



Australian Government
**Australian Radiation Protection
and Nuclear Safety Agency**



Quarterly Report
of the
Chief Executive Officer of ARPANSA

October to December 2018



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Acknowledgement of Country

ARPANSA respectfully acknowledges Australia's Aboriginal and Torres Strait Islander communities and their rich culture and pays respect to their Elders past and present. We acknowledge Aboriginal and Torres Strait Islander peoples as Australia's first peoples and as the Traditional Owners and custodians of the land and water on which we rely.

We recognise and value the ongoing contribution of Aboriginal and Torres Strait Islander peoples and communities to Australian life and how this enriches us. We embrace the spirit of reconciliation, working towards the equality of outcomes and ensuring an equal voice.

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Letter of transmittal

12 July 2019

Senator the Hon Richard Colbeck
Minister for Aged Care and Senior Australians
Minister for Youth and Sport
Senate
Parliament House
Canberra ACT 2600

Dear Minister

The *Australian Radiation Protection and Nuclear Safety Act 1998* (the Act) requires the Chief Executive Officer (CEO) of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to submit to the Minister, at the end of each quarter, a report on:

- the operations during the quarter of the CEO, ARPANSA, the Radiation Health and Safety Advisory Council (the Council), the Nuclear Safety Committee (the NSC) and the Radiation Health Committee
- details of directions given by the Minister to the CEO under section 16 of the Act
- details of directions given by the CEO under section 41 of the Act
- details of improvement notices given by inspectors under section 80A of the Act
- details of any breach of licence conditions by a licensee, of which the CEO is aware
- details of all reports received by the CEO from the Council and the NSC under Part 4, paragraphs 20(f) or 26(1)(d) of the Act, and
- A list of all facilities licensed under Part 5 of the Act.

I am pleased to provide you with a report, meeting the requirements of the Act, covering the period 1 October to 31 December 2018.

Please note that subsection 60(6) of the Act requires you to cause a copy of the report to be laid before each House of the Parliament within 15 sitting days of the day on which this report was given to you.

Yours sincerely



Dr Carl-Magnus Larsson
CEO of ARPANSA

The operations of the CEO and ARPANSA

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is the Australian Government's primary authority on radiation protection and nuclear safety. Our purpose is to protect the Australian people and the environment from the harmful effects of radiation, through understanding risks, best practice regulation, research, policy, services, partnerships and engaging with the community.

ARPANSA sits within the Department of Health portfolio and has a single outcome, as set out in the 2018–19 Portfolio Budget Statements (PBS):

Protection of people and the environment through radiation protection and nuclear safety research, policy, advice, codes, standards, services and regulation.

The Radiation Protection and Nuclear Safety Program, contained within the 2018–19 PBS, describes four performance objectives against which ARPANSA seeks to achieve its outcome. These are:

- protecting the public, workers and the environment from radiation exposure,
- promoting radiological and nuclear safety and security, and emergency preparedness,
- promoting the safe and effective use of ionising radiation in medicine, and
- ensuring risk-informed and efficient regulation.

The report on the operations of the CEO and ARPANSA focuses on these criteria as well as key international engagement undertaken by the agency.

Protecting the public, workers and the environment from radiation exposure

Australian National Radiation Dose Register

In December 2018, ARPANSA approved a project to make improvements to the employer interface for the Australian National Radiation Dose Register (ANRDR), a database which stores and maintains radiation dose records for workers occupationally exposed to radiation in Australia. The work will result in the capture of additional critical information on dose assessment methodologies. This will ensure that records are traceable to identified service providers and methodologies, allowing for future verification and improved data quality. It will also feed information contained in the ANRDR directly back to employers, to improve the identification of individuals and provide access to uploaded files for record management.

The ANRDR data help to inform better work practices and improve radiation safety for occupationally exposed workers in Australia. The ANRDR holds dose records for around 44 000 workers. This currently includes full coverage of workers from all state and territory-licensed uranium mining and milling operations, and partial coverage of workers from Commonwealth licence holders, state and territory regulatory bodies, and the mineral sands mining and processing industry. The ultimate goal for the ANRDR is to cover all occupationally exposed workers in Australia.

Monitor and mitigate population exposures to electric and magnetic (and electromagnetic) energy

The Electromagnetic Energy Reference Group (EMERG) met on 23 October 2018. ARPANSA established bi-annual EMERG meetings to discuss issues related to electromagnetic energy (EME)

and health, and receive input from the community and other stakeholders. This meeting provided updates on the review of international radiofrequency guidelines, as well as a revised Australian radiofrequency standard. Potential avenues to address electromagnetic hypersensitivity conditions—through the Commonwealth Department of Health—were also discussed. A request was made to utilise the medical (clinical) expertise in EMERG to review EME-related studies; however, due to the size of the task it was noted that the relevant EMERG representatives and ARPANSA staff do not have capacity to undertake a full systematic review of the studies.

ARPANSA also informed EMERG that future EME activities within the agency are under review within the context of strategic agency priorities. Engagement with organised community groups and others, both within and outside EMERG, has enabled ARPANSA to better understand the source of community concern around EME and determine the type of information or actions required to address the concerns. More information can be found at www.arpansa.gov.au/about-us/what-we-do/national-collaboration/emerg.

On 23 October 2018, ARPANSA attended the Centre for Population Health Research on Electromagnetic Energy (PRESEE) information event at Monash University. The event provided information on PRESEE's epidemiological research on EME and health (details are available at <https://www.monash.edu/medicine/sphpm/units/clinepi/presee>). ARPANSA is an associate investigator of PRESEE and is a member of the PRESEE advisory board. Through these activities ARPANSA provides advice on PRESEE's research to address gaps in the knowledge in EME and health.

