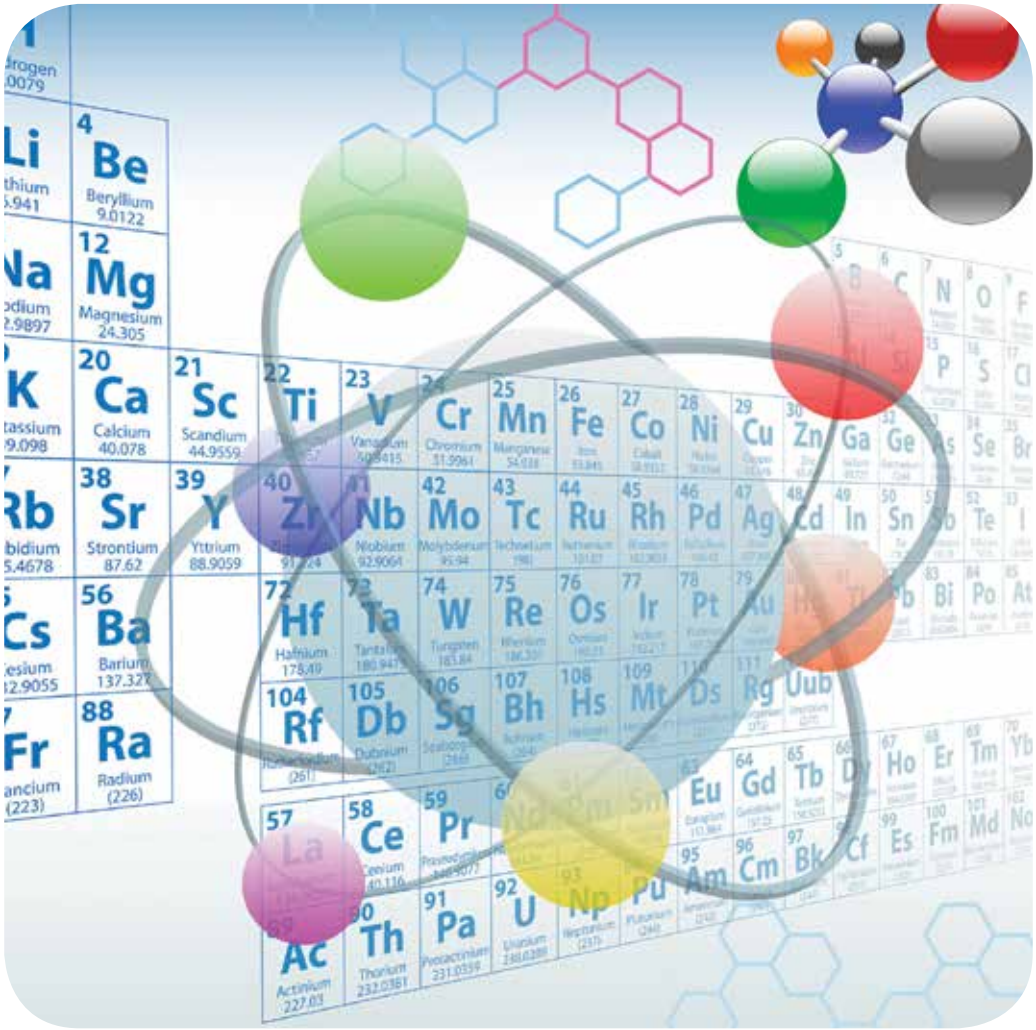
Part 3: Report on Performance



Protect the public and environment from radiation exposure

ARPANSA, on behalf of the Australian Government, undertook a range of activities aimed at improving knowledge about the levels and exposure arising from radiation in the environment, and providing guidance and advice to industry and the public on how best to minimise these exposures.

ARPANSA has the capacity to determine the levels and quantities of radioactivity in environmental samples and in people exposed to radioactivity, to allow the assessment of the impacts of radioactive material on the public and the environment. ARPANSA maintains an accredited Environmental Radiochemistry Laboratory for the accurate measurement of radionuclides in environmental samples, facilities for the calibration and testing measurement systems for the assessment of public and worker exposure from airborne radioactivity as well as systems for the assessment of radioactive material in the body.

During the year, the Radiochemistry Laboratory provided a range of commercial services, successfully participated in proficiency testing programs, and provided laboratory services for the screening of food samples from Japan as part of the Agriculture, Fisheries and Forestry Imported Food Program. It also undertook the analysis of samples collected from selected metal mines, collieries, and quarries in NSW, to assess the levels of naturally occurring radioactive materials (NORM) in these locations.

Locally, ARPANSA commenced work on the analysis of naturally occurring radionuclides in Australian food samples in order to estimate the background radiation dose contribution from foods in the typical Australian diet.

As part of the Maralinga Land and Environment Management Plan and under a Memorandum of Understanding with the Australian Government, Department of Resources, Energy and Tourism, ARPANSA completed and reported on radiological surveys and a reassessment of the health impact on local peoples, of radionuclide contamination from historical British nuclear weapons testing at Maralinga. Oak Valley is a remote aboriginal community located on the southern fringe of the Great Victoria Desert on Maralinga Tjarutja Lands in South Australia. In May 2012 ARPANSA reported to the community that the health impacts from the remediated weapons testing sites was assessed as negligible for the Oak Valley community and that the current restrictions on full time living in the Taranaki restricted area at Maralinga were still appropriate.

Test Site Maralinga

Ultraviolet radiation (UVR) protection

Through its solar ultraviolet radiation (UVR) programs, ARPANSA continues to monitor public exposure to solar UVR to improve understanding of ways to reduce UV exposure. The ARPANSA UVR monitoring network continued to provide real-time 'live' UV Index data for ten Australian sites and three Antarctic bases via the ARPANSA website. The UV Index data (which is updated every minute) is made available to mobile phone users through third-party applications. The ARPANSA website also describes protective strategies for avoiding excessive sun exposure. Research projects measuring the UVR exposures of outdoor workers were carried out in collaboration with the Cancer Council Victoria and with the Australian National University for indoor workers.

ARPANSA continues to work within the UV Alert Group (includes the Cancer Councils from every state, Bureau of Meteorology and more recently NZ Cancer Council and NZ Health Sponsorship Council) which meets 4 to 6 times a year to improve the delivery of UV Index measurements and information as part of the sun protection message. ARPANSA as

a World Health Organization (WHO) Collaborating Centre for Radiation Protection continues to participate in the WHO Intersun (UVR) project. The WHO Intersun Project provides sound scientific information and practical advice on the health impact and environmental effects of UVR exposure and encourages countries to take action to reduce UVR-induced health risks and guidance about effect sun awareness programs. In June 2012, ARPANSA attended the annual international advisory committee Intersun UV meeting in Geneva and reported on ARPANSA's current UVR work programs.

Occupational exposure - UVR

ARPANSA's Radiaion Protection Standard covers exposure to UVR incurred as part of a worker's occupation and includes both solar and artificial sources of UVR. The Standard protects workers by limiting the occupational exposure to UVR from artificfical sources in the workplace, considered to be a controlled environment; and setting requirements for minimising a person's exposure to uncontrollable sources of UVR, such as the sun. While mandatory application of the limits for exposure to solar UVR to outdoor workers is difficult in practice, it is important to limit UVR exposures using engineering and administrative controls as well as personal protection.

Monitor population exposures to electric and magnetic fields and electromagnetic radiation (EMR)

ARPANSA continued to engage in EMR activities including the provision of scientific advice and guidance to the public and the government on exposure to electromagnetic radiation from electrical power infrastructures, mobile phone base stations and handsets and other sources from new technologies such as smart meters. This has involved the ongoing analysis of scientific studies on the potential adverse health effects of exposure to electric and magnetic fields and radiofrequency electromagnetic radiation, to ensure that ARPANSA

Regulation of the solaria industry is the responsibility of each state or territory.

ARPANSA has developed nationally agreed regulatory elements for solaria which are outlined in the National Directory for Radiation Protection and includes banning solaria use by persons under 18 and those with very fair skin (skin type I). These elements, along with ARPANSA's mandatory online training for solaria operators, have now been implemented across all jurisdictions.

Qualitative Deliverable	
Devise protection and exposure reduction strategies to reduce harmful effects of UVR exposure	
Measure	Standards and guides are developed and published in a timely manner.
Result	UV protection information provided to the public on the ARPANSA website in the form of fact sheets and other publications.

Qualitative Key Performance Indicators	
Increase the public awareness about the risk of exposure to UVR.	
Measure	Achieve a high level of awareness of risk of UVR exposure and strategies for protection (measured by survey).
Result	ARPANSA UVR monitoring network continued to provide real-time 'live' UV Index data, with UV protection information provided to public through ARPANSA website, fact sheets and other publications. Demand for ARPANSA fabric UV testing and use of ARPANSA UV Protection Factors tags continues.

Quantitative Deliverable	2011-12 Budget Targets	Actual Achieved
Number of Australian cities provided with live UV index readings.	*10*	*10*
Number of reports, publications and presentation of surveys and assessments of public exposure and occupational exposure to natural sources of radiation.	>10	19
Number of reports, publications and presentations on public exposure to electric and magnetic fields and electromagnetic radiation.	>5	8

ARPANSA maintains a network of dataloggers situated in major Australian cities and in the Australian Antarctic territories which continuously record the solar ultraviolet radiation (UVR) levels at each site. UV index data is taken from three sites in the Antarctic – Casey, Davis and Mawson to advise workers of their daily exposure.

