

THE ANNUAL REPORT OF
THE RADIATION ADVISORY COMMITTEE
FOR THE FINANCIAL YEAR ENDING JUNE 2017

RADIATION ADVISORY COMMITTEE

Melbourne, Australia

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ISBN 1035-7912

This document is available on-line at:

<https://www2.health.vic.gov.au/public-health/radiation/radiation-regulatory-framework/radiation-laws/radiation-advisory-committee>

The Hon Jill Hennessy MP
Minister for Health
Minister for Ambulance Services

Dear Minister

Pursuant to Section 110 of the *Radiation Act 2005*, the Radiation Advisory Committee submits the 2017 annual report of the Committee for presentation to Parliament.

Yours faithfully

Dr Dean Morris
Chair
RADIATION ADVISORY COMMITTEE

CONTENTS

RADIATION ADVISORY COMMITTEE	1
(i) Composition.....	1
(ii) Responsibilities	3
1. Introduction.....	3
2. Ionising radiation	3
2.1 Radiation Regulations 2017	3
2.2 Radiation stakeholder engagement strategy	4
2.3 Issues in relation to disposal of radioactive material in the mineral sands industry	5
2.4 IAEA Integrated Regulatory Review Service (IRRS)	5
2.5 Code for Radiation Protection in Planned Exposure Situations (2016)	6
2.6 Draft code for radiation protection in medical exposure	7
2.7 Draft guidelines for emergency radiation exposures	8
2.8 Draft guidelines for radiation protection in existing exposure situations	8
2.9 Security of portable density/moisture gauges.....	8
2.10 Licensing of radiation oncology medical physicists (ROMPs) to use high dose rate brachytherapy equipment	9
2.11 Proposed exemption of low risk radiation practices from licensing requirements.....	9
2.12 Incident involving X-ray analysis unit.....	10
2.13 Diagnostic reference levels for multi-detector computer tomography scans, positron emission tomography (PET) and nuclear medicine in Australia	11
2.14 Paper on nuclear medicine errors reported in Australian radiation incident registers..	11
2.15 Paper on current perspectives on intraoperative radiation therapy for breast cancer patients.....	12
2.16 Radiation Act Annual Report for the financial year ending 30 June 2016	12
2.17 Use of dual-energy X-ray absorptiometry (DEXA) to assess body fat	13
2.18 Healthy Homes (home energy efficiency retrofit) program – radon issues.....	13
2.19 Metro Tunnel Project and radiation practices at a Melbourne hospital	14
2.20 Naturally occurring radioactive material (NORM) associated with the demolition of Hazelwood power station.....	14
2.21 Werribee Employment Precinct.....	14

2.22	Australian Clinical Dosimetry Service (ACDS)	14
2.23	Conditions on management licences in relation to linacs	14
2.24	Disposal of a caesium-137 (Cs-137) irradiator by a Melbourne hospital.....	15
2.25	Women on boards implementation plan	15
2.26	Expiry of current term of appointment of Radiation Advisory Committee	15
3.	Non-ionising radiation	16
3.1	Enforcement action taken by the Department of Health and Human Services in relation to illegal use of commercial tanning units in Victoria	16
3.2	Proposed Regulation of intense pulsed light sources (IPLs) and Lasers	16
3.3	Smartchips for mobile phones.....	16
3.4	Publications and journal articles reviewed by the committee	16
3.5	The committee’s view on possible health effects of radiofrequency radiation.....	19
3.6	The committee’s view on possible health effects of power frequency electromagnetic fields.	19
Appendix 1 - Terms of reference of the Radiation Advisory Committee.....		20

RADIATION ADVISORY COMMITTEE

The Radiation Advisory Committee (the Committee) is established under Part 10 of the *Radiation Act 2005*. The term of appointment for the Committee is the period 17 August 2014 to 16 August 2017.

(i) Composition

The Committee met on 6 occasions from July 2016 to June 2017.

The members of the Committee for the period from July 2016 to June 2017 were:

<p>Dr Dean Morris (Chair) Head of Operations Australian Synchrotron</p> <p>Meetings attended: 5</p>	<p>Dr. David Bernshaw Consultant Radiation Oncologist Peter MacCallum Cancer Centre</p> <p>Meetings attended: 5</p>
<p>Mr Russell Booth Chief Nuclear Medicine Technologist Medical Imaging Department St Vincent's Hospital</p> <p>Meetings attended: 4</p>	<p>Dr Ray Budd Consultant medical physicist</p> <p>Meetings attended: 5</p>
<p>Dr. Roslyn Drummond Radiation Oncologist Peter MacCallum Cancer Centre</p> <p>Meetings attended: 6</p>	<p>Professor Robert Gibson Radiologist Royal Melbourne Hospital</p> <p>Meetings attended: 4</p>
<p>Dr Russell Horney Physicist Department of Medical Imaging and Radiation Sciences Monash University</p> <p>Meetings attended: 5</p>	<p>Dr. Ken Joyner Director Joyner and Associates Telecommunications Consultancy</p> <p>Meetings attended: 4</p>
<p>Mr Paul Marks Senior Medical Radiation Scientist Australian Radiation Protection and Nuclear Safety Agency</p> <p>Meetings attended: 6</p>	<p>Mr Christopher Perry Chief Radiographer EMI Radiology East Melbourne</p> <p>Meetings attended: 5</p>

<p>Mr Paul Tomlinson Senior Technician ALS Industrial</p> <p>Meetings attended: 4</p>	<p>Dr Joanna Wriedt Physiologist, Epidemiologist and Lawyer</p> <p>Meetings attended: 5</p>
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(ii) Responsibilities

The Committee is to advise the Minister for Health or the Secretary of the Department of Health and Human Services, on any matters relating to the administration of the *Radiation Act 2005*, referred to it by the Minister or the Secretary including the following:

- (a) The promotion of radiation safety procedures and practices.
- (b) Recommendation of the criteria for the licensing of persons and the qualifications, training or experience required for licensing.
- (c) Recommendation of which radiation sources should be prescribed as prescribed radiation sources.
- (d) Recommendation of the nature, extent and frequency of tests to be conducted on radiation apparatus and sealed radioactive sources.
- (e) Codes of practice, standards or guidelines with respect to particular radiation sources, radiation practices or uses.

