	(a), (c)	-	23 815
		-	48 073

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

8 Non-financial assets (continued)

		Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
	Plant and equipment - at independent valuation - 30 June 2004 (fair value)	(b), (c)	66 681	-
			66 681	-
	Plant and equipment - at board valuation - 30 June 2007 (fair value)	(d)	1 029	-
			1 029	-
	Plant and equipment under construction - at cost		14 826	13 731
	Total plant and equipment		191 476	205 016
(ii)	Infrastructure			
	Electrical/site services			
	Electrical/site services facilities - at cost		12	9 886
	Less accumulated depreciation		-	708
			12	9 178
	Electrical/site services facilities at independent valuation - 30 June 2004 (fair value)	(a), (c)	-	20 997
	Less accumulated depreciation	(a), (c)	-	4 634
			-	16 363
	at independent valuation - 30 June 2007 (fair value)	(b), (c)	28 014	-
			28 014	-
	Total infrastructure		28 026	25 541

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

8 Non-financial assets (continued)

	Notes	2007 $'000	2006 $'000
		FINANCIAL YEAR	
(iii) Major national and major research facilities			
Major national research facilities - at cost		34	3 395
Less accumulated depreciation		1	1 656
		33	1 739
Major national research facilities at independent valuation - 30 June 2004 (fair value)	(a), (c)	-	20 225
Less accumulated depreciation	(a), (c)	-	9 627
		-	10 598
at independent valuation - 30 June 2007 (fair value)	(b), (c)	5 645	-
		5 645	-
Major national research facilities at cost		-	295
Less accumulated depreciation		-	16
		-	279
Major research facilities at independent valuation - 30 June 2004 (fair value)	(b), (c)	-	9 937
Less accumulated depreciation	(b), (c)	-	1 537
		-	8 400
Major research facilities at independent valuation - 30 June 2007 (fair value)	(b), (c)	6 257	-
		6 257	-

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

8 Non-financial assets (continued)

	Notes	FINANCIAL YEAR 2007 $'000	2006 $'000
Replacement Research Reactor (OPAL) Project capitalised cost to date	(c)	474 817	413 433
Less accumulated depreciation		2 099	-
		472 718	413 433
Total major national and major research facilities		484 653	434 449
Total infrastructure, plant, equipment and major facilities		704 155	665 006
Total land, buildings, infrastructure, plant, equipment and major facilities		882 267	849 130

Movement summary 2006-07 for all assets irrespective of valuation basis (excluding intangibles)

	Land	Buildings	Total Land and Buildings	Infrastructure, plant, equipment national and major facilities	Total
	$'000	$'000	$'000	$'000	$'000
Gross value as at 1 July 2006	82 027	121 263	203 290	740 277	943 567
Additions - new assets	-	2 083	2 083	40 456	42 539
Add Decommissioning costs	-	-	-	32 155	32 155
Transfers/reclassifications	-	(3 737)	(3 737)	6 705	2 968
Net revaluation decrement	(3 300)	(14 140)	(17 440)	(72 859)	(90 299)
Disposals	(27)	(66)	(93)	(1 672)	(1 765)
Gross value as at 30 June 2007	78 700	105 403	184 103	745 062	929 165
Accumulated depreciation/ amortisation 1 July 2006	-	19 166	19 166	75 271	94 437
Depreciation/amortisation	-	11 320	11 320	34 683	46 003
Recoverable Amount write downs	-	(101)	(101)	52	(49)
Net revaluation decrement	-	(24 386)	(24 386)	(67 987)	(92 373)
Adjustment for disposals	-	(8)	(8)	(1 112)	(1 120)
Accumulated depreciation/ amortisation 30 June 2007	-	5 991	5 991	40 907	46 898
Net book value as at 30 June 2007	78 700	99 412	178 112	704 155	882 267

8 Non-financial assets (continued)

Movement summary 2005-2006 for all assets irrespective of valuation basis (excluding intangibles)

Item	Land	Buildings	Total Land and Buildings	Infrastructure, plant, equipment national and major facilities	Total
	$'000	$'000	$'000	$'000	$'000
Gross value as at 1 July 2005	**82 027**	**111 821**	**193 848**	**667 399**	**861 247**
Additions - new assets	-	9 442	9 442	73 702	**83 144**
Disposals	-	-	-	(824)	**(824)**
Gross value as at 30 June 2006	**82 027**	**121 263**	**203 290**	**740 277**	**943 567**
Accumulated depreciation/amortisation 1 July 2005	-	**7 704**	**7 704**	**32 523**	**40 227**
Depreciation/amortisation	-	11 076	11 076	39 122	**50 198**
Recoverable Amount write downs	-	386	386	4 026	**4 412**
Adjustments for disposals	-	-	-	(400)	**(400)**
Accumulated depreciation/ amortisation 30 June 2006	-	**19 166**	**19 166**	**75 271**	**94 437**
Net book value as at 30 June 2006	**82 027**	**102 097**	**184 124**	**665 006**	**849 130**

Note:

(a) In 2003-2004, an independent valuation of land, buildings, plant & equipment and infrastructure was performed by Mr. Frank Andreatta and Mr. Simon B O'Leary (registered valuer Nos. 3775 and 1128 respectively) of the Australian Valuation Office.

(b) In 2007, an independent valuation of land, buildings, plant & equipment and infrastructure was performed by Mr. Frank Andreatta and Mr. Simon B O'Leary (registered valuer Nos. 3775 and 1128 respectively) of the Australian Valuation Office. The valuation was performed of all assets owned at 28 February 2007.

(c) In accordance with the requirements of Schedule 1 of the Commonwealth Authorities and Companies Act 1997 (Financial Statements 2006-2007) Orders, all revalued assets are shown on a gross basis: asset values are at fair value and accumulated depreciation has been written back. The resulting adjustment has been transferred directly to the asset revaluation reserve and/or Income Statement if the reserve is insufficient.

