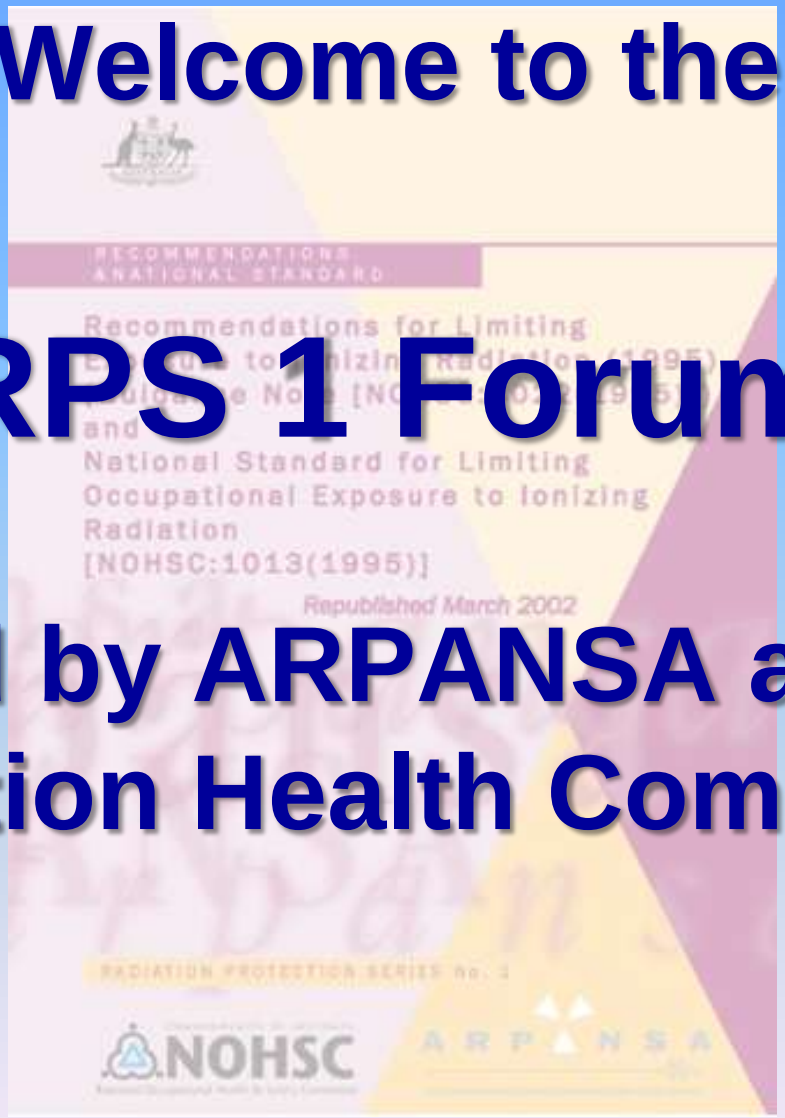
Australian Government

Australian Radiation Protection and Nuclear Safety Agency

Welcome to the



RPS 1 Forum

Hosted by ARPANSA and the Radiation Health Committee

ARPS Conference 19 October 2011

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

RPS 1 Forum – ARPS 2011

Opening	
Introduction	Keith Baldry
RPS Hierarchy	Simon Critchley
RPS 1 revision	Peter Burns
Lunch	
The big picture	Gillian Hirth
Case study: **Medical**	Kent Gregory
Case study: **Environment**	Che Doering
Case study: **Existing exposure situations**	Brad Cassels
Interactive exercise	
Afternoon Tea	
Open forum	
What happens next…	Helen Topfer
Close	

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

Why are we revising RPS 1? ...the Future of Radiation Protection in Australia

Keith Baldry
Regulation and Compliance
SA EPA

ARPS Conference
19 October 2011

Why are we revising RPS 1?

- Australia is committed to:
  - adopting recommended international standards; and
  - implementing best regulatory practice.
- ICRP 103 published in 2007
- IAEA have adopted the recommendations made in ICRP 103.
- Endorsement of the new IAEA Basic Safety Standards (BSS) - September 2011.

Opportunity

- Not just a revision of another Code/Standard
- Setting the radiation protection agenda for the next 15-20 years
- Professions can play a proactive role
- Aiming for a broader audience – education for radiation protection

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

RPS 1 Forum

Review of the Radiation Protection Series Hierarchy

Simon Critchley

Queensland Health

ARPS Conference

19 October 2011

Before the ARPANS Act...

- Nuclear Codes *(published under the Environment Protection (Nuclear Codes) Act 1978)*
  - Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores (1982)
  - Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores (1987)
  - Code of Practice for the Safe Transport of Radioactive Substances (1990)

Before the ARPANS Act...

Radiation Health Series *(published by the NHMRC)* which included:

- Code of practice for the disposal of radioactive wastes by the user (1985)
- Code of practice for the safe use of sealed radioactive sources in borehole logging (1989)
- Code of practice for the safe use of industrial radiography equipment (1989)
- Code of practice for the near-surface disposal of radioactive waste in Australia (1992)

Since the ARPANS Act

- Radiation Protection Series *(published by ARPANSA)*
  - This is the current suite of documents
  - They are known as the ‘RPS’ documents

Old: Radiation Health Series

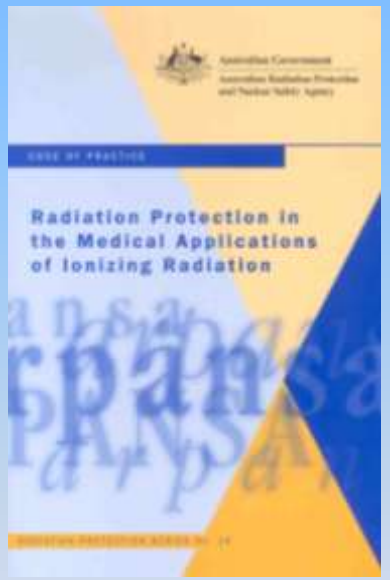
New: Radiation Protection Series

Categories of RPS documents

- Radiation Protection Standards
  - set fundamental requirements for safety
  - prescriptive in style and may be referenced by regulatory instruments
  - contain key procedural requirements regarded as essential for best international practice in radiation protection, and fundamental quantitative requirements, such as exposure limits

Categories of RPS documents

- Codes of Practice
  - prescriptive in style and may be referenced by regulations or conditions of licence
  - contain practice-specific requirements that must be satisfied to ensure an acceptable level of safety and security in dealings involving exposure to radiation
  - requirements are expressed in terms of ‘must’ statements



Categories of RPS documents

- Recommendations
  - provide guidance on fundamental principles for radiation protection
  - written in an explanatory and non-regulatory style and describe the basic concepts and objectives of best international practice
  - if there are related Radiation Protection Standards and Codes of Practice, they are based on the fundamental principles in the Recommendations

Categories of RPS documents

- Safety Guides
  - provide practice-specific guidance on achieving the requirements set out in Radiation Protection Standards and Codes of Practice
  - non-prescriptive in style, but may recommend good practices
  - guidance is expressed in terms of ‘should’ statements, indicating that the measures recommended, or equivalent alternatives, are normally necessary to achieve compliance with the requirements of the Radiation Protection Standards and Codes of Practice

Review of RPS Hierarchy

- The RPS documents were developed to promote practices which protect human health and the environment from the harmful effects of radiation
- Since ICRP 103 was published in 2007, it was determined that a review of RPS 1 would be conducted
- This precipitated a review of the hierarchy of the RPS documents – particularly those relating to ionizing radiation
- Documents relating to non-ionizing radiation will be re-classified in due course
- An effort has been made to align Australian documents more closely with those in the international arena, particularly the International Atomic Energy's (IAEA) Safety Standards Series

IAEA Safety Standards hierarchy

Safety Fundamentals

- presents the fundamental safety objective and principles of protection and safety and provides the basis for the safety requirements