Section 110 of the Radiation Act requires that the Committee must give the Minister a report on its activities during a financial year no later than 1 November following that year.

1. Introduction

Throughout the year a number of issues were considered by the Committee including:

- the regulatory requirements for various ionising radiation practices;
- non-ionising radiation matters;
- licensing requirements and dosimetry in relation to medical radiation oncology;
- radiation stakeholder engagement.

The terms of reference for the Committee are provided in Appendix 1.

The Committee would like to thank the Radiation Team of the Department of Health and Human Services, in particular Mr Morrie Facci, for its continuing assistance and support.

2. Ionising radiation

2.1 Radiation Regulations 2017

The Committee noted the progress regarding the development of the *Radiation Regulations 2017*. The current *Radiation Regulations 2007* sunset on 28 August 2017. The Committee was advised that the final draft of the regulatory impact statement (including the draft Radiation Regulations 2017 and three regulatory instruments) had been completed and were required to be advertised for public comment for 28 days. The department would then address any submissions received, brief the Minister's office concerning the regulations and then lodge the documents with the Governor in Council. The regulatory impact statement would then be publicly exhibited and the department would write to stakeholders to advise them of the new regulations.

The main changes in the Radiation Regulations 2017 are:

- Requirements related to strengthening security of high consequence radioactive material.
- Lowering of the limit for workers' lens of the eye exposure to ionising radiation, in line with 2011 recommendations of the International Commission on Radiological Protection.
- Elimination of the fee associated with applying for a variation to an existing licence or approval and transferring an existing management licence.
- Creating a new fee category for non-enclosed cabinet X-ray units.
- Creating a new fee category for dental 3D Volumetric X-ray units.

2.2 Radiation stakeholder engagement strategy

The Victorian Auditor General made a number of recommendations in March 2015 to improve regulation within the department in a report entitled 'Managing Regulator Performance in the Health Portfolio'.

These recommendations are summarised in the committee's annual report for 2015 available at:

<https://www2.health.vic.gov.au/public-health/radiation/radiation-regulatory-framework/radiation-laws/radiation-advisory-committee>

The committee was advised that, in response to recommendations of the Victorian Auditor General's Office, the department would seek to engage more with stakeholders. The department intended to map out all relevant stakeholders and had commenced work on mapping out medical stakeholders.

The department regulates over 15,000 management and use licence holders in a variety of areas including medical, dental and veterinary sectors; mining of radioactive ores; transport of radioactive material; and industrial uses of radiation. There are also a number of stakeholders that are important to the regulation of radiation including national regulatory authorities, other Australian jurisdictions, professional associations and commercial service providers.

The department has ranked stakeholders to capture the key stakeholders related to the regulation of radiation in Victoria and to determine priorities as to how the department engages with the stakeholders.

The priority sectors identified included high dose medical diagnostic imaging, radiotherapy, industrial radiography, borehole logging and transport of radioactive material.

The aim of the engagement strategy is to ensure that stakeholders are informed of matters pertaining to radiation safety, in particular their own responsibilities under the Radiation Act 2005 and the roles and functions of the department in relation to the regulation of radiation sources in Victoria.

The development of the stakeholder engagement strategy seeks to address the goal of having informed stakeholders.

The objectives of the stakeholder engagement strategy are to:

- raise stakeholder awareness of the role of government in relation to radiation regulation and incident response;
- improve licence holders' awareness of their obligations related to compliance and the identification and management of the safety and security risks associated with their activities; and

- strengthen engagement with stakeholders to improve collaboration in the development of legislation, standards, codes and other materials; and to facilitate and improve the preparation and response to radiation incidents.

A number of tools and strategies have been identified as mechanisms that will assist in delivering key messages to stakeholders. Due to the rising cost of sending hard copy mail, information including newsletters will be provided electronically via the department's website and through emails. Staff from the Radiation Team of the department will develop presentations to stakeholders at various locations in Victoria and possibly interstate.

The following stakeholder groups will be targeted as part of the stakeholder engagement strategy:

Internal stakeholders:

- Minister for Health.
- Chief Health Officer and Deputy Chief Health Officer (Environment).
- Director, Health Protection, Operations and Strategy.
- Deputy Secretary, Regulation, Health Protection and Emergency Management Division.
- Director, Emergency Management.
- Chief Medical Officer, Health Service Performance & Programs Division.
- Manager, Cancer Services and Information - Health Service Performance and Programs.
- Director Infrastructure Planning & Delivery - Capital Projects & Service Planning.

External stakeholders:

- Associations/Colleges/Societies and Committees/Councils.
- Licence holders/approval holders and management licence holders with the largest numbers of sites on their licence.
- Emergency management service providers.
- Regulatory Authorities and Registration Boards.

The committee recommended that the best way to target radiologists and others who may not necessarily hold a use licence would be to contact the relevant professional bodies. The committee particularly recommended that the Royal Australasian College of Surgeons be contacted as this body governs orthopaedic and vascular surgeons, amongst others. These professional bodies could best advise as to the most effective means of communicating with their members.