(d) The Board resolved to value these assets as of 30 June 2007 at Board Valuation.

(e) OPAL was commissioned during the year and transferred from assets under construction effective 1 June 2007.

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

8 Non-financial assets (continued)

	FINANCIAL YEAR	
	2007 $'000	2006 $'000
8C. Inventories		
Raw materials and stores - not held for resale		
Stores - at cost	**1 843**	2 525
Cobalt-60 sources - at net realisable value	**363**	414
Reactor fuel and heavy water - at average purchase price	**2 608**	757
Nuclear materials - at net realisable value	**409**	142
Provision for stock diminution	**(786)**	(1 360)
	4 437	2 478
Work in progress - at cost	**547**	581
Finished goods - at cost	**1 024**	1 632
Total inventories	**6 008**	4 691
8D. Intangibles		
Licences at deemed cost	**1 009**	1 009
Less accumulated amortisation	**1 003**	1 000
	6	9
Design fees at cost	**-**	80
Less accumulated amortisation	**-**	72
	-	8
Software at cost	**8 342**	9 721
Less accumulated amortisation	**8 342**	7 720
	-	2 001
Software at deemed cost	**2 348**	704
Less accumulated amortisation	**1 578**	668
	770	36
Total intangibles	**776**	2 054

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

8 Non-financial assets (continued)

Movement summary 2006-07 for all intangibles irrespective of valuation basis

	Licences $'000	Software $'000	Total $'000
Gross value as at 1 July 2006	1 089	10 505	11 594
Additions - new assets	-	520	520
Disposals	(80)	(335)	(415)
Gross value as at 30 June 2007	1 009	10 690	11 699
Accumulated depreciation/amortisation 1 July 2006	1 072	8 460	9 532
Depreciation/amortisation	3	1 777	1 780
Adjustment for disposals	(72)	(317)	(389)
Accumulated depreciation/amortisation 30 June 2007	1 003	9 920	10 923
Net book value as at 30 June 2007	6	770	776

Movement summary 2005-06 for all intangibles irrespective of valuation basis

	Licences $'000	Software $'000	Total $'000
Gross value as at 1 July 2005	1 078	9 892	10 970
Additions - new assets	11	570	581
Disposals	-	(37)	(37)
Gross value as at 30 June 2006	1 089	10 425	11 514
Accumulated depreciation/amortisation 1 July 2005	1 068	6 505	7 573
Depreciation/amortisation	4	1 905	1 909
Adjustment for disposals	-	(22)	(22)
Accumulated depreciation/amortisation 30 June 2006	1 072	8 388	9 460
Net book value as at 30 June 2006	17	2 037	2 054

8 Non-financial assets (continued)

	FINANCIAL YEAR	
	2007 $'000	2006 $'000
8E. Other		
Prepayments	2 025	4 470
Total other	2 025	4 470
Total non-financial assets	891 076	860 345

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

9 Liabilities

		FINANCIAL YEAR	
		2007 $'000	2006 $'000
9A.	Interest bearing liabilities		
	Other (a)	**2 938**	2 770
	Total interest bearing liabilities	**2 938**	2 770
	Provisions		
9B.	Employees		
	Accrued salaries and wages	**715**	609
	Annual leave	**8 927**	8 206
	Long service leave	**15 011**	14 431
	Aggregate employee entitlement liability	**24 653**	23 246
9C.	Decommissioning costs		
	Decommissioning costs	**223 963**	183 596
		223 963	183 596
9D.	Other		
	Waste management costs (b)	**1 605**	1 509
	Other claims (c)	**898**	1 152
		2 503	2 661
	Total provisions	**251 119**	209 503
9E.	Suppliers		
	Trade creditors	**6 984**	9 354
		6 984	9 354
9F.	Grants		
	Non-profit entities	**43**	293
		43	293

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

9 Liabilities

	FINANCIAL YEAR	
	2007 $'000	2006 $'000
9G. Other		
Revenue received in advance	**2 466**	687
	2 466	687
Total payables	**9 493**	10 334
Total liabilities	**263 550**	222 607

Note:

(a) Relates to prepaid revenue under a lease of property.

(b) A specific appropriation received to cover costs associated with the movement of low level waste to a repository yet to be established.

(c) Provision to cover product warranty and also net disposal cost of industrial sources

9H. Provision movement reconciliation

	Provision for Decommissioning Costs	Provision for Waste Management Costs	Provision for Other Claims	Total
	$'000	$'000	$'000	$'000
Note	9C	9D	9D	
Carrying amount 1 July 2006	**183 596**	**1 509**	**1,152**	**186 257**
Additional provisions made	32 155	96	444	**32 695**
Amounts used	(808)	-	(69)	**(877)**
Amounts reversed	-	-	(629)	**(629)**
Unwinding discount	9 020	-	-	**9 020**
Closing balance 30 June 2007	**223 963**	**1,605**	**898**	**226 466**

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

10 Equity

	FINANCIAL YEAR	
	2007 $'000	2006 $'000
Contributed equity		
Replacement research reactor equity injections		
Balance 1 July	**385 836**	365 349
Equity injections from Government - Replacement Research Reactor (OPAL)	**-**	20 487
Balance 30 June	**385 836**	385 836
Other equity injections		
Balance 1 July	**28 020**	28 020
Balance 30 June	**28 020**	28 020
Total contributed equity	**413 856**	413 856
Reserves, including movements		
Asset revaluation reserve		
Balance 1 July	**252 562**	255 918
HIFAR Revaluation Reserve transferred to retained surpluses	**(24 871)**	-
Revaluation adjustment	**2 074**	(3 356)
Balance 30 June	**229 765**	252 562
Fuel elements reserve		
Balance 1 July	**7 700**	12 400
Transferred to retained surpluses	**-**	(4 700)
Balance 30 June - (a)	**7 700**	7 700
Instrumentation reserve		
Balance 1 July	**6 200**	6 200
Balance 30 June - (b)	**6 200**	6 200
Spent fuel reserve		
Balance 1 July	**2 010**	2 010
Transferred to retained surpluses - (c)	**(2 010)**	-
Balance 30 June - (c)	**-**	2 010