Safety Requirements

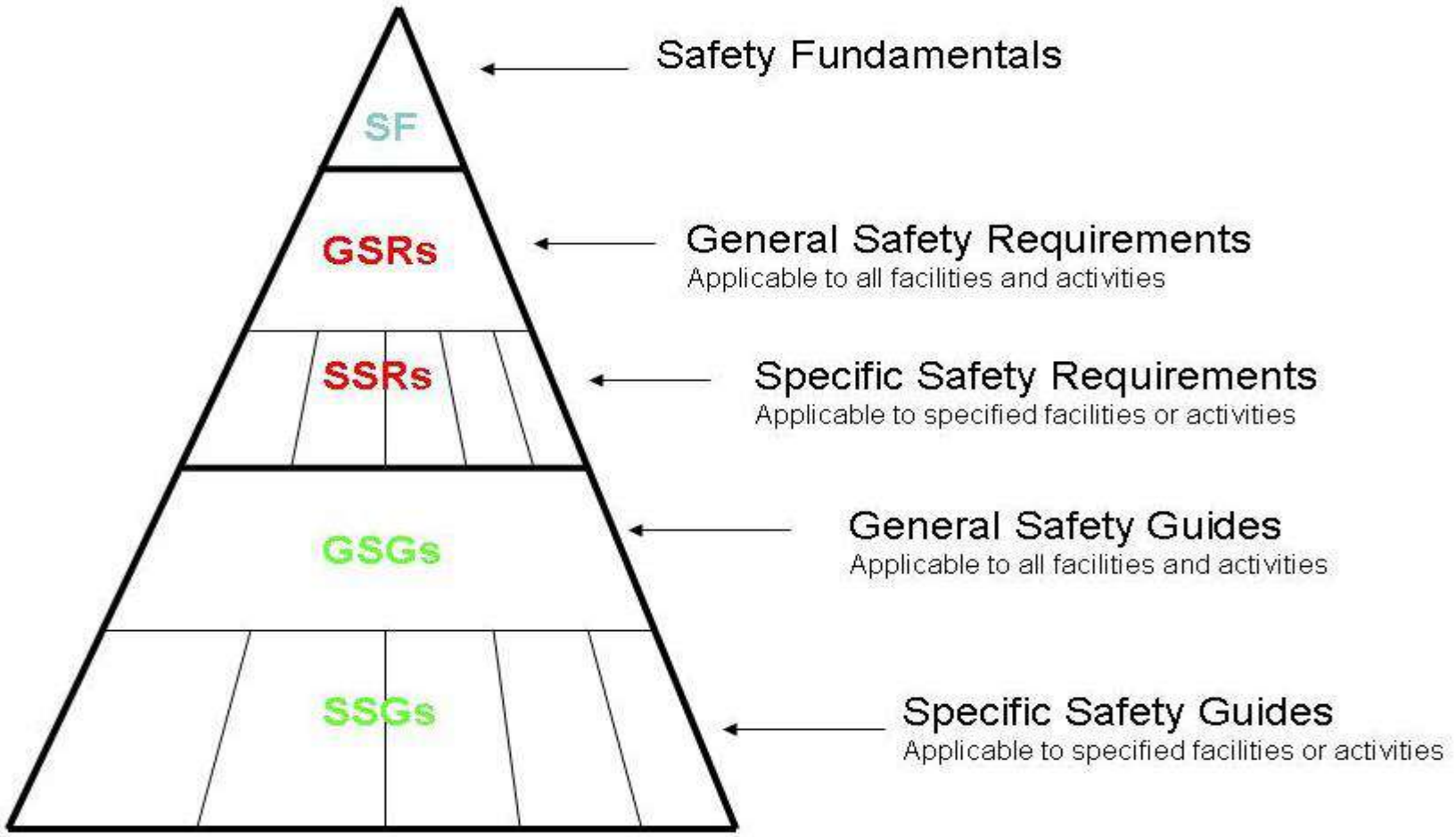
- requirements that must be met to ensure the protection of people and the environment, both now and in the future
- governed by the objective and principles of the Safety Fundamentals
- format and style facilitate their use in a national regulatory framework, e.g. requirements are expressed as ‘shall’ statements and, wherever possible, the person responsible for meeting the requirement is specified

Safety Guides

- provide recommendations and guidance on how to comply with the safety requirements
- present international good practices, and increasingly they reflect best practices, to help users striving to achieve high levels of safety
- recommendations provided in Safety Guides are expressed as ‘should’ statements

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

IAEA Safety Standards hierarchy



Proposed document categories

Fundamentals

- set the fundamental principles for radiation protection and describe the fundamental safety objectives
- written in an explanatory and non-regulatory style and describe the basic concepts and objectives of best practice

Codes of Practice

- prescriptive in style and may be referenced by regulations or conditions of licence
- may contain general safety requirements which may be applicable for all dealings with radiation, or may contain practice-specific safety requirements
- provide overarching requirements and are expressed as ‘must’ statements which must be satisfied to ensure an acceptable level of safety

Safety Guides

- provide recommendations and guidance on how to comply with the Fundamentals or Codes of Practice
- written in an explanatory and non-regulatory style and indicate the measures recommended to achieve good practice, and are generally expressed as ‘should’ statements

Alignment of Categories

Current RPS Categories (ionizing radiation only)	IAEA Hierarchy	Proposed RPS Categories (ionizing radiation only)
National Standard (for limiting exposure to ionizing radiation)	Safety Fundamentals	**Fundamentals** (will no longer include the exposure limits)
Recommendations (overarching)		
Codes of Practice	Safety Requirements	**Codes of Practice**
Recommendations (specific to activities)	Safety Guides	**Safety Guides**
Safety Guides		

Match with the NDRP

Interestingly, the National Directory for Radiation Protection – first published in 2004 – has the following main sections:

PART A – General Principles

- Regulatory frameworks

PART B – Uniform Regulatory Elements

- Scope of Regulation
- Authorisations
- National Adoption of Codes and Standards

PART C – Guidance for Best Practice

- Intervention in Radiological Emergencies and Chronic Exposure Situations
- Patient Discharge Recommendations

Translation of current documents

- Proposed hierarchy will provide for a smooth transition to the new one
- Revised editions of the existing RPS documents will be re-configured to match the new document framework
- The prescriptive documents will change form over time because many of the prescriptive elements are repeated in each of the existing Codes of Practice
- It is likely that future specific Codes of Practice will contain only those elements peculiar to the particular practice
- The generally applicable prescriptive elements will be contained in the RPS1 Code of Practice

Code of Practice – planned exposures

Radiation Protection Principles - Requirements

- Justification; Optimisation; Dose Limits

Responsibilities

- Responsible Persons' (i.e. employers') obligations
- Operators' (i.e. employees') obligations
- Requirements relating to:
  - planning and design - including radiation management plans and plans for radioactive waste management
  - approvals and authorizations
  - induction and training
  - control of exposure to radiation and radiation monitoring and dose assessment
  - routine review for compliance with the Code of Practice
  - emergencies, accidents and incidents
  - record keeping and reporting

Glossary

Heading off into the abyss again...

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

RPS 1 Forum

Revision of Radiation Protection Series No. 1

Peter Burns

ARPANSA

ARPS Conference

19 October 2011

Revision of RPS1

Revision of Radiation Protection Standard RPS1

- RPS1 was based on Recommendations of the International Commission on Radiological Protection ICRP 60 (1990).

- ICRP revised these in 2007

- ICRP 103 – “The 2007 Recommendations of the International Commission on Radiological Protection”

Revision of RPS1

- **ICRP has broadened the scope of the recommendations to cover all conceivable exposure circumstances and be applied to all sources and to all individuals**
  - not just Practices and Interventions
  - three types of exposure situations
    - Planned, Emergency and Existing

Revision of RPS1

- Practices and Interventions fit within the new system
- Practices are a type of planned exposure
- Interventions are the planned treatment of existing situations

Revision of RPS 1

ICRP has also recently published

- ICRP 101, "*Assessing the dose to the representative person for the purpose of radiation protection of the public and the optimisation of radiological protection: broadening the process*".

- ICRP 104, *"Scope of Radiological Protection Control Measures"*

Revision of RPS 1

- **IAEA - *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS)* (IAEA, 2011).**

- BSS specifies Fundamental Safety Principles which outline the requirements for a comprehensive system for ionizing radiation protection regulation.