ARPANSA attended the Science and Wireless Workshop on 28 November 2018, hosted by the Australian Centre for Electromagnetic Bioeffects Research (ACEBR) at the University of Wollongong (<https://acebr.uow.edu.au/events/UOW251889>). The event provided information on the experimental research conducted by ACEBR on EME and health including research on electromagnetic hypersensitivity; details on the research conducted by ACEBR are available at <https://acebr.uow.edu.au/research-programs/index>. ARPANSA is a member of the ACEBR advisory board and similar to the involvement with PRESEE, ARPANSA provides advice on research conducted by ACEBR to address gaps in the knowledge in EME and health.

ARPANSA, in conjunction with the University of Wollongong, Monash University and the University of Auckland, published a study on 9 December 2018 titled *Mobile phone use and incidence of brain tumour histological types, grading or anatomical location: a population-based ecological study* in the British Medical Journal Open (<https://bmjopen.bmj.com/content/8/12/e024489>). The study reviewed the incidence of different types of brain tumours in adults including glioma, glioblastoma and meningioma diagnosed between 1982 and 2013. The brain cancer diagnoses of 16 825 cases was compared with the uptake of mobile phone subscriptions in Australia and found:

- The overall brain tumour rates remained stable throughout this period and showed no increase when compared with the increase of mobile phone use in Australia.
- There was an increase of glioblastoma during 1993 and 2002 which was attributed to better diagnostic techniques with advances made in magnetic resonance imaging (MRI) technology.
- Although mobile phone use has risen rapidly since 2003 there has been no increase in any brain tumour types since then.
- Since 2003 there has also been no increase in brain tumours of the temporal lobe, which is the location most exposed when using a mobile phone.

The results of this study strengthen the advice provided by ARPANSA that there is no substantiated evidence that using mobile phones causes health effects.

Solar ultraviolet radiation and sun protection

On 22 October 2018, historical Ultraviolet Radiation (UVR) Index data covering the period 2007 to 2016 was quality-checked and loaded onto the data.gov.au website. ARPANSA measures solar UVR at 12 sites around Australia and four sites in the Australian Antarctic territories. The UVR Index data generated by the network is used to raise awareness in Australia of the levels of UVR exposure in conjunction with messaging on the health risks associated with excessive sun exposure. The data set contains UVR Index information for each year, recorded at one minute intervals at each of the Australian mainland stations, and is freely available for download by the public and interested researchers. Members of the public, government and non-government organisations, as well as researchers can use the historical data to find new ways for people to reduce their exposure from or raise public awareness of UVR, a leading cause of skin cancer and significant health burden in Australia. ARPANSA's release of the historical UVR Index data is therefore expected to help improve protection of the public and workers from this type of radiation. Historical measurements are available for eleven locations across Australia: Adelaide, Alice Springs, Brisbane, Canberra, Darwin, Kingston, Melbourne, Newcastle, Perth, Sydney and Townsville.

National uniformity

The stakeholder consultation period for the draft *National Directory for Radiation Protection (NDRP)* 2nd edition closed on 3 November 2018. Stakeholders' comments are being reviewed and any necessary changes will be incorporated.

The NDRP has been developed to facilitate harmonised management of radiation risks across all Australian jurisdictions, for the benefit of regulators, businesses, practitioners, educators, consumers and other stakeholders, and ultimately for the health and safety of people and of the environment. The scope includes all sectors involved in implementing controls related to radiation risks, including but not limited to mining, mineral processing, research, education and occupational health and safety. The NDRP promotes risk-informed regulation and specifies which sources are below regulatory concern.

The first edition of the NDRP has been a key tool for promoting national uniformity between jurisdictions and the NDRP 2nd edition is expected to continue this role. Producing the NDRP aligns with ARPANSA's legislated function to promote national uniformity in radiation protection and nuclear safety.

Standards development

During the quarter, ARPANSA published two new codes (outlined below) as part of the Radiation Protection Series (RPS), developed by the Radiation Health Committee. The codes are intended for adoption by each jurisdiction within their legislative frameworks as part of a nationally uniform approach to radiation protection. These codes apply in conjunction with the *Code for Radiation Protection in Planned Exposure Situations (RPS C-1, 2016)*, which sets out the requirements in Australia for the protection of occupationally-exposed persons, and any related exposures to the public or the environment.

The *Code for Disposal Facilities for Solid Radioactive Waste (RPS C-3, 2018)* was published in October 2018. This code describes the 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 safety case and supporting safety assessment provide the basis for demonstration of

safety and for authorisation. They will evolve with the development of the disposal facility, and will assist and guide decisions on its siting, design, operation and closure. This publication, together with the RPS C-1, supersedes the Radiation Health Series No. 35 *Code of practice for the near-surface disposal of radioactive waste in Australia (1992)* (NHMRC 1992), while maintaining its protective intent. The code can be incorporated into regulatory instruments to ensure a uniform approach to siting, design, operation and closure of such facilities across Australia.

The *Code of Radiation Protection Requirements for Industrial Radiography* (RPS C-4, 2018) was published in October 2018. Industrial radiography is widely carried out across Australia, involving many practitioners who work in more than one jurisdiction. This code sets the specific radiation protection requirements in Australia for the protection of occupationally exposed persons and the public in planned exposure situations involving industrial radiography. It complements the overarching requirements contained in RPS C-1. RPS C-4 supersedes the *Code of Practice for the Safe Use of Industrial Radiography Equipment (1989)*, Radiation Health Series No.31. The code can be incorporated into regulatory instruments to ensure a uniform approach.

