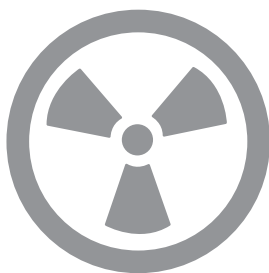




Australian Government



Nuclear-based science benefiting all Australians



*safety, environment,
community, science.*



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Executive Director's introduction

Dr Ian Smith, Executive Director, on ANSTO's corporate social responsibility (CSR).

What were the highlights of ANSTO's CSR performance this year?

Our increased community interaction was a definite highlight, in terms of reaching out to schools and communities. Important confirmation of the desire for ANSTO's CSR reporting came with our market research results. We have used this information to modify report content including our CSR commitments, and will continue to seek feedback to better meet stakeholder expectations (our CSR commitments are also now more in line with organisational Strategic Directions).

Increased emphasis of safety on site was another highlight. We have decreased the severity of incidents, and in April to June cut our time lost through injury frequency rate by over 50 per cent. A good result, but we can still do better. Construction of a new \$1.3 million specially designed site entrance also shows our commitment to staff road safety.

What were the social and economic benefits of ANSTO's scientific research this year?

Our sewage recycling 'bioreactor' is an invention with high potential for very good environmental outcomes. We have interest



from major municipal authorities to trial the technology, with potential savings of tens of millions of dollars. We continue to support local industry with provision of expert services, such as software for the better management of pipeline strength testing and stress analysis for power generation plants.

ANSTO research is contributing to our understanding of what is happening with our water, by tracing water flows and understanding salinity. These are major issues which help us understand climate change.

Our CeramiSphere technology has the demonstrated ability to make narcotic drugs tamper-proof. We are in negotiation with a major pharmaceutical company to ensure important pain relief drugs are not diverted for illegal use. This approach of 'spinning-off' our technology allows ANSTO to adapt its core research into platforms that Australian industry can use to solve specific issues.

Vision, values, strategic directions

ANSTO's Vision

To be recognised as an international centre of excellence in nuclear science and technology for the benefit of Australia.

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

ANSTO's Strategic Directions

- 1 Deliver Excellence in Nuclear Science and Technology
- 2 Focus our Capabilities to Support Issues of National Importance
- 3 Maximise Return on Investment in Expertise and Specialised Facilities
- 4 Promote Understanding of the Benefits of Nuclear Science and Technology

What role will nuclear science and technology play in Australian science and industry in coming years?

There is great excitement in the Australian scientific community. OPAL's neutron scattering^{*} will ensure this is a key technology for the next decade. It will impact on molecular biology, health and food science research.

ANSTO will also play an important role in advising government and community about the benefits of nuclear science and technology, and allowing the nuclear power debate to proceed on the basis of reliable information.

What will OPAL do for Australia?

As a world-class facility, OPAL will irradiate silicon for semi-conductors, secure radioisotope supplies for nuclear medicine and provide neutrons for research. For example, our food

science project uses OPAL's capacities and is an exciting opportunity to understand more about food. Our neutron scattering facility will help keep scientists in Australia, and attract some back.

How is ANSTO working towards nuclear safety and security in our region?

We have a long and well earned reputation as a source of advice and expertise for countries in the region. ANSTO leads a major project promoting safety culture in nuclear facilities, with nine regional countries involved. We actively assist regional countries to secure vulnerable radioactive sources, which are a potential danger with the realities of terrorism very much upon us.

^{*}Neutron scattering is a technique used to determine the atomic structure of a material. It involves bombarding a sample with a beam of neutrons and observing how the neutrons are then scattered.

Our management

As a government organisation, ANSTO needs to be prudent and transparent in how money is spent.

Because 70 per cent of our funding is from taxpayers, through the Australian Government, we must be wise in determining the areas of national importance where nuclear science can make the best contribution.

ANSTO's Board and executive management ensure our activities align with the ANSTO Act and with our Strategic Directions. ANSTO receives government funding under different categories, aligned with our strategic directions. "We are funded in a structured way, to undertake specific activities," said our Executive Director, Dr Ian Smith. "Not in one big lump." Information on ANSTO's spending is freely available.

Leading the way in non-proliferation

Australia has always taken a lead role in promoting nuclear non-proliferation, or the assurance that nuclear material will not be diverted for military purposes. Currently, there is some global concern about the amounts of high-enriched uranium (HEU) fuel used by nuclear facilities worldwide. HEU can be used to produce nuclear weapons, either directly or through further enrichment.

"There has been an international effort to phase out use of HEU fuel," said Dr Ron Cameron. To throw its weight behind this campaign, ANSTO converted HIFAR from HEU to low-enriched uranium (LEU), which contains less than 20 per cent uranium-235 (uranium's 'active ingredient').

LEU cannot be used for nuclear weapons without further enrichment. "The conversion required careful planning and recognition from the outset that there would be some loss of neutrons[†]," Ron said. "However we feel it is more important to make a commitment to the removal of HEU and encourage other countries to do the same."

One of the ways we ensure a good return on investment is through our capital expenditure process. For example, when constructing the site's new secure entrance facility we consulted widely in the design of the facility and had strong project management.

"This ensured money was well spent, with the project actually being under budget," said Dr Ron Cameron, Chief of Operations. Controlling operational spending (especially overheads and administration) means more money has been put into research than in previous years.

OPAL was always designed to operate with LEU, in line with international best practice. "ANSTO's decision to use a reactor designed for LEU fuel sets an important example for others," said John Carlson, Director-General of the Australian Safeguards and Non-Proliferation Office (ASNO).

ANSTO is also leading the way in radiopharmaceutical production of molybdenum-99, widely used in nuclear medicine. "No other major supplier in the world uses LEU to make molybdenum," explained Ron.

With the most advanced nuclear technology in our region and a seat at the International Atomic Energy Agency, ANSTO is obliged to take a leadership role. "ANSTO is highly active in the region, through various outreach and assistance programs, collaborative research projects, and the Regional Cooperation Agreement," John said.