Revision of RPS 1

IAEA, *BSS* (2011)

- **Sets out regulatory style guidance for implementing ICRP Recommendations**
  - General requirements for protection and safety
  - Planned exposure situations
  - Emergency exposure situations
  - Existing exposure situations

Revision of RPS 1

- Replacement RPS 1 is to be a shorter, more concise fundamentals type document
- The new document will set out in simple terms the fundamentals, framework, assumptions and principles that underpin the system of radiation protection.
- The document will not contain advisory, guidance or background material

The Fundamentals

Contents of the Fundamentals Document

1. Introduction
2. Effects of Radiation
3. Quantification of Radiation Dose
4. The System for Radiation Protection
5. Application of the System

The Code of Practice

Contents of the Code of Practice

1. Introduction
2. Implementation of the system of radiation protection
3. Regulatory framework
4. Protection of workers
   - SCHEDULE 1 DOSE LIMITS FOR WORKERS
5. Protection of members of the public
   - SCHEDULE 2 DOSE LIMITS FOR MEMBERS OF THE PUBLIC
6. Medical exposure

The Fundamentals

Effects of Radiation

- For stochastic effects such as cancer and hereditary effects there is no clear limit below which safety can be assured (LNT)
- The probability of developing stochastic effects is proportional to cumulative dose
- Doses should be kept as low as reasonably achievable

The Fundamentals

Quantification of Radiation Dose

- Effective dose is a surrogate for risk
- Universal index of harm for all ages, both sexes, all races, all lifestyles
- Not a physical quantity but close enough for prospective radiation protection
  - weighting factors, metabolic models

The Fundamentals

- **Three exposure situations**
  - Planned, Emergency, Existing
- **Four categories of exposure**:
  - Occupational, Medical, Public, Environmental
- **A matrix of potential exposure situations**.

Exposure Situations

- **Planned Exposure Situations:**
  - situations involving the deliberate introduction and operation of sources.
- **Emergency Exposure Situations:**
  - situations that may occur due to malicious acts, or from any unexpected situations and require urgent action in order to reduce or avoid undesirable consequences.
- **Existing Exposure Situations:**
  - situations that already exist when a decision on control is taken, including natural background radiation and residues from past practices.

Categories of Exposure

- **Occupational exposures**
  - result of deliberately working with radiation sources
- **Medical exposure**
  - exposure of patients in medical diagnosis or treatment
- **Public Exposure**
  - exposures of the public
- **Environmental Exposure**
  - exposure of non-human biota

Principles of Radiation Protection

- **Principle of justification**
  - Any decision that alters a radiation exposure situation should do more good than harm
- **Principle of Optimisation**
  - Individual doses should be kept as low as reasonably achievable
- **Principle of Limitation**
  - Total dose from regulated sources in planned exposure situations should not exceed limits

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

Additional Radiation Dose and Risk

UNACCEPTABLE RISK

DOSE LIMIT

TOLERABLE RISK

DOSE CONSTRAINT

Optimisation

↓

Protection optimized

ACCEPTABLE RISK

TRIVIAL RISK

Dose Limits and Dose Constraints

Dose limits – for planned situations

- effective or equivalent dose limit that must not be exceeded.

Dose constraints – for planned situations

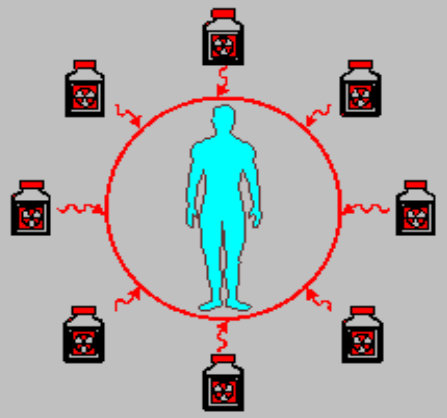
- restrict options to those that have the greatest overall beneficial effect.
- set initially at a value below the dose limit, based on experience in similar planned exposure situations.
- protection measures should be undertaken to optimise protection at or below the dose constraint.

Dose Limit and Dose Constraint

The individual is protected -

From a single source in normal, emergency, or existing controllable situations by

The dose constraints



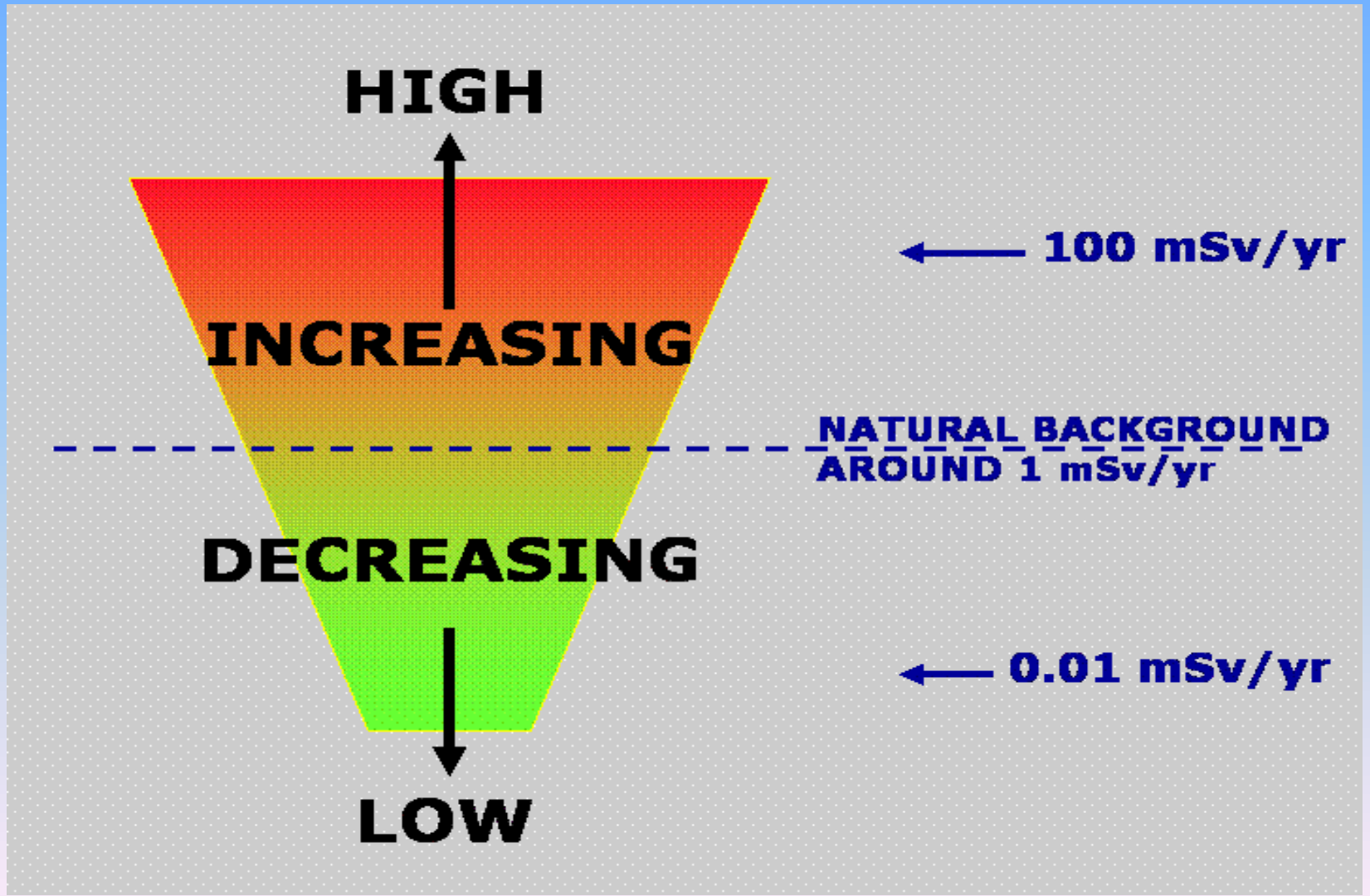
From all regulated sources in normal situations by

The dose limits

Reference Levels

- **For existing and exposure situations**
- Dose limits and dose constraints do not apply to existing and emergency exposure situations
- Reference level represents a level of risk above which it is inappropriate to allow exposures to occur or remedial action will almost always be justified
  - activity or activity concentration, exposure rate

The need for action related to individual effective dose



Application of the System

Regulatory requirements

- Governments' responsibility is to
  - Establish an effective legal and government framework
- Fundamental safety objective
  - protect people and the environment without unduly limiting the operation of facilities or the conduct of activities
- Assess, manage and control exposure to radiation to reduce radiation risks the extent reasonably achievable

Application of the System

- **Governments need to ensure there is**
  - An independent regulator
  - Coordination between departments and agencies
  - Public Health, Environment, Labour, Mining, Science and Technology, Agriculture and Education.