2.3 Issues in relation to disposal of radioactive material in the mineral sands industry

The committee was advised that Iluka Resources Limited (Iluka) has been mining mineral sands in the west of Victoria since 2005. Part of their operation includes disposing of waste by-products generated by processing of heavy mineral concentrate (HMC) at their mineral separation plant in Hamilton into the disposal pit at its Douglas mine site in western Victoria, known as Pit 23.

Disposal of the by-products from the processing of HMC into Pit 23 commenced in 2011. The HMC is produced by mining activities at various Iluka mines, including those at Ouyen and South Australia.

Iluka proposed to continue the disposal into Pit 23 of by-products arising from the processing of HMC from its mining operations. This involved Iluka seeking authorisation from the Environment Protection Authority (EPA) and Horsham Rural City Council (HRCC) to continue to dispose of the waste by-products arising from the processing of heavy mineral concentrate at their Hamilton mineral separation plant into Pit 23.

In May 2016, the EPA informed the department and other stakeholders that it had assessed the works approval application from Iluka Resources to continue disposing of radioactive materials into Pit 23. EPA found that neither pollution nor environmental hazard has occurred or is likely to occur in the future as a result of current or proposed disposal activities.

HRCC subsequently refused to issue a planning permit to Iluka for the proposal to dispose of wastes to Pit 23.

Iluka lodged an appeal against the HRCC decision with the Victorian Civil and Administrative Tribunal (VCAT); the period of the VCAT hearing was from 7 to 25 November 2016. The department was joined as a party to the VCAT hearing. The department engaged a barrister to represent it at key parts of the hearing, primarily those related to discussions about the department's assessments of radiation safety. Other parties joined were Iluka, HRCC, EPA, the Department of Economic Development, Jobs, Transport and Resources, Southern Grampians Shire Council, Kanagulk Landcare Group Inc, two individuals residing in the area of Iluka's Douglas mine, and one individual residing near Horsham.

The department advised the committee that VCAT upheld Iluka's appeal and directed HRCC to issue a planning permit to Iluka and specified the conditions of the permit.

The committee commended the work of the department in relation to this issue.

2.4 IAEA Integrated Regulatory Review Service (IRRS)

The committee was advised regarding the International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service (IRRS) that various state and territory regulators will participate in during 2018. The department has appointed an officer, working with the Radiation Team of the department, specifically to facilitate the department's participation in the IRRS. The IRRS is designed to strengthen and enhance the effectiveness of the national regulatory infrastructure of states for nuclear radiation, radioactive waste, and transport safety. In particular, IRRS missions focus on regulatory, technical and policy issues in the light of international guidelines embodied in the IAEA safety standards and of good practices observed in other states. The service is used to share regulatory experiences, to harmonise regulatory approaches among member states and to create mutual learning opportunities among regulators.

Participating in the IRRS involves the completion of a number of modules that seek to obtain information about the regulatory environment of a particular jurisdiction or state. There are four to five modules, relating to regulatory work, that Victoria and other participating jurisdictions will be required to complete.

2.5 Code for Radiation Protection in Planned Exposure Situations (2016)

The committee was advised that the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has published the *Code for Radiation Protection in Planned Exposure Situations (2016)* for radiation protection in planned exposure situations that is based on the section on planned exposure situations in the International Atomic Energy Agency (IAEA) publication

Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards; General Safety Requirements' Part 3.

The code sets out requirements in Australia for the protection of occupationally exposed persons, the public and the environment in planned exposure situations. The primary means of controlling exposure in planned exposure situations is by good design of facilities, equipment, operating procedures and through training.

In the Australian context, the requirements for planned exposure situations apply to the following practices:

- The production, supply, provision and transport of radioactive material and of devices that contain radioactive material, including sealed sources and unsealed sources, and of consumer products;
- The production and supply of devices that generate radiation, including linear accelerators, cyclotrons, and fixed and mobile radiography equipment;
- The use of radiation or radioactive material for industrial, veterinary, agricultural, legal or security purposes, including the use of associated equipment, software or devices where such use could affect exposure to radiation;
- The use of radiation or radioactive material for education, training or research, including any activities relating to such use that involve or could involve exposure to radiation or exposure due to radioactive material;
- The mining and processing of raw materials that involve exposure due to radioactive material.

The code is not intended to apply to existing exposure situations, emergency exposure situations other than where the emergency situation arises from the planned activity, or exposure of a person to radiation received as a patient undergoing medical diagnosis or therapy, as a volunteer in medical research, or non-occupational exposure received as a consequence of assisting an exposed patient. These exposure situations are expected to be dealt with by later ARPANSA publications in the Radiation Protection Series or, in the case of medical exposures, by the *Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation (2008)* published by ARPANSA and supporting safety guides.

The committee noted that the department would need to implement requirements of the code by means of placing conditions on management and use licences issued by the department.

2.6 Draft code for radiation protection in medical exposure

The committee was advised that ARPANSA had prepared a draft code for Radiation Protection in Medical Exposure (the medical code). The medical code is intended to replace the existing *Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation (2008)* published by ARPANSA. ARPANSA had considered the IAEA publication GS-R-3, *The Management System for Facilities and Activities*, in developing the medical code. The department will consider the medical code, when published, in developing any new conditions on licences authorising medical radiation practices.

The proposed code has not yet been finalised.

2.7 Draft guidelines for emergency radiation exposures

The committee was advised that this ARPANSA document needs a lot more work. Conceptually there were three users of the document: government, regulators and individual organisations.

2.8 Draft guidelines for radiation protection in existing exposure situations

The committee was advised that this ARPANSA document was close to being finalised.

