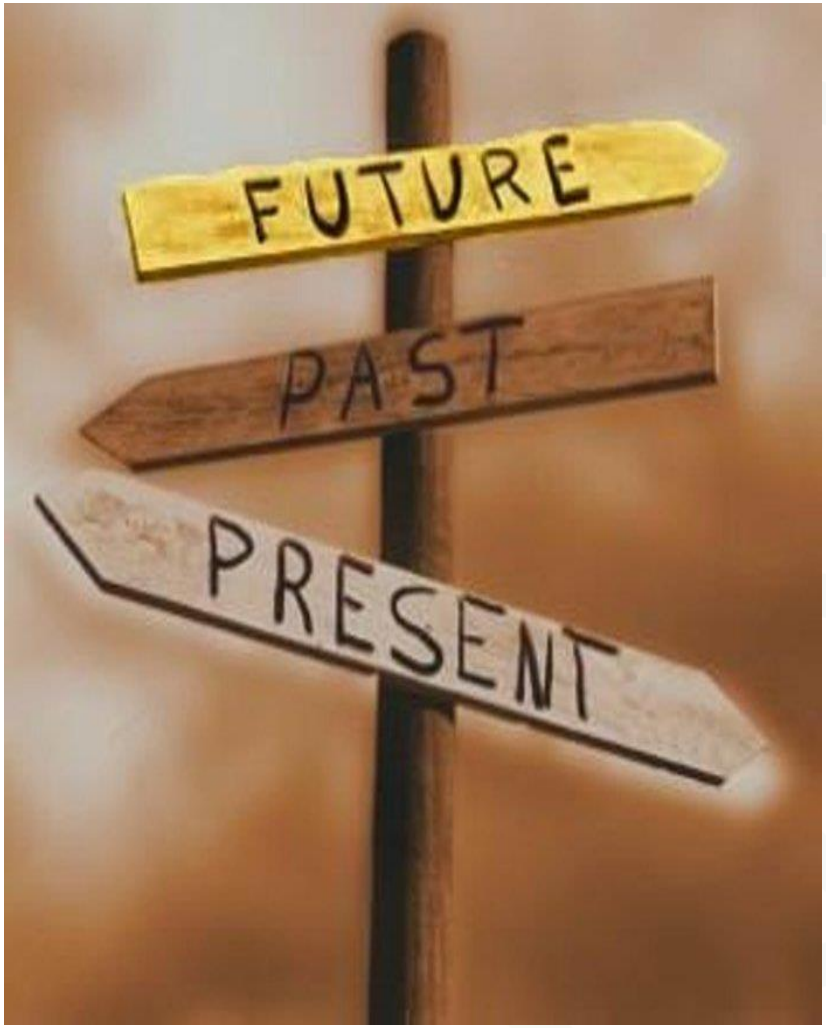
Australian Government
Australian Radiation Protection and Nuclear Safety Agency

arpansa

Australia's Radiation Protection Standards
The Planned Exposure Code

Keith Dessent
Source Control Section
ARPANSA

“You have to know the past to understand the present” – Dr. Carl Sagan (1980)

