# Part 3: Report on Performance

# 3.1 Protect the public, workers 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 effects of radiation in the environment, and providing guidance and advice to industry and the public on how best to mitigate radiation risks.

#### **Major achievements**

- Harmonising solar ultraviolet spectral measurement systems from ARPANSA, Public Health England, and the joint system from the Bureau of Meteorology and the New Zealand National Institute for Water and Atmosphere.
- Completion of the Radiofrequency (RF) Literature review by our RF Expert Panel in March 2014 which confirmed that the exposure limits in ARPANSA's RF Standard continue to provide a high degree of protection against the known health effects of RF electromagnetic fields.
- Collecting radiation dose data for workers across all uranium mines in Australia to assist uranium mining workers to monitor and safely manage their occupational exposure to radiation.

#### Challenges

- Continuing to educate the Australian public about the dangers of sun exposure in a country with more than 400 000 new cases of skin cancer each year and higher than average levels of ultraviolet radiation (UVR) due to Australia's geographical location.
- Continuing to address community concerns about potential health effects from exposure to sources of radiofrequency electromagnetic radiation (RF EMR) including from mobile phones, mobile phone towers, wi-fi and smart meters.
- Expansion of the Australian national radiation dose register to the mining and milling industries, and to Commonwealth licence holders.

# Occupational exposure – ultraviolet radiation protection

Australia has one of highest rates of skin cancer in the world: with more than 400 000 new cases each year and approximately 2 000 deaths from skin cancer per year.



#### Figure 5: Example of UPF rating 'swing tags'



UPF testing of fabric samples

Skin cancer is an avoidable disease and a reduction in UVR exposure will lead to a reduction in skin cancer incidence; the use of sun protection (clothing, hats, sunscreen, sunglasses and shade) can play an important role in this. ARPANSA's National Association of Testing Authorities (NATA)-accredited Ultraviolet Protection Factor (UPF) Testing Service tested 2000 samples of sun protective clothing and hats, sunglasses and other sun protective materials and issued over 4 million labels for sun protective clothing ('swing tags'). Since the testing service began in 1991, over 70 million UPF rating swing tags have been issued. ARPANSA's UPF tags are designed to raise consumer awareness of sun protection strategies and assist in purchasing decisions for effective sun protective clothing.

The ARPANSA UVR monitoring network continues to provide real-time 'live' ultraviolet (UV) Index and exposure data for eleven Australian sites and four RF testing in the RF anechoic chamber

Antarctic stations via the ARPANSA website. The UV Index data (which is updated every minute) is also delivered to mobile phone users through the website and third-party applications. The ARPANSA website also describes protective strategies for avoiding excessive sun exposure. Research projects measuring the UVR exposures of outdoor workers, indoor workers, and other population groups, were carried out in collaboration with Cancer Council Victoria, Queensland Health and the Australian National University.

In October 2013, ARPANSA hosted an international program to support the inter comparison of international solar ultraviolet spectral measurement systems. The program for the first time compared systems from ARPANSA, Public Health England, and the joint system from the Bureau of Meteorology and the New Zealand National Institute for Water and Atmosphere which is based in Melbourne.

# Performance against deliverables

## **Qualitative Deliverables for Program 1.1**

Qualitative Deliverables	2013–14 Reference Point or Target			
Protect the public, workers and environment from radiation exposure				
Devise UV protection strategies for the Australian population and assess their effectiveness	Effective programs in place for assessment of UV exposure to the public and workers			
RESULT	Recent ARPANSA studies of outdoor workers have demonstrated an improvement in the effectiveness of solar UV exposure protection programs for large construction companies			

Overall, the program demonstrated a consistency in measurements taken from each system showing only small variations. Programs like these assist in validating the methodology and verifying ARPANSA's reported UV measurements as well as predictions made by the Bureau of Meteorology, and reinforce confidence in collaborations with the Cancer Councils, Sun Smart and other health related organisations. Together with ARPANSA's public advice, this forms part of a program to reduce the population's UV radiation exposures to assist in reducing the skin cancer rates in Australia.