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

10 Equity (continued)

	FINANCIAL YEAR	
	2007 $'000	2006 $'000
OPAL depreciation reserve		
Balance 1 July	-	-
Transferred from retained surpluses	8 000	-
Balance 30 June	8 000	-
OPAL training and business initiatives reserve		
Balance 1 July	-	6 800
Transferred to retained surpluses	-	(6 800)
Balance 30 June - (e)	-	-
New main entrance reserve		
Balance 1 July	700	8 300
Transferred (to)/from retained surpluses - (f)	(700)	(7 600)
Balance 30 June	-	700
Reactor licensing reserve		
Balance 1 July	1 500	1 500
Transferred to retained surpluses - (g)	-	-
Balance 30 June	1 500	1 500
Australian research project reserve		
Balance 1 July	-	1 000
Transferred (to)/from retained surpluses	-	(1 000)
Balance 30 June	-	-
Regional security of radioactive materials reserve		
Balance 1 July	-	-
Transferred to/from retained surpluses - (h)	1 600	-
Balance 30 June	1 600	-
Nuclear & radiological security reserve		
Balance 1 July	-	-
Transferred (to)/from retained surpluses - (i)	260	-
Balance 30 June	260	-
Total reserves	255 025	270 672

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

10 Equity (continued)

		FINANCIAL YEAR	
		2007 $'000	2006 $'000
Retained surpluses			
Retained surpluses 1 July		**59 153**	54 052
Transfer from fuel element reserve	(a)	**-**	4 700
Transfer to spent fuel reserve	(c)	**2 010**	-
Transfer to OPAL depreciation reserve	(d)	**(8 000)**	-
Transfer to OPAL training & business initiatives reserve	(e)	**-**	6 800
Transfer from new main entrance reserve	(f)	**700**	7 600
Transfer from revaluation reserve - HIFAR		**24 871**	-
Transfer to regional security of radioactive reserve	(h)	**(1 600)**	1 000
Transfer to nuclear & radiological security reserve	(i)	**(260)**	-
Operating loss		**(19 407)**	(14 999)
Retained surpluses 30 June		**57 467**	59 153
Total equity		**726 348**	743 681

(a) Fuel elements reserve

This reserve was established to fund the purchase of core fuel and development cost for the first few years of the replacement research reactor operation.

(b) Instrumentation reserve

In addition to the 1997 Government decision to fund the construction of a replacement research reactor at Lucas Heights, ANSTO has identified a planned future capital investment for the development of instrumentation associated with the replacement research reactor.

(c) Spent fuel reserve

This reserve represents unused spent fuel appropriation that will be used for future costs associated with the return of reprocessed fuel back to Australia.

(d) OPAL depreciation reserve

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

(e) OPAL training and business initiatives reserve

In addition to the 1997 Government decision to fund the construction of a replacement research reactor at Lucas Heights, ANSTO has identified a planned future capital investment for the development of ancillary facilities, business initiatives and operator training to fully utilise the replacement research reactor capabilities.

(f) New main entrance reserve

This reserve, to meet contracted construction costs relating to a new main entrance, has now been fully utilised.

(g) Reactor licensing reserve

This reserve is to meet future licensing costs for decommissioning the HIFAR reactor.

(h) Regional security of radioactive materials reserve

This reserve represents unused funding from prior years. This is due to delays in participation by some regional countries.

(i) Nuclear & radiological security reserve

This reserve relates to funding which will be utilised on a new project which is planned to run through to 2009-10.

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

11 Cash flow reconciliation

	FINANCIAL YEAR	
	2007 $'000	2006 $'000
Reconciliation of Operating Loss to Net Cash from Operating Activities:		
Operating loss	**(19 407)**	(14 999)
Non-cash items		
Depreciation/amortisation	**47 783**	52 107
Assets received free of charge	**(2 968)**	-
Net gain from sale of assets	**(898)**	(109)
Write off obsolete stock	**1 559**	812
Nuclear materials (devaluation)	**-**	(46)
Write off fixed assets	**49**	1 057
Net loss from sale of assets	**321**	223
Unwinding of Discount - Decommissioning Costs	**9 020**	8 740
Changes in assets and liabilities		
(Increase)/decrease in receivables	**(2 070)**	139
(Increase)/decrease in other receivables	**(2 908)**	109
(Increase)/decrease in GST receivables	**1 155**	(246)
(Increase)/decrease in prepayments	**2 445**	(1 037)
(Increase)/decrease in inventories	**(2 876)**	839
Increase/(decrease) in creditors	**(2 370)**	228
Increase in employee entitlements	**1 407**	1 957
Increase/(decrease) in revenue received in advance	**1 503**	174
Increase/(decrease) in accrued interest	**(46)**	82
Increase/(decrease) in other provision	**(158)**	1 200
Increase in interest bearing liabilities	**194**	130
Net cash from operating activities	**31 735**	51 360

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

12 Appropriations

Particulars	Departmental Outputs		Equity		Total	
	2007	2006	**2007**	2006	**2007**	2006
	$'000	$'000	**$'000**	$'000	**$'000**	$'000
Balance brought forward from previous year	-	-	-	28 800	-	28 800
Appropriation Acts 1	**129 653**	117 568	-	-	**129 653**	117 568
Appropriation Acts 2	-	-	-	20 487	-	20 487
Appropriation Acts 3	**11 925**	-	-	-	**11 925**	-
Available for payment of CRF	**141 578**	117 568	-	49 287	**141 578**	166 855
Cash payments made out of CRF	**141 578**	117 568	-	49 287	**141 578**	166 855
Balance carried forward to next year	-	-	-	-	-	-

This table reports on appropriations made by Parliament from Consolidated Revenue Fund (CRF) for payment to ANSTO.