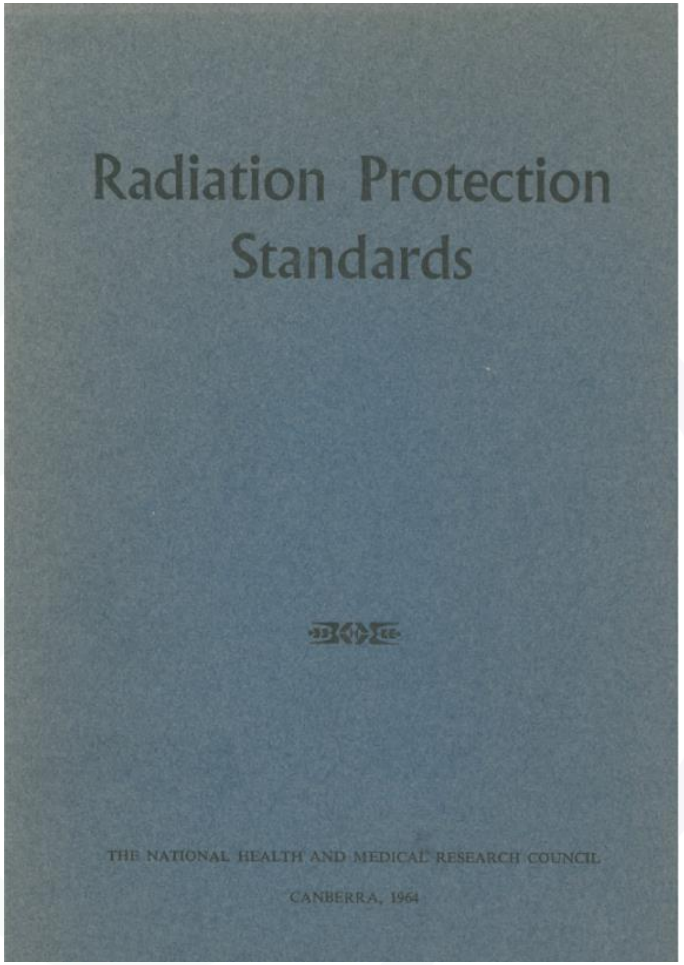


History


THE NEWS
LOTTERY
LAST
BEATLES
TOKYO 1964

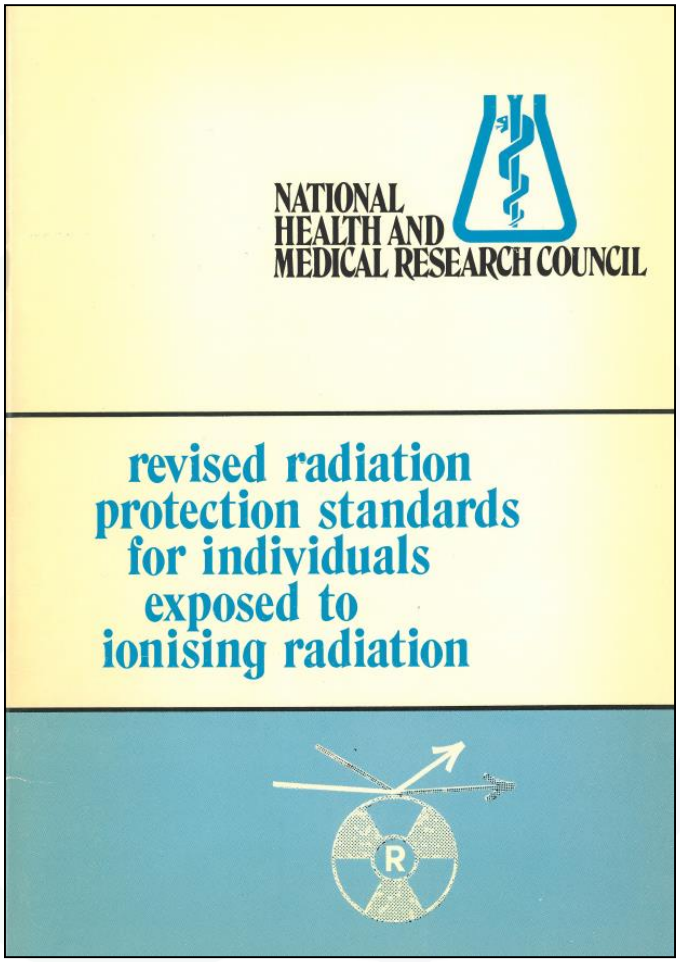
History – 1964

- In 1964, NHMRC published its first Radiation Protection Standards
- Prepared by the ‘Radiation Health Committee’
- Based on “the most recent recommendations of the ICRP” – ICRP6
- Recognised Acts and Regulations of the S/Ts
- NHMRC recommended the application of the Radiation Protection Standards in Australia