ARPANSA continues to work within the UV Alert Group (which includes the Cancer Councils from every state and territory, the Bureau of Meteorology and, the New Zealand Cancer Council and New Zealand Health Sponsorship Council) to improve the delivery of UV Index measurements and information on sun protection. ARPANSA as a World Health Organization (WHO) Collaborating Center for Radiation Protection participates 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 encouraging countries to reduce UVR-induced health risks through provision of guidance about effective sun awareness programs. In June 2014, ARPANSA attended the annual international advisory committee Intersun UVR meeting in Geneva and reported on ARPANSA's current UVR work programs.

During this financial year, ARPANSA applied to Standards Australia to have the Shadecloth Standard revised based upon concerns about limitations of the existing Standard. Originally designed for horticultural use, shadecloths are now also used in a variety of outdoor shade structures in homes, public spaces, swimming pools, nurseries and childcare centres to provide shade for people. ARPANSA's submission to Standards Australia to reopen the Shadecloth Standard was successful. It is likely that the revised Australian Standard for shadecloth will incorporate revised test methods and a rating system to assist consumers in identifying products that provide appropriate levels of personal sun protection.

This financial year ARPANSA also provided input into the review of the Australian Standard for Sun Protective Clothing, Sunglasses and Fashion Spectacles and Lasers.

# Monitor population exposures to electric and magnetic fields and electromagnetic radiation

In July 2013, ARPANSA released version 11 of its Environmental Electromagnetic Energy (EME) Report template (available from www.arpansa. gov.au/emereports/reports.cfm). The ARPANSA Environmental EME Report is a statement of the maximum calculated levels of radiofrequency radiation (RF) that will be produced around a proposed wireless base station or antenna following an installation or upgrade of equipment. This report is generally produced by a network operator (such as a mobile phone company) or consultants working on their behalf. In addition NBN Co is using the ARPANSA EME Report for the wireless base stations being deployed as a part of the National Broadband Network. After consultation with the Electromagnetic Energy (EME) Reference Group (EMERG), ARPANSA introduced changes to the format of the reporting template to make the report easier to read and understand. Completion of this report is part of the industry compliance process and by simplifying this process, ARPANSA supports the objectives of the Australian Government's Deregulation Agenda.

In response to increasing public concerns about the potential health effects from public exposure to radiofrequency (RF) sources, ARPANSA conducted a survey of RF measurements at forty-one sites across Melbourne, measuring the levels of RF produced by man-made sources, including mobile telephone, television and radio broadcast towers. The measurements were performed prior to the shutdown of analog broadcasting in Melbourne on 10 December 2013, to provide a baseline for comparison of future exposure levels. All the measured RF levels were well below the permitted limit for the general public given Radiation Protection Series (RPS) No. 3: Radiation Protection Standard for Maximum Exposure Levels to radiofrequency Fields – 3 kHz to 300 GHz (the ARPANSA RF Standard). The highest measured levels were equivalent to 2.4% of the RPS3 limit. The results showed that AM radio signals were usually the largest measured contributor to RF levels across the suburbs, except at sites with good line of sight to nearby mobile phone towers.

On 9 December 2013, ARPANSA published a technical report on preliminary RF measurements of an installed mesh network smart meter which found

# CASE STUDY Advising the public about smart meters

ARPANSA, as the Commonwealth's radiation regulator, does not regulate smart meters. State and territory governments are directly responsible for the planning and regulation of electrical infrastructure such as smart meters and this role includes a requirement to undertake rigorous environmental assessments which consider the potential health impacts of any electrical infrastructure upon local communities.

RF EMR emissions from smart meters and other wireless devices are regulated by the Australian Communications and Media Authority (ACMA) under the terms of the ACMA Radiocommunications (Electromagnetic Radiation-Human Exposure) Standard 2003. This standard makes mandatory the exposure limits in the ARPANSA RF Standard which sets limits for human exposure to RF fields from all sources including smart meters. The exposure limits in the ARPANSA Standard are supported by current scientific knowledge and are intended to protect people of all ages and health status against all known adverse health effects.