Communication between a mobile phone and the nearest base station is achieved by radiofrequency (RF) electromagnetic fields.

ARPANSA fields numerous public inquiries about mobile phone use including concerns about the level of radiofrequency (RF) emissions to which the brain may be exposed and potential health consequences, particularly brain cancer. ARPANSA continues to gather information on actual exposure levels and provides this to the public together with facts about the underlying science.

guidance is consistent with world's best practice and new scientific developments.

ARPANSA also continues its base station survey program to inform the public about actual exposures in close proximity to mobile phone base stations and validate mathematical predictions. During the present year, ARPANSA undertook three mobile base station surveys and the results have been published on the ARPANSA website. ARPANSA as a WHO Collaborating Centre participates in the WHO International Electromagnetic Fields Program, and in June 2012 ARPANSA chaired the Annual International Advisory Committee meeting of the WHO International EMF project in Geneva.

Extremely low frequency (ELF) electric and magnetic fields project

In March 2011 the Radiation Health Committee (RHC) decided to cease development of an ELF Standard and redraft the document as Guidelines. A significant amount of revision work has since been undertaken. In November 2011, the RHC assessed the draft *ARPANSA Guidelines on Managing Exposure to Electric & Magnetic Fields — 0 to 3 kHz* and considered harmonisation with international ELF standards, in particular the 2010 International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz to 100 kHz)*. The RHC recommended that the ARPANSA ELF Guidelines should implement as much of ICNIRP 2010 as relevant and appropriate. Further revision has resulted in a more mature draft closely aligned with ICNIRP 2010 and with a regulatory context appropriate for Guidelines. This document is nearing finalisation.

Radioactive waste safety

In Australia, the greatest volume of radioactive waste consists of materials with a low level of radioactivity or with a shorter half-life. These wastes are potentially able to be disposed of in a 'near-surface' repository.

Parallel to the recent passage of the *National Radioactive Waste Management Act 2012* ARPANSA developed a *Draft Regulatory Guide: Licensing of Radioactive Waste Storage and Near Surface Disposal Facilities* advising potential Commonwealth applicants on how to proceed to apply for a licence for a radioactive storage or disposal facility under the terms of the ARPANS Act. It also advises other stakeholders and the public of the issues that must be addressed by the applicant. It describes objectives for protection of human health and of the environment, drawing upon international best practice in relation to radiation protection and radioactive waste safety.

The Draft Regulatory Guide is currently undergoing a public consultation process due for completion in September 2012 and a mature draft of the document is posted on ARPANSA's website at www.arpansa.gov.au/Publications/drafts/dr_waste.cfm.

This draft Guide is intended to supersede ARPANSA's 2006 regulatory guide for radioactive waste management, which was due for revision in light of both local and international experience. This Regulatory Guide has been prepared by our specialists in radiation waste in consultation with international peers and key stakeholders. It has been reviewed by ARPANSA's Nuclear Safety Committee, which along with scientific expertise, also has community, industry and government representatives.

The Regulatory Guide is directed to Commonwealth entities applying for a licence under the ARPANS Act to prepare a site for, construct, operate, and decommission or close a storage or disposal facility for radioactive waste; and to other stakeholders including the public, to:

- advise of the regulatory issues and to assist in understanding how the application will be assessed by the regulatory body, and what the overarching statutory considerations are

Qualitative Deliverable	
Develop new guidance for radioactive waste disposal based on existing international frameworks.	
Measure	Publish regulatory guidance on the management of radioactive waste.
Result	ARPANSA's draft regulatory guide: *Licensing of Radioactive Waste Storage and Near Surface Disposal Facilities* was developed and published on our website.

Mobile phone base stations

Public exposure levels from mobile phone base stations are typically hundreds of times below current exposure limits.

Electric and Magnetic Fields – Powerlines

Electrical power distribution and use generates both electric and magnetic fields which in Australia are generated at a frequency of 50 hertz (Hz) (number of oscillations per unit time), and are referred to as extremely low frequency (ELF) fields. The strength of the electric field depends on the voltage (typically 240 V for households) and is present near any live wire whether an electrical appliance is being used or not. At the present time there is no proven evidence that exposure to low level electric fields is a health hazard.

The scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found around the home, the office or near powerlines is a hazard to human health. In view of epidemiological studies, however, the possibility remains that intense and prolonged exposures to magnetic fields may increase the risk of leukaemia in children.

Smart meters

Smart meters measure electricity usage and communicate this information back to the electricity supplier using short bursts of radio waves and ARPANSA often receives public inquiries about the potential health effects of smart meters.

The overall exposure from smart meters is very low and well below ARPANSA exposure limits, even when a number of devices are communicating simultaneously. Typical exposure to an individual from a smart meter is many thousands of times less than the localised exposure to the brain from a mobile phone handset. ARPANSA works through the Radiation Health Committee to deliver national uniformity of radiation regulation; monitor the science around electromagnetic energy and provide advice on any associated health issues to the public.

- assist in understanding the requirements for the content of an application and to address the questions 'what is required?' and 'when (at what stage) is it required?' in the application process
- provide guidance based on national and international best practice for meeting the requirements and to help in striving to achieve high levels of safety.

The CEO may only make a positive decision to issue a licence authorising an applicant to carry out a 'conduct' related to a storage or disposal facility if an applicant demonstrates that the proposed facility will achieve this level of protection. They will do this by carrying out and presenting a 'safety case' that draws upon the organisational and technical arrangements put in place, the nature of the waste to be accepted, the characteristics of the site, the design of the facility, including engineered barriers, and the arrangements for its construction, operation, decommissioning or closure and post-closure stages as appropriate.

A working group has been established to begin revision of the National Health and Medical Research Council *Code of practice for the near-surface disposal of radioactive waste in Australia (1992)* (RHS 35), and the information in the updated *Draft Regulatory Guide: Licensing of Radioactive Waste Storage and Near Surface Disposal Facilities* will form the basis for the revision.

Radiological protection of the environment

Recent international recommendations explicitly makes the radiological protection of the environment part of international best practice and recommends the use of reference animals and plants for radio-ecological impact assessments. There is currently no consolidation of existing Australian data on concentration ratio to support non-human biota radiological assessments in the Australian uranium mining context which impedes the ability of the industry to undertake assessments.

ARPANSA is currently working to implement an improved framework for environmental impact assessment for uranium mining and radioactive waste disposal, to ensure that measures to protect people and the environment are adequate and maintained. The framework is aligned with the system for environmental radiation protection that has been developed by the ICRP taking into account recent international research projects.

In March 2012 ARPANSA and the Department of Resources, Energy & Tourism co-sponsored an Environmental Risk from Ionising Contaminants: Assessment and Management (ERICA) Workshop in Melbourne and Perth. The ERICA Tool is a software system that applies the tiered ERICA Integrated Approach to assessing the radiological risk to terrestrial, freshwater and marine biota. The objective of the Australia-focused workshops was to help attendees improve their knowledge and understanding of issues surrounding radiological protection of the Australian environment, and provide instruction on the use and benefits of the ERICA tool in conducting environmental assessments. Commonwealth agencies, state regulators and industry attended the workshop.

In December 2011, ARPANSA commenced the project, Concentration Ratios for Non-Human Biota inhabiting Australian Uranium Mining Environments which is partly-funded by the Department of Resources Energy and Tourism. The objective of the 12 month project is to collate existing Australian data holdings on concentration ratios for flora and fauna in uranium mining environments. Currently, industry engagement and collation of concentration ratio data has been completed. Data is currently undergoing quality checks and evaluation to identify short-comings, including biota types and environmental conditions, for which data is most

Qualitative Deliverables	
Develop a new national framework for the protection of non-human species and develop methodologies for the assessment of environmental impacts using the ERICA framework and tool	
Measure	Agreement of industry and governments to the framework and assessment methods developed.
Result	This two year program is on track for completion in the third quarter of 2013.

lacking. These concentration ratio data holdings can be applied for radiation protection of the environment in various climate zones of Australia. Their inclusion within the ERICA tool (combined with the guidance provided by the Safety Guide described below) will enable the most up-to-date organism- and site-specific radiological assessments to be undertaken. The table on page 33 notes that the project is on track for completion in the third quarter of 2013.

ARPANSA's *Safety Guide on the Monitoring and Assessment of Doses in the Mining and Milling of Radioactive Ores* is intended to promote a nationally consistent approach to monitoring, assessing and recording occupational exposures to radiation for mining and mineral processing operations. It is a companion volume to the *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (the Mining Code), which was published in 2005. The Mining Code provides a uniform framework for radiation protection and radioactive waste management, including information and guidance to assist in development of a radiation management plan and a radioactive waste management plan.