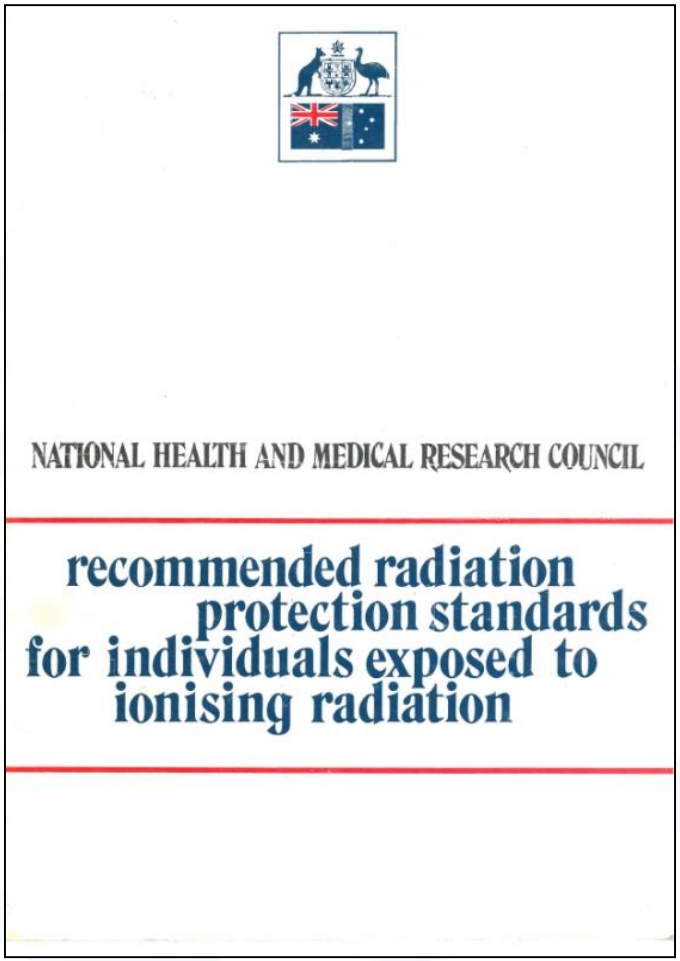
History – 1967/1977

- Revised in 1967 based on ICRP9 (1965) – reprinted with amendments in 1977
- Introduced an annual dose limit for workers – previously only a quarterly limit



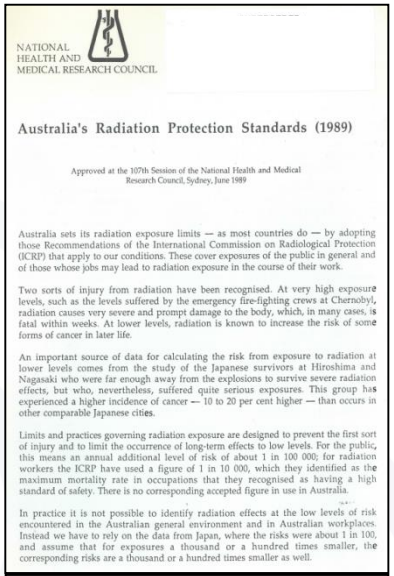
History – 1981

- Revised in 1980 based on ICRP26 (1977)
- First publication in the Radiation Health Series: **RHS1**
- Dose limits: Removed quarterly limit
- “all exposures should be kept as low as reasonably achievable, economic and social factors being taken into account”



History – 1989/91

- **RHS27 & RHS33**
- 2 pages each
- Generally a ‘heads-up’ that a change was coming (ICRP60)
- RHS27 dose limits:
  - Occupational: same
  - Public: aim at 1 mSv per year over a long time
- RHS33 dose limits:
  - Aim at moving towards 20 mSv per annum (occupational)



NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL

Australia's Radiation Protection Standards (1989)

Approved at the 107th Session of the National Health and Medical Research Council, Sydney, June 1989