"ANSTO's support and dedication to non-proliferation ideals has been an important aspect of Australia being at the forefront of safeguards development."

[†]Neutrons are primarily used to examine the properties of materials and make radiopharmaceuticals for nuclear medicine.

Case study

Radiopharmaceutical production safety

The production of radiopharmaceuticals at ANSTO has evolved from a small laboratory process to our current state as a major supplier of radiopharmaceuticals for the Australian nuclear medicine market and beyond.

"However a large number of manual processes still remain," explained Dr Ron Cameron. From time to time, these can lead to minor incidents with some contamination. In June, four minor incidents occurred, and in three cases an ANSTO staff member received a low dose of radiation.

"Prior to these incidents, we had a breakdown (due to a ruptured fission gas trap) in our production area for manufacturing the nuclear medicine molybdenum-99, which caused the facility to be closed down," Ron said.

ANSTO believed that while it was important for us to investigate the radiopharmaceutical production incidents to see if improvements to safety could be made, they did not justify widespread publicity as there were no safety implications for the workers or the public.

Following the ruptured fission trap incident, increased media focus on ANSTO and accusations of secrecy ensued, often without appropriate understanding of the incidents and the context in which they occurred.

"While this reporting caused some concern, we believe it is important to emphasise the incidents were only minor and had no consequences for the health and safety of employees or the public," said Ron.

ANSTO is procuring a completely new molybdenum nuclear medicine production facility, which is expected to be up and running in early 2007. "In addition, we are exploring automation for manufacturing of other radiopharmaceuticals, which reduces reliance on manual handling of radioactive materials and is a move towards best practice," he said.

"This will ensure that not only will we meet Australia's growing demand for radiopharmaceuticals, but that our staff's safety and well-being continues to be looked after."

ANSTO produces more than 70 per cent of the radioisotopes used in Australian nuclear medicine procedures



Neutron beam guide hall, at OPAL



Safety at ANSTO

As ANSTO continues to strive for zero-harm in employee safety, our Executive Director's top down approach plays a vital role.

"Safety is the first item discussed at executive, senior management and Board meetings," Dr Ian Smith explained. All senior staff are aware of safety, not least because it is a major component of their performance assessments.

This year ANSTO celebrated the success of the Engineering Development Services Workshop, which has dramatically improved its safety culture and become a high performer. We are also maintaining vigilance in radiation safety, although this year we had an incident which may have resulted in a staff member receiving more than the regulatory limit for radiation exposure. Although it was not proven that the worker was actually wearing his radiation detector when it received the dose of radiation, the dose was reported to the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), allocated to the individual's dose record and the individual was removed from radiation work. The dose level was not significant for the individual's health, and investigations identified improvements in work practices that have been implemented.

"We obviously follow ARPANSA regulations and report any significant doses received but we strive to exceed ARPANSA's requirements wherever possible," said Ian.

ANSTO has always taken the security of our facilities seriously, and liaises regularly with specialist agencies. "Security is continually reviewed each time there is a change in the external environment, with security upgraded to cope with any changes," explained Ian. "Compared to other facilities, ANSTO is a very hard target."

A team from the United States Department of Energy visited ANSTO in December. As ANSTO holds US-obligated nuclear material the group regularly visits to ensure we are applying appropriate security standards. They noted that while installation and testing was still to be completed, the OPAL reactor should exceed international standards for physical protection at equivalent facilities.

ANSTO employees play a vital role in striving for a zero-harm workplace



Case study

Contractor safety counts at ANSTO

Safe work method statements, hazard identification, risk assessments... sounds like a lot of paperwork before you can get a job done, but these days they are all essential parts of working safely at ANSTO, whether you are a staff member or a contractor.

Evan Burton works for Thomas and Coffey, who have been ANSTO's air-conditioning maintenance providers for around 18 months. Evan, who supervises a team of technicians and tradesmen, said, "Thomas and Coffey is very concerned with safety and ANSTO is the same. The paperwork can be a drag but like our monthly internal safety audits it's now part of our daily job. Like ANSTO we share a high regard for safety overall."

Warren Steele leads a team of eight contractor supervisors, responsible for the majority of contracted works at ANSTO. Specialist contractors undertake preventative maintenance and project-related work, from changing door handles and tap washers to major building refurbishments and equipment installations.



Contractors Thomas and Coffey share ANSTO's high regard for safety

The process of hiring period contractors is not a simple one. As Warren said, "There are no shortage of guidelines to adhere to! We select contractors who have established a proven safety system and strong safety culture." In the past, price was a major factor in contractor selection, but now contractors must have auditable safety systems in place to be considered. "With each three-yearly tender process we raise the bar to keep that forward momentum," Warren said.

During the tendering process, safe work method statements are required to demonstrate understanding of the risk assessment process. Copies of safety plans are needed to show the contractor's commitment to safety.

Once a contractor has been selected and security background checks have been undertaken, general site induction (including a video and questionnaires) is completed. Additional training needs are identified which cover topics such as radiation protection. At all times our contractors need to demonstrate how they will work safely and meet ANSTO requirements, including keeping our own staff safe.

"I've held a number of engineering roles outside this organisation and by comparison ANSTO maintains a high standard of safety," said Warren. "We are constantly reviewing our systems. Like all industries ANSTO has its share of hazards, though once identified and managed correctly they pose no more of a risk than those found at any other site. Through education and a practical approach to risk management, we are able to alleviate any contractor concerns, so they become confident in dealing with our local hazards."



Case study

Health physics staffing changes at HIFAR

In May 2006, ANSTO decided to cease irradiation of silicon ingots at night in its soon-to-be-phased-out research reactor, HIFAR. As radioactive material was not being moved between 11 pm and 7 am, there was no need for an on-site Health Physics Surveyor, whose primary role was to monitor contamination. Unfortunately, this change was reported by some media as suggesting that safety would be compromised.