Comprehensive Nuclear-Test-Ban Treaty

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) bans all nuclear explosions, whether they are for civil or military purposes. To monitor compliance with the CTBT, an International Monitoring System (IMS) is being established. As a signatory to the CTBT, Australia is committed to establish, operate and maintain nine air monitoring facilities which form part of the IMS. ARPANSA continued to operate and maintain radionuclide air monitoring stations at Melbourne, Perth, Townsville, Darwin, the Cocos Islands, and Macquarie Island, Australia, including two noble gas analyser facilities, collocated with the air monitoring stations in Melbourne and Darwin. The installation of the ninth and final radionuclide air sampling station at Mawson Base (Antarctica) is essentially complete.

In addition to operating the stations, ARPANSA also operates the Australian CTBT Radionuclide Laboratory (CRL), which has the role of testing samples obtained by other CTBT radionuclide monitoring stations, and a CTBT National Data Centre that provides advice to the Australian Safeguards and Non-Proliferation Office on any suspicious event detected on the IMS. Since being revalidated in October 2011 and thus returned to full service, the CRL has been operating at capacity levels analysing samples from the CTBT network. The CRL has also participated in a CTBTO Intercomparison Exercise.

Safe transport of radioactive material

The regulation of the transport of radioactive material throughout the world is based on requirements published by the International Atomic Energy Agency (IAEA). The Australian *Code of Practice for the Safe Transport of Radioactive Material (2008)*, Radiation Protection Series No. 2 (the Transport Code) adopts the IAEA's *Regulations for the Safe Transport of Radioactive Material 2005* Edition (No. TS-R-1) and establishes requirements for the safe transport of radioactive material in Australia.

Certification of radioactive sources, packages and certain types of transports is an important aspect of the Transport Code and once obtained, the certification needs to be recognisable by radiation regulators around the world. Australia is in the position of having many competent authorities, all of whom can provide certification. In order to assist

Qualitative Key Performance Indicator **Ensure radiological and nuclear security and emergency preparedness**	
Advice provided to the Australian Government regarding the radionuclide monitoring system and the Comprehensive Nuclear-Test-Ban Treaty is acceptable and reliable.	
Measure	Level of reliability meets the contractual arrangements between ARPANSA and the Comprehensive Nuclear-Test-Ban Treaty Organization.
Result	ARPANSA continued to operate and maintain the radionuclide air monitoring stations, including two noble gas analyser facilities in conformance with the contractual requirements.

Australian regulators and industry in interpreting the detailed provisions in the Transport Code and to facilitate compliance with the Transport Code ARPANSA has developed a draft *Safety Guide for Approval processes for the safe transport of radioactive materials 2012* (Radiation Protection Series No. 2.2). It explains the administrative and legal requirements for obtaining certification in the Australian situation, outlines what the competent authority does, and describes who a person needs to contact in order to achieve certification of packages, radioactive material and the shipment of radioactive material.

This Safety Guide was released for a period of public comment from 16 February to 23 March 2012. The working group reviewed the comments received and finalised the draft. The draft was ready for submission to the Radiation Health Committee and the Radiation Health and Safety Advisory Council for approval. Following approval, this document will be published on the ARPANSA website.

During 2011-12 ARPANSA validated the *Certificate of a Package Design USA/9315/B(U)-96*, revision 5, issued by the United States of America Competent Authority for a B(U) Type Package Design Es-3100. ARPANSA issued the following certificate of validation to ANSTO:

US/2012-44/B(U)F-96

ARPANSA also approved the shipment of OPAL fresh fuel and uranium targets in accordance with the requirements of the Transport Code.

International engagement

The Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management (the Joint Convention)

During this financial year, ARPANSA submitted Australia's Fourth National Report to the Joint Convention. The Joint Convention focuses upon the safe management of spent nuclear fuel and radioactive waste with the objective of achieving and maintaining a high level of safety worldwide in spent fuel and radioactive waste management through a process of national reporting and peer review.

ARPANSA's report addressed questions relating to review of other Joint Convention Contracting Party reports and questions to Australia from the Contracting Parties were all answered according to the stringent timelines of the Joint Convention review process.

The Australian delegation to the review meeting was led by Professor Peter Johnson, Head of ARPANSA's Medical Radiation Services Branch. Australia's presentation to the Joint Convention review meeting was prepared and delivered in Vienna in May 2012 and it was well received by our international counterparts. Australia's National Report is available at www.arpansa.gov.au/Regulation/Collaborations/jointconv.cfm.

The Rapporteur's Report of the Joint Convention noted the following key achievements for Australia:

- Creation of an updated regulatory guide for waste management facilities.
- The *National Radioactive Waste Management Act 2012* has been enacted.
- The Periodic Safety Review for OPAL reactor is currently being undertaken.
- The decommissioning of Moata is now completed.

It also commended good regulatory practices across a range of areas including our:

- participation in Integrated Regulatory Review Service activities
- consideration of only volunteer sites for national radioactive waste management facility
- updated regulatory guidance for storage and disposal incorporating international best practice
- strong legislative requirements to comprehensive community and stakeholder consultation.
- provision of regional training and guidance in decommissioning of research reactors.

It did however conclude that there were a number of significant challenges ahead for Australia including:

- establishment of national radioactive waste management facilities for disposal of low-level waste (LLW) and the storage of intermediate-level waste (ILW)
- licensing for final dismantling of decommissioning of HIFAR
- engagement of public and stakeholder on decision making
- maintaining skills and expertise of regulator and operator

- development of national strategy for disposal of ILW
- interim storage required for ILW generated from reprocessing of spent fuel at ANSTO if a National Radioactive Waste Management Facility is significantly delayed
- establishing national clearance levels.

In October 2011, a national audit of radioactive waste holdings was completed and reported in the Joint Convention National Report. The data was added to the International Atomic Energy Agency database Net-Enabled Radioactive Waste Management Database which maintains records of all radioactive waste in storage or disposed of world-wide.

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

UNSCEAR was formed in 1955 to undertake scientific assessments of sources and effects of ionising radiation, and report its findings directly to the United Nations General Assembly. In May 2011 at the 58th UNSCEAR session a project plan was developed for an assessment of *Levels and Effects of Radiation Exposure due to the Fukushima Dai-ichi Nuclear Accident after the 2011 Great East-Japan Earthquake and Tsunami*. The United Nations General Assembly endorsed the plan in its resolution of 12 January 2012. The work involves 72 scientists from 18 countries.

The UNSCEAR assessment project includes a Coordination Expert Group and four Expert Groups focusing upon the following areas:

- data compilation, screening, quality assurance and documentation
- assessment of radionuclide releases and dispersion
- dose assessment to humans and biota
- assessment of worker doses and health effects.

ARPANSA provides three experts to the Expert Group on dose and risk assessment to humans and biota:

- the Group Leader
- a Rapporteur
- a Critical Reviewer.

The final report will be delivered next year for the Committee's review and acceptance at the 60th UNSCEAR session, and will be published in September/October of 2013.

Limit workers' exposure to radiation

Occupational exposure to ionising or non-ionising radiation occurs in a variety of work environments. Work environments may contain man-made sources of radiation, elevated levels of natural radiation, or radioactive materials from past activities. ARPANSA strives to promote the identification, characterisation and monitoring of work environments to raise awareness and to reduce exposures.

ARPANSA maintains the Australian National Radiation Dose Register (ANRDR), which involves the collection, storage and auditing of radiological dose histories for uranium industry workers in Australia. Following the official launch in June 2011, the ANRDR entered its operational and maintenance phase, and the ANRDR now contains dose history records for more than 24 300 workers from the uranium mining and milling industry.

During this financial year, ARPANSA, with the assistance of the New South Wales Government, assessed levels of naturally occurring radioactive materials (NORM) in a sample of metal mines, collieries, and quarries across New South Wales with a survey report published in August 2012. The survey examined a total of 29 mining operations in New South Wales comprising 7 collieries, 12 mines processing ore for metals, 9 mines that quarried various minerals or rocks and 1 tourist mine. The survey sampled all of the input, product and waste streams from the mining operations and analysed the samples for the activity concentration of those naturally occurring radionuclides which may give rise to significant radiation doses. The survey also included on-site measurement of radon in underground mines.

The survey results indicated that most mining operations do not have issues related to elevated levels of naturally occurring radioactive materials. However, given the high variability observed, both within and between mine sites, and the limited number of mines sampled in this study, it is likely that some underground mines may be above the action level.

ARPANSA has provided advice to the Department of Sustainability, Environment, Water, Population and Communities on the draft South Australian

ARPANSA scientist checking TLDs

Assessment Report that evaluates BHP Billiton's Draft Environmental Impact Statement and Supplementary Environmental Impact Statement submitted under the *Environment Protection and Biodiversity Conservation Act 1999* in relation to its proposed expansion of the Olympic Dam mining operations.

The Radiation Protection Series 9.1 document is a companion volume to RPS 9 - *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* and provides support to the ANRDR by promoting a nationally consistent approach to assessing occupational exposures in the industry.

Qualitative Deliverable	
Develop advice for the uranium mining industry on occupational health.	
Measure	Publish a *Safety Guide for Monitoring, Assessing and Recording Occupational Radiation Doses in Mining and Mineral Processing*.
Result	The *Safety Guide for Monitoring, Assessing and Recording Occupational Radiation Doses in Mining and Mineral Processing* was published in advance of the reporting period in June 2011 as Radiation Protection Series No. 9.1.