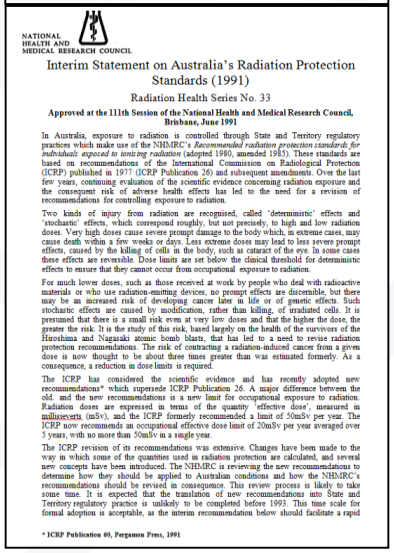
Australia sets its radiation exposure limits — as most countries do — by adopting those Recommendations of the International Commission on Radiological Protection (ICRP) that apply to our conditions. These cover exposures of the public in general and of those whose jobs may lead to radiation exposure in the course of their work.

Two sorts of injury from radiation have been recognised. At very high exposure levels, such as the levels suffered by the emergency fire-fighting crews at Chernobyl, radiation causes very severe and prompt damage to the body, which, in many cases, is fatal within weeks. At lower levels, radiation is known to increase the risk of some forms of cancer in later life.

An important source of data for calculating the risk from exposure to radiation at lower levels comes from the study of the Japanese survivors at Hiroshima and Nagasaki who were far enough away from the explosions to survive severe radiation effects, but who, nevertheless, suffered quite serious exposures. This group has experienced a higher incidence of cancer — 10 to 20 per cent higher — than occurs in other comparable Japanese cities.

Limits and practices governing radiation exposure are designed to prevent the first sort of injury and to limit the occurrence of long-term effects to low levels. For the public, this means an annual additional level of risk of about 1 in 100 000; for radiation workers the ICRP have used a figure of 1 in 10 000, which they identified as the maximum mortality rate in occupations that they recognised as having a high standard of safety. There is no corresponding accepted figure in use in Australia.

In practice it is not possible to identify radiation effects at the low levels of risk encountered in the Australian general environment and in Australian workplaces. Instead we have to rely on the data from Japan, where the risks were about 1 in 100, and assume that for exposures a thousand or a hundred times smaller, the corresponding risks are a thousand or a hundred times smaller as well.



NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL

Interim Statement on Australia's Radiation Protection Standards (1991)

Radiation Health Series No. 33

Approved at the 111th Session of the National Health and Medical Research Council, Brisbane, June 1991

In Australia, exposure to radiation is controlled through State and Territory regulatory practices which make use of the NHMRC's *Recommended radiation protection standards for individuals exposed to ionizing radiation* (adopted 1980, amended 1985). These standards are based on recommendations of the International Commission on Radiological Protection (ICRP) published in 1977 (ICRP Publication 26) and subsequent amendments. Over the last few years, continuing evaluation of the scientific evidence concerning radiation exposure and the consequent risk of adverse health effects has led to the need for a revision of recommendations for controlling exposure to radiation.

Two kinds of injury from radiation are recognised, called 'deterministic' effects and 'stochastic' effects, which correspond roughly, but not precisely, to high and low radiation doses. Very high doses cause severe prompt damage to the body which, in extreme cases, may cause death within a few weeks or days. Less extreme doses may lead to less severe prompt effects, caused by the killing of cells in the body, such as cataract of the eye. In some cases these effects are reversible. Dose limits are set below the clinical threshold for deterministic effects to ensure that they cannot occur from occupational exposure to radiation.

For much lower doses, such as those received at work by people who deal with radioactive materials or who use radiation-emitting devices, no prompt effects are discernible, but there may be an increased risk of developing cancer later in life or of genetic effects. Such stochastic effects are caused by modification, rather than killing, of irradiated cells. It is presumed that there is a small risk even at very low doses and that the higher the dose, the greater the risk. It is the study of this risk, based largely on the health of the survivors of the Hiroshima and Nagasaki atomic bomb blasts, that has led to a need to revise radiation protection recommendations. The risk of contracting a radiation-induced cancer from a given dose is now thought to be about three times greater than was estimated formerly. As a consequence, a reduction in dose limits is required.

