Australian Government

Australian Radiation Protection and Nuclear Safety Agency

*Welcome to the Australian National Radiation Dose Register (ANRDR) annual newsletter,* ***ANRDR in Review.***

# 2016 EDITION

***The past year has been one of significant milestones for the ANRDR.***

Since the publication of the 2015 edition of the newsletter, the ANRDR team has **launched the new database and portal,** and expanded coverage of the Dose Register to two new industries – **Commonwealth Government organisations, and the mineral sands mining and processing industry.**

We thank the organisations who volunteered to participate in the pilot program on behalf of their respective industries, as well as the regulatory authorities who established the necessary legal framework for the submission of data to the ANRDR. We hope to continue our engagement with other organisations in these and other industries as we continue our journey to promote national uniformity and achieve a best practice approach for recording and maintaining occupational dose records.

In this issue of *ANRDR in Review,* we aim to communicate information to stakeholders about ANRDR activities over the past year, including analysis of data, expansion activities and the ANRDR portal redevelopment.

We hope that you find this newsletter of interest, and we encourage your suggestions and input for future issues of the *ANRDR in Review.*

**The ANRDR Team**
*Ben Paritsky and Cameron Lawrence*

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## Significant Events

# 2016

### June

The ANRDR presented at the **AusIMM conference** in Adelaide

### April

The ANRDR presented to the **Mongolian delegation** during their visit to ARPANSA

### February

CSIRO becomes the **first Commonwealth Government organisation** outside of ARPANSA to submit data to the ANRDR

The ANRDR team participated in the annual **MCA Uranium Forum – ARPANSA dialogue**

### January

Sibelco (with the support of DNRM) becomes the **first mineral sands operation** to submit data to the ANRDR

New **ANRDR portal** officially launched

# 2015

### November

The ANRDR team participated in the **2nd International IAEA workshop** on 'Developing guidance material to support safety standards applicable to uranium mining and processing industry' and held an ANRDR workshop as part of the meeting

# New ANRDR Portal

***On 21 January 2016, the new ANRDR system was officially launched.***

The new system (consisting of a new server for data storage, a secure web portal for industry data submissions and the web-based internal administration component) was built in-house and offers improved efficiency and increased flexibility for data management and communication with stakeholders. Some of the improvements include:

## Automated dataset processing and error reporting

Previously, data submitted through the ANRDR portal required processing by ANRDR administrators to assess data integrity and to confirm that the datasets complied with ANRDR requirements. Any errors that were identified were communicated back to the user, requiring the user to address the errors before resubmitting the data. Occasionally these steps would be repeated several times before the datasets were accepted successfully, resulting in a time-consuming process that required substantial communication between ANRDR administrators and users.

The new ANRDR portal provides real-time processing of datasets (up to ten at one time), automatically generating an error report with a detailed description and position of the errors in the data file. This substantially improves efficiency by allowing users to immediately address any issues flagged in the datasets and resubmit the data without having to wait for a response from an ANRDR administrator. As always, the ANRDR team is on hand and happy to assist with any enquiries to facilitate the data submission process for our stakeholders.

## Improved people matching process

For various reasons, a single worker may be inadvertently registered in the ANRDR as several individuals. To assist ANRDR administrators in identifying such duplicates, ARPANSA have acquired specialised 'people matching' software which will be integrated into the administration component of the ANRDR system as an additional feature. This software will be used periodically to identify common details amongst individuals' personal information to suggest potential matches. Employers will then be requested to either confirm or reject these possible matches.

Errors are commonly introduced into data submission files through data entry when the submission files are compiled manually. From an industry viewpoint, one way of minimising the introduction of errors associated with manual data entry is to utilise data management software which can be custom built or purchased 'off-the-shelf', such as Historion (see *ANRDR Expansion Activities* for more information). Data management software facilitates dose optimisation in the workplace by enhancing an employer's ability to effectively and efficiently manage worker exposures and other aspects of a radiation protection program.

## Enhanced communication with users

The new ANRDR portal showcases an improved communication tool between ARPANSA and ANRDR users. The home page features a 'notifications' screen that displays a range of notification types, such as 'information only' messages (including registration approvals or successful data submissions) and actionable tasks (such as completing a 'people matches' form).

ANRDR administrators are able to post announcements and publications of interest, including new safety guides, newsletters and technical reports to all users or specific user groups. Users are also able to contact the ANRDR via the portal with a specific query or to offer feedback in the form of a complaint, compliment or suggestion.

Due to the complex nature of the radiation regulatory framework that exists in Australia, ARPANSA has had limited direct interaction with industry in the past. ARPANSA now has the ability to engage directly with industry through the ANRDR by offering advice, and promoting national uniformity and international best practice in radiation protection across different industries and jurisdictions.

## Quarantine facility

A quarantine facility was implemented to allow the ANRDR administrators to quarantine (or isolate) datasets that have been submitted to the ANRDR, but later determined or suspected to contain errors. This function allows the ANRDR team to analyse data for reporting purposes and to issue dose history reports without the inclusion of potentially compromised data.

# Expansion Activities

***After extensive stakeholder engagement, the ANRDR has now expanded beyond the uranium mining and milling industry to cover occupationally exposed workers employed by the mineral sands mining and processing industry and Commonwealth government organisations.***

## Mineral sands and Commonwealth government organisations

The ANRDR team collaborated with CSIRO and Sibelco's Queensland mining operation who volunteered to represent their respective industries in the pilot phase of the expansion. The pilot phase was designed to assess the technical capability of the ANRDR in accepting data from new industries as well as working with regulatory bodies to introduce a legal framework in their jurisdictions to meet the privacy requirements for submitting data to the ANRDR.

With a clear process for the incorporation of government organisations established through working collaboratively with ARPANSA's Regulatory Services Branch, engagement has commenced with other Commonwealth government bodies. Work has also commenced with state regulatory authorities to review the current structures in place and establish a way forward for the inclusion of dose records into the Dose Register from mineral sands operations within their jurisdictions.

Due to Australia's complex radiation regulatory framework, introducing reporting requirements to address privacy considerations at the state level has been challenging. However, with remarkable industry support and continued positive engagement with state regulatory authorities, ARPANSA will continue to build on existing achievements to ensure that all occupationally exposed workers are covered by the Dose Register.

## Medical sector

Preparations for the expansion into the medical sector are underway with stakeholder identification work in progress. The ANRDR will present at the 2016 Engineering and Physical Sciences in Medicine (EPSM) conference to be held in Sydney in November. Here we will conduct additional stakeholder engagement and seek voluntary participation for the pilot phase of the Dose Register's expansion into the medical sector.

After completing the initial stakeholder identification process, ARPANSA will launch a survey to collect information concerning the status of dose record management practices across the sector. The survey will be targeted at a range of organisations in different jurisdictions to assess a wide cross-section of the sector. The outcome of the survey will provide input into the approach for expansion of coverage to the medical sector.

## Radiation regulatory authorities

It was recognised that a number of state and territory regulatory employees are monitored radiation workers. ARPANSA has engaged these regulatory bodies through the Radiation Health Committee (RHC) to consider options for submitting their dose data to the ANRDR. Work has commenced with the South Australian Environmental Protection Authority (SA EPA) for the inclusion of their dose records into the ANRDR. Engagement with the regulatory agencies for the inclusion of their records will help establish the necessary processes for other industries within their jurisdictions.

## Aviation sector

Aircrew exposures to cosmic radiation are considered 'existing exposure situations' and are not regulated in the same way as 'planned exposure situations' that require employers to maintain radiation licences to operate. Although dose limits for aircrew are not enforced, some airlines are taking a proactive approach to optimise the doses received by workers. In Europe, reference levels are set at 6 mSv per year (1 mSv for pregnant workers), at which point mitigation strategies are considered. Some airlines in Australia are beginning to apply similar strategies for their workers.

Aircrew are among the highest exposure groups of all occupationally exposed workers. The doses are calculated using modelling software which take into consideration such factors as altitude, latitude, flight duration and solar events.