Summary

- The new Fundamentals document sets out a framework together with assumptions and principles that form the basis of a radiation protection system suitable for Australia

- It is the top level document within a suite of documents and provides a comprehensive basis for the implementation of international best practice radiation protection in Australia.

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

RPS 1 Forum

What will be the impact of the review of RPS 1?

Gillian Hirth

ARPANSA

ARPS Conference

19 October 2011

Overview

- What won't change
- What will change
- How will this impact on how we do radiation protection
- What will be the regulatory impact
- Other issues

What won't change

- For most practices there will be limited change to how radiation protection is undertaken
- There may be some additional requirements within radiation management plans.
- Code is not yet well developed and there may be other additional requirements that will need to be taken into account from the BSS.

ICRP 103

- The key changes:
  - Radiation and tissue weighting factors
  - Dose limit to lens of the eye
  - Protection of the environment
  - Exposure situations
    - increased clarity in regard to the different exposure categories
    - increased emphasis on optimisation and a system of dose constraints and reference levels as the primary means of ensuring protection

Radiation & Tissue Weighting Factors

- RHC Statement - January 2010
- Recommendations
  - Familiarise
  - Commence using where practicable
  - Implementation issues?
    - Don’t delay until adoption into RPS 1
    - Notify ARPANSA

Tissue Weighting Factors

Tissue or Organ	ICRP 60 Tissue Weighting Factor, ω_T	ICRP 103 Tissue Weighting Factor , ω_T
Gonads	0.20	0.08
Breast	0.05	0.12
Bladder	0.05	0.04
Liver	0.05	0.04
Oesophagus	0.05	0.04
Thyroid	0.05	0.04
Brain (previously in remainder tissues	0.05	0.01
Salivary gland (not previously specified)	-	0.01
Remainder tissues	0.05	0.12

Radiation Weighting Factors

- **Neutrons** now a continuous function of energy
  - Impact dependent on use
  - Not likely to impact moisture gauge users
  - Will impact in reactor situations (ANSTO)

- **Protons** - weighting factor reduced from 5 to 2

- **Pions** included with a weighting factor of 2

Dose Limit to the Eye

- ICRP Statement (April 2011)
  - For occupational exposure in planned exposure current dose limit is 150mSv
  - New dose limit for the lens of the eye of 20 mSv in a year, averaged over defined periods of 5 years, with no single year exceeding 50 mSv
- New limit will be implemented as part of this revision

Protection of the Environment

- Increasing awareness of the vulnerability of the environment
- Need to demonstrate the environment is protected
- Can no longer assume on the basis of human radiological protection criteria.
- Environment will be a category of exposure

Existing Exposure Situations

- Further work is still required to clarify some situations.
- Existing exposure situations that may be treated as planned exposure situations
- Aircrew exposure to cosmic radiation
- The BSS identifies that
  - *"the regulatory body or other relevant authority shall determine whether assessment of the exposure of aircrew due to cosmic radiation is warranted."*
- Assessment needs to be done

Emergency Exposure Situations

- Changes will flow from ICRP 103/106 and the BSS
- The key changes will be:
  - a move away from the concept of intervention
  - identification of a modified response framework with a stronger focus on Optimisation of protection.
  - revised criteria for use in emergency preparedness and response.
  - transition from an emergency to an existing exposure situation.
- Will be taken into account when RPS 7 is reviewed.

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

RPS 1 Forum

Impacts to medical exposures

Kent Gregory

SA Radiation Pty Ltd

www.saradiation.com.au

ARPS Conference

19 October 2011

Overview

- The key changes flowing from ICRP that may impact on medical exposures:
  - Reduction in dose limit to the eye
  - Increased focus on optimisation of dose
  - Changes to tissue weighting factors

Reduction in eye dose

- Previous limit was based on acute high doses (e.g. A-bomb survivors) with short follow-up times
- In 2008, IAEA initiated research examining ionising radiation and posterior subcapsular (psc) amongst cardiologists (RELID)
- psc incidence in cardiologists was 3.2 times higher than in controls

Image from https://rpop.iaea.org/rpop/rpop/content/news/relid-cataract-study.htm

Reduction in eye dose

- ICRP now considers effect threshold to be 500mGy - previously 5Gy
- ICRP eye limit is now 20mSv/year over 5 years (50mSv/year max) – previously 150mSv/year
- Based on the new limit the effect threshold could be reached within a working lifetime.

Quantifying eye dose

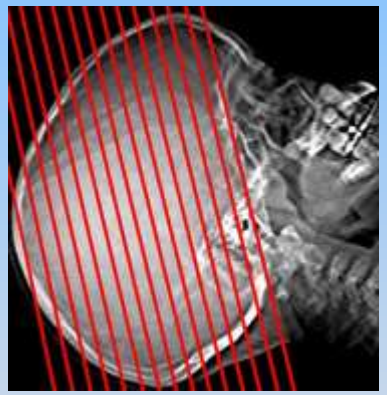
- Assumed (wrongly?) that if whole body dose <<20mSv/y, eye dose <150mSv/y.
- Doses of 0.014 to 4mSv per procedure have been implied/measured without protection.*
- RSO's will need to assess potential dose
- Dosimetry may be required
  - Direct measurement
  - Implied from phantoms/published data

* Radiation and Cataract, M. Rehani et al, Radiation Protection Dosimetry, July 2011

Image from http://www.inmed.com.au/radiation-detection.html, Unfors EDD

Optimisation of dose to patients

- A recent study suggests eye doses for paediatric patients with multiple CT scans can approach ICRP limit*
- The normal tricks of eye dose reduction (gantry angulation, patient positioning) are more important than ever



- Something to highlight to radiographers

* Eye lens radiation exposure and repeated head CT scans: A problem to keep in mind, M.Michel et al, Eur J Radiology 2011

Optimisation of dose to patients

- ICRP also warns that the absorbed dose threshold for circulatory disease may be as low as 500mGy to heart or brain
- Such doses may occur due to extended screening for complex procedures
- Ensure practitioners are aware of this
- Optimisation of these procedures is paramount

Other changes

- Notable TWF changes are gonads (0.2 to 0.08) and breast (0.05 to 0.12)
- This may need to be taken into consideration when undertaking some patient dose assessments
- Not expected that these changes will affect medical practices, since properly fitted lead garments would cover these organs of occupationally exposed persons

Summary of RPS1 impact to medical practices

- Dose to the eye for some medical radiation practitioners will now require the attention of the RSO
- Cardiologists and other high fluoro users needs to be encouraged to use PPE (glasses) or ceiling suspended shields
- Greater focus on optimising patient tissues, in particular the eye, breast, brain and heart

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

RPS 1 Forum

Protection of the environment

Che Doering

Supervising Scientist Division

ARPS Conference

19 October 2011

Content

- Why include protection of the environment in RPS 1?
- The ICRP framework for protection of the environment
- Detail on protection of the environment to include in RPS 1
- Potential impacts and opportunities

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

Current RPS 1 Recommendations

1. Principles underlying the *Recommendations*

Radiation protection is concerned with the protection of individuals, their progeny and populations against possible detrimental effects of **radiation**. While the **system of radiation protection** described in these *Recommendations* does not specifically refer to other species or to the environment, it is generally believed that the standard of environmental control required for protection of people will ensure that other species are not put at risk. Risks arising from **exposure** to radiation should be kept in perspective with other risks, so that society's resources are not