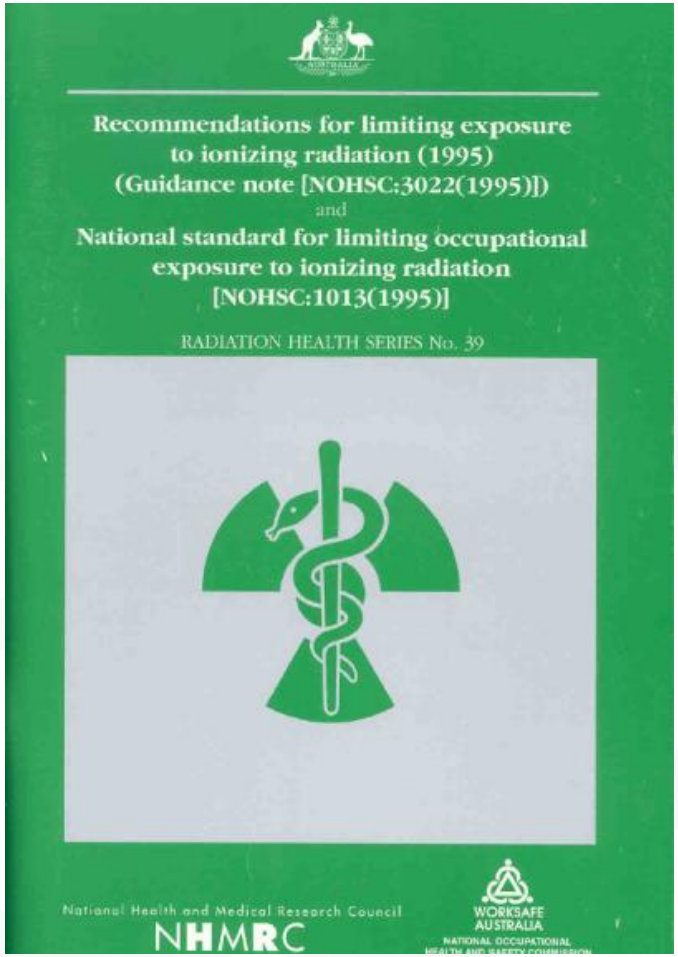
The ICRP has considered the scientific evidence and has recently adopted new recommendations* which supersede ICRP Publication 26. A major difference between the old, and the new recommendations is a new limit for occupational exposure to radiation. Radiation doses are expressed in terms of the quantity 'effective dose', measured in millisieverts (mSv), and the ICRP formerly recommended a limit of 50mSv per year. The ICRP now recommends an occupational effective dose limit of 20mSv per year averaged over 5 years, with no more than 30mSv in a single year.

The ICRP revision of its recommendations was extensive. Changes have been made to the way in which some of the quantities used in radiation protection are calculated, and several new concepts have been introduced. The NHMRC is reviewing the new recommendations to determine how they should be applied to Australian conditions and how the NHMRC's recommendations should be revised in consequence. This review process is likely to take some time. It is expected that the translation of new recommendations into State and Territory regulatory practice is unlikely to be completed before 1993. This time scale for formal adoption is acceptable, as the interim recommendation below should facilitate a rapid

