

Reporting on environmental monitoring 2018-2019

Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act), section 516A

Environmental protection

ANSTO undertakes education, research and innovation to enhance scientific understanding of the environment and to provide solutions for a sustainable planet.

ANSTO's commitment to environmental protection and sustainability principles is defined in its Corporate strategic plans, Environmental Policy and Organisational core values – and in its new Logo. We are committed to effective stewardship, the sustainability of our operations and to responsibly interact with the local ecology and biosphere, and to protect it. We minimise our environmental footprint through continuing to apply the principles of Ecologically Sustainable Development (ESD) and by the prevention, minimisation and control of pollution.

These values are integral to ANSTO's Business Management System – the framework that defines how business is conducted to deliver outcomes to our customers and stakeholders in a safe, consistent and environmentally responsible manner. Objectives and targets for safe, secure and sustainable operations are implemented through documented operational and business plans at all levels of the organisation.

Environmental protection is mandated when planning and undertaking major capital works and any proposed activities which may fall under the *EPBC Act* are assessed for referral to the Department of the Environment and Energy. Proposals for new (or modifications to existing) facilities or activities also undergo a rigorous internal safety, regulatory and environmental assurance process.

Environmental awareness is promoted throughout the organisation via inductions, the staff intranet, training and communication programs.

Environmental and quality management systems

To provide assurance that ANSTO is maintaining sound environmental protection practices, we maintain an environmental management system (EMS) that is certified to the International Standard ISO 14001 for all three sites, including the ANSTO Nuclear Medicine facility which became operational in 2019. This standard requires that:

- the environmental context of the organisation and its operations is defined;
- its environmental impacts and compliance obligations are identified, with the risks managed and mitigated;
- an effective measurement and review system is in operation; and
- there is organisational commitment to continual improvement.

Our extensive environmental monitoring program also operates within a quality framework that is certified to the ISO 9001 standard for Quality Management Systems.

The ANSTO Environmental Management System (EMS) Strategy FY14-FY19 was evaluated against a new suite of key performance indicators, targets and action plans and a revised EMS strategy is being developed for FY20 onwards which will place further emphasis on the United Nations Sustainable Development Goals. The Executive Committee for Workplace Health & Safety and Environment supports the implementation of this strategy and provides oversight of the environmental management system.

Environmental performance

ANSTO aims to reduce its environmental footprint by minimising the generation of waste, monitoring the consumption of resources such as hydrocarbon fuels, paper, electricity and water, and by recycling consumables. We also monitor and annually report our carbon footprint through the National Greenhouse and Energy Reporting (NGER) Scheme and participate in the Sustainability Advantage Program run by the NSW Office of Environment and Heritage for which we were recently awarded a silver partnership award. A program to assess the biodiversity within ANSTO's Lucas Heights Bushland Perimeter has continued to deliver improvements in the eradication of invasive weed species.

The performance indicators in **Table 5** incorporate all three campuses where practicable. The electricity data shows that over the past four years ANSTO's total electricity consumption has slightly increased. Whilst ANSTO continues to look for electricity savings as per the program introduced in FY17, expanded infrastructure and hotter than normal summers are expected to impact electrical consumption. Examples of where ANSTO invests in renewable energy include pathway and streetlights using standalone integrated solar PV/battery storage systems and solar hot water and electricity.

Table 5. Environmental performance indicators for ANSTO sites

Resource Usage	Units	FY 2016	FY 2017	FY 2018	FY 2019	Change on previous year
Electricity	GWh	67.2	66.6	67.2	68.5	+1.9%
Water	m3	315,694	320,369	318,438	323,898	+1.7%
Passenger vehicle petrol and diesel	L/100km	8.98	8.65	8.26	8.20	-0.73%
Waste Water ⁽¹⁾						
Wastewater discharged to sewer	m3	89,235	103,024	75,916	76,711	+1.0%
Landfill and Recycled Waste ⁽¹⁾						
Waste sent to landfill	tonnes	226	237	259	308.7	+19%
Recycled cardboard + paper	tonnes	22.3	85.5	114	130.5	+14.5%
Recycled co-mingled containers	tonnes	5.9	16.7	18.2	20.5	+12.6%
Other recycled streams ⁽²⁾	tonnes	19.8	12.9	24.8	31.5	+27%
Landfill diversion rate	%	17.5	33.2	37.7	37.1	-0.6%

Notes: 1. Data for the Lucas Heights site only (includes tenants).