### **Health effects**

The combination of the relatively low power of the smart meter transmitter and its location on the outside of the home away from people means the overall RF EMR exposure from smart meters is expected to be very low and well below current exposure limits. Health authorities around the world, including ARPANSA and the World Health Organization, have examined the scientific evidence regarding possible health effects from RF EMR exposure and have concluded that the weight of evidence does not demonstrate the existence of health effects below current exposure limits.

#### **ARPANSA smart meter survey**

In early 2014, ARPANSA conducted initial measurements on a smart meter which confirmed the measurement levels expected to occur in an everyday household (ARPANSA Technical Report Series No. 163\*). This study concerned measurements from an installed Mesh Network smart meter and indicated over 15 000 pulses in 25 hours. Of significance, these measurements found that the transmissions were not continuous and occurred less than 0.08% of those 25 hours at an average intensity of 0.00015% of the instantaneous exposure limit in the Australian RF standard for the general public. These levels are far less than the exposures typically encountered by people daily from many other RF EMR sources, including broadcast radio and television, mobile telephony and others. On this basis, there is no established evidence of adverse health effects from these measurements, which are typical for residents with smart meters installed at their homes.

### **Moving forward**

ARPANSA is continually reviewing emerging research into the potential health effects of the RF EMR emissions from smart meters and other devices. Should new scientific evidence indicate that the current ARPANSA RF Standard does not adequately protect the health of Australians, then appropriate regulatory changes would be recommended to the Australian Government. This year, ARPANSA's Radiofrequency Expert Panel concluded that the ARPANSA RF Standard continues to provide adequate protection to users of RF EMR.



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 falls 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.

Wijayasinghe, D, and Karipidis, K, 2013. 'ARPANSA Preliminary Measurements of Radiofrequency Transmissions from a Mesh Radio Smart Meter', Technical Report Series No. 163, December 2013 that measured exposures were well below the public exposure limits of the ARPANSA RF Standard. This study is discussed in more detail in the accompanying Case Study - Advising the public about Smart Meters (p.29). The technical report is available from www. arpansa.gov.au/pubs/technicalreports/tr163.pdf. These findings should provide some reassurance to consumers concerned about potential health effects likely to arise as a result of having a smart meter installed at their home.

# Review of radiofrequency health effects research – scientific literature 2000-2012

On 14 March 2014, ARPANSA's Radiofrequency Expert Panel published its Review of Radiofrequency Health Effects Research – Scientific Literature 2000-2012 (www.arpansa.gov.au/pubs/technicalreports/tr164. pdf). The Expert Panel review found that the science behind the ARPANSA radiofrequency (RF) exposure Standard remains sound and the exposure limits in the Standard continue to provide a high degree of protection against the known health effects of RF electromagnetic fields. However, the Expert Panel also concluded that, on the basis of improved knowledge, some of the reference levels in the Standard are not as conservative under certain circumstances as originally thought; but there is no evidence that this difference has an impact on health. The Expert Panel identified areas where the RF Standard and its annexes could be updated, to incorporate increased scientific knowledge and to better harmonise these with revised international guidance.

### **EMR literature survey**

During this financial year, ARPANSA continued to publish monthly summaries of recent scientific studies addressing electromagnetic radiation and health effects. Papers are selected and reviewed on the basis of importance to the protection of health, on perceived likely interest to the wider public and where Australian research is reported. The summaries are available at www.arpansa.gov.au/RadiationProtection/ EMR/literature. These summaries are intended to communicate and explain emerging highly technical scientific research for members of the public concerned about potential health effects from their exposure to sources of electromagnetic radiation.