Australia's largest domestic carrier, Qantas, will act as a pilot organisation for the inclusion of aircrew dose records into the Dose Register. ARPANSA is in continued discussions with Qantas regarding the legal and technical considerations of this process.

The ANRDR will serve as a vital tool for maintaining radiation doses of aircrew over the long-term, especially for workers who move between employers, or if companies cease to exist. The collection of dose records from all Australian airlines will allow industry data to be published, demonstrating the effectiveness of dose optimisation strategies across the aviation sector.

# Analysis of Data

The ANRDR collects information on quarterly-assessed radiation doses for the following dose types and exposures (where applicable): external gamma, external neutron, inhalation of radioactive particulates, inhalation of radon and radon progeny, as well as ingestion, eye, skin, wound and extremity doses. Employer and personal information are also collected to match a dose with the correct worker. The data collected is used to monitor individual radiological doses and generate annual statistics related to exposure trends to facilitate the optimisation of radiation protection practices for workers.

The ANRDR currently holds the dose records for over 35 000 individuals. Although the ANRDR now collects data from the mineral sands mining and processing industry, as only one operation is covered we are unable to produce an analysis of this industry this year.

## Collective effective dose

The collective effective dose can be used as a comparative tool for the optimisation of radiation protection practices. It has been used by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) for reporting and comparing exposures from different practices around the world (UNSCEAR 2008). The collective effective dose is simply the sum of the individual doses incurred by a group, and is expressed as 'man sieverts' (man Sv) to distinguish the collective dose from the individual doses[I].

The establishment of the ANRDR, which now has complete coverage of the uranium mining and milling industry in Australia, allows for the calculation of the collective effective dose from this industry. The ANRDR does not currently have sufficient coverage to report on other industries. This data may be used in future UNSCEAR or International Atomic Energy Agency (IAEA) reports for comparative studies. A summary of the collective effective dose from the uranium mining and milling industry is provided in Figure I.

### Collective effective doses for Australian uranium industry workers (2011–2014)

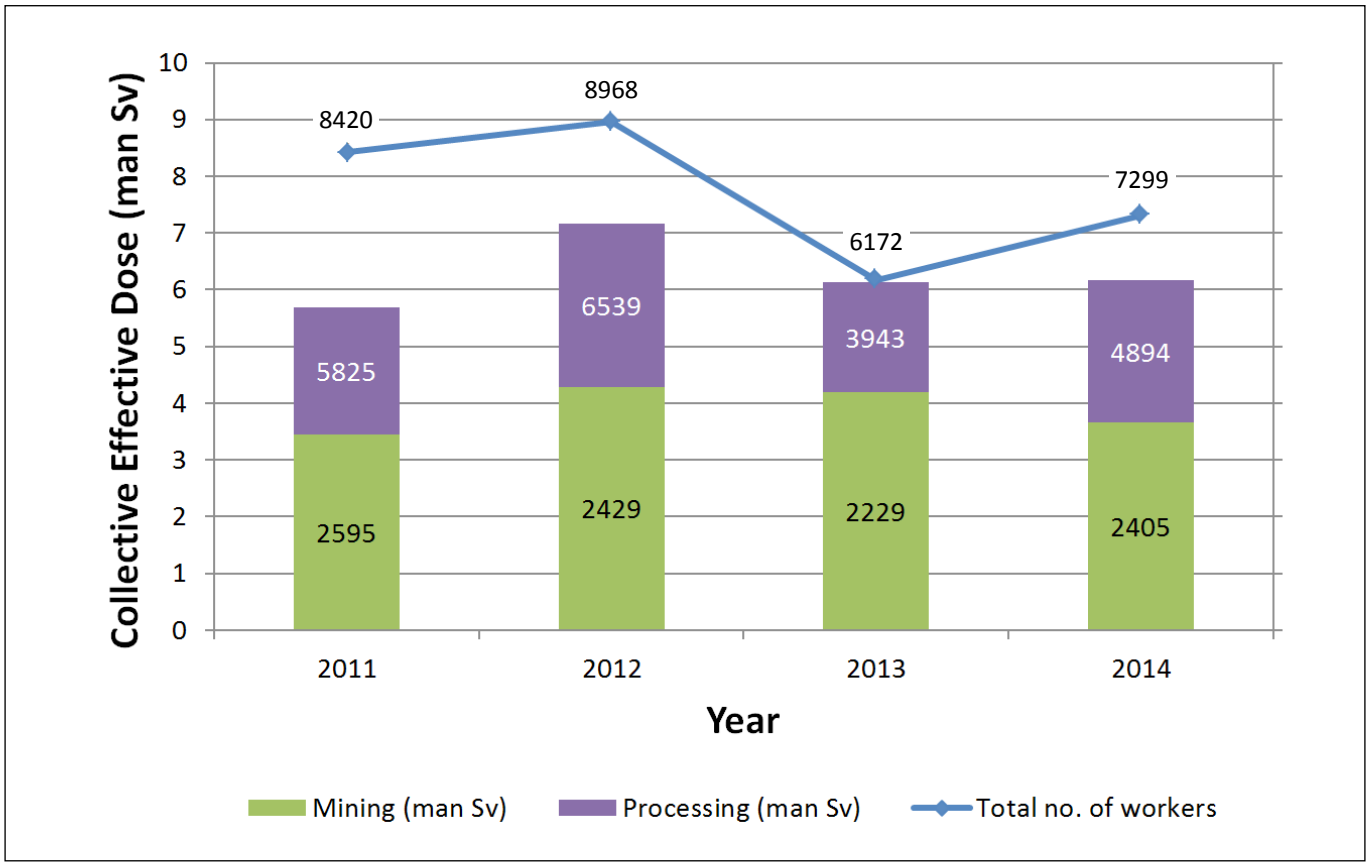



**Figure I:** Australian uranium industry collective effective doses (2011–2014)

[I]IAEA Safety Glossary (2007)

# Analysis of Data

Figure I demonstrates that over the four year period (20II–20I4), the total collective effective doses have remained relatively steady. Over this period, the highest collective effective dose was recorded in 20I2 as 7.2 man Sv. During the latest year for which the ANRDR has a complete dataset, the collective dose was recorded as 6.3 man Sv.

To put the collective doses into context, the number of workers for each work category and the total number of workers for the two categories in each year have been provided on the chart.

This chart shows that mining workers receive a greater effective dose than processing workers despite the processing category employing a larger workforce. This can be attributed to the greater contribution of radon progeny to the exposures received in underground mining operations which is not as significant a contributor in the processing category. Dose contributions by pathway are shown in Figures 5 and 6.

To provide context on exposures in the uranium industry, they may be compared to medical exposures. In 20I3, ARPANSA published an assessment of radiation exposure from medical procedures for Australia[2]. When directly compared, the annual collective effective dose for the uranium industry in Australia is a small fraction (~0.02%) of the collective dose received from radiation-related medical procedures. The average radiation exposure to Australian uranium workers in 20I4 was 0.9 mSv, while the average per caput dose received by Australians from medical procedures is estimated to be I.7 mSv/year.

### 2010 Medical Exposure Collective Effective Dose (man Sv)

| CT Scans | Radiography/ Fluoroscopy | Interventional Procedures | Mammography | Nuclear Medicine | Total Medical Exposure |
|---|---|---|---|---|---|
| I6 820 | 4I06 | 2300 | 485 | 2505 | 26 2I6 |

Assuming an Australian population of 24 million and a background radiation exposure for Australia of I.5 mSv/year, the national collective effective dose is 36 000 man Sv. This helps put the total exposures from the uranium mining and milling industry in Australia into context, with its contribution to whole population exposure being very small.

## Commonwealth Government Organisations

CSIRO began participating in the ANRDR earlier this year. Therefore, a combined assessment of Commonwealth Government organisations (CSIRO and ARPANSA) is available for three quarters of 20I5. The 20I5 edition of *ANRDR in Review* provided an assessment of ARPANSA data back to I987. The assessment in Figure 2 shows that exposures in these organisations are very low. The average effective doses for the first three quarters of 20I5 are all below 0.004 mSv, with the 0.I20 mSv being the highest dose recorded.