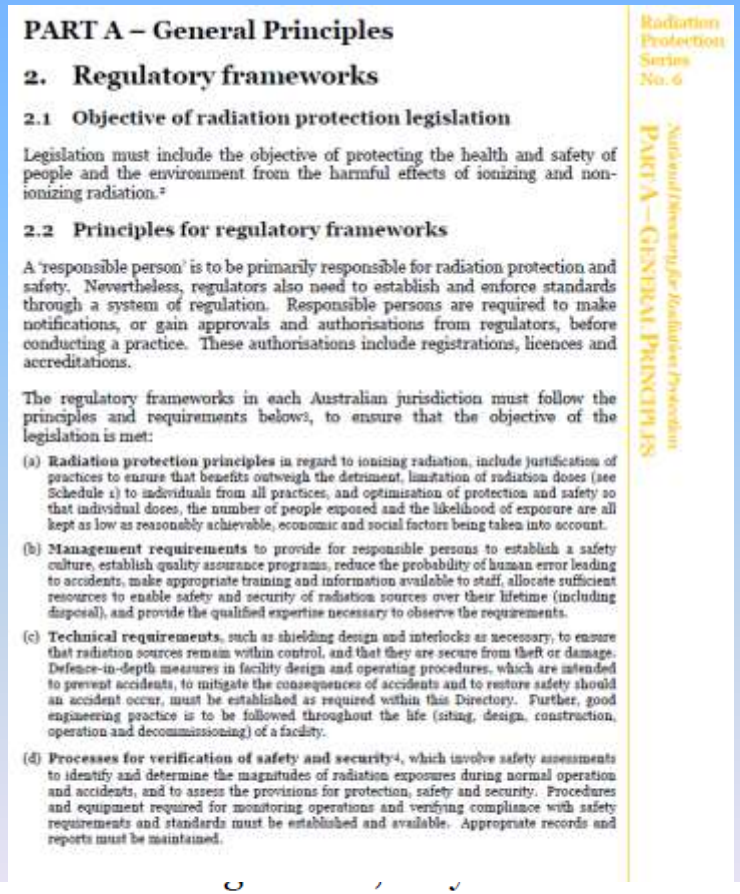
Radiation Protection Series No. 1

Current RPS 1 Recommendations are based on ICRP60, now superseded by ICRP103

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

National Directory



PART A – General Principles

2. Regulatory frameworks

2.1 Objective of radiation protection legislation

Legislation must include the objective of protecting the health and safety of people and the environment from the harmful effects of ionizing and non-ionizing radiation.[2]

2.2 Principles for regulatory frameworks

A 'responsible person' is to be primarily responsible for radiation protection and safety. Nevertheless, regulators also need to establish and enforce standards through a system of regulation. Responsible persons are required to make notifications, or gain approvals and authorisations from regulators, before conducting a practice. These authorisations include registrations, licences and accreditations.

The regulatory frameworks in each Australian jurisdiction must follow the principles and requirements below3, to ensure that the objective of the legislation is met:

(a) **Radiation protection principles** in regard to ionizing radiation, include justification of practices to ensure that benefits outweigh the detriment, limitation of radiation doses (see Schedule 1) to individuals from all practices, and optimisation of protection and safety so that individual doses, the number of people exposed and the likelihood of exposure are all kept as low as reasonably achievable, economic and social factors being taken into account.

(b) **Management requirements** to provide for responsible persons to establish a safety culture, establish quality assurance programs, reduce the probability of human error leading to accidents, make appropriate training and information available to staff, allocate sufficient resources to enable safety and security of radiation sources over their lifetime (including disposal), and provide the qualified expertise necessary to observe the requirements.

(c) **Technical requirements**, such as shielding design and interlocks as necessary, to ensure that radiation sources remain within control, and that they are secure from theft or damage. Defence-in-depth measures in facility design and operating procedures, which are intended to prevent accidents, to mitigate the consequences of accidents and to restore safety should an accident occur, must be established as required within this Directory. Further, good engineering practice is to be followed throughout the life (siting, design, construction, operation and decommissioning) of a facility.

(d) **Processes for verification of safety and security**4, which involve safety assessments to identify and determine the magnitudes of radiation exposures during normal operation and accidents, and to assess the provisions for protection, safety and security. Procedures and equipment required for monitoring operations and verifying compliance with safety requirements and standards must be established and available. Appropriate records and reports must be maintained.

Radiation Protection Series No. 6

National Directory for Radiation Protection

PART A – GENERAL PRINCIPLES

The need to develop guidance on protection of non-human species has been identified in the National Directory for Radiation Protection

3 The principles for regulatory frameworks will require development of specific guidance on protection of non-human species, which will be included when international guidance on the issue becomes clear.

Codes of Practice and Safety Guides

- Codes and Safety Guides that aspire to protect the environment and non-human species include...
  - RPS9 – Code of practice and safety guide for radiation protection and radioactive waste management in mining and mineral processing
  - RPS16 – Safety guide for the predisoposal management of radioactive waste
  - RHS35 – Code of practice for the near-surface disposal of radioactive waste in Australia

However, clear advice on demonstrating protection of the environment and non-human species is currently lacking

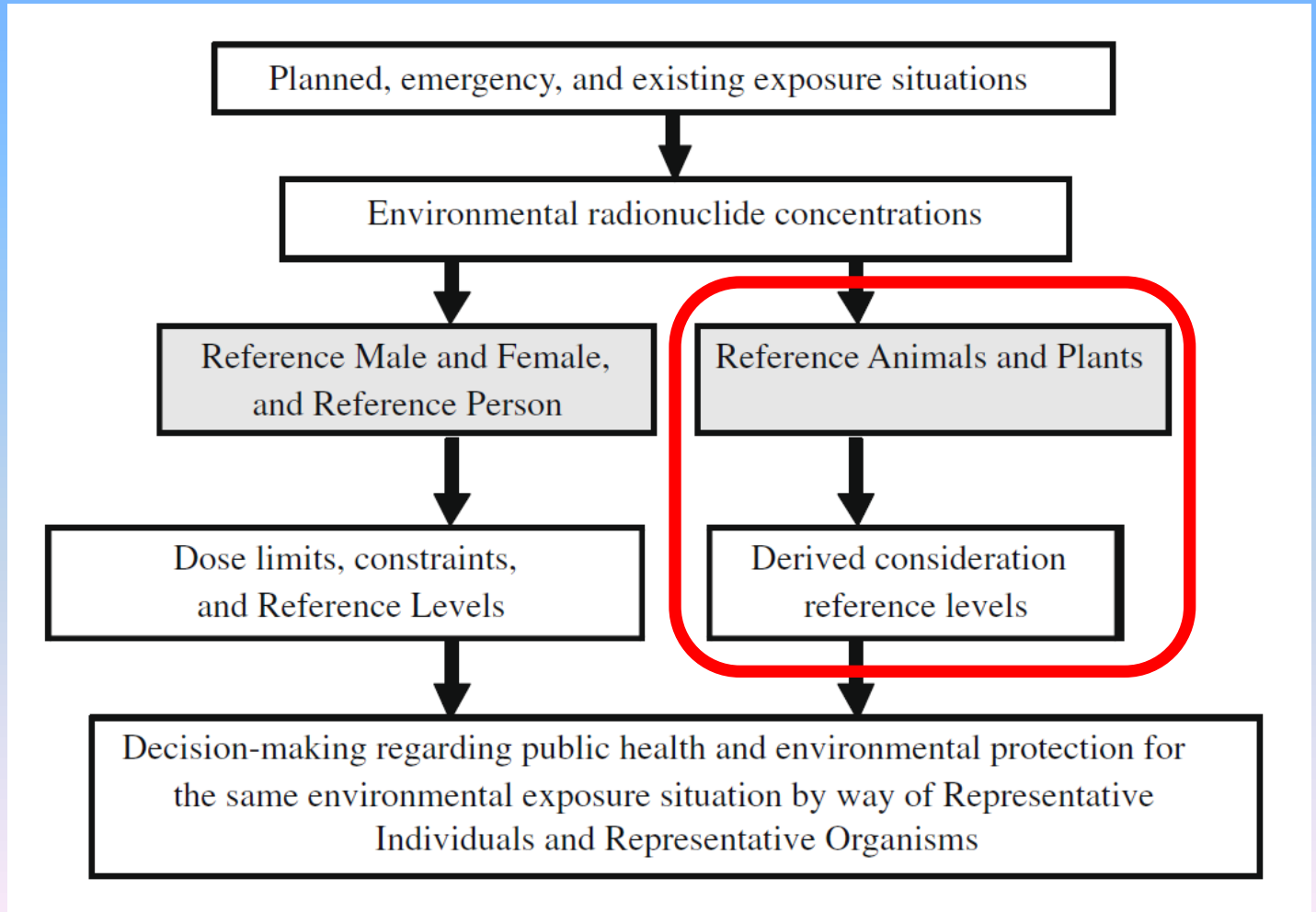
2007 Recommendations of the ICRP

8.1. The objectives of radiological protection of the environment

(361) The Commission acknowledges that, in contrast to human radiological protection, the objectives of environmental protection are both complex and difficult to articulate. The Commission does however subscribe to the global needs and efforts required to maintain biological diversity, to ensure the conservation of species, and to protect the health and status of natural habitats, communities, and ecosystems. It also recognises that these objectives may be met in different ways, that ionising radiation may be only a minor consideration – depending on the environmental exposure situation – and that a sense of proportion is necessary in trying to achieve them.