The Site Operations Safety Supervisors (SOSS), who are trained in radiation safety and aware of hazards on site, continue to be on-site 24/7. Environmental monitoring systems and sampling routines are also unchanged. The system for responding to unusual situations remains in place, and an on-call arrangement exists to provide health physics support outside normal hours.

Initially there was some concern within the NSW Fire Brigade, but this was addressed through meetings with representatives of Fire Brigade senior management and the

Fire Brigade union. While the union has indicated it is not satisfied with the current situation, ANSTO and the Fire Brigade itself are currently working on a Memorandum of Understanding to formalise mutually satisfactory arrangements.

“The Fire Brigade will respond to ANSTO as for any other organisation,” said Karen Wolfe, Occupational Hygiene and Safety Services Manager. “SOSS will provide information and ensure safe entry. There was an initial concern that there would be no professional advice on radiological hazards available. This proved to be a miscommunication.”

In fact, SOSS staff are highly trained first responders who are trained to assess risks and identify whether extra help is required. If an incident occurred, SOSS would assess the situation and contact the Duty Safety Coordinator, who is available 24/7.

“Our health physics surveyors were consulted throughout the process,” said Karen.

Our safety commitments

- Ensure no adverse effect on the health of all our stakeholders, including staff, as our top priority
- Make certain that all activities are safe and in line with international best-practice standards and comply with state and Federal laws and regulations
- Constantly improve our nuclear safety record
- Make sure that radiation doses are as low as reasonably achievable
- Conduct regular and open discussions with staff, the local community and other interested parties on our nuclear safety policies
- Provide clear and concise evidence of the fulfilment of our safety commitments through monitoring and regular public reporting

Safety scorecard

Scorecard comments

	Unit of Measure	2005-06	Target Max
Lost time injury frequency rate (LTIFR)	LTIFR (per million hours worked)	10.1	9.0
Maximum annual effective radiation dose to ANSTO radiation workers	mSv	10.2	15.0 mSv standard dose constraint

Trend Data	2001-02	2002-03	2003-04	2004-05	2005-06
LTIFR (per million hours worked)	11.4	12.1	12.1	13.6	10.1
Maximum effective dose to any individual (mSv)	8.7	9.7	9.8	10.2	10.2*
Average effective dose across all monitored staff (mSv)	0.9	0.8	0.8	0.8	0.8*

*The 2005-06 values do not include dose value of 65.9 mSv for one staff member, which was due to a specific incident (refer to page 7).

The 2005-06 LTIFR result shows that ANSTO is making progress in achieving the target. Safety is a major emphasis at a senior management level, and in April to June the LTIFR was reduced by over 50 per cent.

There is an apparent slight upward trend in the maximum dose, which is a dose to a different individual and not a population dose. The recent stable trend for average whole body (effective) dose for ANSTO employees, despite increasing radiopharmaceuticals production, is a positive safety result.

In 2005-06, the ANSTO dosimetry service monitored 842 workers, 707 of whom received less than 1.0 millisieverts (mSv) whole body (effective) dose (millisieverts are used to measure the effect of ionising radiation on living cells). Nineteen of the 29 workers with doses between five and 10.2 mSv were radiation workers involved in the production of radiopharmaceuticals either at our Lucas Heights or National Medical Cyclotron sites. To ensure employees receive as little radiation exposure as possible, we review work practices whenever staff receive an annual reading above 2.0 mSv.

What's new?

- \$10.6 million security-driven site entrance and reception
- \$1.3 million specially designed entrance to site to minimise traffic hazards
- Engineering Services Development Workshop safety culture celebrated
- Improvements to site infrastructure including roads and footpaths

What's next?

- Continued emphasis on safety and zero-harm
- New safety documentation and improved safety training



ANSTO science is playing a key role in helping scientists understand the Australian environment and develop solutions to environmental problems.

Our research ranges from tracing contaminants in Sydney Harbour, to projects which are improving computer models that predict long - and short-term weather and climate. The radioisotopes we produce can be used to study the movement of sewage and liquid waste in waterways. Spin-off inventions like our sewage and wastewater 'bioreactor' have the potential to cut household water usage by 60 per cent (see *Our science* section).

However, the nuclear technology behind this research and other work at ANSTO generates low releases of radioactive material to the environment which has been of concern to some community members. As we have reported for many years, ANSTO's releases to the environment remain well within regulatory limits, but we are determined to minimise our environmental footprint. This commitment to environmental sustainability means seeking to reduce consumption of resources as well as reducing our releases of radioactive material and other potential contaminants.

ANSTO scientists use the STAR accelerator to help solve environmental problems



For this reason we are introducing further measures of our environmental impact. In line with the continuous improvement approach of our ISO 14001 environmental accreditation, ANSTO has been collecting information on water, fuel and electricity consumption, use of recycled paper and water, and waste generated versus recycling. The data will be incorporated into our Environmental Management System and plans are underway to officially report it next year.

At a hands-on level, 2006 has seen the start of monthly clean up days across site. With both safety and environmental benefits, materials disposed of range from lead bricks and old computers through to packing pallets and broken equipment. A clean up in one business area was planned for one day but met with such enthusiasm that it was extended to two weeks, and saw seven truck-loads of metal (old broken steel cabinets, scrap metal) and three truck-loads of general rubbish taken to the tip for recycling and disposal.

Case study

Pushing the boundaries of environmental monitoring



Maintaining our ISO 14001 environmental management accreditation is a challenge that requires continuous improvement in environmental performance. For ANSTO, this involves moving beyond measuring radioactive releases and looking at some other environmental aspects.

ANSTO Year in Industry (YII) student Tegan Evans (*pictured above right*) helped push these boundaries. Tegan assisted with stormwater, ground water, air and soil monitoring, and proactively took the opportunity to examine stormwater quality at ANSTO. "This meant looking at the non-radiological water quality in three drainage routes," Tegan explained.