During the quarter, ARPANSA also continued to review and respond to public comments on the draft *Code for Radiation Protection in Medical Exposure* (Medical Exposure Code). The Medical Exposure Code outlines requirements for use by state and territory regulators to ensure appropriate radiation protection in relation to the exposures of patients, including volunteers exposed in medical research, and carers assisting in the conduct of a medical exposure to radiation. The Medical Exposure Code, in combination with RPS C-1, is intended to replace the existing requirements in the *Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation* (RPS 14, 2008). The new code aims to align Australia with *General Safety Requirements Part 3 - Radiation Protection and Safety of Radiation Sources*, which is an International Atomic Energy Agency (IAEA) Safety Standard for protecting people and the environment. Consultation is an important part of the development of this code as there are millions of medical procedures involving radiation performed each year by practitioners across Australia who are required to comply with this code. During the period for public comment from 23 February 2018 to 25 May 2018, a total of 430 comments were received from 27 respondents. The working group is finalising responses to the comments and changes to the Code. A completed set of responses and a revised text will be circulated to the Radiation Health Committee for approval.

Regulatory guides

In October 2018, ARPANSA published the Regulatory Guide: *Decommissioning of Controlled Facilities*. This Regulatory Guide provides guidance to ARPANSA's licence holders, technical support organisations, and other interested parties on planning, conducting and completing the decommissioning of nuclear installations and radiation facilities. It aims to assist in ensuring that the decommissioning of these facilities is conducted in a safe and environmentally acceptable manner and in accordance with international best practice. The document applies to all current and future nuclear installations regulated by ARPANSA, and will be used for regulatory assessment of licence applications for the decommissioning of a controlled facility.

Promoting radiological and nuclear safety and security, and emergency preparedness

International monitoring system

The Australian Comprehensive Nuclear-Test-Ban Treaty (CTBT) Radionuclide Laboratory was in service for the entire quarter, and six atmospheric monitoring samples were received from overseas monitoring stations and independently analysed. Our analysis verified the measurements obtained from those stations, and adds to the credibility of the international monitoring system. As part of Australia's ongoing commitment to the CTBT, ARPANSA operates and maintains the Australian CTBT Radionuclide Laboratory in Melbourne and seven radionuclide air particulate monitoring stations that are part of the CTBT International Monitoring System. Australia's stations are located in Melbourne, Perth, Townsville, Darwin, the Cocos Islands, Macquarie Island, and Mawson Base (Antarctica). Two noble gas monitoring facilities are co-located with the air particulate monitoring stations in Melbourne and Darwin. Data is provided to the CTBT Organization on a daily basis.

Maintenance of the Australian CTBT monitoring stations and laboratory forms a part of the worldwide coverage of the international monitoring system. This is an important part of the verification regime for the prevention of clandestine nuclear tests around the globe. The seven particulate stations operated by ARPANSA provided data to the CTBT Organization more than 95 per cent of the time. Such a high level of data availability means that Australia is providing a highly reliable component of the verification regime.

In December 2018, the Pacific Northwest Laboratory (PNNL) and Australia's Nuclear Science and Technology Organisation (ANSTO) hosted the 7th Workshop on Signatures of Man-made Isotope Production (WOSMIP) in Sydney. The workshop provided a unique forum for technical discussions and collaborations on the impact of radioisotopes released from civil and industrial sources on nuclear explosion monitoring in support of the CTBT. Attendance at this event provided ARPANSA with an opportunity to engage with the worldwide community on ways of understanding and possibly reducing the background radiation created as part of man-made isotope production, thus enhancing capabilities in detecting signs of nuclear weapon tests.

Emergency preparedness

ARPANSA participated in an International Atomic Energy Agency (IAEA) emergency preparedness exercise from 16–18 October 2018. The Department of Home Affairs and Department of Foreign Affairs and Trade also participated, and the Department of Health observed the exercise.

Exercises are held to test the operational arrangements of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, and are called Convention Exercises, or ConvEx.

As the designated National Competent Authority under the Early Notification and Assistance Conventions (ENAC), it is important that ARPANSA maintains an effective operating relationship with the Australian Government Crisis Coordination Centre, which is the National Warning Point under the ENAC. Australia's participation in the ConvEx involved the exercising of Australian Government-wide coordination mechanisms, which clarified each organisation's roles and responsibilities. This has improved Australia's readiness to respond in a timely manner to a request for assistance from the international community under Article 2 of the Assistance Convention.

Promoting the safe and effective use of ionising radiation in medicine

New medical linear accelerator

Building works associated with ARPANSA's new medical linear accelerator (linac) were completed during the quarter, and the linac installed. Initial mechanical and electrical tests were conducted prior to the formal acceptance procedure, which was completed on 14 December. Funded by the Australian Government in the 2017–18 Budget, the new linac will ensure that ARPANSA can maintain the national Primary Standard for Ionizing Radiation against which all radiotherapy in Australia is benchmarked. The new linac will support the Primary Standards Dosimetry Laboratory to maintain its internationally recognised status and continue to ensure quality and safety for radiotherapy treatments across Australia. The new linac is also the key enabler for the Australian Clinical Dosimetry Service (ACDS) to maintain and develop its role as the sole radiotherapy dose auditor.

Australian Clinical Dosimetry Service

The ACDS provides all radiation oncology service providers in Australia with a source of independent checks for equipment and patient doses on a cost-recovered basis. This enables an integrated national approach to promoting safety and quality in radiotherapy, which is expected to lead to further improvements in radiotherapy treatment outcomes. During the quarter, three New Zealand radiotherapy facilities also signed-up to the ACDS service.