Environmental protection objectives are primarily targeted at the population level

ICRP framework



Reference organisms

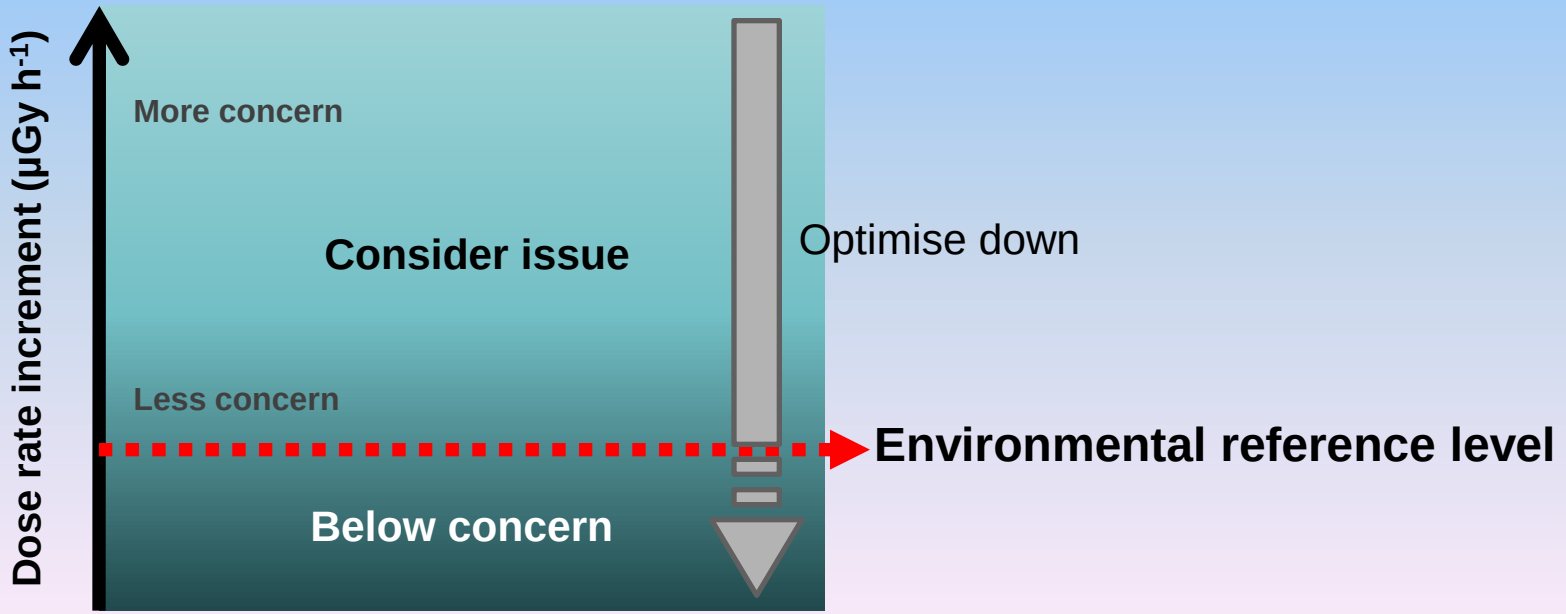
- Hypothetical entities that provide a basis for the estimation of radiation dose rate to living organisms that are typical, or representative, of an impacted environment

Representative organism: A living organism that is typical of a contaminated environment

Reference organism: A numerical approximation of the representative organism which is used to calculate radiation dose rate

Environmental reference level

- A dose rate increment to non-human species that an operator would plan not to exceed; a point of reference to optimise the level of effort expended on environmental protection



Revised RPS 1 Recommendations

- Acknowledge that there are circumstances where it may be necessary to demonstrate rather than assume that the environment and non-human species are protected
- Identify the objectives of radiation protection of the environment
- Conceptual framework for assessing radiation impacts on the environment based on ***reference organisms*** and ***environmental reference levels***

Potential impacts (1)

- **Increased expectation of non-human species assessments for certain practices releasing radionuclides to the environment**
  - **NOTE 1:** Biota assessment tools based on the reference organism approach are available (e.g. ERICA, RESRAD-BIOTA)
  - **NOTE 2:** Some operators are already using these tools to assess potential impacts to non-human species (e.g. ANSTO, U-mining companies)
  - **NOTE 3:** There may be a need to collect site-specific data on radionuclide transfer to non-human species to ensure assessments are technically robust

Potential impacts (2)

- **Training and education need for those responsible to conduct assessments (i.e. operators) and those responsible to review assessments (i.e. regulators)**
  - **NOTE 1:** May require development of a training course on radiation protection of the environment philosophy and use of assessment tools

Potential impacts (3)

- **A consistent national approach for radiation protection of the environment based on best international practice**
  - **NOTE 1:** May require development of a safety guide on protection of the environment to provide additional practical advice to operators and regulators on environmental assessment considerations

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

RPS 1 Forum

ICRP #103 and Existing Exposure Situations

A/Prof Brad Cassels

Radiation Health Committee

ARPS Conference

19 October 2011

What's changed from ICRP 1990 to ICRP 2007?

- ICRP 2007 identifies a core system of protection – justification and optimisation - which can be applied to any situation of radiation exposure.

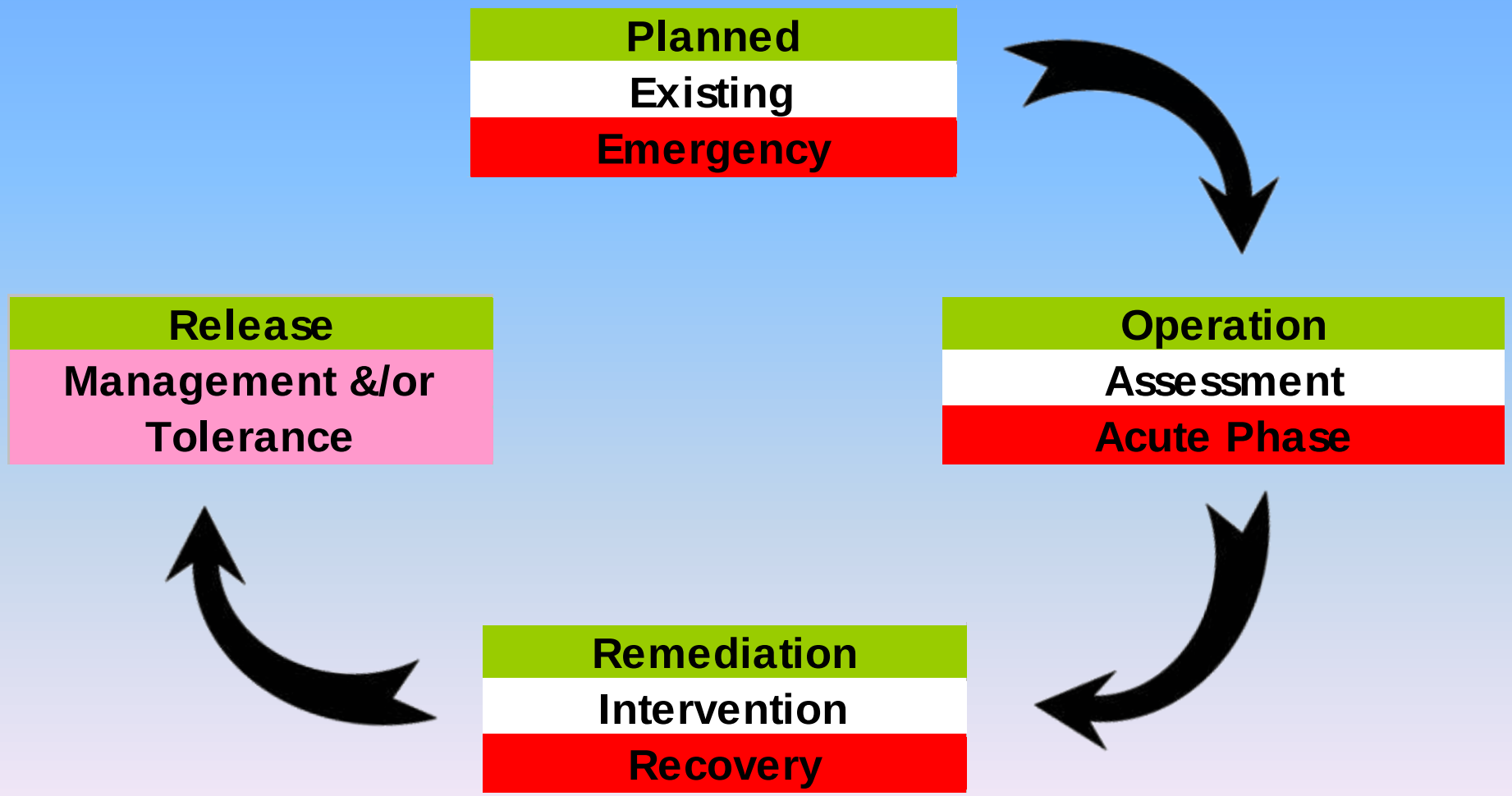
- The application of optimisation with reference levels places additional emphasis on the level of dose remaining after action has been taken; the intention of should be to select protective options that will result in a residual dose below the value of the reference level.