2. Other recycling streams include batteries, ferrous and non-ferrous metal, gardening and e-waste.

In FY19 the Lucas Heights campus received only 726 mm of rainfall, which is lower than the thirty year average. In addition there were higher than average temperatures over summer and as a result, a significant level of irrigation was required across the campus. This was partly offset by utilising the rainwater capture system and communications to staff highlighting the ongoing need to use water efficiently.

ANSTO's landfill diversion rate has remained constant with 37% of waste being diverted from landfill. The ~19% increase in the total amount of waste to landfill is attributed to construction activity. ANSTO continues to recycle ferrous metals, garden waste, concrete, batteries, toner cartridges, mobile phones and redundant computer equipment. Many business units within ANSTO have set up recycling stations for alternative reuse/recyclable waste streams such as soft plastics, coffee grounds and compostable food scraps. This will continue to be a focus for new environmental strategies.

During FY2019 the amount of paper consumed increased by 18%. The causes for this are being investigated further however it may be due to more accurate reporting following the introduction of new printers that record paper use. The recycled paper content of print stock has increased to over 20%.

Environmental monitoring program

ANSTO conducts an extensive effluent and environmental monitoring program that measures radioactivity in authorised emissions to air and liquid effluent discharges to the sewer; and in samples of air, surface water, ground water, sediment and biota from the local environment. Local environmental radiation and weather conditions are reported online via the ANSTO webpage.

Results of environmental monitoring in 2018-2019 demonstrate that ANSTO's authorised releases of radioactive material to the air and sewer continue to be effectively controlled, complied with regulatory limits and had minimal impact on humans, wildlife or the environment.



Good water quality

Stormwater runoff from the Lucas Heights site does not contribute to any public drinking water supply, however ANSTO regularly monitors radioactivity in stormwater leaving the site, as well as sampling the nearby Woronora River. Results show that concentrations of tritium in water in the local environment have decreased since the HIFAR reactor closed in 2007, and are well below the level considered safe for drinking water by the World Health Organisation. Gross alpha and beta measurements were below the radiological levels set for surface waters under the previous NSW *Protection of the Environment Operations Act 1997*. In fact, the majority of results were below the screening level of 0.5 Bq/L for alpha and beta radioactivity set out in the Australian Drinking Water Guidelines.

An extensive network of shallow and deep groundwater wells is designed to monitor potential sources of contamination to groundwater, water quality and groundwater movement. Groundwater from the Lucas Heights site contains only naturally-occurring radionuclides and low levels of tritium. Groundwater near underground fuel storage tanks is analysed for petroleum hydrocarbons to check for evidence of leaks from tanks, however no leaks have been detected to date.



Authorised discharges within limits

Liquid effluent discharged from ANSTO sites into the sewer system complied with the acceptable limits for trade wastewater set by the Sydney Water Corporation. Compliance with these limits, together with effluent dilution studies, ensures that ANSTO's liquid effluent meets World Health Organisation drinking water standards for radioactivity at the Cronulla wastewater treatment plant.

Air ventilated from laboratories and facilities that handle radioactive materials is treated and/or filtered prior to discharge and continuously monitored. ARPANSA sets limits for airborne radioactive discharges from licensed ANSTO facilities and all airborne emissions were within the annual operating compliance limits.



Detailed reporting

Reports on airborne and liquid effluent discharges are submitted to the relevant regulatory authorities on a quarterly basis. Details of our environmental monitoring program are on the ANSTO website and the results and findings are available on request. In addition, ANSTO reports real-time environmental radiation dose-rates recorded in the nearby suburb of Engadine via the ANSTO webpage. The weather data for Lucas Heights are also available on ANSTO's website and published by the Bureau of Meteorology on the Lucas Heights Weather Observations page.

ANSTO reports annually to the Energy Efficiency in Government Operations (EEGO) and National Greenhouse and Energy Reporting (NGER) programs; both of these reports are available on the ANSTO website.

All staff are encouraged to report early and often on any potential or actual safety and environmental incidents. All incidents are subsequently investigated, actioned and mitigation controls evaluated for effectiveness via ANSTO's reporting system.



Safe waste management

ANSTO has maintained safe and effective management of its radioactive wastes for many years. There is minimal environmental impact from the storage of solid radioactive waste since there are no ongoing emissions or energy requirements, apart from the packaging process and building footprint. One of the waste minimisation strategies involves concentration of intermediate level liquid waste using a drum dryer; the electricity consumption of this is offset by the reduction of packaging, handling and storage space required.