During the quarter, the ACDS performed initial measurements on the Australian Magnetic Resonance Imaging (MRI) linac in Liverpool, New South Wales, to develop the ACDS' capacity to measure radiotherapy doses in the presence of a magnetic field. The MRI-linac is a new technology in radiotherapy that will be used for patient cancer treatment for the first time in Australia in 2019. Combining MRI with a linac offers unprecedented ability to see and target cancers, for example in prostate cancer where it is difficult to outline the tumour on a X-ray or CT scan. However the MRI's magnetic fields affect the delivery of radiation dose during treatment and also affect measurements made to check the performance of the equipment. The tests conducted by the ACDS are required to ensure that these effects are properly understood and included in measurement checks and in the computer software that calculates the treatment dose to the patient. The ACDS will provide reference dose checks, and full end-to-end tests on new MRI-linacs before first clinical use, helping to ensure the highest standard of patient safety with new cancer treatment technology.

Primary Standards Dosimetry Laboratory

As a part of ARPANSA's regular calibration services for radiotherapy providers and medical industry users of ionising radiation, ARPANSA calibrated nine therapy dosimeters and two neutron monitors for the quarter. Clinics use therapy dosimeters to determine the radiation dose delivered during radiotherapy. Accurate radiation dose delivery is vital for treatment efficacy and patient safety.

In support of these services and the measurement of doses used in radiotherapy, ARPANSA has developed computer models of the response of common and new radiotherapy detectors to submit to an International Atomic Energy Agency (IAEA) working group to contribute to new dosimetry protocols. During the quarter, computer simulations were completed on eight different chamber types and submitted to the IAEA. The experimental results for eight different chambers types comprising of a total number of ninety seven measurements were also submitted to the IAEA dosimetry protocol working group. Once complete, the resulting protocols will be adopted by all radiotherapy providers within Australia to ensure accurate and safe dose delivery to patients.

Medical imaging

ARPANSA's National Diagnostic Reference Level Service (NDRLS) had a total of 2334 survey reports submitted in the quarter, compared with 1660 in the same period last year. Thirty-five new imaging facilities also signed-up to participate. The NDRLS surveys, completed by participating imaging facilities, collect data on metrics for patient dose from ionising radiation in diagnostic imaging, particularly for computed tomography (CT). ARPANSA uses this data to calculate Australian Diagnostic Reference Levels (DRLs) for common types of CT scans. A larger data sample gives increased confidence in the DRLs that ARPANSA sets. The DRLs encourage imaging facilities to review their practice, and ensure an appropriate balance of benefit and risk, by providing a point of comparison so a given facility can compare their practice with that of their peers. This helps to avoid excess radiation doses to patients from medical imaging.

Ensuring risk-informed and efficient regulation

International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service (IRRS) mission to Australia

ARPANSA hosted an IAEA IRRS mission to Australia from 4 to 16 November 2018, based out of the agency's Melbourne office in Yallambie. The mission reviewed Australia's complete federal system of radiation and nuclear safety regulation, with active participation from all Australian jurisdiction's regulatory bodies, making it the largest multi-jurisdictional mission undertaken. This international peer review of Australia's nuclear and radiological regulatory framework provides international feedback to strengthen and enhance the effectiveness of this framework for nuclear, radiation, radioactive waste and transport safety, and emergency preparedness and response activities. The IAEA mission's Final Report is expected to be provided in early 2019.

Significant regulatory activities

ARPANSA issues licences to Commonwealth entities for the possession and use of sources of radiation, and the construction, operation, and decommissioning of radiation facilities. ARPANSA may also amend a licence following an application from a licence holder, or based on review by ARPANSA. During this quarter, ARPANSA made the following significant licensing decisions:

- On 5 December 2018, the delegate of the CEO of ARPANSA issued a licence to the Medical Radiation Services branch at ARPANSA's Yallambie (Victorian) campus to operate a clinical linear accelerator. In line with ARPANSA procedures and processes, this application decision was reviewed by the Queensland Health radiation regulator to ensure that any potential conflicts of interest associated with an assessment of ARPANSA were well managed and did not affect the outcomes.
- ARPANSA approved a request for the licence covering PETTECH Solutions Pty Ltd, a wholly owned subsidiary of ANSTO, to be changed from an 'operating' licence to a 'possess or control' licence as they will no longer be operating the site. Operation of the business will now be conducted by Cyclotek NSW Pty Ltd subject to regulation by the NSW Environment Protection Authority.

Changes with significant potential implications for safety require prior approval from the CEO of ARPANSA. Significance is determined in accordance with the regulatory guide *When to seek approval to make changes important for safety*. Changes approved in this quarter include:

- ARPANSA approved assessments for the Open Pool Australian Lightwater (OPAL) research reactor at ANSTO's Lucas Heights, including changes to security arrangements, a new condition on the design extension conditions, and changes to the safety assessment report.
- ARPANSA approved the commencement of additional pre-characterisation work on the Commonwealth Science Industrial Research Organisation Waste Inventory at the Woomera Protected Area in South Australia. Efforts were focussed upon conducting further environmental sampling and making improvements to the building that stores the waste and its surrounds. Characterisation will involve the detailed determination of the amount and composition of the radioactive material present. Characterisation is an important step prior being able to make a determination on potential disposal options.

Inspections

ARPANSA undertakes a program of scheduled inspections of licence holders, which is informed by the risk of the activity, to monitor compliance with the ARPANS Act and Regulations.