Qualitative Key Performance Indicator	
Better control of radiation dose to uranium mining workers and informing state and territory regulators on the effectiveness of current controls.	
Measure	Annual reporting of trend in radiation doses received by workers compiled from the Australian National Radiation Dose Register provides evidence of optimisation of radiation protection in the uranium mining industry.
Result	By the end of June 2012 the ANRDR held dose history records for more than 24,300 workers from the uranium mining and milling industry. A system is now available for reporting historical dose data to individuals on request.

Promote the effective use of ionising radiation in medicine

Improved radiation protection of patients through optimising patient doses

In 2011, Australians were exposed to radiation through at least 15 000 000 therapeutic and diagnostic procedures. Exposure to radiation during medical procedures represents the largest radiation exposure of the Australia population. In recent years, the growth in medical radiation usage has resulted in the dose from medical exposures surpassing natural background as the largest source of exposure of the Australian population.

All procedures involving radiation exposure of patients must be justified so that the procedure is appropriate in relation to alternatives and is anticipated to be beneficial to the patient. Procedures should also be optimised to ensure that they are implemented with minimal dose (for diagnostic imaging) or harm (during therapy) to the patient while maintaining efficacy.

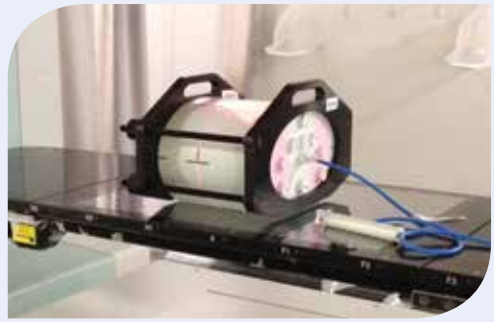
Over 50 000 Australians are treated with radiotherapy for disease cure or management each year. Accurate delivery of radiation dose during radiotherapy is a fundamental requirement for achieving the best patient outcomes. The numerous advantages include ensuring that the patient has the best chance for disease-free survival with minimal complications. Additionally, accurately planned and delivered radiotherapy enhances the efficiency of clinical trials, ensuring that research outcomes are achieved faster allowing more rapid introduction into clinical practice.

ARPANSA is involved in radiotherapy in two key ways. Firstly, ARPANSA maintains the national primary standard for absorbed dose. This standard for absorbed dose is the traceable reference to which all Australian radiation treatment machines, or linear accelerators, are calibrated. Secondly, ARPANSA audits radiation treatments through the Australian Clinical Dosimetry Service (ACDS). The ACDS provides an independent audit service to radiotherapy providers which measures whether the correct dose is being delivered by the radiotherapy treatment.

The Primary Standard for Absorbed Dose

The cobalt-60 calibration service, upon which all external beam radiotherapy treatments in Australia are currently based, continued operation and services were provided to 23 radiotherapy centres (an almost 50% increase over previous years). This amounted to the calibration of 24 secondary standard therapy ionisation chambers. A secondary standard calibration was also provided to the National Radiation Laboratory of New Zealand for dissemination to hospitals within New Zealand.

Level III Audit Phantom used by the ACDS arranged on a linac couch during a Level III clinical audit. The phantom allows the measurement of dose at key locations within the phantom to determine whether the correct dose is being delivered to the correct location. The audit simulates the process used with a real patient of imaging, planning, treating the phantom as a patient would be treated.



The direct calibration service from the ARPANSA medical standards linac was not made available to clinical radiotherapy centres in 2011-12. A decision was made early in 2012 to delay the introduction of the service in the light of unexpected technical challenges encountered in adapting measurement systems to the ARPANSA linac. These challenges have been addressed and the service will commence after an international comparison in September 2012. The comparison is required to provide necessary quality assurance and to assess the magnitude of changes that will inevitably occur in moving from a cobalt-60 calibration. A consistent reliable process is being developed with appropriate quality assurance that is important for patient safety. Pilot calibrations were made for the secondary standard ionisation chambers used by the ACDS for their linac audit program.

The Australian Clinical Dosimetry Service

In February 2011, the Australian Government formally launched the Australian Clinical Dosimetry Service (ACDS) as part of a three year trial to determine whether an independent auditing service can provide dosimetric and thus clinical support to radiation therapy patients and staff within Australia. The ACDS has designed a three level audit program, with each succeeding level having a more complex and challenging geometry. Level I is operational, Level II is in final development and Level III is in preliminary testing. This ACDS is similar to other audit programs internationally, but is unique in its coverage, national participation, audit design and final review process.

The ACDS enhancement of radiation oncology safety throughout Australia continued over the 2011-12 year. The ACDS has achieved nearly complete signup to its voluntary audit program from centres nationally and has requests for audits extending into 2013. These two indicators, participation rate and active engagement in the audit program, highlight both the importance that the radiotherapy providers assign to independent auditing, and acknowledgment that the ACDS can deliver a valuable program for radiation therapy in Australia.

Oversight of the ACDS is mandated through a Memorandum of Understanding (MoU) between ARPANSA and the Department of Health and Ageing (DoHA). The MoU requires that ARPANSA report to DoHA, the auditing requirements, milestones required for ongoing funding, and the formation of a Clinical Advisory Group (CAG). The CAG comprises of representatives from the professional organisations in Australia covering Radiation Oncologists, Radiation Therapists and Medical Physicists, private practice, the Radiation Oncology Reform Implementation Committee and the Trans Tasman Radiation Oncology Group. The CAG provides expert opinion to the ACDS and reviews the audit development. The MoU requires the ACDS to hold CAG meetings four times a year.

CT scanner

Since its inception, the ACDS has a performed Level I basic reference dosimetry audits on 52 linacs and 16 higher accuracy Level Ib audits on newly installed linacs. All the audits have been performed voluntarily at the request of radiotherapy providers. Counting all the audits performed throughout Australia, 66% of the radiotherapy centres have had at least one linac audited, equating to 42% of the individual facilities and just under half of all the linear accelerators in Australia.

The development of the Level II audits, which provide more extensive testing of the linear accelerators, and the Level III audits, which review the entirety of the treatment process, are being finalised. The Level II audit completed its planning phase and entered initial testing in early 2012. A requirement to re-equip for this audit has resulted in a slight delay. The end-to-end Level III audit field testing was completed at the end of May 2012. Providers across four states have already requested this audit.

Now a year into operation, the philosophy behind the audit design, initial results and future projections have been published and presented internationally resulting in considerable positive feedback and interest.

The mutual engagement between the ACDS and the wider radiation oncology community is further demonstrated by invitations to present on the establishment and progress of the audit program by The Royal Australian & New Zealand College of Radiation Oncology, The Australian Institute of Radiology and the Australian College of Physical Scientists and Engineers in Medicine. In addition to the formal yearly conferences, the ACDS has also presented to numerous state based branches of the three colleges, and many hospitals as part of a local audit. In total the ACDS has formally presented 18 times at national and international fora over the reporting period.

It is worth noting that external auditing for radiotherapy is recommended internationally to ensure patient safety, and that the accurate delivery of dose to the desired identified anatomy occurs when patients are treated.

Diagnostic imaging and nuclear medicine

Most of the 15 000 000 procedures involving ionising radiation that Australians undergo each year are diagnostic imaging procedures. Each of these procedures should provide images obtained with equipment and protocols which have been optimised for the radiation protection of the patient.

To obtain a measure of the contribution of diagnostic imaging to the Australian population dose, ARPANSA has undertaken two projects to estimate its impact. The first project is an analysis of the frequency data of imaging procedures using Medicare data and applying dose estimates for common procedures (see Figure 2). The summation of these figures enables an estimate of total dose delivered and dose delivered per modality.

Figure 2: Breakdown of diagnostic imaging procedures

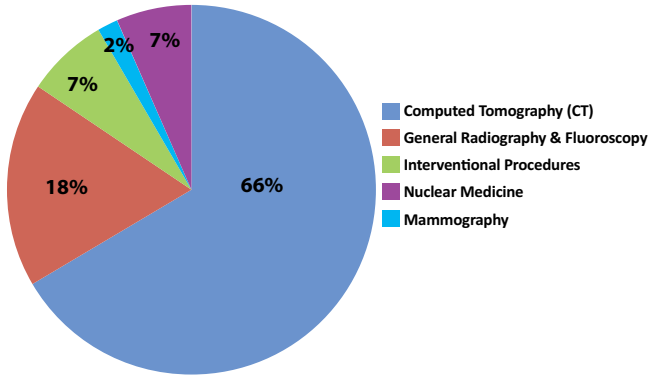


Table 2: Australian Adult MDCT Diagnostic Reference Levels

Adult Protocol	Dose Length Product (mGy.cm)	Computed Tomography Dose Index - $CTDI_{vol}$ (mGy)
Head	1000	60
Neck	600	30
Chest	450	15
AbdoPelvis	700	15
ChestAbdoPelvis	1200	30
Lumbar Spine	900	40

A Diagnostic Reference Level (DRL), is defined by the International Commission on Radiological Protection (ICRP) as:

'a form of investigation level, applied to an easily measured quantity, usually the absorbed dose in air, or tissue-equivalent material at the surface of a simple phantom or a representative patient.'