# ARPANSA guidelines for ELF and static electric and magnetic fields

ARPANSA, through the Radiation Health Committee, is currently developing *Guidelines for Managing Exposure to Electric and Magnetic Fields* – 0 to *3kHz* to replace the National Health and Medical Research Council (NHMRC) Interim Guidelines published in 1989. The new Guidelines will align with the most recent scientific research and guidance from the International Commission on Non-Ionizing Radiation Protection (ICNIRP) published in 2010. The new Guidelines focus upon limiting human exposure to electric and magnetic fields in the frequency range of 0 to 3 kHz (which is extremely low frequency or ELF) and will include basic restrictions for occupational and public exposure, indicative reference levels, advice on how to reduce



ARPANSA Dose Register team at work

exposure through precautionary measures, and risk management for exposed persons. They will include a recommendation to assess the potential for reducing exposure to magnetic fields where this can be done in a cost-effective way.

# The Australian National Radiation Dose Register

Occupational exposure to ionising or non-ionising radiation occurs across a variety of work environments which 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 radiation levels present in work environments to assist workers to take the necessary steps to reduce their occupational exposure.

Uranium workers are one such occupationally exposed group who are monitored for exposure to ionising radiation. Radiation protection of workers requires the maintenance of radiation dose records to assess compliance with occupational dose limits and to minimise the radiation health risk to individuals through the continued improvement of work practices. ARPANSA operates and maintains the Australian National Radiation Dose Register (the Dose Register) for the collection, storage and auditing of radiation dose histories for uranium mine workers. The Dose Register is an electronic



Promotional poster developed as part of the educational outreach program for the Australian National Radiation Dose Register

database which stores radiation dose information for workers who are occupationally exposed to radiation. Uranium mining workers can request a copy of their dose history from ARPANSA and they can track their dose records throughout their career in the uranium mining industry. A worker's dose history report contains all past doses received while working in applicable industries in Australia, and while registered with the Dose Register.

# Performance against key performance indicators

#### **Qualitative Key Performance Indicators**

Qualitative Indicator	2013-14 Reference Point or Target			
Protect the public, workers and environment from radiation exposure				
Control radiation dose to uranium mining workers	Annual reporting of trend in radiation doses received by workers compiled from Australian National Radiation Dose Register provides evidence or optimisation of radiation protection in the uranium mining industry.			
RESULT	Delivered by providing trend updates at national stakeholder meetings, conferences and Senate Estimates. Analysis of ANRDR data has shown an overall downward trend in radiation doses received by workers in the uranium mining industry. The information included in the ANRDR will assist industry to strengthen and maintain safe work practices for occupational exposed workers in the uranium mining industry			



ARPANSA Radiation Protection Services staff processing TLD badges which measure occupational radiation dose to determine the radiation dose to the wearers

The Dose Register has now been successfully implemented across all four operating uranium mines in Australia: Olympic Dam, Beverley and Honeymoon in South Australia, and Ranger in the Northern Territory. However, Honeymoon has been in a care and maintenance phase since November 2013. The Dose register currently holds dose records for more than 31 700 workers from the uranium mining and milling industry.

In supporting the control of doses to uranium workers, ARPANSA has focused upon reporting trends to key stakeholders as required, or on request, and ARPANSA is confident that this measure has been successfully met. Now that all operating uranium mines in Australia are actively providing records to the Dose Register, the trend data will become more meaningful and will allow ARPANSA to characterise radiation doses to uranium workers at the national level.

The Dose Register is now being considered for rollout to other industries where workers may be exposed to radiation sources, such as mineral sands mining and processing operations, and applicable Commonwealth practices. During this financial year, ARPANSA performed a review of the Australian mineral sands mining and processing industry to evaluate the feasibility of expanding the Register beyond uranium mining. In February 2014, a technical report outlining the key findings and recommendations of the review was published.<sup>14</sup> This report will assist ARPANSA, regulatory authorities, and operators in establishing the legal and practical requirements for the proposed

implementation of the Dose Register to occupationally exposed workers in the mineral sands industry.

ARPANSA has also commenced stakeholder engagement to include occupationally exposed Commonwealth employees in the Dose Register. During this financial year, ARPANSA performed a survey of applicable Commonwealth Licence Holders to assess the current status of dose record management practices, and identify possible issues relating to the disclosure of workers' dose records to ARPANSA.