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

13 Remuneration of members of the Board

	FINANCIAL YEAR	
	2007 $	2006 $
Members' remuneration is determined by the Remuneration Tribunal and payment is made in accordance with Section 12 of the *ANSTO Act 1987* (as amended).		
Included in operating expenses (Note 6) are:		
Aggregate amounts of superannuation payments in connection with the retirement of members of the Board	**39 758**	28 989
Other remuneration received, or due and receivable by members of the Board	**502 938**	513 815
	542 696	542 804
The number of members included in these figures is shown below in each relevant remuneration band:		
Remuneration between	**Number**	Number
$Nil and $14 999	**-**	2
$15 000 and $29 999	**3**	3
$30 000 and $44 999	**2**	1
$45 000 and $59 999	**-**	1
$300 000 and $314 999	**-**	-
$360 000 and $374 999 (a)	**-**	1
$405 000 and $419 999 (a)	**1**	-
	6	8

(a) Includes incentives payment

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

14 Remuneration of executives

		FINANCIAL YEAR	
		2007 $	2006 $
	Executive remuneration is determined by the ANSTO Enterprise Agreement 2006 which is underpinned by the ANSTO Award. Included in operating expenses (Note 6) is total remuneration received or due and receivable, by executives (excluding the Executive Director who is included in Note 13) who earn $130 000 or more in connection with the management of ANSTO.	**2 414 272**	2 704 456
	The number of executives included in these figures is shown below in each relevant remuneration band:		
	Remuneration between	**Number**	Number
	$130 000 and $144 999	**-**	1
	$145 000 and $159 999	**-**	7
	$160 000 and $174 999	**1**	2
	$175 000 and $189 999	**4**	-
	$190 000 and $204 999	**2**	-
	$205 000 and $219 999 (a)	**3**	2
	$220 000 and $234 999	**1**	1
	$235 000 and $249 999	**-**	1
	$250 000 and $264 999	**-**	-
	$265 000 and $279 999	**1**	-
	$280 000 and $294 999 (a)	**-**	1
		12	15
(a)	The aggregate amount of the separation and redundancy / termination benefit payment during the year to executives shown above.	**32 000**	172 759

15 Replacement Research Reactor Project (OPAL) costs

Following the requisite approval from the Minister for Industry, Science and Resources, a contract was executed on 13 July 2000 between ANSTO and INVAP SE for the design, construction and commissioning of a replacement research reactor at Lucas Heights.

The cost of construction of the replacement research reactor is A$278.5 million excluding GST (November 1999 dollars).

The Government has agreed to maintain the purchasing power of the $278.5 million in regard to foreign currency movements, changes in prices arising from movements in price indices attributable to the contract, and for the changes in the Government parameters where appropriate.

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

16 Insurances

Insurance risks, including professional indemnity, general liability, industrial special risk for property used substantially for commercial purposes, directors and officers, and travel, are placed through Comcover, the Government's insurable risk managed fund.

Workers compensation is insured through Comcare Australia and by virtue of statute under the *Safety Rehabilitation and Compensation Act 1988*.

A Deed of Indemnity between the Commonwealth Government and ANSTO, under which the government has formally agreed to indemnify ANSTO and ANSTO Officers from any loss or liability arising from claims caused by ionising radiation, remains in place.

17 Remuneration of auditors

	FINANCIAL YEAR	
	2007 $	2006 $
Remuneration to the Auditor-General for auditing the financial statements for the reporting period	**125 000**	105 000

No other services were provided by the Auditor-General.

18 Board membership

The members of the Board during the financial year and to the date of the report on the statements were:

Member	Appointed	Term Concluded	Term Concludes
I O Smith	17 May 2004		16 May 2008
A Van der Schaaf	25 July 2002		24 July 2007
K Schindhelm	20 March 2003		19 March 2008
M Eager	1 January 2002	31 December 2006	
M Eager	1 March 2007		29 February 2008
C Hillyard (a)	22 July 2004		21 July 2009
Z Switkowski (b)	1 January 2006		31 December 2010

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

18 Board membership (continued)

For the 2006-2007 financial year the aggregate remuneration paid to members of the Board is disclosed in Note 13.

The aggregate of superannuation payments paid to the Commonwealth Superannuation Scheme (CSS) and Public Sector Superannuation Scheme (PSS), in connection with the retirement of members of the Board was $39,758 (2006: $28,989).

(a) Dr. C. Hillyard resigned from the Board effective 30 June 2007.

(b) Dr. Z. Switkowski stood aside on 6 June 2006 to take up the appointment as Chairman of the Prime Minister's Taskforce undertaking the Review of Uranium Mining Processing and Nuclear Energy in Australia. He rejoined the Board on 28 February 2007 when this appointment had ended.

19 Related party disclosures

Several ANSTO Board Members were associated with entities with which ANSTO had commercial transactions during the year. All such transactions were in accordance with ANSTO's normal commercial terms and conditions.

20 Average staffing levels (full time equivalent)

	FINANCIAL YEAR	
	2007	2006
The average staffing levels for ANSTO during the year were:	**978**	872

21 Trust money

	$'000	$'000
ANSTO receives monies from trade creditors as security deposits for contracts to be performed. These monies are held in a Trust Account and refunded to the respective trade creditors on satisfactory completion of the contract.		
Balance 1 July	**7**	7
Add: receipts	**11**	-
Add: interest received	**1**	-
Balance 30 June	**19**	7