Among the interesting results was that phosphorous levels from one route were higher than for the other two. This was investigated because too much phosphorous is linked to excessive algal growth and lower biodiversity in receiving waters (the river, lake or estuary that eventually receives the stormwater runoff). Also, because waters draining from Sydney Sandstone are notoriously low in phosphorus, we are working with a relatively low 'background' phosphorus concentration in local streams.



The main aim of Tegan's project was to gather baseline information. "The phosphorus levels could be from fertilisers or misting from the HIFAR cooling towers, or maybe even kangaroo droppings," said Tegan.

The phosphate levels don't appear to have an observable detrimental effect on downstream biodiversity, based on an investigation started by a current YII student.

"However we won't overlook these results, and they provide a basis for further study," said Tegan.

"ANSTO is to be commended for extending their monitoring beyond radiological parameters to examine the potential impacts of other components of stormwater on the environment," said Ian Drinnan, Principal Environmental Scientist at Sutherland Shire Council. "Monitoring such as this will assist in the long term conservation of the high value natural areas of the Woronora Valley."

Tegan now has a permanent role in Forensic and Nuclear Security Research at ANSTO. "I got so much out of my twelve months as a student at ANSTO, I wasn't going to pass up an opportunity of full time work here," she said.

Case study

Airborne radiation and ANSTO

Some local residents have asked questions about the possible effect radiation from ANSTO may have on their health.

Richard Barton, who works with ANSTO's Safety and Radiation Services, said the facts show that residents needn't worry. "In suburbs surrounding ANSTO, naturally occurring background radiation would vary more from one street to the next than by the amount from ANSTO's emissions."

Richard works in a team responsible for estimating radiological effects from ANSTO's operations. One part of the group is in charge of routine monitoring from the stacks which release airborne emissions. The meteorology group measures weather information including wind speed and direction.

Richard takes ANSTO's stack monitoring and meteorological data, and through dispersion and exposure-scenario modelling calculates potential dose to the public living in different directions from our site, sometimes with enough resolution to estimate slight differences between two sides of the same suburb.

"Our closest neighbours – those living in Engadine, for example – are exposed to an average of 1.5 millisieverts (mSv) each year from naturally occurring sources of radiation from soil, rocks and foods. ANSTO's operations add a tiny amount – less than 0.005 mSv or 0.3 per cent – to this," he said. This tiny amount of radiation is so low it can't be measured, it can only be calculated through computer modelling.

The modelling is deliberately conservative. "We assume people are at home 24 hours a day, spend all their time outside, and grow one quarter of their fruit and vegetables in their backyard," Richard said.

The results of the monitoring and modelling are regularly reported to the Australian nuclear regulator ARPANSA, and are published on ANSTO's website every year.

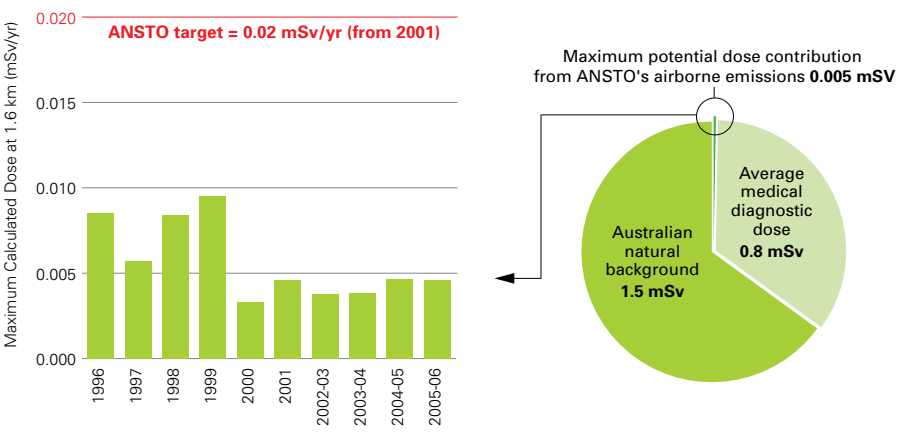
Argon-41 emissions account for about 80 per cent of the dose to the public, calculated at 1.6 kilometres from HIFAR at the edge of ANSTO's buffer zone. Richard said, "Once HIFAR shuts down, these emissions will virtually stop."

Environment commitments

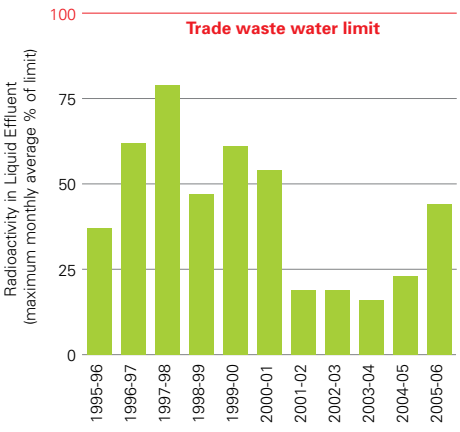
- Ensure there is no significant radiological impact on the environment as a consequence of ANSTO's operations
- Continually improve ANSTO's environmental management system
- Raise levels of environmental responsibility throughout the organisation
- Minimise the use of water, energy and other resources

Environment scorecard

Scorecard comments



The calculated dose from ANSTO's airborne emissions is shown in the left chart. The pie chart shows ANSTO's potential dose contribution placed in the context of natural background radiation and average medical diagnostic exposure. At a maximum of nearly 0.005 mSv in 2005-06, we added only 0.3 per cent to the average dose a person receives each year from natural background radiation in Australia. We have consistently restricted airborne dose to less than half our target over the past ten years.



ANSTO's liquid effluent discharges to sewer were well within the water quality requirements for trade wastewater in 2005-06. A key requirement is that any radioactivity directly from ANSTO's operations is consistent with Australian drinking water guidelines at the Cronulla sewage treatment plant. Modelled doses from ANSTO's liquid effluent, for example to people eating fish caught at Potter Point, have been calculated as less than 0.0005 mSv/yr. This is a very small dose. We have maintained this performance under successive trade wastewater agreements in the past ten years.