[2]Hayton A. et. al. Australian per caput dose from diagnostic imaging and nuclear medicine Radiation Protection Dosimetry (20I3), I56(4), 445–450

# Analysis of Data

## Average and maximum effective doses for Commonwealth Government organisations (quarter 1–quarter 3 2015)

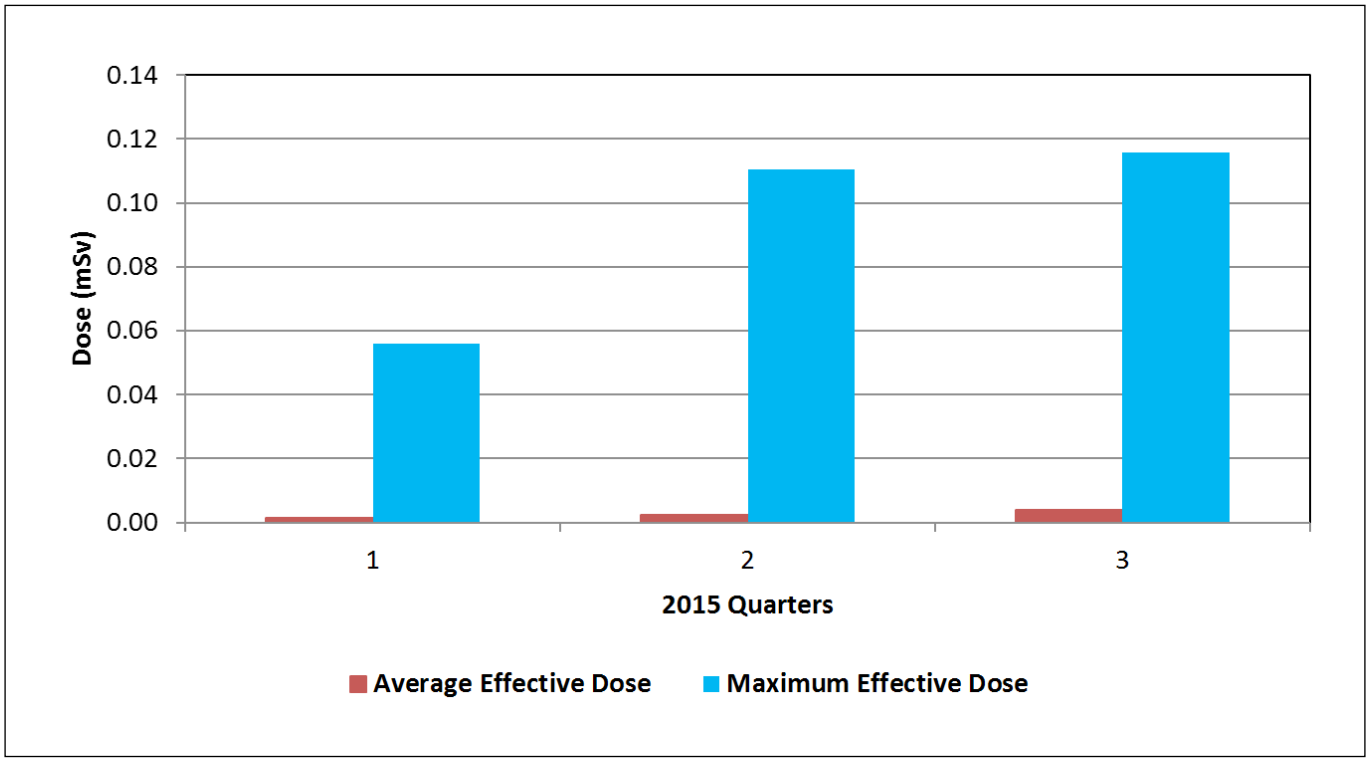



**Figure 2:** Average and maximum effective doses for registered Commonwealth government organisations (Quarters 1–3 2015)

## Uranium industry data

The ANRDR has coverage of the entire Australian uranium mining industry with exposure records that cover all operators from 2011. Due to a delay in the receipt of some exposure records, analysis in this newsletter consists of a quarterly assessment of doses from 2011 to quarter 3 of 2015. An updated annual analysis will follow in the coming months once complete 2015 data is available.

Prior to the publication of this year's newsletter, the ANRDR team engaged with each of the uranium mining operators to review the work category codes that are used to define roles in the ANRDR. This review has resulted in some minor changes to the classification of some work groups. Due to identified variations for the classification of administrative and other workers, the analysis this year has focused only on mining and processing workers. Workers who are defined as being in the 'Other' category are analysed alongside the mining and processing categories shown in Figure 4.