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

22 Financial instruments

(a) terms, conditions and accounting policies

Financial Instruments	Notes	Accounting Policies and Methods (including recognition criteria and measurement basis)	Nature of underlying instrument (including significant terms & conditions affecting the amount, timing and certainty of cash flow)
Financial assets		Financial assets are recognised when control over future economic benefits is established and the amount of the benefit can be reliably measured.	
Cash at bank	7A	Cash is recognised at cost. Interest is accrued as it is earned.	All Australian dollar cash balances are with the Commonwealth Bank of Australia. At 30 June current rates were 5.00%pa (2006 4.50%pa), calculated daily
Fixed term investment	7C	The deposits or investments are recognised at cost. Interest is accrued as it is earned.	The deposits & investments are with the Commonwealth Bank of Australia, and earn a weighted average effective rate of interest of 6.19% (2006, 5.51%pa) payable on maturity.
Receivables for goods & services	7B	Receivables are recognised at the nominal amounts due less any provision for bad and doubtful debts. Provisions are made when collection of the debt is judged to be less rather than more likely.	Credit terms are net 30 days (2006 - 30 days).
Other debtors	7B	Receivables are recognised at the nominal amounts due less any provision for bad and doubtful debts.	$1.5 million of this amount in (2006 $nil) is receivable as a result of a dispute settlement.
Loans to related parties	7B	Receivables are recognised at cost	These amounts are advances to ANSTO subsidiaries, and ANSTO has a agreed to defer recovery to no earlier than 1 July 2008.
Financial Liabilities		Financial liabilities are recognised when a present obligation to another party is entered into and the amount of the liability can be reliably measured.	
Trade creditors	9E	Creditors and accruals are recognised at their nominal amounts, being the amounts at which the liabilities will be settled. Liabilities are recognised to the extent that the goods or services have been received (and irrespective of having been invoiced).	Settlement is usually made net 30 days. (2006, 30 days)
Revenue received in advance	9G	Revenue received in advance is initially brought to account as "other payables" and subsequently recognised as revenue when earned.	Revenue earned is brought to account when the transaction is completed.

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

22 Financial instruments (continued)

(b) Interest rate risk - consolidated

Financial Instruments	Notes	Floating Interest Rate		Fixed Interest Rate				Non-Interest Bearing		Total		Weighted Average Effective Interest Rate	
				1 year or less		2 - 5 years							
		2007 $'000	2006 $'000	2007 $'000	2006 $'000	2007 $'000	2006 $'000	2007 $'000	2006 $'000	2007 $'000	2006 $'000	2007 $'000	2006 $'000
Financial assets													
Cash at bank	7A	3 476	11 337							3 476	11 337	4.85%	4.32%
Cash on hand	7A							1	1	1	1	n/a	n/a
Fixed term investment	7C	79 103	82 140							79 103	82 140	6.19%	5.52%
Investment in Australian Synchrotron	7C							5 000	5 000	5 000	5 000	n/a	n/a
Receivables for goods and services	7B							9 305	7 336	9 305	7 336	n/a	n/a
Interest accrued	7B							58	104	58	104	n/a	n/a
Other	7B							1 879	25	1 879	25	n/a	n/a
Total financial assets (recognised)		82 579	93 477					16 243	12 466	98 822	105 943		
Total assets										989 898	966 288		
Total financial liabilities (recognised)													
Trade creditors	9E							6 984	9 354	6 984	9 354	n/a	n/a
Grant received in advance	9F							43	293	43	293	n/a	n/a
Interest bearing liablities	9A					2 938	2 744			2 938	2 744	6%	6%
Other	9G							2 466	687	2 466	687	n/a	n/a
Total financial liabilities (recognised)						2 938	2 744	9 493	10 334	12 431	13 078		
Total liabilities										263 550	222 607		

Notes to and forming part of the Financial Statements for the year ended 30 June 2007

22 Financial instruments (continued)

(c) Net fair values of financial assets and liabilities

		FINANCIAL YEAR			
		2007		2006	
	Note	Total carrying amount $'000	Aggregate net fair value $'000	Total carrying amount $'000	Aggregate net fair value $'000
Financial assets (recognised)					
Cash at bank	7A	**3 476**	**3 476**	11 337	11 337
Cash on hand	7A	**1**	**1**	1	1
Fixed term investments	7C	**79 103**	**79 103**	82 140	82 140
Investment in Australian Synchrotron	7C	**5 000**	**5 000**	5 000	5 000
Receivables for goods and services	7B	**8 251**	**8 251**	7 336	7 336
Loans to related parties	7B	**1 054**	**1 054**	-	-
Interest accrued	7B	**58**	**58**	104	104
Other	7B	**1 879**	**1 879**	25	25
Total financial assets		**98 822**	**98 822**	105 943	105 943
Financial liabilities (recognised)					
Trade creditors	9E	**6 984**	**6 984**	9 354	9 354
Grant received in advance	9F	**43**	**43**	293	293
Interest bearing liabilities	9A	**2 938**	**2 938**	2 744	2 744
Other	9G	**2 466**	**2 466**	713	713
Total financial liabilities		**12 431**	**12 431**	13 104	13 104

Notes to and forming part of the Financial Statements
for the year ended 30 June 2007

22 Financial instruments (continued)

(c) Net fair values of financial assets and liabilities (continued)

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 revenue received in advance, all of which are short-term in nature, are in accord with their carrying amounts.

(d) Credit risk exposures

ANSTO's maximum exposures to credit risk at reporting date in relation to each class of recognised financial assets is the carrying amount of those assets as indicated in the Balance Sheet.

Appendices

Appendix 1
Equality of Employment Opportunity

Objectives

1. To ensure that Equal Employment Opportunity (EEO) principles and practices are actively incorporated into all people management practices.
2. To ensure that the structures and processes used to implement EEO adjust to changing employment needs.
3. To confirm and communicate the vision that ANSTO's employment activities reflect ANSTO's values.

ANSTO actively seeks to implement EEO and diversity principles in its management practices. Human resource processes operate within the ISO 9001 framework. All new employees are introduced to the principles of EEO as part of their induction program and are required to undertake the relevant online training. While there is a predominance of male employees in ANSTO, women are relatively well represented in key management and research scientist roles. The percentage of female employees continues to increase, as does the percentage of employees from non English speaking backgrounds.