What's new?

- Collection of environmental data including water and electricity consumption
- Clean up days around site
- Toilets have been upgraded to dual flush

What's next?

- Reporting new environmental measures
- Reporting environmental data on our website

Our employees

Motivational guru Bob Nelson said, "Take time to appreciate employees and they will reciprocate in a thousand ways."

This advice is especially pertinent in the nuclear industry, where worldwide shortages and fierce competition for top talent mean attracting and holding onto first-rate employees is essential for both operational and research activities to be viable. ANSTO sees attracting, developing and retaining excellent staff as critical.

One aspect of retaining excellent staff involves creating a workplace culture in which staff feel safe, supported and valued. ANSTO's *Building a Better Workplace* online learning program aims to create such a culture, and was rolled out in early 2006, with 'Privacy' and 'Workplace Rights and Wrongs' the first modules released. Site-wide completion rates are at 65 per cent, but in actuality are higher as the program is yet to be rolled out across three areas. We will be introducing additional content in the coming months, including modules on 'Workplace Bullying' and 'Ethical Behaviour'.



Attracting, developing and retaining world-class staff is critical to ANSTO

"It's designed to help create a supportive, safe and healthy workplace," said Liz Lowe from Human Resources (HR). "The program gives an understanding of individual rights and responsibilities, plus guidance and practical tips on workplace rights, good culture, and understanding privacy provisions."

Also online, we are developing an induction system to replace the current one day face-to-face course, for which some staff can wait two months. The new system ensures HR can deliver the course to staff when they need it most. The system, which combines several learning styles and is based on best practice adult education, allows supervisors to check staff have completed modules. It also ensures needs for individual business areas across the complex organisation are met – such as good manufacturing practices or radiation requirements.

Other highlights this year include external recognition of the Institute of Materials and Engineering Science for good work in supporting staff in seeking secondments and projects that can contribute towards degrees. Acting Head, Dr John Bartlett, said, "It's easy to do – if you give people your commitment at a leadership level, they will achieve for both themselves and the organisation."

Staff under the Enterprise Bargaining Agreement started the year with 5 per cent more in their pay-packets – an outcome achieved through well-planned negotiation between ANSTO, staff and union representatives. The new agreement covers 830 staff and will last until 2008.

Case study

Health and wellbeing for ANSTO staff

You don't have to be an ANSTO scientist to work out that a happy and healthy workforce is a more productive workforce. And in an era where Australians are spending more time at work than ever before, employees who support health and well-being programs have a competitive edge in terms of attracting and retaining top quality staff.

The Lucas Heights Research Laboratories Social Club caters to staff who look at work as more than a financial and professional pursuit, and with numerous studies demonstrating that lunchtime exercise improves afternoon productivity levels, its not just fitness levels that are improving.

"ANSTO management cooperates with the Social Club to enable us to provide a range of sporting facilities and activities," said Derek Wyburn, Social Club President. "We have squash and tennis courts, yoga and aerobics classes, touch football, soccer, basketball and running competitions."

With a membership fee of \$2 fortnightly, the social club boasts 630 members, or 75 per cent of staff based at the Lucas Heights site. While the club provides trained instructors and organises the activities, ANSTO provides guidelines for the establishment of approved sporting activities, thus enabling the activities to be covered under workers' compensation.

"Social Club activities help build a workplace where people relate to each other more – it breaks down barriers between different divisions and departments," Rod Davies from HR said.

"Activities such as giving blood and playing sport together encourage what is virtually a 'family' atmosphere," said Rod. The analogy becomes a reality when the club hosts the Children's Christmas Party for staff and their families, featuring the rural fire service and attended by 720 people in 2005.

ANSTO also recognises the importance of preventative health programs, such as the annual women's health checks facilitated by site nurse Zlata Risby. She said, "In November we will roll out a men's health screening program, covering mental and physical health including medical history, blood pressure and skin checks."

Everyone who has been under stress knows it affects their performance at both work and home. Rod explained, "We assume people want to work hard and do a good job, so we give all staff access to an Employee Assistance Program (EAP), to help manage life's hiccups, without being intrusive."

The outsourced service for both workplace and personal issues is confidential and enables staff free phone and face-to-face access to qualified counsellors and psychologists.

"It also acts as issue mitigation for ANSTO," Rod explained. "The consultants would inform us, for example, if a lot of staff from a particular area were under stress or feeling pressured. These comments, which never identify individual staff, can act as warning triggers for organisational issues."



The 2006 Soccer Grand Final consisted of three (!) hard-fought matches between the Atomic and Bolters teams



Case study

Managing the move from HIFAR to OPAL

Managing a workforce of nearly one thousand staff with diverse skill backgrounds is always a challenge for ANSTO. This is especially so in the transition from operating HIFAR to OPAL, which has the potential to be highly stressful.

“HIFAR staff are intensively trained in an outmoded technology, and have an older age profile,” said Rod Davies. ANSTO has been conscious of the transition while developing our staff plan over the last three years. “The challenge is to staff the existing and new reactor and then blend the groups or find alternatives,” he explained.

A variety of arrangements are being used, allowing individual staff choice to manage the process. Some staff have retired or are planning retirement, while others transferred to short-term contracts. A small group has accepted retention offers which provide financial incentive to stay at HIFAR until its closure, while others will be retrained to work at OPAL.

Some HIFAR staff were upset that they had to apply for positions at OPAL, believing they

were entitled to automatically move across. “They could have done it better, with more dialogue between staff, unions and management,” HIFAR reactor operator John Brown said. “We have worked hard to keep HIFAR running. There is still a lot of speculation and rumour that creates uncertainty amongst staff.”

“This is new territory for ANSTO,” explained Dr Greg Storr, General Manager of Reactor Operations. “The management plan evolved recognising the need to keep HIFAR operating safely, while commissioning and early operation of OPAL proceeded. We are also conscious of the need to optimise staffing for OPAL, and be fair and open in the way those staff are recruited and appointed.