# **Protection of the environment**

ARPANSA has also provided ongoing advice, as part of follow-up to work required under an *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral to the Department of Environment from Cameco Australia Pty Limited relating to their application under the EPBC Act for their proposed Kintyre Uranium Project. ARPANSA's advice included an adequacy check of key areas and confirmation that dose constraints were in accordance with international best practices specified by the International Commission on Radiological Protection (ICRP).

# **Protection of workers**

Changes to recommendations made in 2011 by the ICRP on the calculation of radiation doses from the inhalation of radon and radon progeny had significant

<sup>14.</sup> Collett, S, Guilfoyle, R, Paritsky, B and O'Brien, R, 'Proposed Expansion of the Australian National Radiation Dose Register to the Mineral Sands Mining and Processing Industry', ARPANSA Technical Report Series No. 165, February 2014.

implications for assessing doses to uranium mine workers. In response, ARPANSA has formed a small group with representatives from the uranium mining industry, and state and territory regulatory authorities to coordinate an Australian response to these changes. In December 2013, the group commenced a program of measurements in the Olympic Dam mine at Roxby Downs, South Australia, to characterise the radioactive aerosols in different work situations within the mine and it is anticipated that these results will be published in late 2014.

# **Comprehensive Nuclear Test-Ban Treaty**

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) bans all nuclear explosions, whether they are for civilian or military purposes. An International Monitoring System has been established to monitor compliance with the CTBT. As a signatory to the CTBT, Australia is committed to establish, operate and maintain air monitoring facilities at seven locations, which form part of the International Monitoring System. During this financial year, ARPANSA continued to operate and maintain the radionuclide air monitoring stations at Melbourne, Perth, Townsville, Darwin, the Cocos Islands, Mawson Base (Antarctica) and Macquarie Island, Australia, including two noble gas analyser facilities located in Melbourne and Darwin. As part of this commitment, ARPANSA also continued to act as a certified laboratory for analysis of check samples, as part of the CTBT laboratory network.

# **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' disposal facility. Australia's national inventory of radioactive waste is recorded and published by ARPANSA on the IAEA website for the Net Enabled Waste Management Database (NEWMDB)<sup>15</sup>, as part of our commitment to the *Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management*.

### **ARPANSA radiation emergency preparedness**

Radioactive material poses potential health risks if released into the environment through accidental 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.

The Accident Reporting and Guidance Operating System (ARGOS) is ARPANSA's primary atmospheric dispersion modelling and decision support software tool and has been applied to a range of radiological and nuclear release situations, including emergencies and planning. ARGOS can provide an overview of the situation, create a prognosis of how the situation evolves, and calculate the consequences of the situation. ARPANSA continues to strengthen this tool by participating in the annual ARGOS consortium and user group meetings. Participation in the ARGOS Consortium and User Group meetings and through joint international collaborations has established ARPANSA as a world leader in the application of ARGOS as a decision support tool.

# **The ARPANSA Incident Management Plan**

ARPANSA has continued to maintain specialised radiation emergency capabilities in line with the ARPANSA Incident Management Plan, including the Operations Centre and provision of a 24 hour a day point of contact. Work has progressed towards the finalisation of additional processes and procedures to support the full implementation of the Incident Management Plan across the Agency in preparation for testing and exercising in 2014–15. ARPANSA participated in two IAEA international Convex-2a exercises. The aim of these exercises was to test National Competent Authorities' ability to respond to hypothetical radiological emergency scenarios. Participation in the exercises enabled testing of the responsiveness of ARPANSA's Operations Centre.

During this financial year there were no security incidents requiring reporting.

<sup>15.</sup> The NEWMDB contains information on national radioactive waste management programs, radioactive waste inventories, radioactive waste disposal, relevant laws and regulations, waste management policies, and plans and activities The NEWMDB contains information on national radioactive waste management programs, radioactive waste inventories, radioactive waste disposal, relevant laws and regulations, waste management policies, and plans and activities.