What are Existing Exposure Situations?

ICRP 103 defines existing exposure situations as situations that already exists when a decision on control has to be taken, including natural background radiation and residues from past practices that were operated outside the Commission's recommendations.

This now includes transition from an emergency to an existing exposure situation.

Cradle to grave comparison



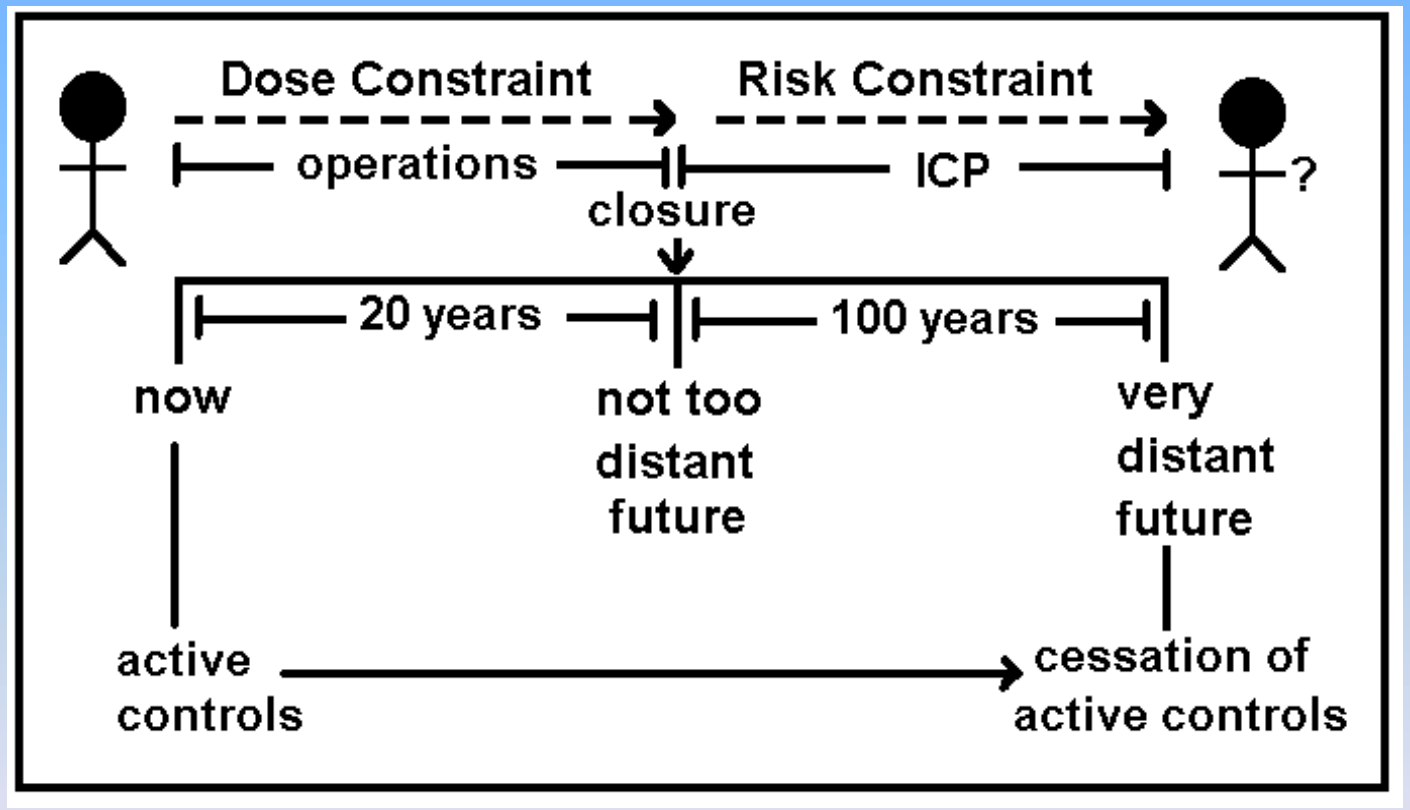
How might they arise?

- Recovery=intervention=existing exposure
- The post-acute phase of a radiation emergency is effectively an existing exposure situation
- Off-regulatory-book practices that create contamination
- Historical practices released by the regulators where subsequent findings reveal problems

How might they be dealt with?

- Demonstrate that proposed remediation will do more good than harm
- Examine likely exposure situations in initial assessment of a newly identified legacy, during remediation period and after cessation of remediation works.
- Long-term considerations need to be made with application of reference levels in the shorter-term and risk constraints in the longer term.

A possible control model…



What laws exist to deal with health/environmental risks?

- Com'wealth/State/Territory Radiation Laws
- Com'wealth/State/Territory Environment Laws
- Com'wealth/State/Territory Occupational Health Laws
- Com'wealth/State/Territory Mining Laws

Legacy site examples ...

- Maralinga and Emu Nuclear Weapons Test Sites
- Minor Trials conducted outside ICRP controls spread weapons contents (non-fissile explosions)

Reference Level

Site or Circumstance	Materials Involved	ICRP Type	Remediation Performed or Action Planned	Post Remediation Dose	Dose Constraint Applied
Maralinga and Emu, South Australia	Weapons grade plutonium	Existing requiring Intervention	Removal of contaminated fragments and associated soils	5 mSv	No, some restricted fenced areas will remain

Legacy site examples ...

- Homes and driveways built on mineral sands waste fill

Reference Level

Site or Circumstance	Materials Involved	ICRP Type	Remediation Performed or Action Planned	Post Remediation Dose	Dose Constraint Applied
Homes built on Mineral Sands fill, Queensland	Monazite	Existing requiring Intervention	Removal of sands	5 mSv	No

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

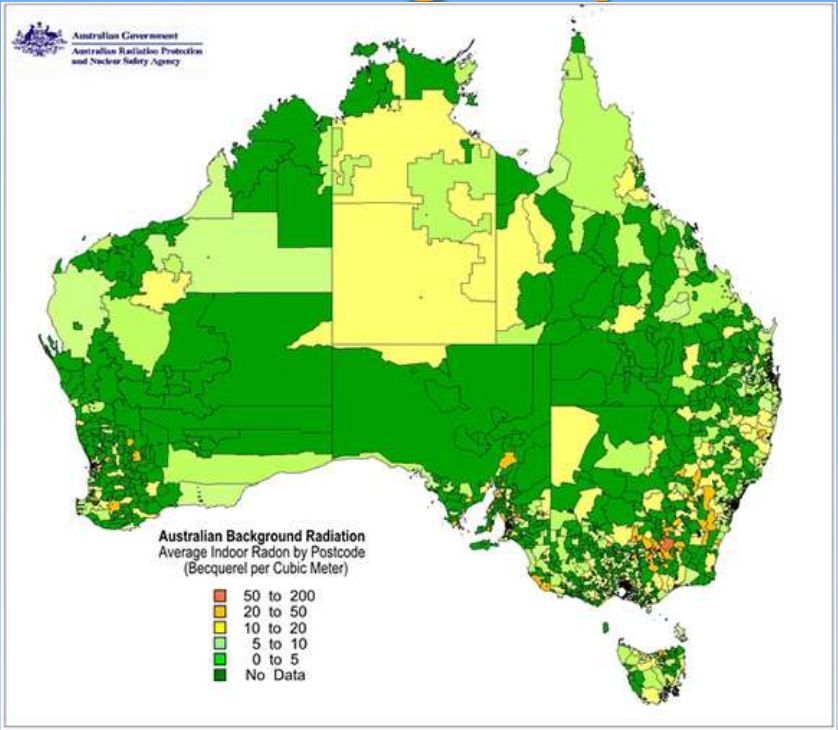
Legacy site examples ...