ANSTO has sought to accommodate employees seeking part-time employment wherever feasible, and it is noted that this has been utilised by both male and female employees.

Access to parental leave has been improved via new provisions, which also provide for increased paid maternity leave. All employees and their families continue to have access to the services of counsellors through the Employee Assistance Program, provided as an employee benefit through an external provider.

Staff in specific employment categories

This information is based on data obtained from 914 staff.
Note: Staff had the option of choosing not to provide information when answering questions.

	Number employed		% of total staff		Average salary	
	2005-06	**2006-07**	2005-06	**2006-07**	2005-06	**2006-07**
Female	232	**255**	25%	**26%**	$53 777	**$57 302**
Male	682	**726**	75%	**74%**	$65 708	**$66 130**

	Number employed		% of total staff		Average salary	
	2005-06	**2006-07**	2005-06	**2006-07**	2005-06	**2006-07**
People with disabilities	15	**18**	2%	**1.9%**	$56 998	**$60 070**
Aboriginal and Torres Strait Islanders	10	**11**	1.09%	**1.1%**	$60 838	**$64 792**
Non-English speaking background	33	**53**	3.6%	**5.4%**	$61 956	**$65 983**

Appendix 2
Freedom of Information

In compliance with Section 8 of the Freedom of Information Act 1982, the following is the annual statement on consultative arrangements, categories of documents maintained, and facilities and procedures for access to documents relating to ANSTO.

Details of the functions of the organisation, membership of the Board and decision-making powers of the Board and the Executive are provided elsewhere in the annual report.

Arrangements for external participation

Liaison groups

A technical advisory committee advises the ANSTO Board on the research projects being undertaken at ANSTO. Details of its role and composition can be found on pages 86-87 of this Annual Report.

The Local Liaison Working Party (LLWP), established in 1967, comprises representatives from the NSW Police, Ambulance, Fire Brigades, Rural Fire Service, the NSW Department of Environment and Conservation, the NSW Department of Health, the Australian Federal Police, the Georges River District Emergency Management Officer, the State Emergency Management Committee, the State Emergency Service, Sutherland Shire Council and ANSTO, as well as an observer from the Australian Radiation Protection and Nuclear Safety Agency. The LLWP is a communication forum for all parties which play a role in emergency preparedness and response at the Lucas Heights Science and Technology Centre (where ANSTO is located).

ANSTO state government arrangements

As it is located in New South Wales, ANSTO liaises with a range of NSW departments and authorities responsible for emergency management, environmental planning and other matters.

Associated organisations

AINSE, which is an association of ANSTO, GNS Science and 39 universities, arranges access by staff and students of Australasian universities to the major facilities at ANSTO.

Other arrangements

Less formal arrangements exist for promoting discussions, the exchange of views and/or collaboration with organisations outside the Commonwealth administration. These organisations include local government authorities, universities, standards bodies, professional societies, unions and staff associations, industrial groups and international nuclear agencies.

Categories of documents held

Computer software packages, computer printouts, technical books and reports, and International Nuclear Information System documents are available for purchase. Single copies of the annual report, *Nuclear Matters*, strategic plans, ANSTO emergency plans, environmental monitoring reports, general information literature, videos and DVDs (under loan arrangements) are available on request.

Documents relating to decision-making processes include Cabinet documents about matters in which ANSTO has an interest; ministerial correspondence and directions; ANSTO Board agenda, memoranda and decisions; deeds, legal contracts and formal agreements; minutes and submissions; employment, delegations, security, finance and accounting handbooks and manuals. General correspondence includes ministerial briefs; speeches; conference papers for national and international meetings; parliamentary questions

Appendix 2
Freedom of Information

and answers; cables, telexes and facsimiles; and general records files.

Technical documents held include scientific and technical reports and laboratory notes comprising patents and inventions; computer media; plant and equipment operating manuals; maintenance, quality assurance and safety manuals; reactor operating authorisations, records and log books; radioisotope quality control procedures manuals; radioisotope catalogues and price lists; engineering service general records; nuclear material movement vouchers and accounting records; photographs; and radiographs.

Health and safety documents include staff medical records; safety-related survey records; film badge and radiological records; accident reports; and emergency response procedures.

Administration documents held include personnel records such as staff promotion files; organisation and establishment reports; compensation files; computer media with administrative instructions and information storage; staff lists and classifications; accounting records; pay-roll, flexitime and overtime records; tender and contract documents; building plans, specifications and instructions; directives; orders; memoranda; bulletins; notices; and information.

Other documents held include drawing office records such as plans, microfilm, drawings, maps and photographs.

Facilities for access

By arrangement, Freedom of Information (FOI) inquirers can peruse information in the Reception Centre at the entrance to the Lucas Heights Science and Technology Centre. Other arrangements for access may be made by contacting the FOI Coordinator, ANSTO, Private Mail Bag 1, Menai, NSW 2234, Australia (email samantha.thorogood@ansto.gov.au).

ANSTO also has a free enquiry service for members of the public requiring information about the Organisation and its research, called the Community Right to Know Charter.

Interested parties are encouraged to contact enquiries@ansto.gov.au for any information.

Information about ANSTO is available on the internet through the organisation's homepage at www.ansto.gov.au.

The ANSTO Senior Adviser, Government Liaison and General Manager, Public Affairs, have been appointed as authorised officers under Section 23 of the *Freedom of Information Act 1982.*

Appendix 3

Functions and powers of the Organisation under the ANSTO Act

This appendix describes the functions and powers of the organisation under the *Australian Nuclear Science and Technology Organisation Act 1987*, which is ANSTO's enabling legislation. In the text below, 'Organisation' means the Australian Nuclear Science and Technology Organisation.

Section 5: Functions of the 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:

Appendix 3
Functions and powers of the Organisation under the ANSTO Act

(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, 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

(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

Appendix 3

Functions and powers of the Organisation under the ANSTO Act

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.