During the quarter, 11 routine inspections and eight site visits were conducted. Inspections identified four potential non-compliances and 21 areas for improvement. Potential non-compliances indicate an area where the licence holder may not have complied with legislation or a condition of licence, such as adherence to a code—once confirmed these are considered a breach as described in section 'Details of any breach of licence conditions by a licensee' of this report. Areas for improvement indicate where licence holder safety performance could be improved, such as to meet international best practice. These inspection reports can be found on ARPANSA's website at www.arpansa.gov.au/regulation/inspections/reports.

Additionally, ARPANSA conducted a transport security inspection of a routine shipment of iridium-192 to South Africa. The purpose of the inspection was to verify that the plans and arrangements in the approved transport security plan were in place and complied with the *Code of Practice on the Security of Radioactive Sources* (RPS 11, 2019). While routine inspections look at the arrangement for transport, this type of inspection targets a specific shipment.

Stakeholder engagement

ARPANSA held its second 'Meet the Regulator Forum' in Perth, Western Australia. The forum enables operational staff at regulated entities to interact directly with ARPANSA inspectors and each other. This helps to build effective relationships with licence holders and to promote international best practice. Licence holder staff gain an increased awareness of ARPANSA's expectations and requirements. These information sessions help to increase compliance through education and complement other compliance monitoring activities.

Radioactive material import and export permits

The importation and exportation of radioactive material to and from Australia requires permission under Regulation 4R of the Customs (Prohibited Imports) Regulations 1956 and Regulation 9AD the Customs (Prohibited Exports) Regulations 1958. Under these regulations, the Minister for Health has authorised ARPANSA officers to issue import and export permits. Permits ensure that radioactive material entering and exiting the country is subject to appropriate regulatory control. This includes

that the end user is authorised to deal with the material, and that it is subject to appropriate safety and security provisions on route and at its final destination. This material is used for a wide range of medical, industrial and scientific purposes. The efficient movement of nuclear medicine internationally is particularly important to ensure that patients receive appropriate imaging and therapy.

Permits issued this quarter:

Type of Permits	<i>Urgent (single shipment)</i>	<i>Standard (single shipment)</i>	<i>12 Month</i>
<i>Import of Non-Medical radioisotope</i>	54	55	4
<i>Import of Medical radioisotope</i>	-	134	2
<i>Export of high activity source</i>	-	9	-

Transport of radioactive material

ARPANSA approves certain plans and packages for the transport of significant quantities of radioactive material by licence holders.

ARPANSA endorsed three transport security plans this quarter. Under the *Code of Practice for the Security of Radioactive Sources* (RPS 11, 2019), security enhanced sources are assessed to ensure the safety and security considerations, including the transport arrangements and route, are suitable for the shipment.

This quarter, ARPANSA issued a certificate of approval for a package design manufactured in South Africa, and validated a package design issued by the United States that will be used for the transport of fresh fuel. Prior to being transported, these packages require approval (or validation if the package has been approved by another international jurisdiction) under the *Code for the Safe Transport of Radioactive Material* (RPS C-2, 2014). These checks ensure that the package meets safety design criteria, such as materials and construction requirements, to ensure they are suitable to transport a specific type of material.

Inter-agency collaboration

ARPANSA conducted a joint scientific research project with the Australian Federal Police regarding measuring the radiation exposures due to security X-ray analysis of individuals who may be carrying an explosive device (known as a person-borne improvised explosive device). The research led to a greater understanding of potential doses to individuals wearing such a device and operators of the analysis equipment. The technical paper produced from this research will inform future regulatory decisions.

This year's Australian Radiation Incident Register (ARIR) report was published in December 2018 following consultation with Australian regulatory and peak professional bodies. The ARIR is a repository of radiation incident information from Commonwealth, state and territory radiation regulators. It is intended to raise awareness of radiation safety and to facilitate the sharing of lessons learnt from radiation incidents across Australia, thereby leading to the improved protection

of people and workers from unnecessary radiation. Improvements to the ARIR have made it easier to identify and share recommendations and learnings. These learnings are generally identified by the incident reporter, or in some cases the relevant regulatory body.

This latest ARIR report has a focus on computed tomography (CT) scanning incidents, and includes the analysis of an incident that occurred in August 2017 and was reported to the IAEA on the International Nuclear and Radiological Event Scale (INES) as level three ('serious incident'). CT was selected as the feature topic as more than 3.25 million diagnostic CT scans were carried out in 2017, most of which are completed without incident. Incidents involving CT scans result in more dose than many other diagnostic procedures such as plain X-rays. The most common category of incident is where procedures other than those planned are undertaken, such as the wrong patient or the wrong body part. These incidents have the potential to significantly affect patient outcomes if not picked up and wrong clinical decisions may be made based on this imaging. Where incidents are detected and patients rescanned, it is not only resource and time consuming for both the medical imaging practice and the patient, but the patient also receives extra radiation exposure from the repeated imaging. Patient identification and procedure matching is a critical control for these types of incidents, and is discussed in detail in the report including specific strategies for improvement.

International engagement

ARPANSA's international engagement provides the agency with the means of influencing the international radiation protection and nuclear safety and security framework, and for taking stock of international developments to ensure ARPANSA's regulatory framework and radiation protection standards are based on international best practice. The following is a summary of key international engagement activities undertaken in this quarter.

International Symposium on Communicating Nuclear and Radiological Emergencies to the Public 2018, 1–5 October 2018, Vienna, Austria

ARPANSA attended this first-ever symposium at the IAEA which discussed the latest developments in communication with the public in the event of a nuclear or radiological emergency. The symposium allowed participants to share experiences and good practices to further strengthen emergency preparedness within the radiological sector. This travel was funded by the IAEA.