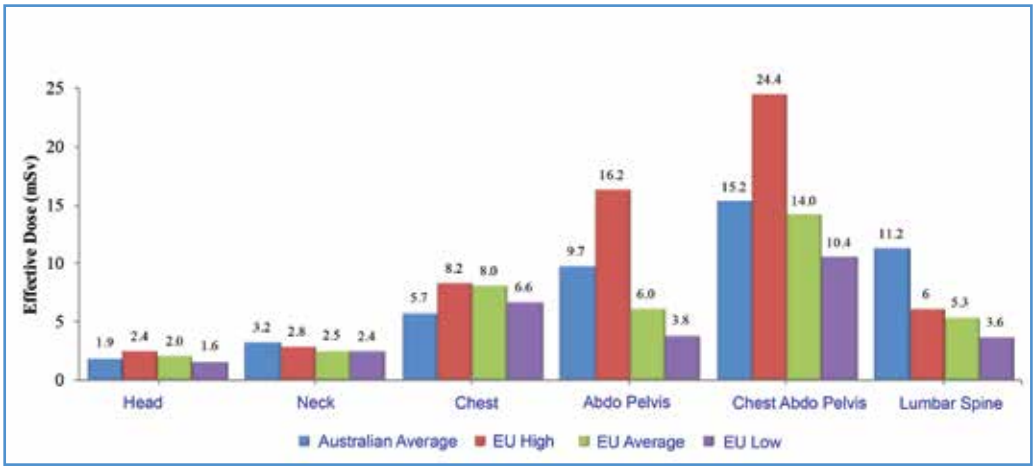
Australian Diagnostic Reference Levels provide a reference dose value(s) which 75% of participating practices are below for the acquisition of a particular image or imaging series of diagnostic quality. The published national DRLs for adult CT are presented above.

Optimising patient protection using diagnostic reference levels (DRLs)

National Diagnostic Reference Level Database

The second project is the National Diagnostic Reference Level Database (NDRLD). This survey allows radiology practices to log patient doses and receive Practice Reference Level (PRL) reports with which they can compare their practice dosimetry against those of their peers. While a nationally determined DRL is not a dose limit, in cases where the practices are delivering higher doses than Australian DRLs, it is expected that the practice will investigate and, where appropriate, optimise their doses. Suitable use of the NDRLD and PRL reports should enable a practice to ensure radiation doses to their patients are optimised while maintaining diagnostic image quality. In June 2012, Australian DRLs for CT of adults (Table 2) were published by ARPANSA with support from the Royal Australian and New Zealand College of Radiologists, the Australasian College of Physical Scientists and Engineers in Medicine, the Australian and New Zealand Society of Nuclear Medicine and the Australian Institute of Radiography.

Figure 3: Australian Average and Dose DataMed Effective Dose Comparison (mSv)



DRLs have been established and released for adult CT protocols. The survey software went live on 1 August 2011, with the first cohort of data finalised on 31 December. Over this five month period, data was provided by 88 radiology practices who submitted approximately 280 surveys. The calculated DRLs indicate that Australian values are in the mid to higher dose cohorts of comparative practices in Europe. The data survey is ongoing, based on calendar year acquisition periods and future DRLs will be developed and released on a three yearly cycle. Liaison panels, made up of representative professional groups as stakeholders, have been established for interventional cardiology and mammography DRL programs.

Figure 3 shows a comparison of Australian to European Union CT doses based on a conversion of Australian DRL dose values to effective dose (E, mSv).

ARPANSA did not meet the 2011-12 Budget Target of 2 DRL dose surveys because of unexpected delays in the software build which shortened the time frame for data to be collected and the number of practices that could respond to the initial invitation.

The 2011-12 budget target of 30% of cancer treatment centres transitioning to direct calibration based on ARPANSA's Linac was not met because of a deliberate delay in the introduction of the service because of significant problems encountered in adapting measurement systems to the ARPANSA Linac. These problems have subsequently been addressed and the service will commence after an international comparison in September 2012. The percentage of practices responding to the CT DRL survey was only 10% instead of the 50% forecast for this financial year because of the software delays which shortened the time frame for practices to respond.

International engagement

The ACDS attended the European Medical Physics and Engineering Conference in 2011, combining the conference with presentations at St Luke's Hospital in Dublin, the European Federation of Organisations for Medical Physics Workshop on Justification and Optimisation in Diagnostic Radiology and three day visit to the National Physical Laboratories (NPL) in the UK. Useful and practical discussions occurred

Qualitative Deliverable	
Develop diagnostic reference levels for radiology and performance criteria for radiotherapy treatments	
Measure	Diagnostic reference levels for radiology and performance criteria for radiotherapy treatments are developed and implemented with the involvement of professional peak bodies.
Result	Adult CT DRLs published.

Quantitative Deliverable	**2011-12 Budget Target**	**2011-12 Achieved**
Number of diagnostic reference level/doses surveys of diagnostic imaging modalities.	2	1
Cumulative proportion of centres audited by the ACDS for accuracy in dose measurement of radiotherapy.	50%	66%
Number of reports, publications and presentation on the optimisition of the use of ionising radiation in medicine.	>15	32

Quantitative key Performance Indicators	**2011-12 Budget Target**	**2011-12 Achieved**
Percentage of cancer treatment centres transitioning from indirect calibration (cobalt-60) to direct calibration based on ARPANSA Medical Standards Linac.	30%	0%[1]
Percentage of practices responding to computed tomography diagnostic reference levels survey.[2]	50%	10%

[1] Pilot calibrations were made for the secondary standard ionisation chambers used by the ACDS for their linac audit program. The 30% target was not met because of deliberate delays to address measurement problems.

[2] Unexpected delays in the software build limited the timeframe for data acquisition and the number of practices that responded to the initial invitation.

with all the centres visited, and the ACDS program stimulated great deal of interest from Irish Health System representative and the clinical audit group within the NPL. Outcomes from this trip have been an international cross-calibration of the new ACDS dosimetry technique, and an ongoing discussion with Irish-based physicists about national audit designs.

ARPANSA participated in IAEA Coordinated Research Project 2.10.08 on the Development of Advanced Dosimetry Techniques for Diagnostic and Interventional Radiology. Further laboratory work on the calibration and phantom dosimetry of Gafchromic film was completed and written up.

ARPANSA staff met with counterparts at the Radiological Society of North America in Chicago in November 2011 and met with specialists from the American College of Radiology concerning collaborative work on respective DRL projects and obtaining updates on development of radiation dose structured reports for use as a data logging tool for future DRL surveys.

ARPANSA staff attended Dose Datamed 2 held in Athens, Greece in April 2012 and presented Australian adult CT DRLs and also met with project managers concerning application of Dose Datamed 2 to Australasian and potentially SE Asian development. Direction and advice was taken on development of non-CT DRL survey structure and data sets.

ARPANSA attended the World Congress of Medical Physics in Beijing and the ACDS team delivered four presentations: two at the conference and one each for the Chinese National Institute Metrology (NIM) and Beijing Cancer Hospital. Interest and continuing enquiries are ongoing with representatives from the Bureau International des Poids & Mesures (BIPM) and NIM (China).

The results of international comparisons of the Australian primary standards for kilovoltage X-ray air kerma and Co-60 absorbed dose to water were published. All of the primary standards maintained by ARPANSA now have recent comparisons with their overseas equivalents, and the new results are available to users via the online BIPM Key Comparison Database. Measurements of neutron dose were undertaken for a regional comparison between seven standards laboratories in the Asia Pacific region. A new authorisation of ARPANSA by the National Measurement Institute (Australia) to maintain the Australian primary standards for radiation dosimetry was signed on 22 May 2012.

Ensure radiological and nuclear security and emergency preparedness

Radioactive material poses potential health risks if released into the environment through accidents or malicious acts. Measures need to be in place to control radioactive materials both within Australia and crossing Australia's borders. Protection of the Australian public and environment requires effective radiation emergency planning.

Development of incident management plan

In 2012 the ARPANSA Incident Management Plan (IMP) has been reviewed and revised, taking into consideration ARPANSA's roles as a regulatory authority, adviser and as the IAEA-designated National Competent Authority on radiation emergencies both domestic and abroad. ARPANSA has also incorporated many lessons learned after the Fukushima Dai-Ichi accident, recognising that the public and the government turned to ARPANSA for our nuclear safety, radiation heath and emergency response expertise. It is expected that ARPANSA will continue to collaborate closely with the Department of Health and Ageing National Incident Room and the Emergency Management Australia Crisis Coordination Centre in the further development and harmonisation of the IMP, which will ensure a seamless whole-of-government response to radiation and nuclear incidents or emergencies by Australia.

Australian Defence Force Visiting Ships Panel (Nuclear)

ARPANSA chairs the Technical Working Group (TWG) of the ADF Visiting Ships Panel (Nuclear), or VSPN. As part of the role as the TWG chair, ARPANSA (in conjunction with the ADF, ANSTO and the Tasmanian Government) conducted a Nuclear Powered Warship (NPW) Port Validation inspection for visiting NPW's to Hobart. Port Validations include assessing the emergency plan, running a desktop exercise and physically inspecting the anchorage locations and emergency response facilities. Recommendations were made to the chair of the VSPN and the site has been endorsed by the VSPN for future NPW visits. The Tasmanian government has consistently demonstrated a long-term commitment and competency to manage NPW visits, and continues to strengthen and improve their emergency plans and arrangements with each visit.