(5) The Organisation may perform its functions to the extent only that they are not in excess of the functions that may be conferred on it by virtue of any of the legislative powers of the Parliament, and, in particular, may perform its functions:

(a) in so far as it is appropriate for those functions to be performed by the Organisation on behalf of the Government of the Commonwealth as the national Government of Australia; and

(b) for purposes for which it is appropriate for the Parliament as the national Parliament of Australia to authorise the Organisation to perform functions; and

(c) by way of expenditure of money that is available for the purposes of the Organisation in accordance with an appropriation made by the Parliament; and

Appendix 3
Functions and powers of the Organisation under the ANSTO Act

(d) in the course of, or in relation to, trade and commerce with other countries, among the States, between Territories or between a Territory and a State; and

(e) for purposes related to external affairs; and

(f) for purposes in or in relation to a Territory; and

(g) for purposes related to the defence of the Commonwealth.

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).

Appendix 4
Commonwealth Disability Strategy

ANSTO's primary role under the Commonwealth Disability Strategy is as an employer, and as such we are committed to equity and fairness in the workplace and in our recruitment practices.

All our job advertisements state that ANSTO is an equal opportunity employer. All new employees are made aware of our practices during induction and in our revised orientation program which is currently being prepared for online delivery.

All employees participate in our compulsory online compliance training covering workplace rights and wrongs, privacy, ethics and bullying. Our human resources policies, which include our approach to employees with disabilities, are incorporated into ANSTO's Business Management System and are available to employees online.

Formal complaints and grievance processes are set out in ANSTO's 2006 Enterprise Agreement. It is through this Agreement that any complaints or grievances raised by people with disabilities in relation to ANSTO's employment practices may be directed.

ANSTO also has a separate whistleblower directive which safeguards any employee who seeks to raise a complaint or grievance. The Agreement also contains a supported wage arrangement for employees with disabilities.

We maintain a network of internal contact officers with whom difficulties may be discussed. All staff have access to an independent employee assistance program, which is publicised throughout the organisation. ANSTO has secondary roles as a policy adviser and as a regulator.

As a policy adviser, we consider what effect our products and services may have on people with disabilities, and we provide explanatory information where required.

As a regulator, we ensure that internal policies and procedures comply with the relevant legislation and that staff are kept informed of requirements under organisational policy.

Appendix 5
Research Performance Assessment

Under its 2004-07 Triennium Funding Agreement, ANSTO agreed to assess the performance of its research, addressing four subjects:

1. Quality of research

2. Systems for ensuring research quality and achievements

3. The application and/or dissemination of research outputs

4. The development of researchers.

The assessment was undertaken in 2005-06 and on 9 June 2006 the Board reported to the Minister for Education, Science and Training, the Hon Julie Bishop MP, on the findings of the assessment process.

The Minister responded on 21 August 2006, approving the Board's report and confirming that it met the objectives of the Government's quality framework. She noted that, "the overall assessment is very positive and that it confirms that 60% of ANSTO staff are in the top 25% internationally."The Minister also noted that, "ANSTO management and staff believe that they have gained many benefits as a result of the assessment of performance of its research."

The Committee to Oversee the Publicly Funded Research Agencies Performance Assessment Process endorsed ANSTO's summary report on the outcomes of its process on 10 May 2006.

Actions arising

The Board is committed to ensuring implementation of the recommendations that were made during the assessment process by ANSTO's Technical Advisory Committee and the expert panels that reviewed each research institute.

Listed below are the seven areas for action that were identified in the Organisation's 2005-06 Annual Report as a result of the research performance assessment, and progress on these during 2006-07.

Appointments of key management and research project staff	At the beginning of the financial year, three research institutes were being led by acting heads. All three positions have been filled. Staffing decisions give considerable weight to recommendations of the TAC and panels, but also take account of strategy, funding and timing of availability of high quality staff. Notable appointments in the Bragg Institute include a high standing neutron scattering group leader, an internationally recognised small angle scattering instrument scientist, a highly calibre thermal triple-axis spectrometer instrument scientist and a highly experienced scientific coordinator. The staffing recommendations of the Institute for Materials and Engineering Science expert panel have been met.

Appendix 5
Research Performance Assessment

Appointments of key management and research project staff	The Institute for Environmental Research has filled one of the roles identified by its expert panel, but recruitment for other roles recommended by the panel is continuing. The recommendations of the panel that reviewed the Institute for Radiopharmaceuticals Research are pending the arrival of the new institute head, although some other notable appointments have been made. In addition, support staff numbers have been increased and ANSTO has awarded two Senior Research Fellowships to extend our portfolio into previously unexplored areas.
Establishment, evolution, operation and quality of organisation-to-organisation collaborative agreements	ANSTO has consolidated its partnerships with the Defence Science and Technology Organisation through a new memorandum of understanding. A formal, well publicised agreement with CSIRO (covering the Food Futures and Preventative Health Flagships and Food Science Australia – a joint venture of CSIRO and the Victorian Government) is supporting research on food science using neutron scattering. ANSTO research projects had collaborations underpinned by formal agreements with nine universities in the current year. Of these six were with Group of Eight universities. The other three university collaborators offer specialist areas of research, in detectors and medical physics, and environmental research. The agreement with the University of Melbourne stands out at the highest level. ANSTO had 19 international collaborations with institutions underpinned by formal agreements; involvement in one European Union Framework 6 Integrated Project; one global environmental research project and four IAEA programs.
Consolidation of long-term and strategic partnerships	ANSTO has joined a new Cooperative Research Centre for Biomedical Imaging Development (CRC-BID), providing a formal structure for relationships in the development and application of new radiopharmaceutical imaging agents. The organisation is using support received from the Department of Prime Minister and Cabinet's National Security Science and Technology Unit for counter-terrorism work with the Australian Federal Police and Australian Customs.