## Average and maximum effective doses for uranium mining and processing (2011–2015)

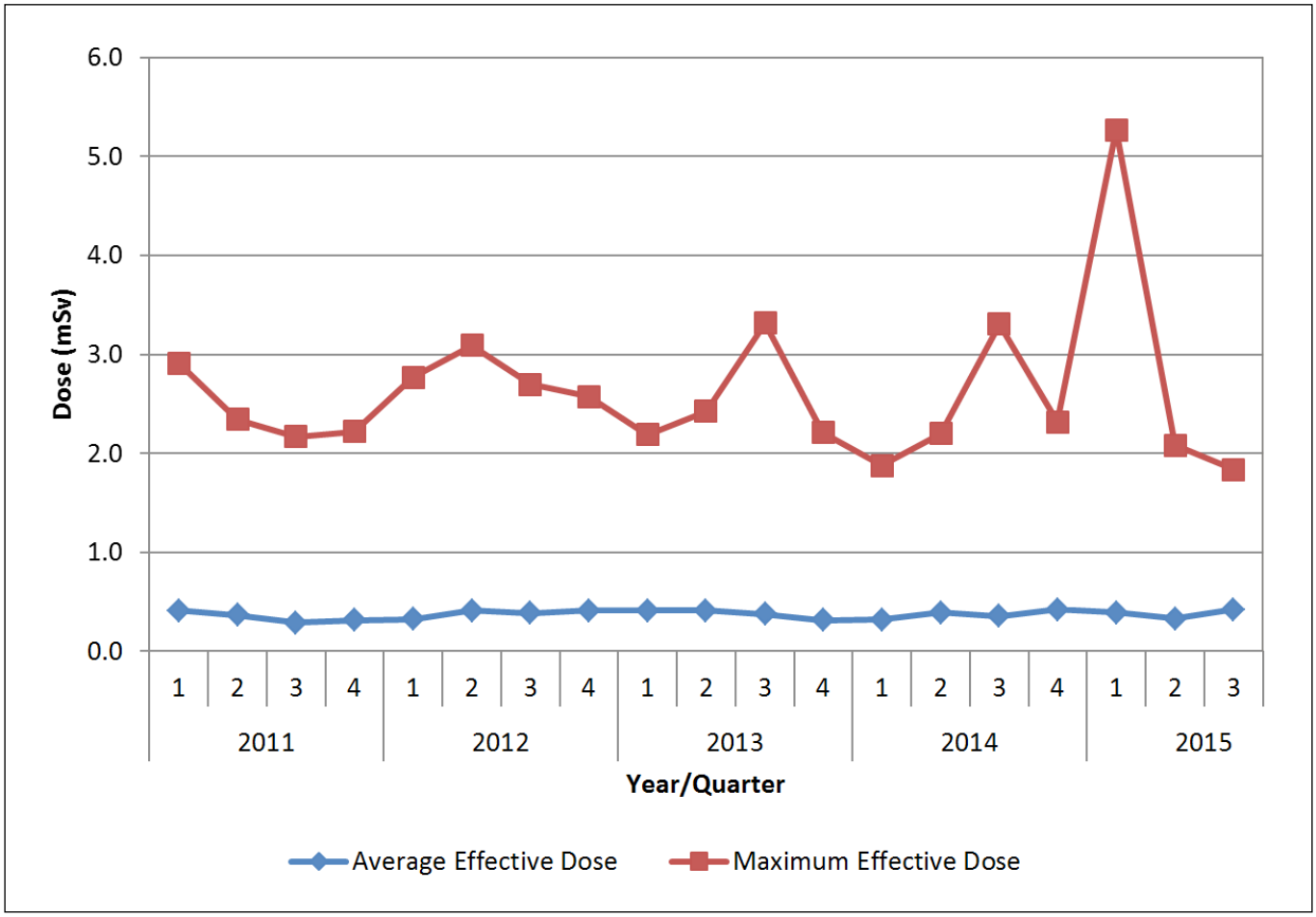



**Figure 3:** Average and maximum effective doses for uranium mining and processing (2011–2015)

The average quarterly effective dose for uranium mining and processing workers has remained relatively constant at an exposure level of around 0.4 mSv. Maximum quarterly exposures typically range between 2-3 mSv, however, a maximum exposure of 5.2 mSv was observed in quarter I, 2015. Quarterly dose assessments are a requirement for all Australian uranium operators and allow for investigation and implementation of controls when individual exposures exceed action limits. The remaining maximum exposures for 2015 have returned to the typical range. The data in Figure 3 shows that doses are well below the occupational dose limit of 20 mSv per year.

# Analysis of Data

## Trend in average quarterly doses by work category for uranium industry workers (2011–2015)

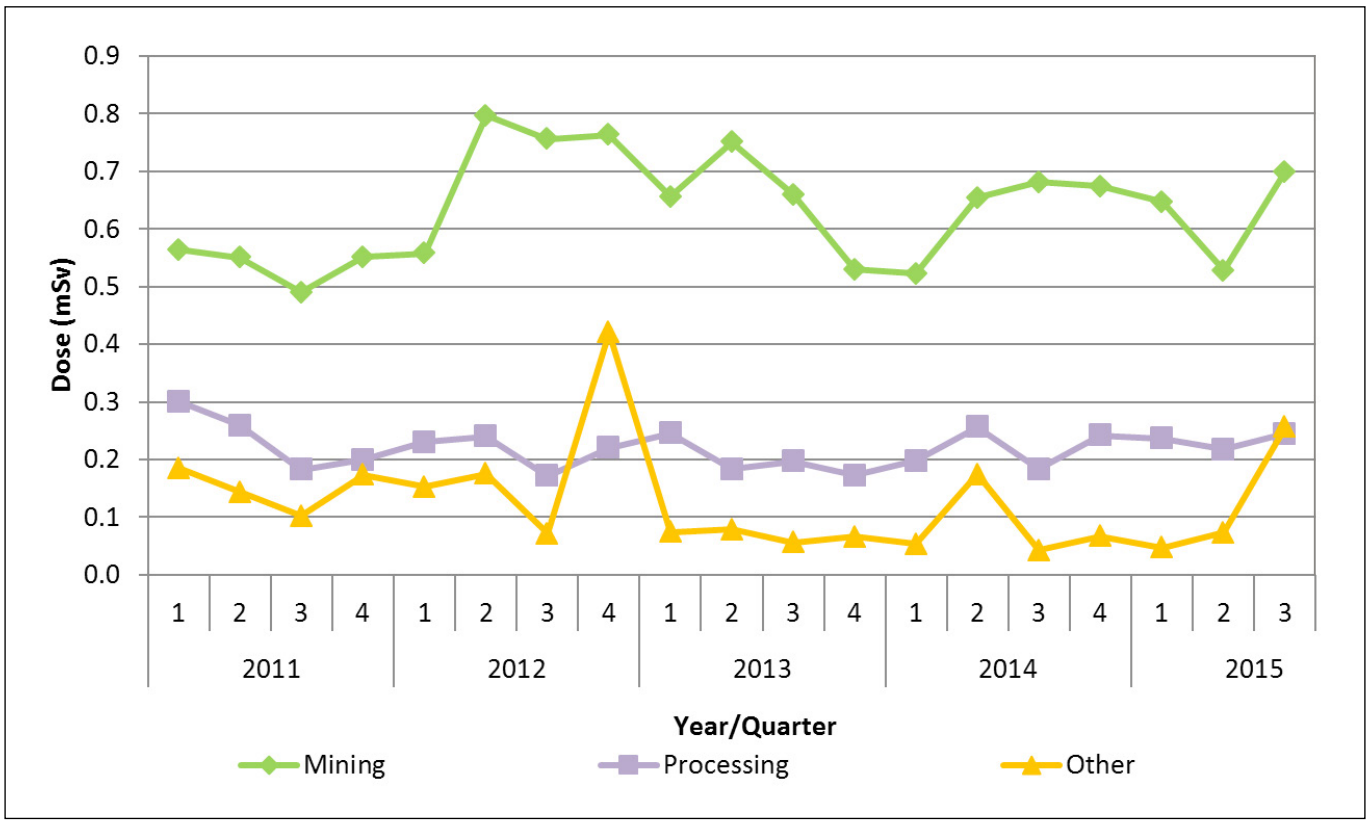



**Figure 4:** Trend in average quarterly doses by work category for uranium industry workers (2011–2015)

The trend in quarterly doses by work category, displayed in Figure 4, continues to demonstrate that workers in the mining category receives the highest doses in the uranium industry, typically ranging between 0.5–0.8 mSv per quarter over the last five years. The higher variability in their exposures compared to the processing workgroup is related to the diversity of the work performed, differences in ore grade and radon decay product exposure, as well as other factors relating to the different mining methods used in Australian uranium mines. The processing workgroup is more stable since milling processes are carefully controlled with less variability in exposure pathways. Average quarterly exposures for the last five years are around 0.2 mSv for this exposure group.

The 'Other' workgroup comprises of personnel who spend little time in operations and includes a less stringent assessment process for monitoring. Some operations monitor all personnel while others perform dose assessments only on operational workers. For some operations, the 'Other' category includes personnel who have little to no access to controlled areas. As expected, this workgroup receives the lowest exposures and has been excluded from the calculations in Figures I and 3. The peaks identified in quarter 4 of 2012 and quarter 3 of 2015 should prompt operators to review the classification and/or work practices of these workers.

The ANRDR maintains dose records of exposure from various pathways, and with almost five years' worth of combined data, an assessment of the pathways for the mining and processing workgroups can be performed for trend analysis. Figures 5 and 6 represent the percentage of dose contribution by pathway for the mining and processing workgroups. These figures are almost an inverse of each other and clearly show the expected dominant pathways for the workgroups. Mining doses in the Dose Register are dominated by underground exposures. Radon progeny exposure contributes the largest dose. In a processing environment, the exposures from radioactive particulates dominate as a result of radionuclide concentration and drying activities.