Council of Australian Governments (COAG) report on the security of radioactive sources

ARPANSA has continued to work with state and territory radiation regulatory bodies, the Department of the Prime Minister and Cabinet, state and Federal Police and ARPANSA licence holders to address the recommendations contained

ARPANSA Emergency Response teams on exercise detecting and characterising radioactive materials

USS Ronald Reagan (CVN76) visited a VSPN endorsed Berth in Brisbane in 23 Jan 2006.

within the 2006 COAG Report on the Security of Radioactive Sources. Specifically, ARPANSA and state and territory radiation regulatory bodies have agreed to a National Transfer Protocol for the transfer and transport of radioactive sources within Australia's borders. This new system will improve the movement of security enhanced sources across Australia and ensure that they can be monitored and regulated more closely.

ARPANSA in cooperation with state and territory radiation regulators are also developing a National Radiation Background Checking Framework which will compliment similar systems such as the highly successful Security Sensitive Biological Agents scheme, currently administered by the Department of Health and Ageing. This undertaking is aimed at ensuring that only approved persons have access to security enhanced radioactive sources within Australia.

ARPANSA, in consultation with the Radiation Health Committee and the radiation and security industries, have developed nationally accredited training competencies for a Radiation Security Advisor certification scheme. The training competencies have been accredited by the Australian Skills Quality Authority as a Vocational Graduate Certificate in Radiation Security Advice, and ARPANSA is negotiating with a Registered Training Organisation to deliver this qualification.

This will provide a pool of nationally qualified Radiation Security Advisers for the provision of protective security advice and the endorsement of Source Security Plans in all states and territories in accordance with the ARPANSA *Code of Practice for the Security of Radioactive Sources* (RPS 11). ARPANSA has continued to work with jurisdictions and licensees providing awareness training and advice, on an as required basis, for security enhanced radioactive sources in use, storage and transport.

ARPANSA has also assisted the IAEA in 2012 by developing guidance material and an international

Qualitative Deliverable	
Strengthened national and agency radiological/nuclear emergency planning and preparedness	
Measure	National system consistent with international requirements.
Result	ARPANSA Incident Management Plan developed which is currently being harmonised with the Attorney-General's Department Crisis Coordination Centre and the Department of Health National Incident Room consistent with IAEA requirements.

Quantitative Deliverable	**2011-12 Budget Target**	**2011-12 Achieved**
Number of Australian jurisdictions that maintain the integration of their source register with the national sealed source register.	9	9

training package on the Physical Protection of Nuclear Material During Transport. As a result, ARPANSA and the Australian Safeguards and Non-Proliferation Office will be co-hosting a Regional Training Course in Sydney in December 2012 to assist other countries with their transport security activities.

Border security and illicit trafficking of radioactive sources

The Australian Customs and Border Protection Service (Customs) is currently producing a report on the effectiveness of the detection of radioactive materials across Australia's borders, which maintains a strong regulatory emphasis on monitoring compliance with import/export permit processes; including mapping regulatory control either side of the physical border crossings to the Australian mainland. In order to balance the input and broaden the guidance to policy makers on border monitoring of radioactive sources; and the detection of illicit and inadvertent movement of sources, ARPANSA has also been engaged in the development of two international guidance documents with the Global Initiative to Combat Nuclear Terrorism (GICNT) Nuclear Detection Working Group (NDWG) and the IAEA.

ARPANSA's involvement in the development of GICNT NDWG awareness guidelines will benefit government officials and designated authorities within nation states undertaking nuclear detection architecture development when establishing rules and regulations around preventing the illicit trafficking of nuclear and other radioactive materials and devices; and offer guidance on how different organisations might collaborate.

ARPANSA assisted the IAEA in adapting the GICNT Model Guidelines on Nuclear detection architectures into an IAEA Implementing Guide on improving nuclear security detection infrastructure. This undertaking complements lessons learned from the recent ARPANSA and Australian Customs and Border Protection Service Radiological Exports Campaign exercise held earlier this year. In addition, ARPANSA is working with IAEA's Illicit trafficking database to improve information reporting and sharing of incidents and trafficking involving radioactive material that has fallen out of regulatory control to increase Australia's awareness and capability to monitor radioactive source movements.

Strengthened visibility in the movement of sources across our borders and within the region is achieved by ARPANSA through our officers who are authorised to approve the import and export of radioactive sources in accordance with Regulation 4R of the Customs (Prohibited Imports) Regulations 1956, and Regulation 9AD of the Customs (Prohibited Exports) Regulations 1958, respectively. As a result, 613 import permits and 12 export permits were granted by ARPANSA officers this year for the release of non-medical radioisotopes, and our close working relationship with Customs and state and territory radiation regulators continues to develop as we coordinate our activities in this area.

In September 2011, ARPANSA officers attended the annual Accident Reporting and Guidance Operating System (ARGOS) Consortium meeting in Copenhagen, Denmark which focuses upon Chemical, Biological, Radiological and Nuclear emergencies and included discussions on each consortium member country's use of ARGOS over the past year and the use of ARGOS during the Fukushima crisis.

Quantitative Key Performance Indicator	2011-12 Budget Target	2011-12 Achieved
Number of security incidents involving high activity radioactivity sources requiring immediate reporting.	<5	0

Develop and implement regulatory systems

National uniformity

ARPANSA is committed to effectively regulating the use of radiation by Australian Government entities and by promoting the adoption of a uniform framework across all jurisdictions. The main vehicle for the promotion of national uniformity of radiation protection throughout the jurisdictions is the National Directory for Radiation Protection (NDRP) which is jointly developed by ARPANSA and the state and territory radiation regulators through the Radiation Health Committee (RHC).

During the year the national uniformity process was advanced by the publication of Amendment 5 to the NDRP in July 2011. Amendment 5 clarifies that the justification principle applies to ionising radiation and adopts the *Code of Practice and Safety Guide for Radiation Protection in Veterinary Medicine* (RPS 17) and the *Code of Practice for Radiation Protection in the Application of Ionizing Radiation by Chiropractors* (RPS 19) for national implementation.

A further NDRP amendment (No. 6) has been developed and includes a number of issues: restructure of the wording of schedule 13 to clarify the scope of incidents to be reported, exemptions for certain lighting products, supplementary authorisation criteria for chiropractors and an updated reference to the transport code (RPS 2). A preliminary regulatory assessment report relating to this draft amendment was prepared and sent to the Office of Best Practice Regulation who confirmed that a Regulatory Impact Statement was not required. The public consultation process for Amendment 6 is underway with an expected completion date in September 2012.

To support implementation of the previous NDRP amendment (No. 4) regarding regulation of solaria, ARPANSA developed an online training course for solarium operators, which was launched in May 2011. In its first twelve months of operation over 160 solaria operators undertook the course.

The Safety Guide (RPS 18) for the Use of Radiation in Schools was republished to include the newly prepared Part 2 on lasers. This document provides practical advice and guidance on the use of radiation sources in Australian secondary schools and colleges and will promote a nationally consistent approach.

International engagement

IAEA Commission on Safety Standards (CSS)

ARPANSA maintains a significant presence in the Commission on Safety Standards and Safety Standards Committees and in the new Nuclear Security Guidance Committee. ARPANSA represented Australia at the 30th Meeting of the CSS held in Vienna from 1 to 3 November 2011. ARPANSA's CEO is a Member of the Commission. This meeting considered the consequences of the Fukushima nuclear emergency with a view to reflecting the lessons learned into future safety standards and revision of existing ones. The CSS also considered the IAEA Action Plan developed in 2011. We followed this up with our attendance at the 31st meeting of the IAEA CSS in Vienna between 27 to 29 March 2012. Both the 30th and the 31st meetings considered a range of Safety Requirements covering all aspects of radiation protection, radioactive waste safety, transport and nuclear safety including a major rewrite of the IAEA Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards. Both the Safety Standards Committees and the CSS performed a 'gap analysis' of the whole suite of Safety Standards following the Fukushima accident forming the conclusion that the existing Safety Requirements provide a robust framework. Nonetheless, as a result of this gap analysis, a number of safety issues were identified and more are likely to emerge once international stress testing of nuclear power plants is completed and reported on.

IAEA Waste Safety Standards Committee (WASSC)

ARPANSA's Dr Geoff Williams, who is Chair of WASSC, attended the 32nd meeting of WASSC in December 2011 during which, approval was given to begin drafting a revision of the international Safety Guide on '*Management of Radioactive Waste from the Mining and Milling of Ores*' (WS-G-1.2). The scope of the updated safety guide will include radioactive residues that arise from

mining and milling of ores for the extraction of uranium or thorium, and NORM industries including mining and processing of other ores, the oil and gas industry and the phosphate industry. Guidance on occupational exposures is outside the scope of this Safety Guide. The tentative working title is *Management of NORM residues from Mining and Processing of Ores*.

Other documents approved included the revised Safety Guide '*Safety Aspects in Siting for Nuclear Installations*' for sending to Member States for comment, after inclusion of a footnote to include predisposal waste management facilities into the definition of nuclear installations.