2.9 Security of portable density/moisture gauges

Portable density/moisture gauges (PDMGs) are devices incorporating a small amount of radioactive material and are typically used to assess the level of compaction in road construction materials.

The department commenced a programme of inspections of companies authorised to possess PDMGs in February 2016. The aim of this was to gain a better understanding of methods of security currently being used during transport, with the intention of developing more prescriptive guidance for licence holders if required.

Following review of the information collected by the department during the inspections conducted up to the end of June 2016, it was proposed to vary existing management licences to mandate the methods which can be used to secure PDMGs during transport.

Proposed methods of securing the PDMGs included:

- Securing in a closed vehicle (i.e. van or closed tray utility vehicle),
- Securing in a locked tool cabinet attached to an open tray utility vehicle, securing in a locked frame attached to an open tray utility vehicle,
- Securing with chains locked to anchor points on an open tray utility vehicle.

The committee considered that the best method was firmly securing the PDMG inside a closed tray utility vehicle or, in the case of an open tray utility vehicle, securing it in a locked frame attached to the utility vehicle.

After considering the review of PDMG security, the committee's views and practicalities in the industry, the department developed a new condition of licence that management licence holders must comply with the DHHS document *Security of PDMGs during transport* developed by the department. This document is available at:

<https://www2.health.vic.gov.au/about/publications/policiesandguidelines/security-of-pdms-during-transport>

In summary, this document requires that a vehicle is only acceptable as a store for short periods when the PDMG is in transit and that PDMGs must only be kept in a parked vehicle overnight if it is not reasonable to provide or make use of a proper store.

The document also requires that, during transport, PDMGs must be secured within the vehicle using one of the following four methods:

- Locked within an enclosed vehicle
- Locked within a metal toolbox secured in an open tray vehicle
- Locked within a metal frame secured in an open tray vehicle
- Locked to an open tray vehicle using chains/steel cable.

The committee supported the actions taken by the department to address the security of PDMGs.

2.10 Licensing of radiation oncology medical physicists (ROMPs) to use high dose rate brachytherapy equipment

Professor Tomas Kron, Director of Physical Sciences, Peter MacCallum Cancer Centre; Ms Nilgun Touma, Director of Radiation Therapy Services, Peter MacCallum Cancer Centre; and Ms Min Ku, Professional Standards Manager, The Australian Society of Medical Imaging and Radiation Therapy (ASMIRT, formerly AIR), gave short presentations to the committee summarising their views and concerns in relation to licensing of Radiation Oncology Medical Physicists (ROMPs) to use high dose rate brachytherapy equipment.

The committee noted that this issue had been discussed at a committee meeting a number of years ago and that a guidelines document for intravascular brachytherapy had been developed by the Radiation Team of the department in conjunction with the committee. The committee considered this document so that it would come to an informed position in relation to licensing of ROMPs for the treatment of patients. The committee also considered that the other jurisdictions should be consulted to ascertain their licensing requirements in relation to high dose rate brachytherapy.

The majority of the other jurisdictions only permitted ROMPs to use high dose rate brachytherapy equipment for medical physics and quality assurance purposes.

This matter is still being considered by the committee.

2.11 Proposed exemption of low risk radiation practices from licensing requirements

The committee was advised that the audit report by the Victorian Auditor General (see 2.2 above) contained a number of findings, including one that *'regulators have not taken a systematic, risk-based approach and do not fully understand the impact of their regulatory activities'*.

To assist in addressing this recommendation a systematic review of radiation practices for 2015 was conducted to determine the radiation detriment to the Victorian population from each practice.

Intra-oral dental X-ray practices accounted by far for the largest number of licences authorising low risk practices. Intra-oral dental X-ray practices were classified as low risk because of the low radiation dose received by both patients and dental as a result of their use.

The department advised that it is investigating the merits of a proposal to exempt both individuals and body corporates (e.g. companies) from licensing in relation to the use, possession and disposal of intra-oral dental x-ray units.

The proposal would see a conditional exemption made using the power of section 16 of the Radiation Act 2005. The proposed exemption would require compliance with the *Code of Practice for Radiation Protection in Dentistry (2005)* published by ARPANSA.

The continued licensing of this type of practice results in a significant administrative workload for the department principally due to the large number of licences involved. The question for the department is whether this is an appropriate use of resources that could be better spent targeting higher risk radiation practices.

The committee noted that concerns might be raised if Victoria adopted this approach when no other states/territories are considering it.

The committee advised that it would be helpful to consider the residual risk, if any, after introducing the exemption and to compare radiation doses from intra-oral dental procedures with doses from other radiation practices.

The committee was advised that consultation had commenced about the proposal. All but one of the comments were supportive of exempting the requirement for a use licence. The proposal to exempt the requirement for a management licence was met with divided comments, some supportive of the proposal and some not. The committee advised that the department should seek comment from the Australian Dental Association (ADA) and the Australian Health Practitioner Regulation Agency (AHPRA). Feedback from the ADA was extremely positive in relation to the proposal to remove the requirement for individuals who use these units to hold a use licence. It was less supportive of the proposal to remove the requirement of licensing of the companies and individuals who possess these units.

The department will pursue this proposal further in the second half of 2017.

2.12 Incident involving X-ray analysis unit

The committee was advised of an incident at a Melbourne university in which a staff member inadvertently placed two digits into the X-ray beam of an X ray analysis unit while replacing the phosphor target inside a goniometer. The staff member's digits were potentially exposed to the X ray beam approximately 8 cm from the X-ray source for about 10 to 15 seconds.