“Naturally, some staff have been anxious and uncertain about their futures, especially at those times when we couldn’t give details on exact requirements. On the positive side, we’ve tried to be as flexible as possible, present a ‘menu’ of options and constantly talk with staff throughout the process.”

Employee commitments

- *Attract, develop and retain excellent staff by encouraging individuals to reach their full potential through learning and development opportunities*
- *Provide equitable employment opportunities for all*
- *Foster an environment where staff are productive and happy, and where they feel that any problematic issues will be dealt with fairly and promptly*

Employee scorecard

Scorecard comments

Total separation rate

Years	2001	2002	2003	2004	2005
ANSTO	9.5%	11.0%	20.7%	8.23%	14.86%
AHRI*	16.01%	13.59%	15.06%	13.24%	15.3%

* Median as reported by Australian Human Resource Institute

This table represents the proportion of employees who left ANSTO for any reason during the calendar year 2005. ANSTO’s separation rate was comparable to the median reported by the Australian Human Resource Institute (AHRI), and was an increase on previous years because of a large number of age retirements combined with a greater resignation rate.

ANSTO training investment per employee

Years	2003	2004	2005
ANSTO	\$1 937	\$1 177	\$2 052
AHRI*	\$1 021	\$1 100	\$855

* Median as reported by Australian Human Resource Institute.

The average training cost per employee (excluding trainee time costs) in 2005 was almost double the figure we reported in 2004. This is directly attributable to the investment in staff training required to support OPAL commissioning. ANSTO’s investment for 2005 was significantly greater than the Australian median as reported by AHRI.

ANSTO workforce age profile 2005

Age Group	15-24	25-34	35-44	45-54	55+
ANSTO 2005	7.38%	19.74%	25.38%	28.42%	19.09%
Australian Workforce Age Profile**	18.7%	19.0%	19.9%	18.5%	14.5%
Australian Population Age Profile**	13.9%	14.1%	14.8%	13.7%	23.9%

** Business Work & Ageing Centre for Research, Swinburne University of Technology as at August 2006.

The proportion of ANSTO staff aged 45 or older continues to be significantly higher than that reported in the Australian Workforce Age Profile. These figures show that an ‘ageing’ workforce with the associated problems of succession planning remains an issue for the organisation.

Number of ANSTO staff from a non-english speaking background - June 2006

Years	2006
Male	145
Female	51
Total Workforce	922

What’s next?

- Completing online induction
- Workplace training on ethics and bullying
- Rollout of men’s health program



Our community

As a taxpayer-funded organisation, every Australian is a shareholder in ANSTO – and that is why we are dedicated to enhancing community understanding of how nuclear science impacts on people's lives.

We have developed *Careers in Science* lesson plans to give teachers a valuable resource and share the passion about career opportunities in science. "This is especially important as not enough students are choosing science subjects, creating a nationwide shortage of scientists and engineers," explained Martha Halliday, Education and Community Liaison. Aimed at science teachers and careers advisers, the lesson plans tie in with ANSTO's other nationally relevant syllabus-related resources. We also offer careers in science talks in high schools across Sydney and the Illawarra, and have resourced local libraries with ANSTO publications.

Our *future vision* overview publication was released and reached hundreds of science teachers. One commented, "Congratulations on the quality of your booklet and I am excited at the idea of incorporating it into our classroom teaching."

Our website is currently being redeveloped in order to meet best practice guidelines. Content on our current website is structured in a way that makes it inaccessible for those who can't use the mouse or keyboard, and for the reading programs of blind users. "There is a growing focus on meeting user needs and we are working towards best practice in an evolving and legally volatile environment," said Peter Hindmarsh, ANSTO's Web Coordinator.

One of the medical services we provide to the country is treating bones and tendons with radiation. Bone is the second most commonly transplanted tissue after blood and ANSTO treats bone before transplant to ensure it does not transmit infection. We also supply nuclear imaging centres with nuclear medicine and science information.



Case study

Dealing openly with the media

ANSTO knows that the media is an important way for the broader community to gain knowledge and understanding of the organisation's science and operations. So we place a high priority on interactions with journalists, and strive to be proactive and transparent with them.

"Honesty is the best policy," said ANSTO's Executive Director, Dr Ian Smith. "Whilst it is in our interest to let people know about our ground-breaking scientific research, we also need to be upfront and address occasional lapses in the quality of work processes in a manner our stakeholders find satisfactory."

For example, when concerns about alleged terrorists being in the vicinity of ANSTO arose, we invited journalists onsite to view our world's best practice approach to security and gave full briefings on the issue.

Journalist John Mulcair frequently writes on ANSTO for local paper, *The St George and Sutherland Shire Leader*. John said he tries to ensure accuracy and present all sides of the story.

"ANSTO can, however, appear selective in deciding whether to communicate or inform," John commented. "The most recent example was the incident which saw contamination of the radiopharmaceutical [production] cells, about which the media and public was informed by a brief note posted on ANSTO's website. I only found it because I check the site regularly.

"Updates on resumption of radiopharmaceuticals production have been scratchy despite ANSTO consistently promoting the importance of having a reactor to maintain vital national nuclear medicine supplies," John said.

Piers Akerman, columnist with Sydney's *The Daily Telegraph*, believes ANSTO is an essential



ANSTO strives to build proactive and transparent relationships with journalists

element in the Australian infrastructure and has found the organisation open and informative. "Every time I have needed information it has been supplied as fully and quickly as possible; ANSTO should maintain its open approach."

Regarding coverage of ANSTO, Piers said, "I think some media bodies have a default position to be cynical of the organisation. Some groups are unbalanced in their coverage."

Perhaps, as John Mulcair said in relation to media balance on ANSTO issues, "Radioactivity = atomic bombs = Three Mile Island = Chernobyl makes for easy and cheap journalism. The nuclear industry will always have to accept this."

In response, Ian Smith observed, "We are certainly up to the challenge of communicating the benefits of, and minimal risks associated with, nuclear science and technology. The media will continue to be an important mechanism through which we engage with the Australian community."