WASSC continued to review the implications of the Fukushima Accident on the suite of IAEA Waste Safety Standards, and a report was prepared for the IAEA Commission on Safety Standards.

At the 33rd meeting of WASSC held in June 2012, the draft Safety Requirements standard '*Decommissioning of Facilities*' (GSR Part 6) was approved to be sent to Member States for comment, after incorporating changes agreed at the meeting and approval of the WASSC Chair. Changes requested included simplifying the title from '*Safe Decommissioning...*', removing any suggestion that 'entombment' is a strategy for decommissioning (rather than a remediation strategy), and ensuring proper allowance for flexibility in the time-frames (such as the usual need for a short transitioning period). This international standard is important for Australia in light of future decommissioning of HIFAR.

Approval was given to begin drafting a new Safety Guide '*Communication and Consultation with Interested Parties*'. This important IAEA Safety Guide will aid in confidence-building with stakeholders.

Reports were presented to WASSC of a number of standards under development that are relevant for ARPANSA's new Regulatory Guide on waste storage and disposal. These draft documents have been referenced in the current draft submitted for public consultation from July to September 2012.

IAEA Transport Safety Standards Committee (TRANSSC)

ARPANSA represented Australia at the 23rd meeting of TRANSSC from 24 to 28 October 2011. The meeting was very productive in resolving the key issues related to TS-G-1.1 (Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material). It is expected that the revised IAEA Regulations for Safe Transport of radioactive Material, TS-R-1, will be published in 2012. TS-G-1.1 will also be published in line with TS-R-1. The outcomes of the TRANSSC meeting will be reflected in Australian context by updating:

- the ARPANSA *Code of Practice for Safe Transport of Radioactive Material* (RPS 2) in line with the IAEA cycle to ensure uniformity and harmonisation for safe transport of radioactive material nationally and internationally
- the *Safety Guide for the Safe Transport of Radioactive Material* (RPS 2.1).

In September 2011, ARPANSA attended the 7th International Conference on Isotopes held in Moscow and presented two papers related to safety performance indicators in Radioisotope Production facilities in Australia and Decommissioning of 30 MeV National Medical Cyclotron Facility. This triennial conference provided an opportunity to reflect upon the Australian process for nuclear installations in the light of international best practice.

In October 2011, ARPANSA also attended the International Conference on the Safe and Secure Transport of Radioactive Material: The Next Fifty Years - Creating a Safe, Secure and Sustainable Framework was held in Vienna. ARPANSA presented an invited paper on Australian Experience in Implementing the Transport Safety Regulations and Transport Security Recommendations. The conference provided an opportunity to reflect on the Australian practice in the light of practices adopted by other countries, industry experience and the areas where Australia can improve.

Ensure compliance with regulation

The Australian Government is committed to the effective and independent regulation of radiation sources, radiation facilities and nuclear installations. ARPANSA will continue to regulate the use of radiation by Australian Government entities through: licensing, inspecting, monitoring, enforcing compliance, enhancing awareness of good radiation practices and nuclear safety, controlling the import and export of radioactive sources, and controlling the transport of radioactive materials by Australian Government entities and their contractors.

Compliance with Commonwealth legislative and regulatory frameworks are monitored by ARPANSA in a number of ways, including assessment of licence applications, inspections, and surveys. Enforcement actions may be used in situations of non-compliance. The aim is to establish a safety culture that effectively provides reassurance that activities carried out under a licence from ARPANSA will not be harmful to people or the environment.

ANSTO OPAL reactor - Periodic Physical Protection and Security (PP&S) Review

Consistent with the expectations contained within the IAEA Nuclear Security Fundamentals general principles for competent authorities and regulatory bodies, ARPANSA continues to work closely with the Australian Safeguards and Non-Proliferation Office (ASNO) on nuclear security matters relating to nuclear material, other radioactive material, associated facilities and associated activities.

In January 2012 ARPANSA and ASNO jointly created the PP&S Review Working Group in order to assess the ANSTO periodic security review submission, which was received August 2012. This working group consists of members from ARPANSA's Security and Community Safety team and ASNO's Nuclear Security team. The working group will review ANSTO's submission this financial year and may also provide nuclear security suggestions or recommendations to ANSTO based upon our collective experiences and knowledge of international best practice.

The IAEA Nuclear Security Series and the ARPANSA Radiation Protection Series No.11 *Code of Practice for the Security of Radioactive Sources (2008)* will be the primary benchmarks for the assessment, notwithstanding the existing ARPANSA licence conditions and stringent ASNO permit requirements. Nuclear facilities such as ANSTO's OPAL Reactor are heavily regulated facilities where safety, security and safeguards are closely monitored and continuously assessed.

ARPANSA has also worked closely with ASNO and other relevant government bodies in reviewing and revising the National *Design Basis Threat* for which the ANSTO physical protection and security systems are to be designed and implemented against. This undertaking led by ASNO's Nuclear Security team forms an essential element of a country's Nuclear Security Regime, ensuring that any security measures that are designed and implemented are risk-informed and consistent with current international nuclear security trends.

ARPANSA is committed to carrying out its regulatory functions in a responsive and timely manner. To ensure this, ARPANSA has established its own Key Performance Indicators and targets. For timeliness of assessing licence applications see Table 3 which lists the targets and performance for 2011-12 for incidents, inspections and breaches against the previous four years.

Qualitative Key Performance Indicator	
Acceptable safety culture observed amongst regulated entities.	
Measure	Acceptable safety culture achieved in all observed entities, as assessed by a compliance program, including holistic safety assessments of a representative sample of entities.
Result	There were no major deficiencies observed and substantial progress by two key licence holders was determined by active regulatory oversight and liaison between the licence holder and regulator.

Table 3: Trend Data: achievement against the targets included in the PBS for 2011-12

Measure	Annual Target	Result 2008-09	Result 2009-10	Result 2010-11	Result 2011-12
Incidents[1]	<20	12	25	5	4
Inspections	60	66	40	49	62[2]
Breaches	<20	42	31	23	2

[1] The number of incidents reported here is the number which have been reported to the Australian Radiation Incident Register as detailed in Schedule 13 of the *National Directory for Radiation Protection*.
[2] Of the 62 inspections undertaken, 47 inspections were announced and 15 inspections were unannounced.

Inspections

During the course of the year ARPANSA undertook a planned inspection program of sources, prescribed radiation facilities, and nuclear installations operated by its licence holders in order to monitor compliance with the ARPANS Act and the Australian Radiation Protection and Nuclear Safety Regulations 1999.

A summary report of these inspections can be found on the ARPANSA website at www.arpansa.gov.au/Regulation/Inspections/index.cfm.

The inspection program was planned on the basis of:

- licence holder risk ranking
- licence holder compliance history
- licence holder incident and accident history
- date of last inspection.

Significant activities in relation to regulatory oversight

- Between 20-21 October 2011 ARPANSA inspectors participated in a training workshop by an external training organisation relating to compliance investigations.
- From 7-15 November 2011 ARPANSA was the subject of an IAEA Integrated Regulatory Review Service (IRRS) follow-up mission. The initial mission was conducted from 25 June to 6 July 2007. A copy of the report, and an action plan describing the activities ARPANSA plans to deal with outstanding or new recommendations and suggestions can be found on the ARPANSA website at www.arpansa.gov.au/Regulation/irrsreview.cfm.
- In November 2011 ARPANSA approved ANSTO to undertake stage 2 decommissioning activities of the Camperdown Facility.
- In November 2011 ARPANSA inspection report summaries were made available on the website for the first time to improve transparency. Feedback was sought from licence holders and significant comments addressed before the new initiative commenced.
- An ARPANSA licence holder forum was held on 29 November 2011 at Victoria Barracks, Department of Defence, Melbourne. The forum addressed, among other things, 'holistic safety assessments' as parts of improving and promoting a good safety culture, and was attended by 70 licence holder representatives from 15 organisations. A series of presentations was made by ARPANSA regulatory officers and external speakers. These can be accessed on the website at www.arpansa.gov.au/Regulation/forums/index.cfm.
- On 23 December 2011, ARPANSA received a report on the Periodic Safety Review (PSR) of the ANSTO OPAL reactor which was a

Quantitative Deliverable	2011-12 Budget Target	2011-12 Achieved
Number of inspections of facilities holding a Commonwealth licence.	60	62
Regulatory processes measured by the number of reports prepared per regulatory officer, for each of licence application assessment reports; licence amendment assessment reports and licence inspection reports.	>7	6

Table 4: Internal ARPANSA Key Performance Indicators for timeliness

Internal ARPANSA Key Performance Indicators	2011-12 BudgetTarget	2011-12 Achieved
Average time to assess facility licence applications	<60 days	93 days[1]
Average time to assess source licence applications	<30 days	29 days
Average time to assess Regulation 51 requests	<30 days	34 days

[1] The KPI for facility licence applications is for typical prescribed radiation facilities. In this case there was only one facility licence application which was not typical, and consequently required more assessment time.

requirement of licence condition 1 of the OPAL licence. Since the initial submission ARPANSA has held a series of regulatory meetings with ANSTO Senior Management to agree on a list of actions to be taken as a result of the Periodic Safety Review. In accordance with IAEA recommendations, the PSR should produce a set of corrective actions to improve plant and processes to improve nuclear safety.