Appendix 5
Research Performance Assessment

Consolidation of long-term and strategic partnerships	Radiopharmaceutical research is increasingly focused on a few strategic partners, notably the Peter MacCallum Cancer Institute (through the CRC-BID), the Garvan Institute, Austin Health and the Brain and Mind Research Institute at the University of Sydney. ANSTO has placed a neutron scattering specialist in CSIRO to increase that organisation's awareness of potential applications of OPAL. ANSTO Minerals and minerals research teams in CSIRO have also been working towards closer relationships, with a project recently commenced involving Geoscience Australia, under the umbrella of Minerals Down Under. ANSTO also using its postdoctoral program as part of our strategic partnering. Of the 43 postdoctoral projects currently under way, 16 are jointly funded. Among new arrangements to encourage cooperation are a collaborative project fund with the University of Melbourne and joint PhD scholarships with the University of Sydney. The new postdoctoral fellowships being offered by the Australian Institute of Nuclear Science and Engineering are also directed at activities aligned with ANSTO strategies. ANSTO is also working with AINSE to contribute to the development of new nuclear education programs in Australia.
Project monitoring	The Executive contracts with research institutes for delivery of research outcomes against agreed milestones. Institute heads and senior managers review projects for their performance against milestones and require justification to modifications. The Executive approves major redirections and review overall progress as required, but at least annually. Major milestone achievements are collated as part of ANSTO's new balanced scorecard for reporting. Project leaders are required to prepare project summaries with measurable and realistic outputs. Performance against these is reported quarterly in the balanced scorecard.
The framework for staff development and recruitment	The first stage of a strategic staff development and recruitment framework has been implemented. This includes succession planning. Staff with potential to become institute heads are increasingly undertaking relevant training.

Appendix 5
Research Performance Assessment

Postgraduate appointments and subsequent employment	Four scholarships have been placed for the University of Sydney postgraduate scheme. Two vacancies have been carried forward. AINSE's postgraduate scholarships are also better aligned now with ANSTO's research portfolio.
Developments regarding nuclear science and technology in Australian universities	The Australian Government is supportive of ANSTO's and AINSE's efforts to work with universities to build the national skills base in nuclear science and technology. ANSTO is focusing its collaborations on universities in the research-intensive Group of Eight (namely the Universities of Melbourne, Sydney and NSW) or with particular alignments to ANSTO's interests (e.g. the University of Wollongong). The organisation has held discussions with a number of universities about their programs. In addition, AINSE intends to coordinate a national program.

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* (As amended)**

Commonwealth Authorities and Companies Orders (Financial statements for reporting periods ending on or after 30 June 2005) under the *Commonwealth Authorities and Companies Act 1997* (As amended)

Commonwealth Authorities and Companies (Report of Operations) Orders 2005 under the *Commonwealth Authorities and Companies Act 1997* (As amended)

Requirements under other guidelines and legislation

Acronyms

ADWG	Australian Drinking Water Guidelines
AEIFRS	Australian Equivalents to International Financial Reporting Standards
AFP	Australian Federal Police
AIMS	Australian Institute of Marine Science
AINSE	Australian Institute of Nuclear Science and Engineering
AIP	Australian Institute of Physics
AMT	Australian Membrane Technologies
ANAO	Australian National Audit Office
ANSN	Asian Nuclear Safety Network
ANSTO	Australian Nuclear Science and Technology Organisation
ANTARES	Australian National Tandem for Applied Research
AOFSRR	Asia-Oceania Forum for Synchrotron Radiation Research
ARI	ANSTO Radiopharmaceuticals and Industrials
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASIO	Australian Security Intelligence Organisation
ASNO	Australian Safeguards and Non-Proliferation Office
ASRP	Australian Synchrotron Research Programme
ATLAS	ANSTO Technologies, Leaders in Analytical Science
AVO	Australian Valuation Office
CAC Act	Commonwealth Authorities and Companies Act 1997
CcASH	Cosmogenic climate Archives of the Southern Hemisphere
COMET	Commercialising Emerging Technologies
CRC	Cooperative Research Centre
CRC-BID	Cooperative Research Centre – Biomedical Imaging Development
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSS	Commonwealth Superannuation Scheme
CT	Computed Tomography
DEST	Department of Education Science and Training
DSTO	Defence Science and Technology Organisation
EEO	Equal Employment Opportunity
EMS	Environmental Management System
ESD	Ecologically Sustainable Development
FMOs	Finance Minister's Orders
FNCA	Forum for Nuclear Cooperation in Asia
FOI	Freedom of Information
GIF	Generation IV International Forum
HIFAR	High Flux Australian Reactor

Acronyms

HIP	hot isostatic pressing
IAEA	International Atomic Energy Agency
IFRS	International Financial Reporting Standards
ISO	International Organisation for Standardisation
IsoTrans	Isotopic Tracers in Atmospheric Transport
ISL	International Science Linkages
IYPE	International Year of Planet Earth
LLWP	Local Liaison Working Party
MDU	Minerals Down Under
mSv	millisieverts
NEA	Nuclear Energy Agency
NCRIS	National Collaborative Research Infrastructure Strategy
NMAC	Nuclear Materials Accountancy and Control
NMB	Nanoparticulate Membrane Bioreactor
NORM	Naturally-occurring radioactive materials
NRP	National Research Priorities
NUPP	Nuclear and Particle Physics group
OECD	Organisation for Economic Cooperation and Development
OFMR	NSW Office for Science and Medical Research
OPAL	Open Pool Australian Light-water reactor
PBR	Peripheral-type Benzodiazepine Receptor
PET	Positron Emission Tomography
PSS	Public Sector Superannuation Scheme
QFA	Quadrennium Funding Agreement
RCA	Regional Cooperative Agreement
RIP	Resin in pulp
RRI	Radiopharmaceutical Research Institute
SAR	Safety Analysis Report
SPECT	Single Photon Emission Computed Tomography
STAR	Small Tandem for Applied Research
Sv	Sieverts
UNESCO	United Nations Educational, Scientific and Cultural Organisation

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Public Information
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