Liquid wastewater comprising mainly sewage with some trade waste is tested for compliance with limits for radioactivity before being discharged to the sewer. Concentration limits for non-radioactive materials such as ammonia, zinc and total dissolved solids were also met. Sydney Water conducts independent testing of ANSTO's liquid effluent discharges and the Trade Waste Agreement is periodically reviewed to provide assurance that ANSTO's discharges are fully characterised, remain within authorised limits and pose no threat to the environment. Effluent from the Sutherland Shire undergoes tertiary treatment at the Cronulla wastewater treatment plant and is ultimately discharged to the ocean at Potter Point. Analyses of marine biota (fish, seaweed and barnacles) from Potter Point confirmed that wastewater from ANSTO has a negligible effect on the local marine environment.

ANSTO continues to support a national approach to safe waste management, including the establishment of a National Radioactive Waste Management Facility (NRWMF).

Little Forest Legacy Site

ANSTO is responsible for the Little Forest Legacy Site (LFLS) located within the 1.6km buffer zone. This site, formerly known as the Little Forest Burial Ground (LFBG), was used by the Australian Atomic Energy Commission and other government agencies during the 1960's to dispose of waste containing low levels of radioactivity and non-radioactive beryllium oxide, in a series of shallow trenches. There has been ongoing monitoring, maintenance and management of the site since 1966 including routine air, soil and groundwater testing, results of which are publicly available and confirm that the site is being safely managed.

The site is subject to a licence issued by ARPANSA and is managed by ANSTO on behalf of the Government. ANSTO has established a steering committee for the ongoing management of LFLS and continues to conduct detailed scientific studies of the site, in order to investigate options for the final disposition of the radioactive material and to ensure the continued safe management of the site.

Dose levels low

Environmental gamma radiation levels are continuously measured by thermoluminescent dosimeters at the Lucas Heights site and averaged 1.36 mSv/yr for 2018-19. The environmental dose recorded in surrounding suburbs and at the Cronulla wastewater treatment plant were also at normal background levels with an average of 1.21 mSv/yr (the national average natural background radiation dose is 1.5 mSv/yr).

Studies carried out of ANSTO's liquid effluent discharges to sewer have confirmed that the radiological risk to humans (working at the Cronulla wastewater treatment plant or swimming in the sea near the Potter Point ocean outfall) is negligible.

Computer modelling is used to estimate the potential radiation dose to people from airborne emissions at the Lucas Heights site. The model inputs include the quarterly stack emission results, local weather data and conservative assumptions about environmental exposure pathways. The maximum potential dose to local residents from ANSTO's airborne emissions in 2018-19 was calculated to be 0.0027 millisievert (mSv). This is less than 0.3 per cent of the annual public dose limit of 1 mSv established by ARPANSA.

Maximum Annual Effective Dose from Airborne Emissions at 1.6 km

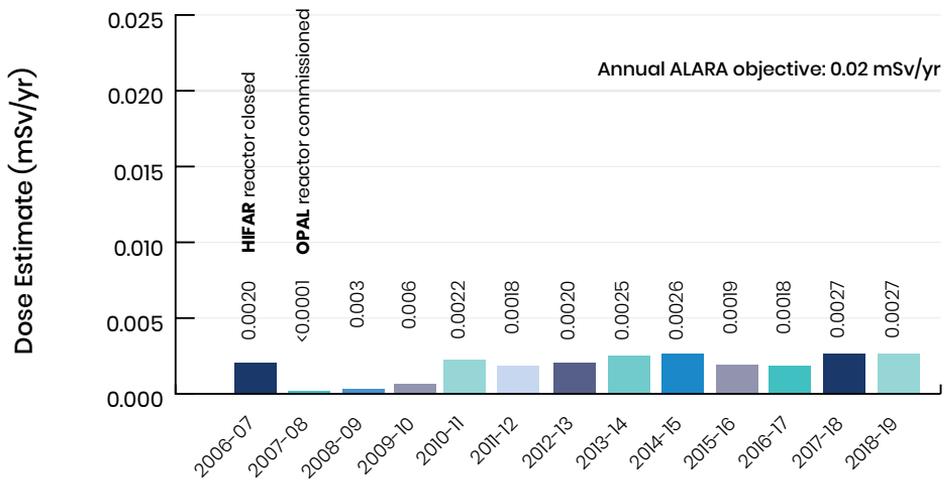


Figure 1: Maximum estimated annual effective dose from LHSTC airborne discharges at the boundary of ANSTO's 1.6 km buffer zone, July 2006 to June 2019.