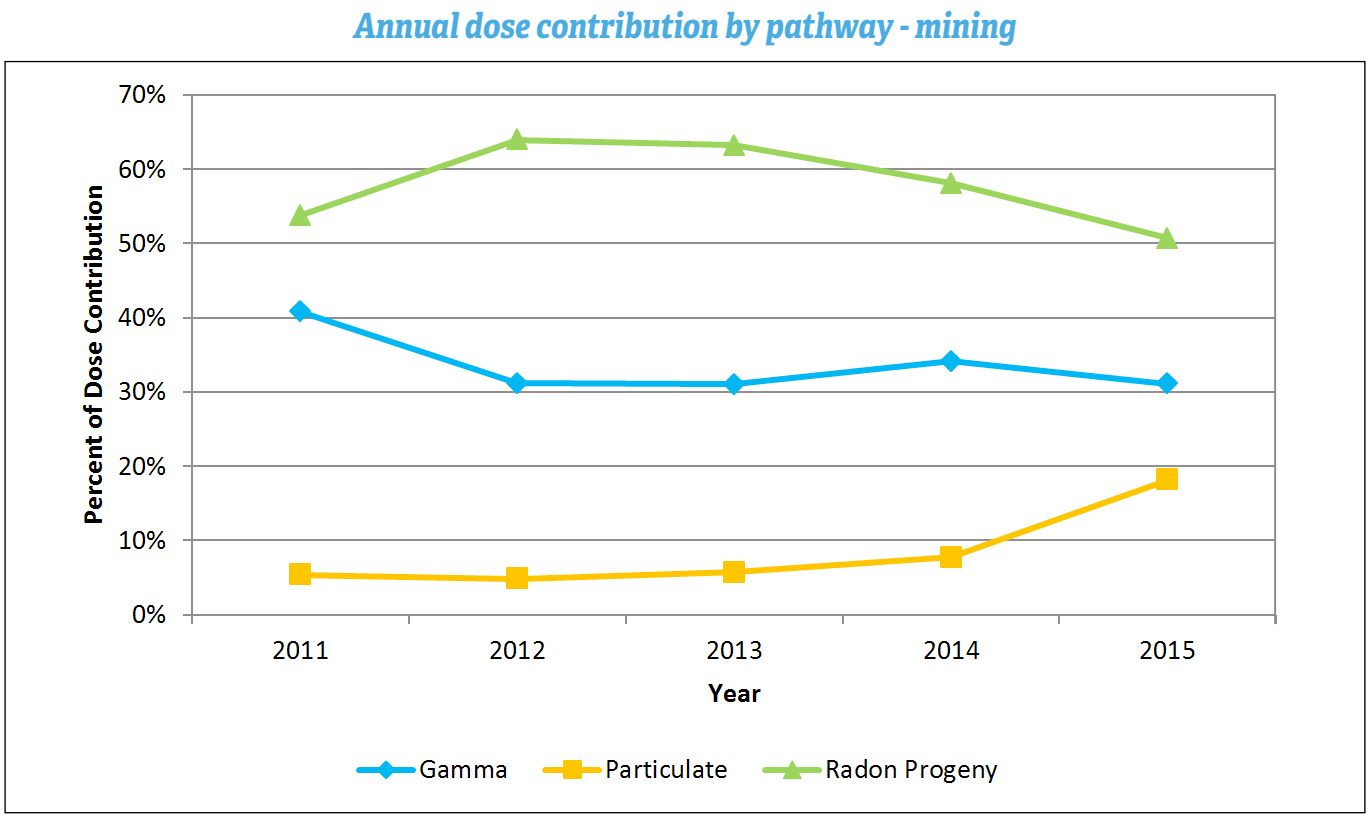



**Figure 5:** Annual dose contribution by pathway - uranium mining

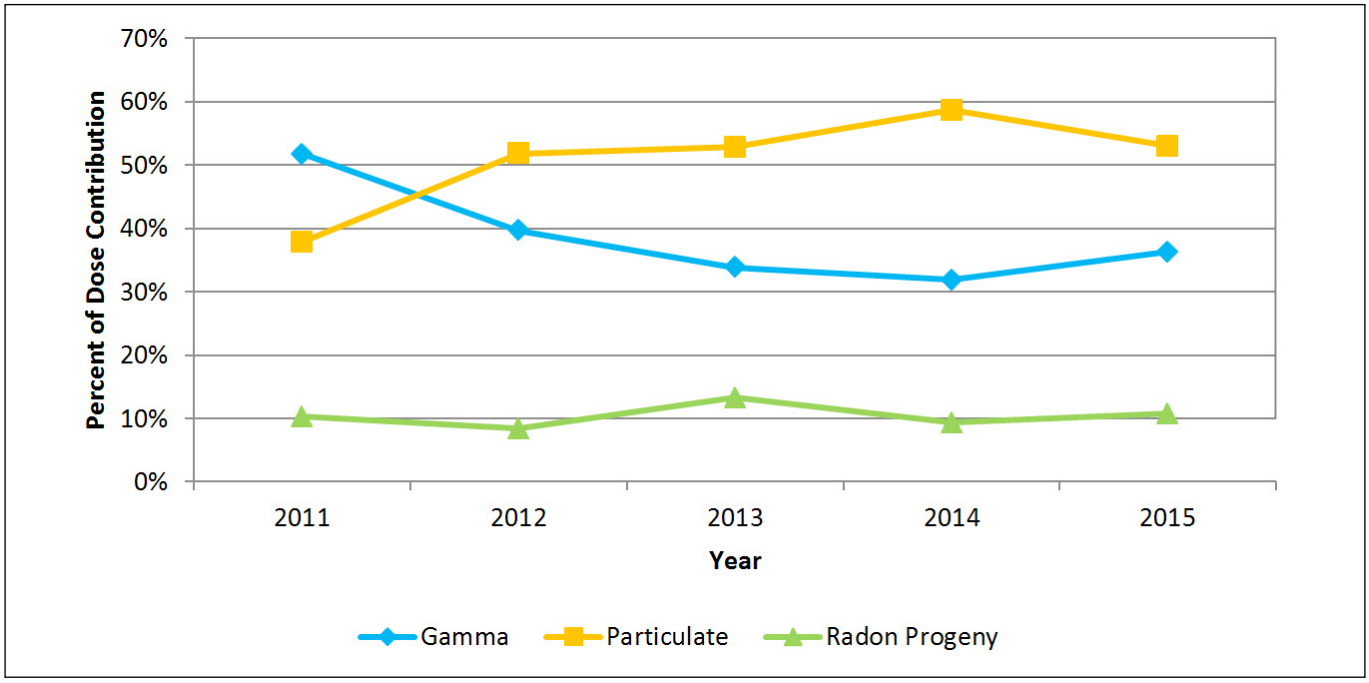



**Figure 6:** Annual dose contribution by pathway – uranium processing

# Radiation in Context

***Naturally occurring radioactivity is in the air we breathe, the food we eat and the buildings we live in.***

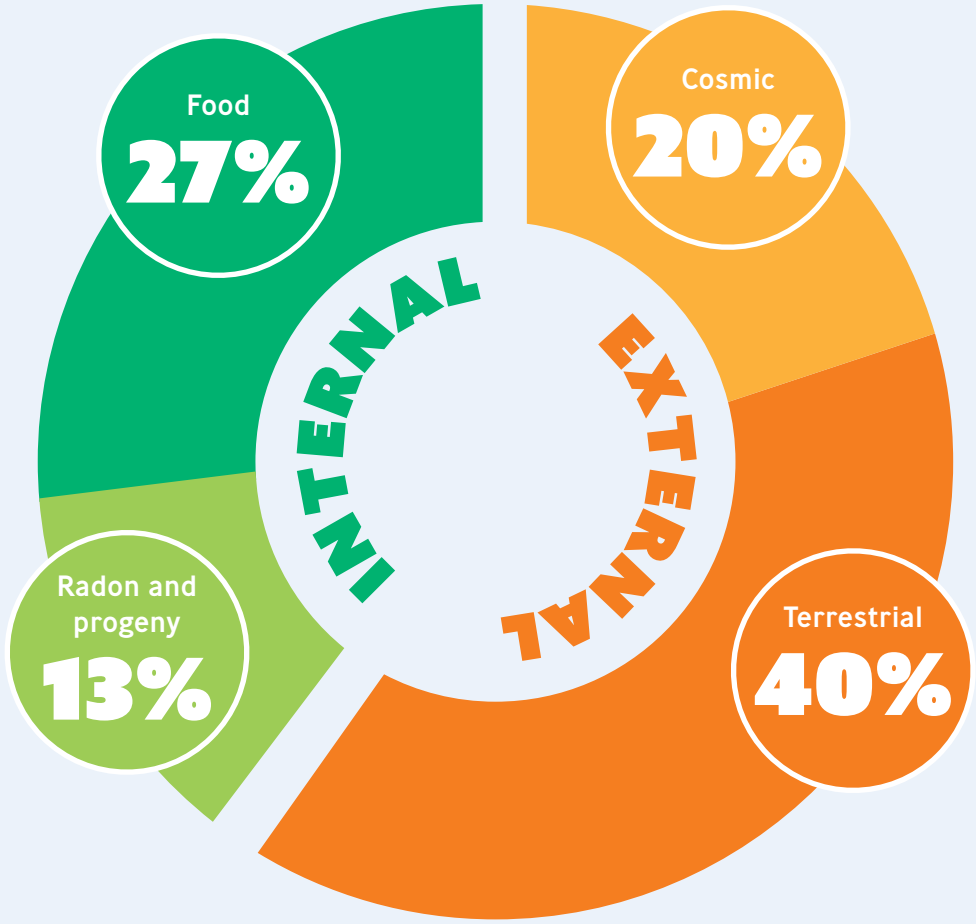
## What is natural background radiation?