* ICRP Publication 60, Pergamon Press, 1991

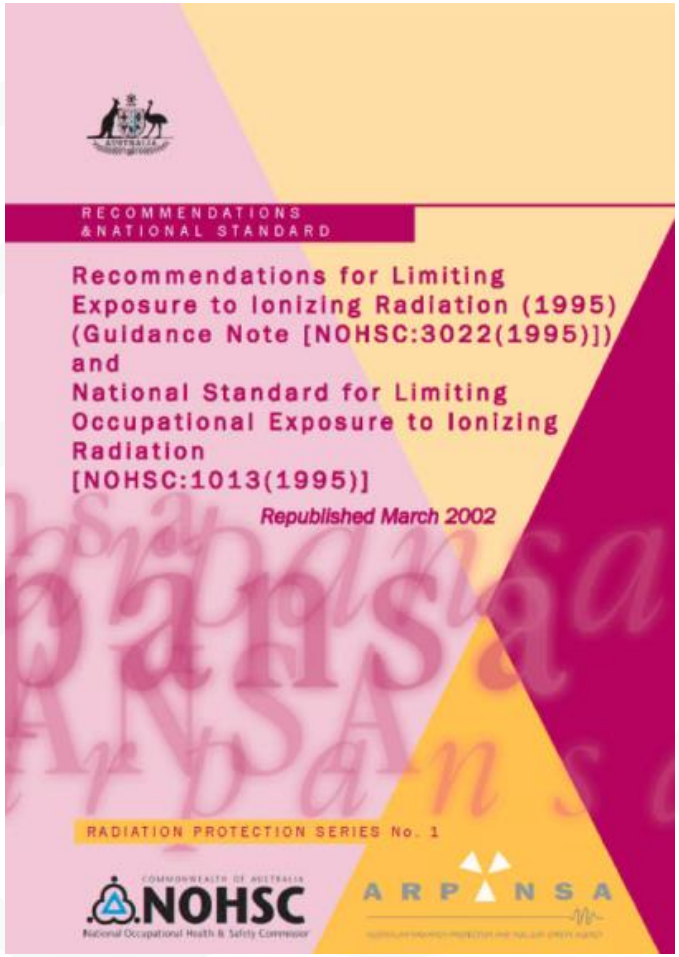
History – 1995

- **RHS39**: NHMRC joint publication with NOHSC – Recommendations and National Standard for Limiting Occupational Exposure.
- Formally incorporated ‘new’ ICRP60 dose limits:
  - **Occupational**: 20 mSv per year averaged over 5 consecutive calendar years with no more than 50 mSv in any one year
  - **Public**: 1 mSv in a year



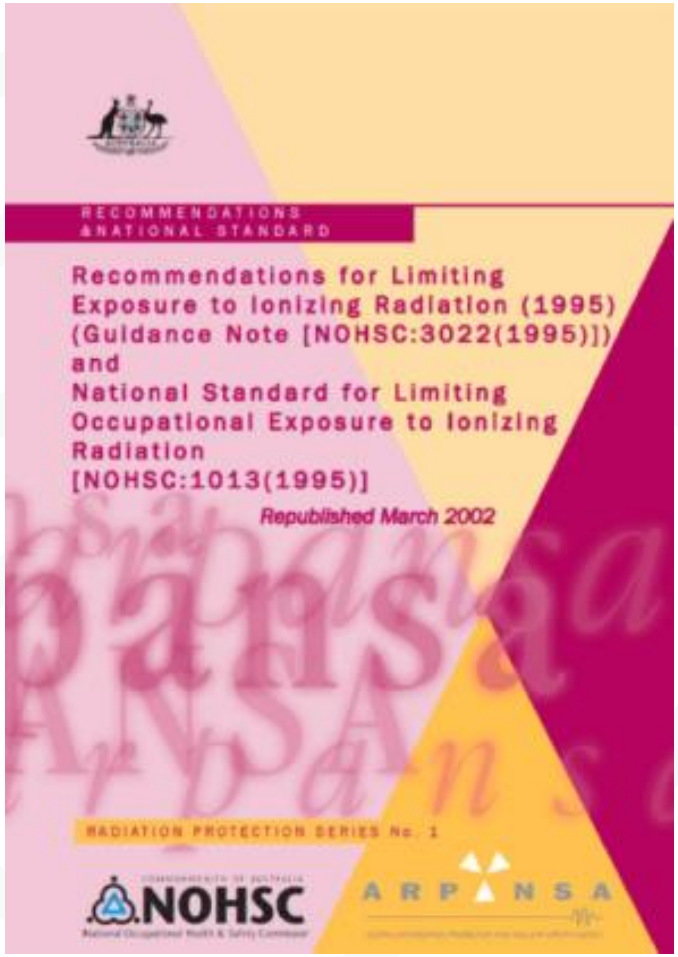
History – 2002

- RHS39 rebadged to become the first publication in ARPANSA's new radiation protection series – RPS1
- Same as RHS39 with a few minor 'tweaks'