Integrated Regulatory Review Service (IRRS) mission, 14–26 October 2018, Madrid, Spain

The CEO of ARPANSA led the IRRS component of a combined IRRS and Waste Safety Review Service mission to Spain. The combined mission was led by the former Executive Director for Operations of the US Nuclear Regulatory Commission, and the arrangements were coordinated by the IAEA. The review team involved 24 international experts and eight IAEA staff. The mission reviewed the legal framework for nuclear, radiation and waste safety in Spain. Peer review missions of this nature, coordinated by the IAEA, have become cornerstones in the international framework for safety. Australia will receive its second IRRS mission in November this year. In the margins of the review mission, the Spanish regulator, the Consejo de Seguridad Nuclear and ARPANSA entered into a memorandum of understanding governing future collaboration between the two agencies. This travel was jointly funded by the IAEA and by Spain.

Wellington Hospital and New Zealand (NZ) Chief physicist meeting, 14–16 October 2018, Auckland, New Zealand

ARPANSA performed the computed tomography (CT) scanning component of an Australian Clinical Dosimetry Service (ACDS) audit at Wellington public Hospital. ARPANSA also presented on the ACDS service at the New Zealand chief physicist meeting, comprising the heads of New Zealand hospital physics departments, in Auckland. These individuals will be key influences as the ACDS seeks to increase the ACDS customer base in New Zealand. This travel was funded by ARPANSA.

6th Consultative Meeting for the Update and Development of Training Material for Security of Nuclear and other Radioactive Materials in Transport, 22–25 October 2018, Vienna, Austria

ARPANSA participated in this meeting as both subject matter expert and meeting rapporteur. The purpose of this meeting was to finalise training material to enhance transport security capabilities for developing member states, in preparation of its publication by Oak Ridge National Laboratories (United States) and delivery by selected IAEA trainers. ARPANSA provided current material and industry knowledge inputs focussing on transport security plans and inspection processes, to influence training content and outcomes. This travel was funded by IAEA and ARPANSA.

Research and annual Canadian Federal Provincial Territorial Radiation Protection Committee, 22–26 October 2018, Ottawa, Canada

ARPANSA visited Canada as part of a research trip to document the Canadian system of nuclear/radiation regulation. The visit also included attendance at the annual Canadian Federal Provincial Territorial Radiation Protection Committee, which provided an opportunity to meet provincial and territory regulators, and explore the issue of uniformity of regulatory systems. Although there are minimal issues around the area of nuclear regulation with a single national regulator, Canada was facing a number of challenges in uniformity regarding aspects of radiation protection regulation. This travel was funded by ARPANSA.

IAEA Consultancy Meeting – Radioactivity in Food and Drinking Water, 29 October to 2 November 2018, Xi’an, China

ARPANSA attended this IAEA meeting and workshop on “Technical Challenges in Developing Guidance on Radioactivity in Food and Drinking Water in Non-Emergency Situations” organised in cooperation with the World Health Organization (WHO) and hosted by the National Institute for Radiological Protection of the Chinese Centre for Disease Control and Prevention. The implementation needs for harmonized radiation protection guidance on food and drinking water safety was discussed during this meeting. It identified gaps in approaches to estimating radiation dose from the consumption of food and water contaminated with artificial and naturally occurring radionuclides. Australia was recognised as a world leader in food and drinking water safety using a risk based approach. The IAEA funded this travel.

US Nuclear Regulatory Commission (NRC) 2018 Radiation Protection Computer Code Analysis and Maintenance Program (RAMP) users meeting, 29 October to 2 November 2018, Ottawa, Canada

Attendance at this meeting provided the opportunity for technical discussion on the various computer codes within RAMP and their use in undertaking various exposure assessments at ARPANSA. A symposium on radiation dose limits to the lens of the eye was also held in the margins of this meeting and provided ARPANSA with the opportunity to compare how different countries set

dose limits for the lens of the eye and implement international recommendations. This provided a useful comparison of Australia's approach to eye dose limits with other international agencies. The travel was funded by the US NRC and ARPANSA.

7th Meeting of the Emergency Preparedness and Response Standards Committee (EPreSC), 30 October to 1 November 2018, Vienna, Austria

The focus of this meeting was the review of documents related to radiological emergency preparedness and response, including documents in relation to attribution of risk due to exposure to ionising radiation and communication during a nuclear or radiological emergency. A key outcome was the agreement to progress advice on communication during an emergency. This travel was funded by ARPANSA.

Blood and Cancer Hospital audits and Elekta Users Meeting 2018, 9–14 November 2018, Wellington and Auckland, New Zealand

ARPANSA attended the Elekta Users meeting and then separately performed an ACDS audit at the Wellington Blood and Cancer Centre. This annual meeting covers the clinical practice of Elekta radiotherapy products. ARPANSA has the full clinical solution of Elekta radiotherapy products. The Elekta meeting is particularly relevant for ARPANSA, as Elekta is the supplier of the agency's linear accelerators, radiotherapy treatment planning and oncology information systems. Attendance allows ARPANSA to gain knowledge of current Elekta product applications and recent developments in the clinical setting. This travel was funded by ARPANSA.

6th Workshop on the Operation and Maintenance (O&M) of the International Monitoring System (IMS), 11–16 Nov 2018, Vienna, Austria

During this workshop matters relating to the IMS including sustainment, data availability and State-of-Health systems were discussed. Attendance ensures that ARPANSA is able to contribute to the technical aspects of implementing the Comprehensive Nuclear Test Ban Treaty and verification regime in regards to O&M activities. Contributions to this workshop have a direct impact on ARPANSA's operations, which are significant as the third largest operator of radionuclide stations in the global IMS. It also provided the opportunity to meet with other station operators and CTBT Organization Provisional Technical Secretariat staff to discuss and share information on current and emerging operational issues. This travel was funded by ARPANSA.