Case study

Support for ANSTO’s CSR reporting

With 70 per cent of funding coming from taxpayers, it is vital ANSTO understands what Australians expect regarding the running of our operations and the way we communicate with them. “This is why we undertake market research, to continue dialogue with stakeholders and alter, where feasible, the way we do things to meet their expectations more closely,” explained Dr Ian Smith.

This year research indicated environmental and safety reporting interested our stakeholders the most. “The positive response to science information also shows a strong interest in what we do and how it benefits Australia,” Ian said.

Our CSR reporting enhanced 90 per cent of stakeholders’ perceptions of ANSTO as an organisation which operates in a safe manner and is environmentally and socially responsible. Ninety per cent also believe the reporting is credible.

Of stakeholders surveyed, 67 per cent believe they are getting the ‘full story’ through our

CSR reporting all or most of the time, with 25 per cent believing they are getting it some of the time. Whilst not perfect, this is still a strong result on which we intend to improve.

“It is gratifying to see that our CSR is having an impact and that our diverse stakeholders generally recognise the proactive way we communicate on issues such as safety and the environment,” said Ian.

We have responded to the findings by reducing overall report length, decreasing case study size and including more information on our science. “We recognise our stakeholders want us to be better at informing them of issues related to safety, for instance, whilst at the same time it is clear there is a strong degree of trust in what we say,” Ian said.

ANSTO will continue to seek feedback on our reporting, so we can better promote mutual understanding with our stakeholders and enhance their knowledge of how ANSTO’s science is benefiting all Australians.

Community commitments

- Enhance understanding of the benefits of nuclear science and technology, and its applications to everyday life
- Engage with the broader Australian community; science teachers nationally; and national and international media in a proactive and transparent manner
- Increase support for our work by strengthening our profile as an innovative organisation

Community scorecard

Scorecard comments

Site tour numbers and attendance continues to grow, allowing more community members to understand our science first hand. Presentations to community groups also grew, thanks to the introduction of careers in science talks to Year 10, 11 and 12 science classes in the local area.

One student said: “Science has broader career options than I thought. There are endless possibilities of where you can go with science.”

Years	2004-05	2005-06
Number of ANSTO site tours	150	172
Total tour attendance	4 225	4 801
Off-site community presentations	14	53

We have removed scorecard measures of general enquiries and unique website visits in response to market research feedback.

What’s new?

- Customised teacher and student resources for school science tours of ANSTO’s site
- Sponsorship of more state science teacher associations
- Principals’ day, fostering relationships between ANSTO and local high schools

What’s next?

- Professional development for high school science teachers
- Rebuilding ANSTO’s website
- Using the launch of OPAL to educate more people across Australia about ANSTO’s nuclear science and technology
- Educational program and nuclear science exhibitions at the Powerhouse Museum
- DVD on ANSTO science and operations
- HIFAR documentary (HIFAR is Australia’s soon-to-be-retired nuclear research reactor)

ANSTO’s website is being rebuilt



ANSTO’s educational resources are encouraging the next generation of Australian scientists



ANSTO's dual role in Australian science means balancing our own research with the management of our major scientific facilities.

As part of our Research Performance Assessment (which assessed the quality and systems for managing our research), the impact of research was assessed as an integral part of its quality. "In research areas with a direct impact on the environment, health or industry competitiveness, we want to be sure end users are getting the best outcomes," said Dr George Collins, Chief of Research.

As OPAL comes on line, we are conscious that it is a significant investment by the Australian Government and want to ensure it gives maximum benefit to the community in terms of scientific outputs. International interest in OPAL was exemplified when 750 scientists from 38 countries visited as part of the Eighth International Conference on Neutron Scattering. "As stewards of this world-class neutron scattering facility, we want to promote it in a way that encourages new users and facilitates great science," George said.

OPAL's main pool (foreground) and service pool



Case studies

SarAr improves cancer treatment technology

For a decade there has been a demand for PET (Positron Emission Tomography) radiopharmaceuticals to provide a screening process for cancer patients – many of them older people – to determine who is likely to respond to treatment. However the use of PET radiopharmaceuticals has been limited firstly by the short half-lives (decay times of less than 2 hours) of commercially available PET isotopes, and secondly by a need for strong ligands to bind the isotopes to cancer treating molecules.

Copper-64 is an emerging PET radioisotope with a half-life suitable for shipping across a continent. With scientists at the Australian National University, ANSTO's Dr Suzanne Smith has developed SarAr technology, which is the means to attach isotopes to carrier molecules for imaging purposes. "SarAr has many applications and is easy to use. It rapidly encapsulates copper-64 and generates a product that is stable in the body," Suzanne explained.

SarAr can be used to attach isotopes, such as copper-64, to carrier molecules at a wide range of pH levels. A major commercial advantage is that the process is undertaken at room temperature. "That means the technology can be applied to heat sensitive carriers such as peptides or antibodies," said Suzanne.

Studies with Harvard Medical School demonstrated the technology allows copper-64 to be attached to an antibody and tracked in the body to the tumour site. This antibody can be used to diagnose and treat neuroblastoma, a cancer that affects children. There are also possibilities for treating melanomas and a number of other cancers.

SarAr technology also has the potential to improve the drug development process by enabling scientists to adapt cancer treatments specifically for individual patients. Suzanne said, "By labelling the drug, we can see whether it is taken up at the cancer site or, if there is no uptake, to understand where the drug is going and then how to adjust the treatment to make it more effective with less side effects."

Science commitments

- Operate world-class nuclear facilities to ensure a high return on investment for the Australian government, our customers and our collaborative partners
- Produce excellent research that yields significant returns for society, the economy and the science community
- Be the source of significant new discoveries, producing new knowledge, capabilities and technologies
- Focus our research on issues of national importance, especially Australia's nuclear, industrial, environmental, health, security and international relations priorities



Case study

Bioreactor is breakthrough sewage treatment system

An ANSTO scientist has invented a technology that can cheaply treat sewage and wastewater, and produce food for aquaculture farms at the same time.