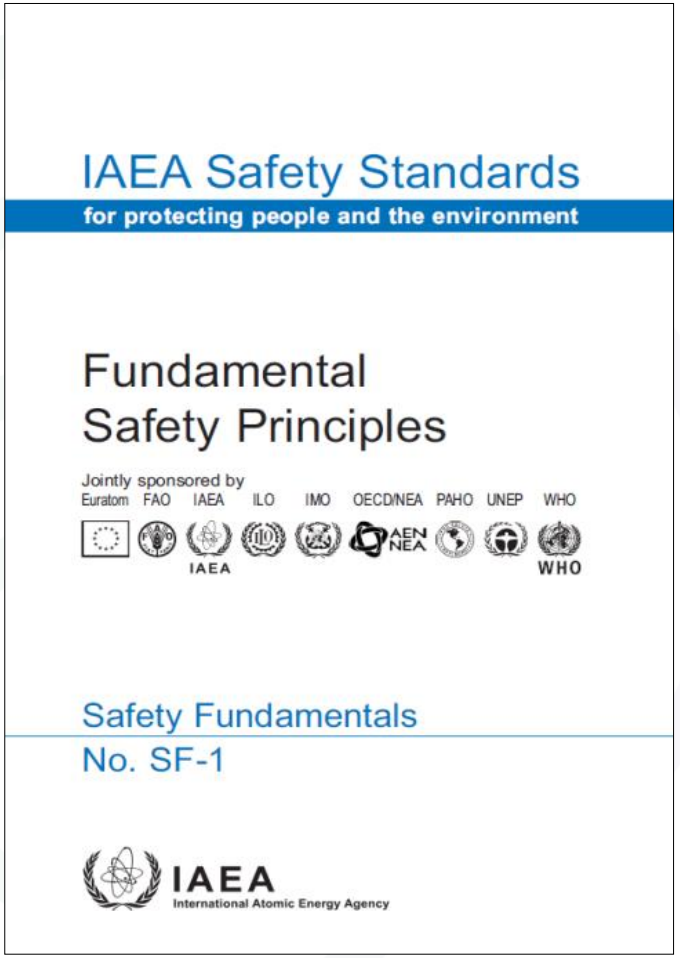
Australia's Radiation Protection Standards – RPS1

- RHS39/RPS1 more or less adopted into the regulatory frameworks of each Australian jurisdiction.
- Contained *inter alia*:
  - dose limits, radiation and tissue weighting factors, exposure classification, protection philosophy (*Recommendations*)
  - obligations for occupational exposure (*National Standard*)