International Commission on Non-Ionizing Radiation Protection (ICNIRP) Cosmetics Group meeting and Global Coordination of Radio Frequency (RF) Communications on Research and Health Policy on RF Electromagnetic Fields (GLORE) meeting 13–15 November 2018, Paris, France

ARPANSA chaired the ICNIRP Cosmetics Group meeting, which is preparing a statement on the safety of non-ionising radiation treatments for cosmetic purposes. ARPANSA recently published draft advice for cosmetic treatments and beauty therapy using optical non-ionising radiation sources. This meeting allows ARPANSA input into ICNIRP's statement on the safety of non-ionising radiation cosmetic treatments.

The GLORE meeting discussed results from the latest epidemiological studies on RF and health, the National Toxicology Program animal study and future regulation and limits in view of the upcoming 5G network. It is important for ARPANSA to keep abreast of the latest research into RF and health as well as different regulations and policies around the world in order to provide the best advice to the Australian Government and the Australian people. This travel was funded by ICNIRP and ARPANSA.

46th Meeting of the IAEA's Waste Safety Standards Committee (WASSC) 19–21 November 2018, Vienna, Austria

This focus of this meeting was the development and publication of safety standards and guides related a range of topics including storage of spent nuclear fuel, remediation activities, naturally occurring radioactive material, environmental monitoring, radioactive waste, stakeholder involvement, deep geological disposal, and facility decommissioning. These documents will be very useful for regulatory management of radioactive waste in Australia and incorporation of these documents in ARPANSA's Radiation Protection Series (RPS) and review of the existing RPS documents in light of these safety standards will strengthen national uniformity in regulatory framework across Australian jurisdictions. This travel was funded by ARPANSA.

45th meeting of the IAEA Radiation Safety Standards Committee (RASSC) 21–23 November 2018, Vienna, Austria

This meeting allows Australia to contribute to, and influence, the development of safety standards for radiation protection. This in turn allows for the efficient implementation of international best practice in Australia, a key function of ARPANSA. The main discussion centred on the draft report of the expert review of the IAEA's Safety Fundamentals, which was request from the IAEA Commission on Safety Standards (CSS) to all of IAEA safety standards committees (SSC) in response to the UNSCEAR 2012 Report *Attributing Health Effects to Radiation Exposure and Inferring Risks* (UNSCEAR Report). RASSC prepared a progress report on which safety standards could be strengthened in light of the UNSCEAR Report, joined the CSS Working Group to develop a safety report on the issues raised by the UNSCEAR Report and formed an Electronic Working Group to review the IAEA Safety Fundamentals and prepared a report of their expert review. This travel was funded by ARPANSA.

6th Consultative meeting for the Update and Development of Training Material for Security of Nuclear and other Radioactive Materials in Transport, 22–25 November 2019, Vienna, Austria

ARPANSA attended this technical workshop which focussed on developing standardised transport security workshop training material for use by IAEA trainers in order to enhance transport security capabilities for developing Member States. Participation in these consultancy meetings is aligned with ARPANSA's aim to take a leading role in the enhancement of the international radiation safety and security frameworks, and to promote and implement best practice nationally, in the region and the wider international community. This travel was jointly funded by the IAEA and ARPANSA.

Asia Pacific Metrology Programme Technical Committee for Ionizing Radiation (TCRI), 23–27 November 2018, Singapore

This annual meeting featured a technical workshop, a focus group meeting on medical metrology, the two-day TCRI meeting itself, and a half-day laboratory tour. Highlights included a presentation from the president of the leading body for ionising radiation standards (Consultative Committee for Ionising Radiation) and the Executive Secretary, including their strategic plans. These plans include areas ARPANSA had already identified for attention (proton dosimetry, increasing use of diagnostic radiology, health impact of naturally occurring radioactive material) but included new directions, such as standards to support measurements important for the decommissioning of legacy nuclear power stations and the sterilisation of medical products. Also relevant to ARPANSA is a general shift towards primary standards based on water calorimetry. An ARPANSA staff member was nominated as the Chair of the TCRI to commence November 2019. This travel was funded by ARPANSA.

37th Meeting of the IAEA Transport Safety Standards Committee (TRANSSC), 26–30 November 2019, Vienna, Austria

ARPANSA attended this meeting of TRANSSC, which enables Australia to be involved in the development of international best practice standards in safe transport of radioactive material. This supports ARPANSA's role in developing nationally uniform standards and codes specifically to safe transport of radioactive material. The ARPANSA *Code of Practice for the Safe Transport of Radioactive Material* and an associated guide are currently under review and will consider recent TRANSSC publications on safe transport of radioactive material. This travel was funded by ARPANSA.

The European Society for Radiotherapy and Oncology (ESTRO) 'Estro meets Asia' conference, 5–9 December 2018, Singapore

This conference is the inaugural event of the ESTRO Asia series. ARPANSA was invited as a panellist for the Quality Management Roundtable Panel Discussion, and Chair of the Teaching Lecture session on Quality Management. ARPANSA presented papers on Quality Management and Verification, and illustrated the power of the data behind ACDS audits. This travel was funded by ARPANSA.

Details of directions given by the Minister

No directions were given by the Minister under section 16 of the Act.

Details of directions given by the CEO

No directions were given by the CEO of ARPANSA under section 41(1A) of the Act.

Details of improvement notices given by inspectors

No improvement notices were issued by ARPANSA under section 80A of the Act.