The absorbed dose to the fingers of the staff member could have been up to about 50 Gy to 70 Gy. This dose, however, would only have occurred in the unlikely scenario of the same area of the skin being exposed over this time period. Medical follow-up was advised.

The university is reviewing the incident and will provide a final report to the department. The department will review the report to determine whether there are any mitigating steps that may be taken to minimise the likelihood of a recurrence of such incidents.

2.13 Diagnostic reference levels for multi-detector computer tomography scans, positron emission tomography (PET) and nuclear medicine in Australia

The committee was advised that, as part of ARPANSA's ongoing work in the medical imaging space, national diagnostic reference levels (DRLs) have now been derived for 70 general nuclear medicine procedures.

ARPANSA has provided a spread of radiation dose data for each of these procedures with the 75th percentile being defined as the DRL. As ARPANSA continues to promote the ALARA principle (ensuring that doses are kept **As Low As Reasonably Achievable**, economic and social factors taken into account), it considers that the use of the median value (the 50th percentile) of administered activities should be considered in protocol design.

The committee commented that compliance with DRLs does not, by itself, indicate that a particular procedure is performed at an optimised level with regard to the amount of radiation used.

2.14 Paper on nuclear medicine errors reported in Australian radiation incident registers

Nicole Kearney and Gary Denham Recommendations for Nuclear Medicine Technologists Drawn from an Analysis of Errors Reported in Australian Radiation Incident Registers. J Nucl Med Technol 2016; 44:243–247.

The authors of this paper reported that a multidisciplinary team comprising a nuclear medicine technologist, a radiation therapist, and a diagnostic radiographer analysed all nuclear medicine technology-, radiation therapy-, and diagnostic radiography-related incidents recorded in ARPANSA's Australian Radiation Incident Register and in the registers of New South Wales, Western Australia, Victoria, South Australia, and Tasmania between 2003 and 2015.

They state that information drawn from the registers has revealed steps that can be taken by any nuclear medicine department to prevent repetition of the incidents that have already occurred.

The recommendations cover the areas of radiopharmacy training, radiopharmacy management, radiopharmaceutical administration and dose, pediatric dosing and weight estimation, medical imaging department protocols, education, improved supervision of students and new graduates, removing disincentives for error reporting and the creation of a culture of safety throughout medical imaging department.

The committee noted the conclusions of this paper and indicated that the authors did not appear to address the question of why the time-out protocols weren't used properly. The committee felt that a root-cause analysis should have been undertaken.

2.15 Paper on current perspectives on intraoperative radiation therapy for breast cancer patients

Dutta SW et al. Intraoperative radiation therapy for breast cancer patients: current perspectives. Breast Cancer - Targets and Therapy 2017;9, 257–263.

The authors of this paper consider that accelerated partial breast irradiation (APBI) provides an attractive alternative to whole breast irradiation through reduced normal tissue radiation exposure and reduced treatment duration. Intraoperative radiation therapy (IORT) is a form of APBI with the shortest time interval, as it delivers the entire planned radiation course at the time of breast surgery. However, IORT has been met with a certain amount of scepticism.

Patients treated with IORT have an increased compliance and overall satisfaction when compared to patients treated with WBI. However, early randomised trial results demonstrate an increased rate of recurrence after IORT, slowing its widespread adoption. Despite these controversies, IORT utilisation is increasing in the USA and several novel developments are aimed at continuing to minimise the risk of recurrence and treatment-related toxicity while maximising the patient experience.

The committee noted that this was not new technology and should only be used as part of clinical trials investigating its efficacy.

2.16 Radiation Act Annual Report for the financial year ending 30 June 2016

Section 134 of the Radiation Act requires that the Secretary publish a report for each financial year that:

- describes the activities of the Secretary under the Radiation Act 2005
- includes a summary of all authorities issued, renewed, suspended, cancelled, varied, transferred or surrendered during that year
- includes all radiation incidents investigated in that year
- includes a summary of all prosecutions for offences against the Radiation Act or the Radiation Regulations 2007 commenced in that year.

The committee was provided with a copy of the Radiation Act Annual Report for the financial year 2015 -2016 for information.

The committee noted that the department's document Mandatory reporting of radiation incidents (available on the department's web site) requires a management licence holder authorised to conduct a medical radiation practice to report unplanned exposures of pregnant females. The committee was of the view that the department is currently including in the Radiation Act annual report cases of inadvertent exposures of pregnant women rather than unplanned exposures of pregnant women. An inadvertent exposure of a pregnant female involves the correct patient undergoing the correct procedure and later discovering that she was pregnant at the time of the procedure. Unplanned exposure of a pregnant woman involves that person undergoing a procedure that was not intended for her.

The committee believed that incidents involving imaging prior to radiotherapy should be included specifically amongst the categories of reportable incidents.

Other jurisdictions and ARPANSA were consulted as to their incident reporting requirements in general, including their requirements for incidents involving medical imaging procedures on pregnant women in particular. The medical incident reporting requirements varied considerably across the jurisdictions. The only jurisdiction other than Victoria to have reporting requirements for exposure of pregnant patients was Western Australia, and then only for incidents that have resulted in or were likely to result in a radiation dose to the embryo or foetus of more than 1 mSv.

The committee was advised by the department that the Radiation Team of the department would prepare draft Victorian incident reporting requirements for publication on the department's web site and that they were likely to be based on those in Schedule 13 of the National Directory for Radiation Protection (RPS 6), published by ARPANSA. Consideration, however, would be given to the requirements in the International Atomic Energy Agency's General Safety Requirements Part 3 (GSR Part 3).

Development of these guidelines by the department was still ongoing as at 30 June 2017.