Doses from ANSTO's airborne emissions in 2018-2019 also remained well below the 0.02 mSv 'as low as reasonably achievable' (ALARA) performance objective despite increased production of beneficial medical isotopes (see **Figure 1**). For its closest neighbours, ANSTO's activities added less than 0.2 per cent to the 1.5 mSv dose that every Australian receives from natural background radiation each year, as shown in **Figure 2**.

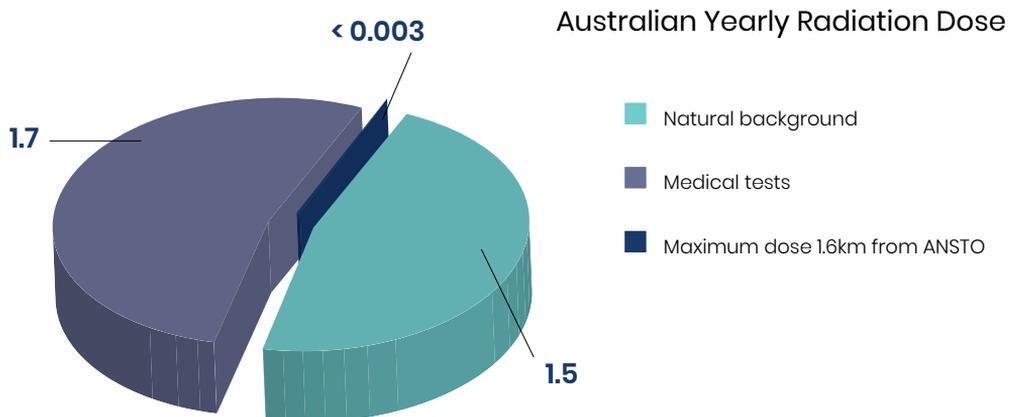


Figure 2: The average annual dose received by Australians from various sources compared to the maximum potential airborne dose to ANSTO's nearest residents in 2018-2019.

*Source: ARPANSA Fact Sheet <http://www.arpansa.gov.au/pubs/factsheets/IonisingRadiationandHealth.pdf>

Radiological protection of wildlife

A screening assessment was performed in 2018 to investigate the potential dose rates received by local wildlife from radiological effluent releases associated with operations at the Lucas Heights site, including expected releases from the ANM Mo-99 production facility.

The assessment applied the methodology laid out in ARPANSA Guide: *Radiation Protection of the Environment*, which is consistent with current international best practice approaches. Dose assessments were performed for a range of terrestrial and marine organisms using conservative radioactivity concentrations for the air and water exposure pathways (determined from routine stack monitoring of airborne emissions and liquid effluent releases to sewer).

Even using a very conservative approach, the potential dose rates to all organisms were below the lowest benchmark for potential harmful effects (10 $\mu\text{Gy/hr}$). These results were consistent with previous studies that concluded no significant impacts to wildlife from ANSTO's operations.

Managing the ANSTO bushland perimeter

ANSTO manages a section of land with an area over ~450 ha within the 1.6 km buffer zone centred on the existing HIFAR reactor in accordance with the ANSTO Bushland Perimeter Plan of Management, updated in 2018. This area comprises the Lucas Heights Science and Technology Centre, a number of legacy waste disposal sites and ~350 ha of undeveloped native bushland and riparian zones. A qualitative review of the biodiversity potential of the ANSTO Bushland Perimeter assessed 110 sample sites against benchmark criteria for the different vegetation communities, such as native species diversity and density, connectivity, soil exposure and weediness. The results of this assessment are being used to prioritise management actions including: revegetation and rehabilitation works, stormwater system upgrades, and weed management programs. This assessment will form the baseline for future assessments utilising the same benchmark criteria to evaluate improvement programs and any ongoing impact of ANSTO's operations on the surrounding environment.

The area has numerous bush walking trails, and is actively managed through a program of regular inspections, maintenance, culling of feral animals and weed reduction programs. An ANSTO staff bush care group has been meeting monthly for a number of years to target high risk locations. The work of this group has seen the eradication of noxious weed species such as Crofton Weed, Cotton Bush, African Love Grass and Cassia from over two hectares of riparian vegetation within the ANSTO Perimeter Bushland. ANSTO also engages with the local Dharawal Indigenous Group to identify and protect areas of cultural importance within the ANSTO Bushland Perimeter.