Details of any breach of licence conditions by a licensee

Three breaches determined in the quarter are considered to have minor or no significant safety implications. The breaches were for failing to comply with licence conditions under the Australian Radiation Protection and Nuclear Safety Regulations 1999. These breaches were for failing to:

- comply with operating limits and conditions
- apply for approval to construct a safety item as required by Section 66 of the Regulations
- seek approval to dispose of a source as required by Section 65(1) of the Regulations.

There were no breaches with significant safety implications this quarter.

List of facilities licensed under Part 5 of the ARPANS Act

During the quarter, a licence was issued to ARPANSA to operate a medical linear accelerator. See the 'Significant applications and licencing activities' section of this report for further information.

The operations of the Council and Committees

Radiation Health and Safety Advisory Council

The Radiation Health and Safety Advisory Council (Council) met on 11 October 2018. The Council is the peak advisory body to the CEO of ARPANSA with its members appointed by ARPANSA's Minister. At the time of the meeting, there were only six appointed members of the Council including the CEO of ARPANSA. The remaining seven positions, including the Chair, were vacant pending appointment.

Key topics discussed were issues associated with the identification of naturally occurring radioactive material including a graded approach to regulation of such material, and issues related to the overlap between regulatory approvals by ARPANSA and the Department of Environment. The Council agreed to explore the issue of naturally occurring radioactive material further, establishing a working group to discuss the possible components of a strategy to improve awareness of the issues, as well as inviting input from the Radiation Health Committee.

The Council noted that the co-ordination of ARPANSA and Department of Environment regulatory processes was particularly relevant to the Department of Industry, Innovation and Science's proposed National Radioactive Waste Management Facility.

The CEO of ARPANSA updated Council on his direction to ANSTO following recent safety-related events, and the subsequent report on safety practices at ANSTO from an independent expert panel, which included some recommendations directly in relation to ARPANSA's role as the regulator.

The Council also received an update on planning for the International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service mission to Australia, due in November 2018, to provide a peer review of Australia's federal system of regulation for radiation protection and nuclear safety.

The minutes of past Council meetings are on ARPANSA's website at www.arpansa.gov.au/rhsac. The next meeting is scheduled for March 2019 in Melbourne.

Reports to the CEO from the RHSAC under paragraph 20(f) of the Act

The Council did not provide any reports to the CEO during this quarter.

Radiation Health Committee

The Radiation Health Committee (RHC) met on 9–10 October 2018 in Melbourne. The RHC is an advisory body to the CEO of ARPANSA, which includes representation from the state and territory radiation regulatory bodies. The functions of the RHC include formulating draft national policies, codes and standards for the promotion of uniform national standards of radiation protection.

Outcomes of this meeting included updated implementation plans for the NDRP 2nd edition, and advice for cosmetic treatments and beauty therapy using lasers, intense-pulsed light devices and high-powered light-emitting diodes is to be published.

The Guide for Radiation Protection in Emergency Exposure Situations, RPS G-3 was circulated out-of-session to the Members for approval; and the draft revision of the *Code for the Safe Transport of Radioactive Material*, (RPS C-2) will also be circulated to Members out of session for endorsement.

A guidance document on the concept of risk related to the safety of disposal facilities for solid radioactive waste, and the draft update to *Code for Disposal Facilities for Solid Radioactive Waste* (RSP C-3, 2018), will be circulated out-of-session for review.

The RHC formed a working group to critically analyse discrepancies between the *Safety Guide for Classification of Radioactive Waste*, (RPS 20, 2010), and IAEA General Safety Guide (GSG) *Classification of Radioactive Waste* GSG-1, and prepare a work-plan to address these discrepancies.

The RHC also formed a working group for a national sealed source register, to explore options, re-examine the scope, and identify lessons from a previous database and improvements required.

Further information can be found in the meeting minutes which are provided online at www.arpansa.gov.au/rhc. The next RHC meeting is scheduled for 12–13 March 2019 in Sydney.

Nuclear Safety Committee

The Nuclear Safety Committee (NSC) met on 2 November 2018. The NSC is an advisory body to the CEO of ARPANSA which advises on matters relating to nuclear safety and the safety of controlled facilities.

The NSC received an update on regulatory activities since its previous meeting, including on the CEO of ARPANSA's direction issued to ANSTO that required it to initiate an independent review of safety practices, in particular in relation to ANSTO Health's activities in Building 23 of its facility at Lucas Heights, NSW. On 5 October 2018, ANSTO provided ARPANSA with a report by the independent expert review team outlining 85 recommendations to improve ANSTO's occupational radiation safety practices, and operational processes and procedures. The report was given to the NSC ahead of the meeting and two members of the ANSTO independent review team provided an overview of the report. The NSC discussed and provided comments on the report and on how ARPANSA may work to promote safety improvements at ANSTO Health and ANSTO more generally. The NSC noted that, at the time of the meeting, while an initial response by ANSTO was received, a detailed response which includes an action plan had not yet been submitted for ARPANSA's approval.

Under the Australian Government's Regulator Performance Framework all Commonwealth Regulators, including ARPANSA, are required to undertake an annual self-assessment of its regulatory performance. The NSC is the appointed independent validator of ARPANSA's self-assessment report. The NSC endorsed and validated ARPANSA's report for 2017-18.

IAEA Deputy Director General and head of the IAEA's Department of Nuclear Safety and Security, Mr Juan-Carlos Lentijo, addressed the NSC covering recent IAEA activities and upcoming priorities in the nuclear safety and security department.

The minutes of the meeting are provided online at www.arpansa.gov.au/nsc. The next NSC meeting is scheduled for 15 March 2019 in Miranda (Sydney), NSW.

Reports to the CEO from the NSC under paragraph 26(1)(d) of the Act

The NSC did not provide any reports to the CEO during this quarter.