- A regulatory guide has been produced on how to determine when a radiofrequency (RF) device is a controlled apparatus under the ARPANS Regulations (1999). This advice can be found on the website at www.arpansa.gov.au/Regulation/guides.cfm#4b.
- In December 2011, ARPANSA inspectors observed an emergency exercise at Lucas Heights for the OPAL research reactor. The inspection report can be found on the ARPANSA website at www.arpansa.gov.au/pubs/regulatory/inspections/R11-14686.pdf.
- During 2011-12 ARPANSA developed a new compliance and enforcement policy. This policy also describes ARPANSA's graded response to non-compliance which is detailed in the guidance at www.arpansa.gov.au/pubs/regulatory/guides/OS-COM-SUP-270J.pdf.
- In February 2012, ARPANSA gave approval to ANSTO to move from an 8 hour to a twelve hour shift roster for the OPAL Operations staff.
- In May 2012, at the request of ARPANSA Operations Services an inspection of the ARPANSA Medical Radiation Services laboratories at Yallambie was undertaken by independent inspectors from Queensland Health appointed under the ARPANS Act. No non-compliances with licence conditions were found and a number of recommendations for improved safety and security practices were made. A summary inspection report will be posted on the ARPANSA website when it is finalised.
- In May 2012, ARPANSA consented to the surrender of facility licence F0200 by ANSTO for the 3 MV Van De Graff generator at Lucas Heights.
- In June 2012, ARPANSA approved a Regulation 51 request by ANSTO to move to a flexible fuel management strategy for the OPAL reactor. The flexible fuel management strategy allows for more flexibility in refuelling of the OPAL reactor so that unscheduled reactor trips do not have extensive knock-on effects for users.
- In June 2012, ARPANSA issued a facility licence to ANSTO to operate the 18 MeV cyclotron at Camperdown, New South Wales.
- In order to conform with a recommendation by the IRRS mission, ARPANSA is developing a *Regulatory Guide: Transport of Radioactive Material*. A series of 3 Defence ARPANSA Liaison Forum meetings were held in August 2011, February 2012, and March 2012 to discuss Defence compliance issues.

Breaches

Breaches with safety implications

Australian Customs and Border Protection Service (Customs) was in breach of the ARPANS Act for possessing a controlled apparatus, a class 4 laser contained in a FLIR (Forward Looking Infrared) device, which was not covered by their source licence (see Table 5). On 1 November 2010, Customs informed ARPANSA of the potential breach and subsequently a new licence application was submitted by Customs. On 16 December 2011, ARPANSA issued Customs with a new licence

Quantitative Key Performance Indicator	2011-12 Budget Target	2011-12 Achieved
Number of breaches by Commonwealth users of radiation of their conditions of licence	<20	2[1]

[1] During the financial year 2011-12, the policy for reporting breaches changed and comparison with previous years is not meaningful, particularly, in relation to the determination of when a non-compliance is to be reported as a breach by ARPANSA in its Quarterly Report. As a result of these new reporting processes during this transitional period, the number of non-compliances which were determined to be breaches by ARPANSA decreased. A revised compliance and enforcement policy, including how breaches are determined, is now available on the ARPANSA website at www.arpansa.gov.au/Regulation/LicenceHolders/index.cfm#1.

authorising their dealings with class 4 lasers.The root cause of the breach was identified as being the licence holder's lack of awareness of their regulatory requirements. The breach was assessed to have moderate safety implications, however, as the FLIR was brought within regulatory control, no enforcement action was taken.

Breaches with no or minor safety implications

A licence holder was found in breach of section 30(2) of the ARPANS Act by failing to comply with licence conditions, which was subsequently determined to have minor safety implications. Due to the corrective actions undertaken by the licensee no enforcement action was considered necessary.

Table 5: Breaches with safety implications

Licensee	Licence number	Nature of breach
Australian Customs and Border Protection Service	S0092	Breach of S31(1) of the ARPANS Act for unauthorised possession and use of a class 4 laser on a forward looking infra-red device on an Australian Customs ship.

Discussion and analysis of financial performance

Financial Report on Performance

For the financial year ending 30 June 2012, ARPANSA reported an operating deficit of $2.39m. This deficit was primarily attributable to changes in the way depreciation expenses are funded by Government.

Total revenue for the year was $26.7m of which 60% is appropriated by government. The remaining amounts relate to fee revenue generated from our licence holders and from the sale of goods and services.

This financial year ARPANSA incurred $29.1m in expenses. Employee benefits account for nearly $18m of this total. Further, $3.1m did not require appropriation in the budget year. This amount was made up of $2.54m in depreciation and amortisation expenses with the balance made up of an increase to the revaluation of long service leave provision as a result of the government's change to the bond rate.

The agency continues to review the efficiency and effectiveness by which it delivers its program to the Australian people to ensure that we operate within our financial constraints.

The agency's non-financial assets were re-valued at 30 June 2012, and now total $28.6m. This includes increases to both the recently-renovated Yallambie building and the associated land holding. As part of the agency's capital replacement program, we invested $5.34m to complete the renovation of stage 2 of the Yallambie facility along with the purchase of new and replacement scientific and computer equipment to support the delivery of our services to the government and the community. Our cash holdings continue to be at levels required to support current resourcing requirements to achieve the agency's strategic objectives.

There have been no developments since the end of the financial year that have affected or may significantly affect the Agency's operations or financial results in the future.

Table 6: ARPANSA Expenses for Outcome 1

Outcome 1: Protection of people and the environment through radiation protection and nuclear safety research, policy, advice, codes, standards, services and regulation	**Budget* 2011-12 $'000 (a)**	**Actual Expenses 2011-12 $'000 (b)**	**Variation $'000 (a)-(b)**
Program 1.1: (Radiation protection and nuclear safety)			
Departmental expenses			
Ordinary annual services (Appropriation Bill No. 1)	16 130	16 130	0
Special Accounts	9 411	9 927	(516)
Expenses not requiring appropriation in the Budget year	2 338	3 080	(742)
Subtotal for Program 1.1	27 879	29 137	(1 258)
Total for Outcome	27 879	29 137	(1 258)

	2009-10	**2010-11**
Average staffing level (FTE)	144	147

* Full year budget, including any subsequent adjustment made to the 2011-12 Budget.

Table 7: ARPANSA Resource Statement – 2011-12

	Actual Available Appropriation for 2011-12 $'000 (a)	Payments Made 2011-12 $'000 (b)	Balance Remaining 2011-12 $'000 (a-b)
Ordinary Annual Services[1]			
Prior year departmental appropriation[2]	2 535	2 535	
Departmental appropriation[3]	18 483	17 903	580
Total	21 018	20 438	580
Total ordinary annual services	21 018	20 438	
Other services[4]			
Departmental non-operating			
Equity injections			
Total			
Total other services			
Special Accounts[5]			
Opening balance	1 602		
Appropriation receipts6	20 438		
Non-appropriation receipts to Special Accounts	12 939		
Payments made		33 323	
Total Special Account	34 979	33 323	1 656
Total resourcing and payments	55 997	53 761	
Less departmental appropriations and equity injections drawn from the above and credited to special accounts	(20 438)	(20 438)	
Total net resourcing for ARPANSA	35 559	33 323	

[1] Appropriation Bill (No.1) 2011-12.

[2] Balance carried from previous year for annual appropriations.

[3] Includes an amount of $2.353 million in 2011-12 for the Administered Capital Budget. For accounting purposes this amount has been designated as 'contributions by owners'.

[4] Appropriation Bill (No.2) 2011-12.

[5] Does not include 'Special Public Money' held in accounts like Other Trust Monies accounts (OTM). Services for other Government and Non-agency Bodies accounts (SOG), or Services for Other Entities and Trust Moneys Special accounts (SOETM).

[6] Appropriation receipts from ARPANSA's annual and special appropriations for 2011-12 included above.

Service charter

ARPANSA has committed to a service charter that sets out the standards of service that all stakeholders can expect from the agency. Amongst other things the charter provides a complaints resolution mechanism and is available in full on the ARPANSA website at www.arpansa.gov.au/AboutUS/corporate/servicecharter.cfm.

ARPANSA's customers are in both the public and private sectors (overseas as well as within Australia) and include:

- people who use radiation in medicine, research and industry (including mining)
- Commonwealth, state and local government agencies
- environment protection agencies
- international organisations
- academia and research organisation
- general public, interest groups and the media.

Services provided by ARPANSA include:

- traceable calibrations of ionising and non ionising radiation monitoring equipment
- the Personal Radiation Monitoring Service (PRMS)
- the assessment of Ultraviolet Protection Factors (UPF)
- advice, measurements, consultancy, and training on a range of radiation protection issues
- the issue of Customs (Prohibited Imports) permits for the importation of radioactive materials into Australia.

Client complaints

As part of the quality management system of ARPANSA services accredited by the National Association of Testing Authorities, all corrective actions arising from client complaints are recorded. In accordance with the quality system, these actions are reported to the ARPANSA Quality Manager and the relevant Branch Head.