2.17 Use of dual-energy X-ray absorptiometry (DEXA) to assess body fat

The committee noted that there seemed to be a proliferation of the use of DEXA to analyse body composition (such as proportion of fat), where there was no medical justification for such use, e.g. amongst persons concerned with body image. The committee was advised that the department had initiated an investigation of this use and would take any necessary action to minimise such use.

The department advised the committee that management licences authorising the possession of medical imaging equipment had conditions placed upon them which included required that the management licence holder have a system in place to ensure justification of medical procedures as required by the *Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation (2008)* published by ARPANSA.

The committee noted that the doses involved in DEXA scans were very small (0.001 - 0.01 mSv) and that South Australia does not regulate DEXA units because the doses were so low. The committee nevertheless did not consider that such use of DEXA unit was justified.

2.18 Healthy Homes (home energy efficiency retrofit) program – radon issues

Sustainability Victoria wrote to the department seeking advice from the department and the committee on how to address increased radon concentrations in houses associated with a home energy efficiency retrofit program that it is planning to run starting around June 2017. There exists the potential for an increased level of radon in houses that are more physically sealed from the environment, to maintain temperature, due to lack of an escape route for radon that seeps upward from the ground into the house. Around 1000 homes would be recruited into the program which is aimed at low-income households where at least one person is receiving home-based community care, or is using complex care services (as defined by the department), or has a chronic respiratory disease such as asthma or chronic obstructive pulmonary disease (COPD).

The committee advised Sustainability Victoria that it would be prudent to carry out track-etch monitoring of radon in a representative sample of the homes both before and after the retrofit and that a respiratory physician be consulted as a part of the program.

2.19 Metro Tunnel Project and radiation practices at a Melbourne hospital

The committee was advised that the Metro Tunnel Project would result in infrastructure of the tunnel (an escalator) being near to a radiation practice at a Melbourne hospital. The adequacy of the shielding needed to be assessed and confirmed. Vibration due to trains may be an issue for the radiation practices at the hospital.

2.20 Naturally occurring radioactive material (NORM) associated with the demolition of Hazelwood power station

The committee was advised that two members of the Radiation Team of the department had attended Hazelwood evaluating the low level NORM occurring as a result of the demolition of the power station there. The Radiation Team is currently investigating the health implications; the NORM is not likely to be a significant issue.

2.21 Werribee Employment Precinct

The committee was advised of the work being undertaken by the department and the EPA in relation to determining the health risk from animals incorporating tritium and other isotopes being buried in the Werribee Employment Precinct in the past. It is not likely that there would be any significant levels of these isotopes that would pose any health risk to future occupants of the site.

2.22 Australian Clinical Dosimetry Service (ACDS)

Dr Ivan Williams of ARPANSA gave a presentation to the committee on developments in relation to the Australian Clinical Dosimetry Service (ACDS). The ACDS is a national independent dosimetry auditing program of ARPANSA, providing quality assurance for radiation oncology facilities. The ACDS has been operating since February 2011, covering 100% of Australian radiotherapy facilities. ACDS is accredited by NATA to the International Organization for Standardization standard ISO: 17025 under Performance and Approvals Testing. The ACDS offers a multi-level audit service on a four year subscription basis. Dr Williams advised the committee that ACDS is moving to be a user-pay system in 2017 and that it needed participation by 50% of the states and territories to remain commercially feasible. Victoria, Tasmania and the Northern Territory have indicated that they would participate and it was likely that facilities from the other states and territories would also participate.

2.23 Conditions on management licences in relation to linacs

The committee was advised that the department would shortly be placing conditions on the management licences of facilities that use linear accelerators requiring auditing of dose delivery by an approved service provider. The department also advised that the Team Leader Radiation Team had prepared a paper outlining the rationale for this requirement.

2.24 Disposal of a caesium-137 (Cs-137) irradiator by a Melbourne hospital

The committee was advised that a Melbourne hospital had disposed of a Cs-137 irradiator to a disposal facility in the Czech Republic, citing an activity calculated from initial activity and decay. This facility reported that it had measured the activity to be 6 to 7 times greater than the calculated activity and that the measured activity was greater than what they were licensed to receive. The committee suggested that the department may want to request a second, independent measurement of the activity of the source. The department is currently working to resolve this issue.

2.25 Women on boards implementation plan

The committee was advised that it is government policy that government boards and committees should more accurately reflect the composition of the Victorian community in relation to gender balance; cultural diversity; and rural and regional representation. There is a whole of government target of a minimum 50 per cent representation of women on boards and committees. Appointment submissions should state whether women have been considered for appointment. This government policy is relevant to the reappointment of the committee in 2017. It was noted that the requirement for 50 per cent representation of women on boards and committees was across all boards and did not apply to boards individually.

2.26 Expiry of current term of appointment of Radiation Advisory Committee

The committee was advised that its three year term expired on 16 August 2017 and that the appointment process for the new committee would shortly begin. The committee members were advised of the process for reappointment.

3. Non-ionising radiation

3.1 Enforcement action taken by the Department of Health and Human Services in relation to illegal use of commercial tanning units in Victoria

The Committee noted that, on 1 January 2015, the department had cancelled all radiation management licences that authorised the possession of commercial tanning units. It is now an offence to possess or sell a commercial tanning unit, or conduct a commercial tanning practice (solarium). A person must not provide, or offer to provide the use of, a tanning unit, or operate or offer to operate a tanning unit for fee or reward.

The department continues to investigate the illegal use of commercial tanning units in Victoria with a view to prosecution of serious offenders. The committee was advised that, during the financial year, 19 investigations had been initiated by the department, two prosecutions had been successfully completed, one case came before the courts, and 11 search warrants had been executed. Nine tanning units were seized by or forfeited to the department during search warrant actions.