# ARPANSA radiation emergency response capability

ARPANSA maintained specialised radiation emergency capabilities in line with Australian emergency planning arrangements and continued its training cycle by providing emergency response training to its staff, including in the certification in the use of breathing apparatus.

ARPANSA emergency response personnel took part in joint training exercises with other government agencies on advanced radiation and nuclear detection techniques. In September 2013, ARPANSA personnel also attended, as experts, an IAEA Response and Assistance Network capacity building exercise within the Fukushima Prefecture, Japan.

ARPANSA undertook a gamma spectroscopy capability exercise for Australasian radionuclide measurement laboratories. Six laboratories in Australia and New Zealand were sent a reference water sample for testing for six anthropogenic radionuclides. The technical report on this exercise was published in June 2014 and is available from www.arpansa.gov.au/pubs/technicalreports/tr169.pdf.

# Performance against deliverables

**Qualitative Deliverables for Program 1.1** 

Qualitative Deliverables	2013–14 Reference Point or Target				
Protect the public, workers and environment from radiation exposure					
Enhanced system for response to radiological and nuclear threats and events consistent with international guidance and best practice	The ARPANSA Incident Management Plan is implemented and tested				
RESULT	Partially met - Elements of Incident Management Plan covering the ARPANSA Operation Centre successfully tested as part of an IAEA Exercise program. A review of Business Continuity Planning resulted in the implementation of an alternate off-campus site to store a portion of the response kit.				

#### **Quantitative Key Performance Indicators**

Quantitative Indicator	2012–13 Revised Budget	2013–14 Budget Target	2014–15 Forward Year 1	2015–16 Forward Year 2	2016–17 Forward Year 3		
Protect the public, workers and environment from radiation exposure							
Number of security incidents involving high activity radioactive sources requiring immediate reporting	<2	<2	<2	<2	<2		
RESULT	0	0	N/A	N/A	N/A		

# CASE STUDY Working with industry and regulators to protect radiation workers

A small but expert team in the Radiation Health Service Branch at ARPANSA operates and maintains the Australian National Radiation Dose Register (Dose Register) for the collection and long-term storage of radiation dose records for workers who are occupationally exposed in the Australian uranium mining and milling industry. This year the Dose Register team achieved a significant milestone - complete implementation of the Dose Register to the uranium mining industry. Achievement of this milestone, from its initiation in 1 July 2010, was only possible with the valuable contribution and strong support provided by operators, regulators and industry groups.

The Dose Register team has engaged with key stakeholders and worked through the technical issues to achieve this milestone. The Dose Register has been implemented to all four uranium mines that are licensed to operate in Australia: Olympic Dam, Beverley and Honeymoon in South Australia, and Ranger in the Northern Territory. Records for more than 31 700 individual workers in the uranium mining industry are currently registered in the Dose Register. This includes historical dose records dating back to commencement of uranium production for some operators (Beverley and Honeymoon).

ARPANSA performs periodic analysis of the Dose Register data in order to characterise the occupational exposure situation at the national level. The average and maximum annual effective doses to Australian uranium workers has exhibited an overall downward trend over the past 10 years. Doses to uranium mine workers have remained consistently low, with the average dose being kept at less than a tenth of the annual dose limit, as shown below.



Average and maximum effective dose trends for all Australian uranium mine workers (2004-2013)

The Dose Register works to promote uniformity and achieve a best practice approach for recording and maintaining occupational dose records that can be requested by workers. ARPANSA is currently seeking to expand the Dose Register beyond uranium mining to include occupationally exposed workers in other industries. This will initially include workers in the mineral sands mining and processing industry, and applicable Commonwealth licence holders. In February 2014, ARPANSA published Technical Report No. 165 which presents the findings of a review assessing the current status of dose record management practices in the mineral sands mining and processing industry. This report considers the legal and practical requirements for the proposed expansion of the Dose Register to cover occupationally exposed workers in the mineral sands industry.