Natural background radiation is the ionising radiation in the environment that all living things are exposed to every day. The largest source of external radiation exposure comes from natural radioactivity in rocks and soil (terrestrial radiation), while the largest source of internal radiation exposure comes from naturally occurring radioactivity in food. There are also significant contributions from cosmic radiation and inhalation of radon gas that seeps from the ground into all buildings. The average annual exposure to background radiation in Australia is I.5 mSv, whereas the global average is around 2.4 mSv.

## Risk and potential health effects

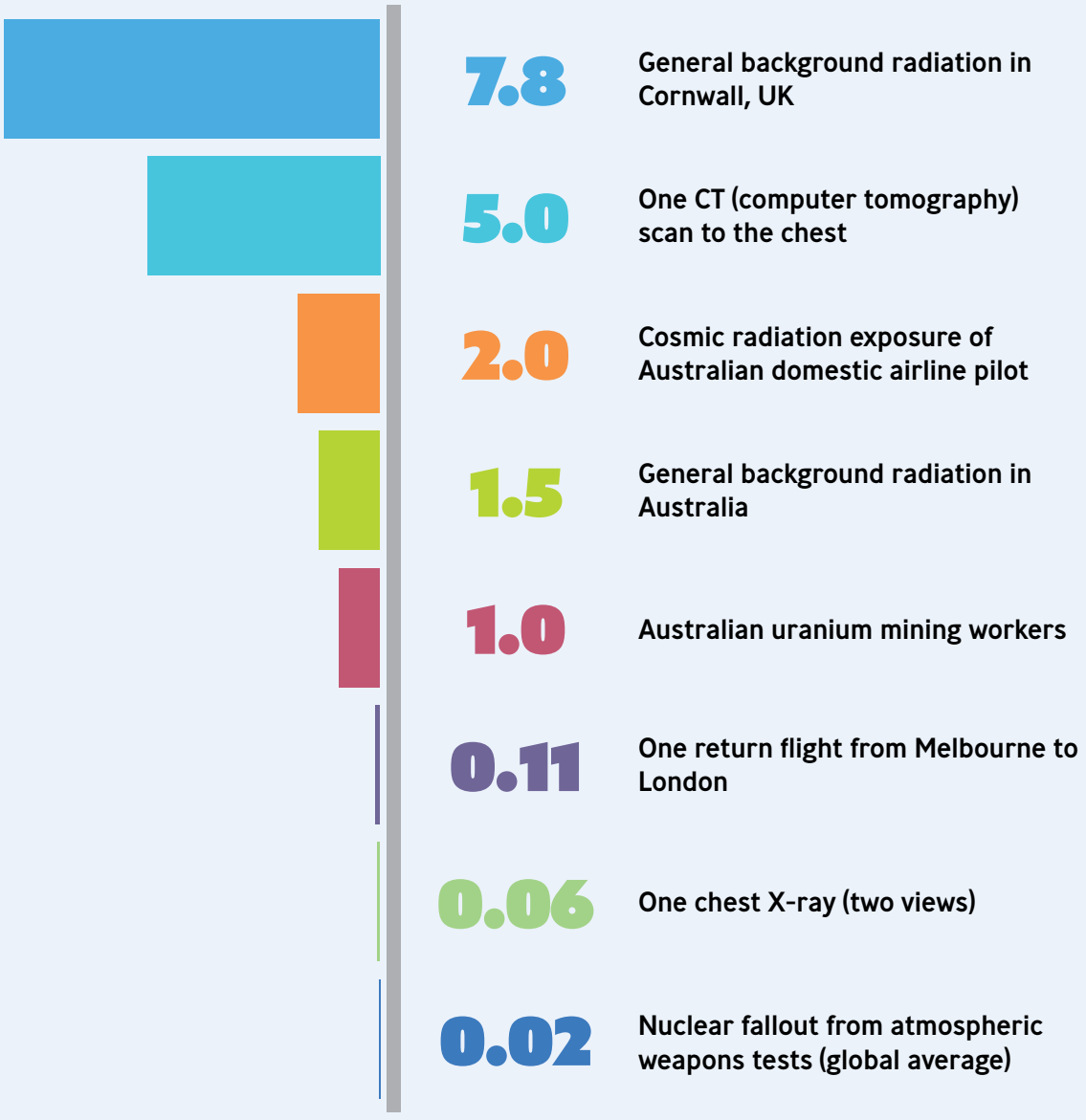
There have been many large scale studies worldwide of cancer risk in people arising from radiation exposure. The risk from exposure to high radiation doses is relatively well quantified, but for low radiation exposures the scientific evidence for increased health risk is limited.

*Breakdown of the average annual background radiation exposure to the public in Australia (mSv)*



# Radiation in Context

## *Present-day exposures to ionising radiation (mSv per year)*




For more information on radiation, visit *ARPANSA's Radiation Basics webpage.*

### *References:*

*ANSTO - Measuring Radiation*
*ARPANSA - Ionising Radiation and Health*
*UNEP - Radiation Effects and Sources*

# Stakeholder Engagement

## MCA Uranium Forum – ARPANSA Dialogue

Each year, ARPANSA and the MCA Uranium Forum meet to exchange information, views and ideas on radiation safety and radiation protection-related issues associated with the exploration, extraction, processing and transport of minerals that contain radioactive material.

On 24 February 2016, the second annual *MCA Uranium Forum – ARPANSA Dialogue* took place at ARPANSA's Melbourne site. A range of issues were covered. Some of the key topics discussed include:

## Tentative Findings of the Nuclear Fuel Cycle Royal Commission

A round table discussion took place on the Tentative Findings of the Nuclear Fuel Cycle Royal Commission released on 15 February 2016. The report was found to consider the important and most relevant issues of the nuclear fuel cycle in Australia using a process that was evidence-based with a focus on community engagement.

## Nuclear Waste

The Australian Government is planning to build a National Radioactive Waste Management Facility (NRWMF) to provide a centralised location for the disposal of Low Level Waste (LLW) and storage of Intermediate Level Waste (ILW) generated in Australia. An overview was provided and key project milestones were discussed. ARPANSA highlighted the importance of regulatory independence and community consultation.

## Radon

The International Commission for Radiological Protection (ICRP) made recommendations as part of their 2009 Statement on Radon, that doses from radon and radon progeny should be calculated using a dosimetric approach, resulting in an increase of around a factor of two for the dose coefficients. These changes have significant implications for assessing doses to uranium mine workers and resulted in a major revision of international reference levels.

In 2013, as part of a working group with industry and regulatory authorities, ARPANSA and BHP's Olympic Dam commenced a program to characterise the radioactive aerosols in different areas of the mine. The joint project on *'Assessment of radon progeny dose conversion factors from particle size measurements in the underground uranium mine at Olympic Dam'* has been completed, and a final report is now pending.

The ICRP is drafting the *'Occupational Intakes of Radionuclides Part 3'* document reflecting the new radon progeny dose conversion factors. This is expected to be published late 2016 or early 2017.