A significant bushfire occurred within ANSTO's Bushland Perimeter in April 2018, resulting in 200 ha of bushland being burnt. ANSTO is monitoring the progress of vegetation regrowth and any weed infestations and will respond according to best practice. Annual hazard reduction burns are planned in consultation with NSW Rural Fire Services.

Referrals under the EPBC Act

Within this reporting period ANSTO did not submit any new referrals under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Construction activities for the expansion of the solid low-level waste facility and the ANSTO Nuclear Medicine Mo-99 production facility at the Lucas Heights site were completed, and construction of the Synroc Waste Treatment Facility commenced.

Regular independent inspections have been undertaken throughout the projects to evaluate conformity with the environmental commitments made by ANSTO in the referrals.

Mitigating environmental impacts

ANSTO encourages staff to cycle, carpool or take public transport to get to work and to walk rather than drive around the site. ANSTO provides staff with a carpooling website and regular shuttle-bus services to and from the local railway station. Numerous paths, tracks, bike racks, lockers and shower facilities are available for use by the avid walker/cyclist.

The ANSTO online 'swap shop' continues to provide a forum for staff to pass on unwanted goods. From furniture to chemicals to analytical equipment, by exchanging useful products staff can help save time, money and the environment by reducing waste going to landfill. The online Equipment Database tool also allows staff to share resources and knowledge whilst minimising the procurement of new equipment.

ANSTO's chemical management system enables staff in different business areas to share and track chemical resources, which will reduce the need to procure new chemicals. ANSTO is also utilising the system to better determine its reporting requirements under the National Pollution Inventory and to improve the identification and control of environmentally hazardous chemicals.

In line with ANSTO's focus on digitisation, new IT systems and solutions including digital authorisations continue the transition to a paperless office which reduces power and paper consumption. Many functions such as budgeting, business planning, procurement, maintenance, recruitment, on-boarding, training and waste transfers are now managed through online user interfaces.

ANSTO has adopted an integrated approach to planning and decision-making across the business, to optimise the management of all that we do. By managing its people, resources, and infrastructure more effectively, ANSTO aims to increase productivity thereby enhancing the environmental sustainability of our operations.

Accordance with ecologically sustainable development (ESD) principles

Ecologically sustainable development (ESD) is embedded into ANSTO's core values. The ANSTO Building Code (ABC) provides the minimum standard that new facilities at ANSTO must conform with. Within the ABC, the principles of ESD are mandated through the requirement for all new and refurbished buildings to have an independent ESD consultant involved in the design, achieve a target minimum 4.5 star NABERS rating and comply with the requirements for the Energy Efficiency in Government Operations (EEGO) Policy. Furthermore, minimum standards for the efficient use of water in offices and laboratories, installation of rainwater tanks, re-use of waste water and sub-metering are enforced through the ABC.

ANSTO has integrated environmental protection into management processes by requiring project/ construction environmental management plans (P/CEMP) at the project planning phase. All capital projects such as construction of buildings, infrastructure and support facilities must have P/CEMP in place to prevent environmental impacts such as soil erosion, dust, noise and discharges to stormwater. Independent oversight of these projects includes the approval of P/CEMPs, ad-hoc inspections and formal audits.

ANSTO is also moving to more sustainable procurement practices.

Other ANSTO activities that contribute to improved social, environmental and economic outcomes include our research into significant environmental issues such as air quality, soil erosion, water resource management, wetland health, biodiversity, food provenance, climate variability and global warming impacts such as rising sea levels and temperatures on marine ecosystems.

ANSTO's support of nuclear non-proliferation ideals and the development of nuclear safeguards also accords with ESD principles. We contribute to the global non-proliferation agenda through the Global Initiative to Combat Nuclear Terrorism and collaborate with bodies such as the International Atomic Energy Agency and the Comprehensive Test Ban Treaty Organisation.

Finally, ANSTO's commitment to environmental protection means that special emphasis is placed on reducing our environmental footprint by minimising waste and the consumption of resources and by recycling consumables. Our scientific research provides practical, science-based advice to inform decision makers, creating opportunities to conserve resources and sustain our fragile environment. It also ensures that we manage our past and current waste in a manner that protects human health and the environment, now and in the future.