3.2 Proposed Regulation of intense pulsed light sources (IPLs) and Lasers

The committee was advised that the issue of regulation of lasers and intense pulsed light (IPL) sources was discussed at the 16 November 2016 meeting of the Radiation Health Committee (RHC) of ARPANSA. The RHC will not be considering such regulation at present due to an inadequate cost-benefit ratio in the regulatory impact statement. The RHC will revisit the regulation of lasers and IPLs at some time in the future.

3.3 Smartchips for mobile phones

The department sought the committee's advice concerning a smart chip that was being advertised that is attached to mobile phones and purported to reduce users' exposure to radiofrequency radiation by 90%. The committee advised that the device did not reduce exposures as reported; it merely changed electric currents that flow in the phone and shifted radiofrequency energy distribution. The committee further stated that it was in the interests of the mobile phone industry to design mobile phones in such a way that radiofrequency absorption in the head is minimised so as to maximise output to the antennae.

3.4 Publications and journal articles reviewed by the committee

Soffritti M, Tibaldi E, Padovani M, Hoel DG et al. Life-span exposure to sinusoidal-50 Hz magnetic field and acute low-dose γ radiation induce carcinogenic effects in Sprague-Dawley rats. International Journal of Radiation Biology, 2016, 92(4): 202-214.

In 2002 the International Agency for Research on Cancer classified extremely low frequency magnetic fields (ELFMF) as a possible carcinogen on the basis of epidemiological evidence. Experimental bioassays on rats and mice performed up to now on ELFMF alone or in association with known carcinogens have failed to provide conclusive confirmation. This study looked at the carcinogenic effects of combined exposure to 50 Hz magnetic fields and acute

γ -radiation in Sprague-Dawley rats. The authors studied groups of male and female Sprague-Dawley rats exposed from prenatal life until natural death to 20 or 1000 μ T 50Hz MF and also to 0.1 Gy γ -radiation delivered as a single acute exposure at 6 weeks of age. The results of the study showed significant carcinogenic effects for the mammary gland in males and females for 1000 μ T 50Hz MF and 0.1 Gy γ -radiation together and a significant increased incidence of malignant schwannomas of the heart as well as increased incidence of lymphomas/leukaemias in males. The authors state that their results call for a re-evaluation of the safety of non-ionizing radiation. The magnetic field level of 1000 μ T should be compared to the 24 hour guideline limit for members of the public of 100 μ T.

The committee noted that the controls in this study lived longer than the controls in previous studies and that the range of incidence of malignancies in the cases in this study is comparable to the range in the controls in previous studies.

Conclusion: The authors reported significant carcinogenic effects for the mammary gland in male and female Sprague-Dawley rats for 1000 μ T 50Hz magnetic fields and 0.1 Gy γ -radiation together.

The committee does not believe findings indicate a risk to humans due to the extreme exposure factors used and the limitations in relation to the mouse type used in the study.

Report of Partial Findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley[®] SD rats (Whole Body Exposures), Draft 5-19-2016: <http://dx.doi.org/10.1101/055699>.

The committee considered that this paper was important and would keep a watching brief on it.

S. Chapman et al., Has the incidence of brain cancer risen in Australia since the introduction of mobile phones 29 years ago?, Cancer Epidemiology (2016), <http://dx.doi.org/10.1016/j.canep.2016.04.010>.

The authors note that mobile phone use in Australia has increased rapidly since its introduction in 1987 with whole population usage being 94% by 2014. The authors explored the popularly hypothesised association between brain cancer incidence and mobile phone use.

Using national cancer registration data, they examined age and gender specific incidence rates of 19,858 male and 14,222 females diagnosed with brain cancer in Australia between 1982 and 2012, and mobile phone usage data from 1987 to 2012. The authors modelled expected age-specific rates based on reports of relative risks published by Morgann LL et al (Int. J. Oncol. 46 (5) (2015) 1865-1871), assuming a 10-year lag period between use and incidence.

The authors found that age-adjusted brain cancer incidence rates have risen slightly in males but were stable over the 30 years in females. Significant increases in brain cancer incidence were observed only in those aged over 70 years (both sexes), but the increase in incidence in this age group began from 1982, before the introduction of mobile phones.

The authors conclude that the observed stability of brain cancer incidence in Australia between 1982 and 2012 in all age groups except in those over 70 years compared to increasing modelled expected estimates, suggests that the observed increases in brain cancer incidence in the older age group are unlikely to be related to mobile phone use. The authors hypothesise that the observed increases in brain cancer incidence in Australia are related to the advent of improved diagnostic procedures when computed tomography and related imaging technologies were introduced in the early 1980s.

The authors note that a limitation of this study is that it was an ecological trends analysis, with no data on individual mobile phone use and outcome.

Conclusion: The authors conclude that the general observed stability of brain cancer incidence in Australia between 1982 and 2012 despite an increasing use of mobile phones suggest that brain cancer incidence is unlikely to be related to mobile phone use.

The committee noted that, whilst the study is an ecological study, it supports the committee's position that there is no substantive evidence linking exposure to radiofrequency radiation to an increased risk of cancer or other adverse health events (see 3.5 below).

Van Moorselaar I et al. Effects of personalised exposure on self-rated electromagnetic hypersensitivity and sensibility – A double-blind randomised controlled trial, Environ Int (2016), <http://dx.doi.org/10.1016/j.envint.2016.11.031>.

The authors found no evidence that subjects who reported being able to respond quickly to electromagnetic field (EMF) exposure, and who were verified as being able to do so in an open exposure session, were able to distinguish exposure from sham conditions better than chance.