The *full meeting minutes* of the Australian radon progeny workshop can be found on APRANSA's website.

bhpbilliton

# Stakeholder Engagement

*ANRDR Manager Cameron Lawrence with ARPANSA Chief of Staff Tone Doyle and ARPANSA CEO Carl-Magnus Larsson at the Ranger uranium mine.*

## Ranger Visit (above)

On Ist June 2016, the ANRDR Manager Cameron Lawrence joined ARPANSA CEO Carl-Magnus Larsson and Chief of Staff Tone Doyle for a site visit to Ranger uranium mine. The visit focused predominantly on the preparations that are being made towards the operation's closure and remediation. Part of the visit included a brief review of the radiation management system and exposure controls that are in place at Ranger. It was noted that the drumming operation upgrades which included automatic vacuuming, washing and labelling of the final product drums were a significant ionising radiation exposure reduction control. The process safety management systems that have been introduced since a leach tank failure in late 2013 were visible and feedback from ERA management indicated that the system was working well.

## 2016 AusIMM Uranium Conference

Held at the Adelaide Convention Centre, the AusIMM uranium conference focused on geology, exploration, mining, processing, regulatory, and Health, Safety and Environment (HSE) aspects of the uranium mining industry. There was a particular focus on the recommendations of the South Australian Nuclear Fuel Cycle Royal Commission and the future of other activities in the nuclear fuel cycle in South Australia. ANRDR Manager, Cameron Lawrence, presented a review of the current status of the ANRDR and future expansion activities during the HSE session. The conference was well attended despite the current challenges in the uranium market.

# International Engagement

## Mongolian Delegation Visit


*ARPANSA staff with the Mongolian delegation and European Commission representatives.*

**On 21st April 2016, ARPANSA hosted a delegation from Mongolia and Europe to discuss the practical aspects of regulating uranium mining facilities. The visit forms part of a project funded by the European Commission to support regulatory authorities in Mongolia in the effective regulation of an expanding uranium mining industry.**

Mongolia has substantial known mineable uranium resources, with uranium produced from the Dornod deposits in Mongolia by Russian interests up until the 1990s. There are currently no uranium mining activities in Mongolia, however, the regulator is considering a number of mining licences and is dealing with legacy sites that have resulted from historical mining practices. Work is also underway in Mongolia to move towards ratification of relevant international treaties.

Mongolia are in the process of strengthening their regulatory framework and visited Australia and Canada to view operational uranium mines and the regulatory systems in place for uranium mining and processing in advanced uranium producing countries. The Australian portion of the visit included a tour of the Beverley uranium mine, and discussions with the SA EPA and ARPANSA.

During the meeting, the Mongolian delegation provided an overview of the current Mongolian regulatory framework and ARPANSA discussed its role in the Australian regulatory framework for uranium mining. Although regulation of uranium mining and milling in Australia is principally the responsibility of the states and territories, ARPANSA plays an important role in promoting national uniformity and international best practice.

Among the topics discussed were the development of guidance material to support safety standards applicable to the uranium industry, general mineral extraction and processing, protection of wildlife and the environment, and the prevention and remediation of legacy sites. The ANRDR team provided an overview of its operation, maintenance and the progress of expansion efforts currently underway.

Successful stakeholder engagement was identified as a shared challenge, particularly in communication to the public on the risks of uranium mining and other components of the nuclear fuel cycle. ARPANSA discussed some of the strategies that are being used in Australia to overcome these limitations, such as greater use of social media, and the recent success of the *Talk to a Scientist Program.*

# International Engagement

***The ANRDR Workshop and the 2nd IAEA Workshop on Developing Guidance Material to Support Safety Standards Applicable to the Uranium Mining and Processing Industry.***

*Delegates from Australia, Canada, Kazakhstan, Sweden, South Africa, USA and IAEA at the third and final IAEA workshop held in Cape Town, South Africa, May 2016.*

**In June 2015, ARPANSA signed a practical arrangement for cooperation with the IAEA to develop guidance material to support safety standards applicable to the uranium mining and uranium processing industry.**

From 12–16 October 2015, ARPANSA, in cooperation with IAEA and with support from BHP Billiton, hosted the *2nd International Workshop on Developing Guidance Material to Support Safety Standards Applicable to the Uranium Mining and Processing Industry* at BHP Billiton's Adelaide offices. This was the follow-up activity of the first workshop organised in Saskatoon, Canada in September 2014.

Whilst the main focus of the workshop was for the international members of the drafting group to further develop the structure and content of the guidance material, ARPANSA took this opportunity to bring Australian industry representatives together on 12 October as part of its *Australian National Radiation Dose Register (ANRDR) Annual Workshop,* which formed part of the afternoon session of the International IAEA workshop. As part of this session, chaired by Dr Stephen Solomon (former ARPANSA Chief Radiation Health Scientist), the ANRDR team (Ben Paritsky and Fiona Charalambous) delivered presentations focusing on:

- Providing an overview/update on the ANRDR to the IAEA, ANRDR stakeholders and international visitors on key aspects, such as international best practice and Australia's radiation protection framework in the context of monitoring and recording doses, uranium data analysis, current status and expansion plans.
- Providing an overview of Radiation Protection Series (RPS) 9 and RPS 9.1 and facilitating a discussion on which aspects of these documents work well and which aspects need to be revised to ensure that they remain fit for purpose and reflect current best practice.
- Presenting the results of a survey circulated to Australian uranium operators and regulators prior to the workshop aimed at collecting information about the approach taken by uranium mining and milling sector in monitoring, assessing and recording occupational doses.

## ANRDR Workshop (cont.)

The ANRDR session provided a platform for Australian industry feedback and sharing of information that could be taken into consideration by the international drafting group as they continued their work during the remainder of the week. The IAEA drafting group is comprised of industry, regulatory and IAEA representatives from Australia, Canada, USA, India, Kazakhstan and Namibia. During the first two days, presentations from all international participants on radiation safety practices at uranium mining and processing facilities in their respective countries were delivered.

The drafting group visited the SA EPA radon chamber and received presentations from SA EPA staff and ARPANSA on some of the cooperative work that the two organisations have been doing to support radon measurement in occupational exposure situations. These have been focused primarily on measurement techniques and characterisation of radon progeny parameters in underground uranium mines.

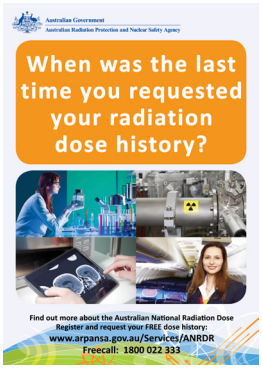
At the conclusion of the drafting sessions, it was evident that the work undertaken to refine the IAEA safety report during the week had been highly successful. The IAEA consolidated the final draft and the resulting document was the subject of the 3rd International Workshop on *Occupational Radiation Protection in the Uranium Mining and Processing Industry* which was jointly hosted by the IAEA and the National Nuclear Regulator of South Africa from 5–7 May as a side activity to the IRPA-14 congress held in Cape Town (8–13 May 2016). The purpose of this workshop was to further develop the draft safety report that had been started during and after the 2nd workshop


*ARPANSA's Fiona Charalambous presenting at the 2015 IAEA/ANRDR workshop in Adelaide.*

that was held in Adelaide. The working group aim to prepare a complete final draft by September 2016. The draft will then be progressed through the IAEA approval process for safety reports. It is hoped that the document will be approved for publication by late 2016 or early 2017.

Once published, this safety report will provide a consolidated source of information on all types of uranium mining, the primary exposure pathways for different mining techniques and processes, and the occupational radiation protection practices that need to be implemented to meet the IAEA Basic Safety Standards (BSS). This safety report covers the whole life cycle for uranium mining and processing, from exploration through to decommissioning.