Dr Tony Taylor describes his invention as a simple arrangement of gills that uses bacteria to operate as a lung and stomach. "It literally eats poo and breathes air," he said. It is called a nano-particulate membrane bioreactor and is ideal and cost effective for recycling sewage and grey (shower) water. The versatile system can be built in a variety of sizes for use in houses, unit complexes or municipal sewage treatment plants.

The bioreactor contains fungi and bacteria, which eat solid material. Aeration is critical to sewage treatment, but in most systems cells are grown in liquid, which means oxygen levels are low and aeration is expensive. Tony's invention is different because it involves a simple cheap porous membrane, being patented by ANSTO.

"Cells are grown on one side of the membrane in direct contact with air, enabling 50 times as much biomass (cells) to grow on

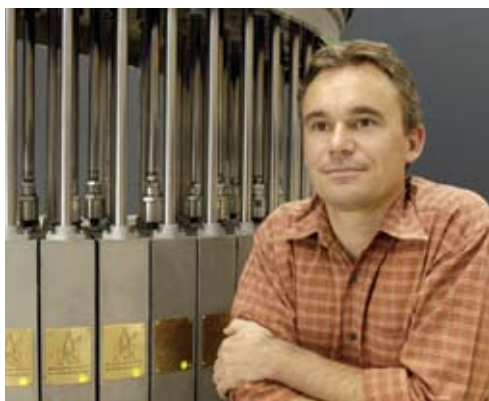
the membranes, compared to other membrane-surface culture technologies," Tony said. On the other side, a liquid nutrient stream (sewage or wastewater) feeds the cells through the extremely porous membrane.

"At about \$1 per square metre, our technology is cheaper than current membranes which can cost up to \$500 per square metre," Tony explained.

The bioreactor also has cheaper running costs. Most sewage treatment plants spend significant amounts every year on electricity to provide aeration to their systems, but the bioreactor should cost only a fraction of this. Because aeration is passive, air simply passes between the gills.

The captured sludge can either go back into the sewage system or be used for other purposes like aquaculture or fertiliser. Tony believes sewage treatment plants with aquaculture farms downstream could be transformed from costing \$5 million a year run, to making \$40 million. ANSTO has interest from major municipal authorities and a number of other parties to trial the technology.

ANSTO scientist, Oliver Kirstein, uses neutrons to examine stress in industrial components



ANSTO scientists are using 'isotopic signatures' to figure out who eats who in food webs



Case study

The signature dish of fish

Chefs typically have a signature dish which characterises their particular cuisine. However, the signature of food eaten by all organisms is actually an 'isotopic' one, referring to the unique carbon and nitrogen ratios in the food they eat.

ANSTO environmental scientists are working with the NSW Department of Primary Industries (NSW Fisheries) and NSW Department of Environment and Conservation to examine who eats what in the estuarine food webs of Sydney's Homebush Bay and Botany Bay, by analysing the isotopic signatures of carbon and nitrogen.

Working out the links in the food web of estuaries using nuclear science can greatly improve ecological risk assessment. "This research is really important because the isotopic signature, which is passed on as one fish eats another, gives us real evidence for how the food web is structured," explained ANSTO's Ron Szymczak.

Other ways of working out what fish are eating, such as stomach content analysis, don't necessarily give an accurate picture of what the most significant foods are for a species. "We have found some clear food chain linkages such as particulate organic material (faeces and dead organisms) being consumed by crabs, which are eaten by bream, which are eaten by mullet," said Ron.

"Once we know how different species are connected through specific food chains in these environments, we can trace how pollutants in the water move through the complex food web up to the species that humans eat, such as mullet (jewfish) and bream," said Ron. The research is part of ANSTO's work using nuclear techniques to study the human impact on water resources in Australia and our region.

Neutrons put the brakes on stress

Don't you hate it when you're driving along, put your foot on the brake, and feel that juddering feeling through the pedal? It happens when the disc brake rotors become distorted through normal use of the brakes. In the car manufacturing industry it's called 'runout' and is a multimillion dollar warranty problem each year.

ANSTO scientists wanted to figure out whether runout is caused by residual stresses from the manufacturing process, or by normal use of the brake. So they decided to test and compare a used and new brake disc.

While many methods were available to test the discs, Dr Oliver Kirstein (*pictured overleaf*) and Dr Maurice Ripley picked neutrons from HIFAR as their tool of choice. "Neutrons allow us to look at the inside of the metal without damaging it. They can penetrate through the iron, so we were able to take measurements at a series of points at different depths through the brake disc," said Oliver.

Car industry thinking is that when residual stresses are relaxed through heating of the brake disc during use, the discs could potentially distort, causing the runout and juddering feeling. The question is - to what extent the stresses are from the manufacturing process.

Oliver and Maurice found there were not large residual stresses in the new disc brakes, but large stresses were found in the used brake. "Our results suggest that runout is not caused by relaxation of residual stresses that were in the brake discs from manufacture," Maurice stated. "It looks more likely that runout is due to uneven cooling of the hot disc through use - from severe braking, for example - because we found such large stresses in the old worn out brake compared to the new one."

With their results showcasing the power of neutrons to measure residual stress in important commercial components, the scientists hope to spark the car industry's interest. Oliver said, "With the insight of neutrons, the industry may find, in combination with improved modelling techniques, new ways of manufacturing components to overcome these problems."



ANSTO is the Australian Nuclear Science and Technology Organisation, this country's premier nuclear research and development agency. We deliver market-leading products and services to public and private sector organisations in medicine, mining, aerospace, minerals, agriculture, manufacturing and the environment.

Our 900+ staff primarily conduct these activities at ANSTO headquarters, located on the outskirts of southern Sydney. This site contains the nuclear research reactor, OPAL, as well as many other leading-edge scientific facilities and instruments. We also operate the National Medical Cyclotron, an accelerator facility, near central Sydney.



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Public Information

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



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