Conclusion: The authors found no evidence that subjects were able to distinguish exposure from sham conditions better than chance.

This study supports the committee's position that there is no substantive evidence linking exposure to radiofrequency radiation to an increased risk of cancer or other adverse health events (see 3.5 below).

Karipidis K, Henderson S, Wijayasinghe D, Tjong L and Tinker R. Exposure to radiofrequency electromagnetic fields from Wi-Fi in Australian schools. Radiation Protection Dosimetry (2017), pp. 1–8.

The authors measured radiofrequency (RF) radiation levels in 23 schools in Australia and found that all of the levels measured were much lower than the exposure reference levels of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines.

Conclusion: The authors conclude that levels of RF radiation measured in Australian schools were very low.

Simon Chapman - Apocalypse now: wifi and radiation sickness sweeping, <http://theconversation.com/apocalypse-now-wifi-and-radiation-sickness-sweeping-the-world-74842>

Professor Chapman cites international research on idiopathic environmental intolerance attributed to electromagnetic fields which concludes that *at present, there is no reliable evidence to suggest that people ... experience unusual physiological reactions as a result of exposure to electromagnetic fields.*

Conclusion: The authors conclude that *there is no reliable evidence to suggest that people experience unusual physiological reactions as a result of exposure to electromagnetic fields.*

This study supports the committee's position that there is no substantive evidence linking exposure to radiofrequency radiation to an increased risk of cancer or other adverse health events (see 3.5 below).

Rubin GJ, Nieto-Hernandez R, and Wessely S. Idiopathic environmental intolerance attributed to electromagnetic fields (formerly 'electromagnetic hypersensitivity'): An updated systematic review of provocation studies. Bioelectromagnetics. 2010 Jan;31(1):1-11. doi: 10.1002/bem.20536.

The authors report that idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF) is a medically unexplained illness in which subjective symptoms are reported following exposure to electrical devices. In an earlier systematic review, they reported data from 31 blind provocation studies which had exposed IEI-EMF volunteers to active or sham electromagnetic fields and assessed whether volunteers could detect these fields or whether they reported worse symptoms when exposed to them. In this article, the authors report an update to that review. An extensive literature search identified 15 new experiments. Including studies reported in their earlier review, 46 blind or double-blind provocation studies in all have tested whether exposure to electromagnetic fields is responsible for triggering symptoms in IEI-EMF. No robust evidence could be found to support this theory. However, the studies included in the review did support the role of the nocebo effect in triggering acute symptoms in IEI-EMF sufferers. Despite the conviction of IEI-EMF sufferers that their symptoms are triggered by exposure to electromagnetic fields, repeated experiments have been unable to replicate this phenomenon under controlled conditions. The authors conclude that a narrow focus by clinicians or policy makers on bioelectromagnetic mechanisms is therefore, unlikely to help IEI-EMF patients in the long-term.

Conclusion: This review found that repeated experiments on idiopathic environmental intolerance attributed to electromagnetic fields have been unable to replicate this phenomenon under controlled conditions.

This study supports the committee's position that there is no substantive evidence linking exposure to radiofrequency radiation to an increased risk of cancer or other adverse health events (see 3.5 below).

3.5 The committee's view on possible health effects of radiofrequency radiation

The scientific papers reviewed by the committee during the year have not altered the committee's position that there is no substantive evidence linking exposure to radiofrequency radiation to an increased risk of cancer or other adverse health events. However in light of public concerns over mobile phones, base stations and smart meters the Committee will continue to review the relevant research.

3.6 The committee's view on possible health effects of power frequency electromagnetic fields.

The committee's position, based on the research reviewed by the committee, is that there is no substantive evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans. The committee will continue to review relevant research in this area.

Appendix 1 - Terms of reference of the Radiation Advisory Committee

1. The Radiation Advisory Committee (RAC) is established under the Radiation Act 2005 and provides advice to the Minister for Health or the Secretary on protecting the health and safety of persons and the environment from the harmful effects of radiation, with a view to adopting best practice for radiation safety in Victoria.
2. The RAC may provide advice on matters including:
 - administration and amendments of the Radiation Act 2005 and the Radiation Regulations 2007;
 - licensing of persons and companies to use radiation sources and conduct radiation practices;
 - inspection and testing of radiation sources;
 - new radiation sources and technologies;
 - development, implementation and review of state and national codes, standards and guidelines;
 - transportation, storage and disposal of radioactive materials;
 - security of radioactive sources;
 - radiation incidents;
 - medical research proposals involving ionising radiation;
 - non-ionising radiation matters including:
 - solaria and their regulation;
 - health effects of radiofrequency electromagnetic fields (including mobile communications);
 - health effects of extremely low frequency (ELF) electromagnetic fields (including power frequency fields); and
 - lasers and intense pulsed light (IPL) sources.
 - the promotion and improvement of radiation safety in Victoria;
 - developments that impact on best practice for radiation safety; and
 - any other matter put to it by the Radiation Team of the department.
3. The RAC meets on the first Thursday of every second month, starting February.
4. The RAC may call an extraordinary meeting as required or upon request by the Department of Health and Human Services.
5. A minimum of five members constitutes a quorum for meetings of the RAC.
6. The RAC regulates its own proceedings.
7. The RAC may establish sub-committees and working groups to consider specific issues, and may recommend that the department engage additional expert contractors to support these entities.
8. From time to time the RAC may invite visitors to its meetings in order to hear submissions or information from them, or to take or ask questions.
9. Secretarial support for the RAC is provided by the Radiation Team.

10. The RAC will provide an annual report to the Minister for each financial year, no later than 1st November following that year.