## Worker Outreach Program



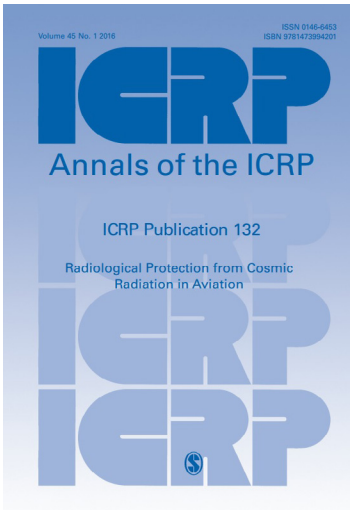
**Following on from the work done last year in revitalising the Worker Outreach Program posters, the ANRDR team has developed a new brochure which can be distributed by the radiation safety team (or human resources) to existing and new staff.**

Outreach material is provided free of charge by ARPANSA to employers who register with the ANRDR and is intended to advise workers on the capabilities and benefits of the ANRDR, and to encourage workers to periodically request their dose histories to facilitate optimisation of radiation protection practices.

The Worker Outreach Program consists of informative and engaging brochures and a poster series, as well as a PowerPoint slide which can be integrated in radiation safety training or induction presentations. The outreach material is envisioned to be generic enough so that it may be used by all occupationally exposed industries, however, PowerPoint slides may be customised for individual organisations.

We understand that every workplace and industry is different. As such, the ANRDR team would like to work with your organisation on enhancing the Worker Outreach Program, and we welcome your ideas and suggestions on effectively engaging with workers.

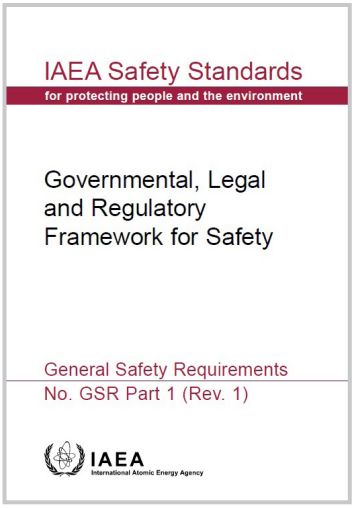
# Publications of Interest




## ICRP 132 – Radiological Protection from Cosmic Radiation in Aviation

In this publication, the International Commission on Radiological Protection (ICRP) provides updated guidance on radiological protection from cosmic radiation in aviation, taking into account the current ICRP system of radiological protection, the latest available data on exposures in aviation, and experience gained worldwide in the management of exposures in aviation. The publication describes the origins of cosmic radiation, how it exposes passengers and aircraft crew, the basic radiological protection principles that apply to this existing exposure situation, and the available protective actions.

For implementation of the optimisation principle, the Commission recommends a graded approach proportionate to the level of exposure that may be received by individuals. The objective is to keep the exposure of the most exposed individuals to a reasonable level. The Commission also recommends that information be disseminated to raise awareness about cosmic radiation, and to support informed decisions among concerned stakeholders.



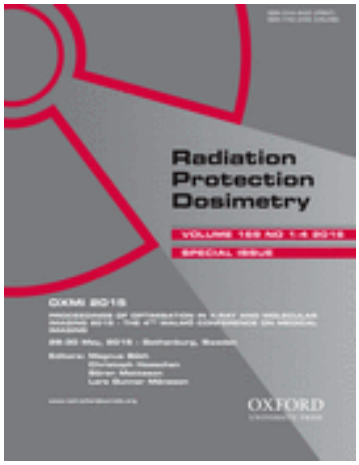

## IAEA Safety Standards Series GSR Part 1 – Government, Legal and Regulatory Framework for Safety

This publication establishes requirements with respect to the governmental, legal and regulatory framework for safety. It covers the essential aspects of the framework for establishing a regulatory body and taking other actions necessary to ensure the effective regulatory control of facilities and activities utilised for peaceful purposes. A review of Safety Requirements publications was commenced in 20ll following the accident in the Fukushima Daiichi nuclear power plant in Japan. The review resulted in a set of amendments to strengthen the requirements and facilitate their implementation, which are contained in the present publication. This publication makes note that the regulatory body shall establish a national dose register as one of the key systems for regulatory control.


## Experiences in Developing a National Dose Register in Finland and Merging it with the Overall Supervisory Data System (Radiation Protection Dosimetry 168(4) 2016)

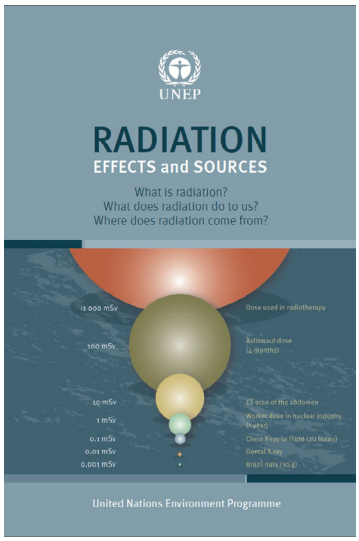
In recent years, a new national dose register has been under development in Finland. This article presents this work, the challenges in the project, the features of the new register and experiences in using it. There were several motivations for creating a new register. The technical implementation of the existing dose register needed to be reformed, and there was also a need to improve electronic communication and access to the recorded data. The development was challenging and took more time and effort than expected. Despite the challenges, the new system works reliably and enables the use of registered data to improve radiation safety.

# Publications of Interest




## Establishment of a National Dose Register and a Dosimetry Service Approval System in Ireland (Radiation Protection Dosimetry 2016)

Until the end of 2012, the Radiological Protection Institute of Ireland (RPII) operated a personal dosimetry service for workers in the medical, industrial, education and research sectors in Ireland. The data recorded by the RPII service were used to generate national dose statistics and as such acted as a National Dose Register (NDR). In preparation for the closure of the RPII dosimetry service in 2012, a formal NDR was introduced for the first time in Ireland and data on all monitored workers are now supplied to it annually by Approved Dosimetry Services. A new system for approving dosimetry services operating in Ireland was also introduced in 2012. The criteria for approval are based on the recommendations given in the European Commission's publication, 'Radiation Protection No. 160'. This paper describes the steps involved and the operational experience gained in establishing both the NDR and the system for approval of dosimetry services. A key requirement of the dose register is for dosimetry services used by organisations submitting data into the Register to have ISO 17025 or equivalent certification.




## United Nations Environment Programme (UNEP) Radiation Effects and Sources (2016)

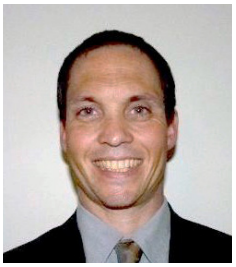
Based on UNSCEAR reports, this report takes the most up-to-date scientific information and makes it accessible for general readers. The report provides information on the basic physical properties of radiation, its potential effects and where it comes from. The scientific information is detailed and is combined with well thought out imagery to convey the message.

The history of radiation discovery, half-life, units, types and penetration of radiation is covered with the basic physical properties. The effects of radiation are detailed providing the impacts of acute and chronic exposures for humans, plants and animals as well as the relationship between the dose received and effects. Sources of radiation are clearly defined as natural and artificial with clear information on each of the exposure pathways for the various types of sources. Medical exposures are put into context in relation to other sources.

This report would be of benefit to a Radiation Safety Officer to provide additional information to personnel who seek or require a better understanding of radiation exposure.

# Team, Events and Contact

## The ANRDR Team



### *Cameron Lawrence, ANRDR Manager*

Cameron joined ARPANSA as the ANRDR Manager in early 2016 and brings his extensive experience in health, hygiene and radiation safety from the uranium mining and aluminium industries to the team. Cameron is responsible for the continued expansion of the ANRDR into other sectors and the overall management of the Dose Register.

### *Ben Paritsky, Science Officer*

Since joining the ANRDR in 2012, Ben has managed the operation, ongoing maintenance and development of the ANRDR. Most recently, Ben has driven the activities related to the expansion of the dose register beyond uranium mining and coordinated the redevelopment of the database, portal and quality management system.

## Upcoming Events

### *ARPS Conference*

11–14 September 2016, Adelaide, SA

### *Eighth International Symposium on Naturally Occurring Radioactive Material*

18–21 October 2016, Rio de Janeiro, Brazil

### *Engineering and Physical Sciences in Medicine (EPSM) Conference*

6–10 November 2016, Sydney, NSW

## Contact ANRDR

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