Site or Circumstance	Materials Involved	ICRP Type	Remediation Performed or Action Planned	Post Remediation Dose	Dose Constraint Applied
Abandoned Uranium Mines, South Alligator Valley	Uranium Mine Wastes	Existing requiring Intervention	Burial of contaminated materials and addition of extra soil cover	Essentially background	No, but no buildings or excavations permitted

Reference Level

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

Existing exposure examples ...

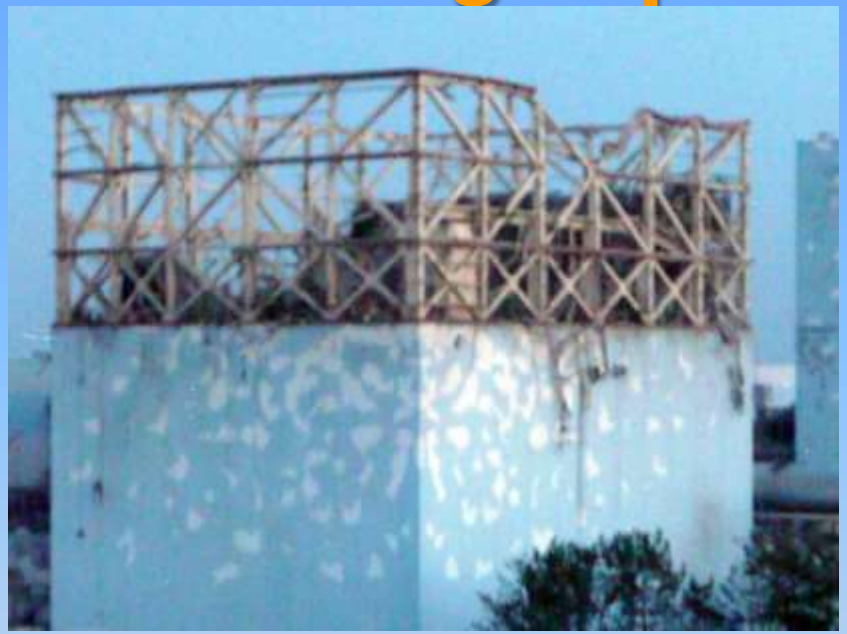


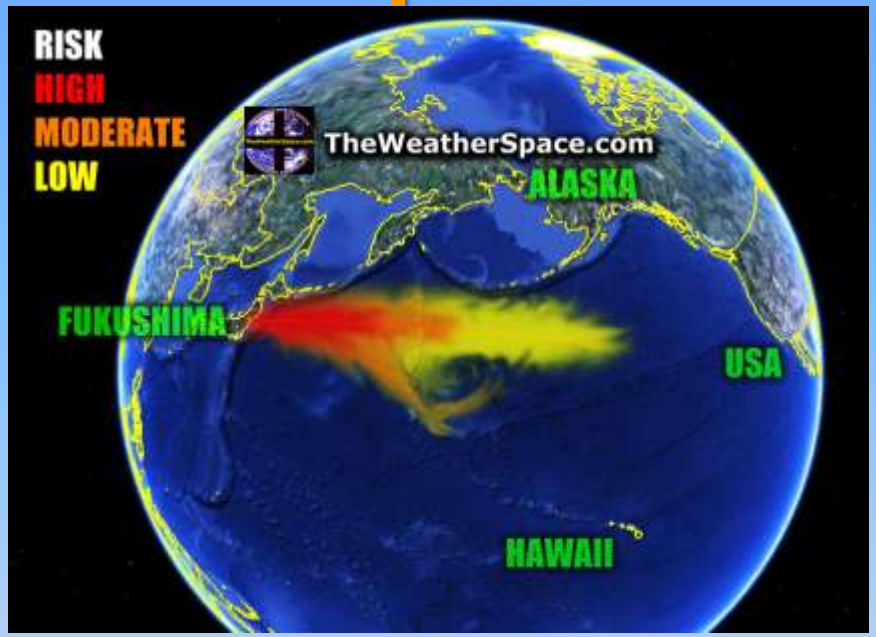
- Radon surveyed Oz-wide in 1990. Reference levels established by Radiation Health Committee

Reference Level

Site or Circumstance	Materials Involved	ICRP Type	Remediation Performed or Action Planned	Post Remediation Dose	Dose Constraint Applied
Radon in homes and workplaces	radon	Existing requiring Optimisation	Increased ventilation in rare cases		200 Bq.m3 homes equates to 10 mSv p.a

Existing exposure examples ...





Reference Level

Site or Circumstance	Materials Involved	ICRP Type	Remediation Performed or Action Planned	Post Remediation Dose	Dose Constraint Applied
Fukushima	nuclear fuel cycle materials Caesium Strontium Iodine	Emergency morphing into Existing requiring Optimisation	Restoration of access to essential public and private spaces	Optimised	T.B.A

Further thoughts …

- Potential for inadvertent overlap and/or "fragmentation" of legislative controls split between authorities and/or jurisdictions.
- Planned practices are bound by dose limits; interventions are optimised via averted doses and now further constrained by optimisation targets according to ICRP
- Do Australian radiation laws require enhancement to permit greater clarity with respect to existing exposure situations?

Suggestions

- Further work is required to clarify some situations
- Criteria for reference levels need to be established within Australia
- Parallel to the Planned Practice Code there appears to be a need for an Existing Exposure document describing how ICRP 2007 requirements are to work within Australia. Similar material should be included in the National Directory for Radiation Protection to ensure consistency in the application of principles between jurisdictions.

Interactive session

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

What will these proposed changes mean for you and how will they affect your workplace?

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

RPS 1 Forum

What happens next…

Helen Topfer

Best Practice Regulation

ARPANSA

ARPS Conference

19 October 2011

Project steps...

- Finalise drafts
- Regulatory impact assessment
- Consultation
- Revision and finalisation
- Approvals
- Gap analysis
- Implementation

Over - lapping steps

3 - 5 year timeline

Regulatory impact assessment

- Case for action already established
- Data collection – details of impact depend on contents of Code
- Preliminary analysis of impacts leads to a regulatory impact statement (RIS)
- Liaise with Office of Best Practice Regulation

Consultation

- Practice specific working groups
- Presentations and discussion at other conferences
- Survey/questionnaire
- Public forum

- RIS and draft documents released for public comment on ARPANSA website
  - Email notification of interested parties – complete form

Approvals

- Any document intended for inclusion as a regulatory requirement in the National Directory for Radiation Protection (NDRP) must go to Australian Health Ministers Advisory Council (AHMAC) and Australian Health Ministers' Conference (AHMC) for approval

Implementation

- Gap analysis – RPS publications (including NDRP)
- Timing will be important
- Implementation will vary across jurisdictions
- May need modification of legislation
  - Revised licence conditions
- Education

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

We need your input

- Working groups or provision of data
- Notification of public consultation
- Any questions / comment

Contact :

Best Practice Regulation, ARPANSA

Email: secretariat@arpansa.gov.au

Thank you

- All speakers
- ARPS conference convenors
- Members of the RPS 1 steering group and ARPANSA staff