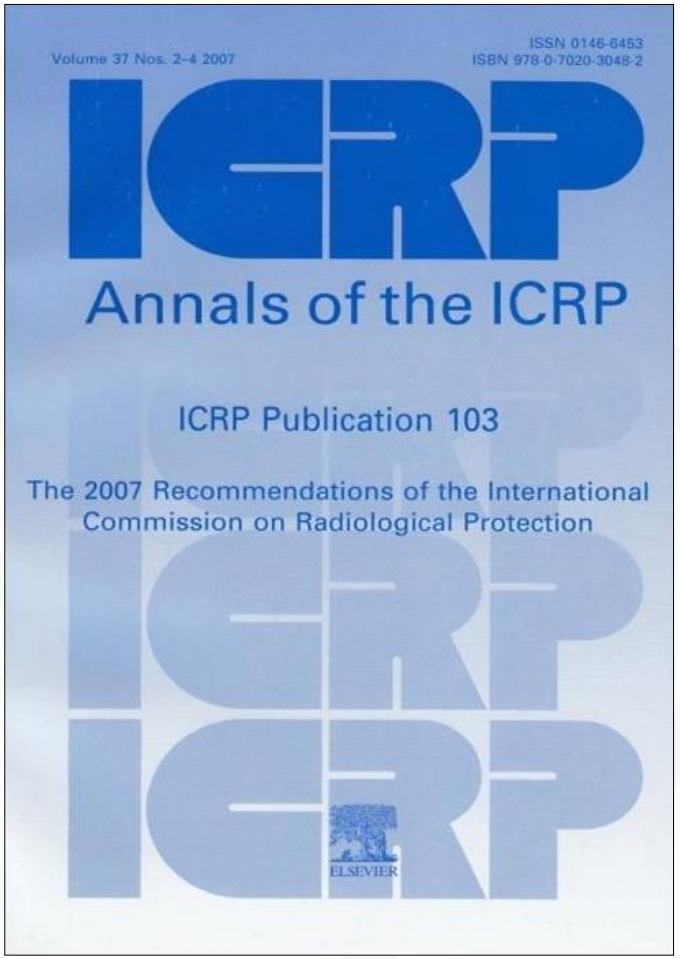
Subsequent International Developments

- **2006:** IAEA published its *Fundamental Safety Principles SF-1*.



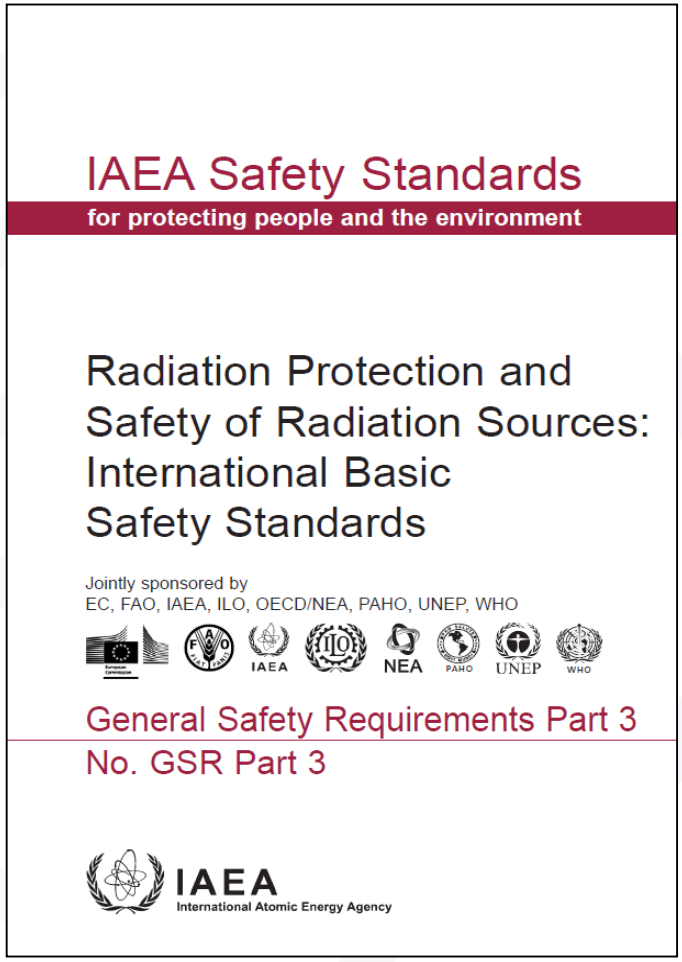
Subsequent International Developments

- **2006:** IAEA published its *Fundamental Safety Principles SF-1*.
- **2007:** ICRP published *The 2007 Recommendations of the International Commission on Radiological Protection, ICRP103*.



Subsequent International Developments

- **2006:** IAEA published its *Fundamental Safety Principles SF-1*.
- **2007:** ICRP published *The 2007 Recommendations of the International Commission on Radiological Protection, ICRP103*.
- **2014:** IAEA published its *International Basic Safety Standards* as a 'final' edition – GSR Part 3 (following an 'Interim' edition in 2011).



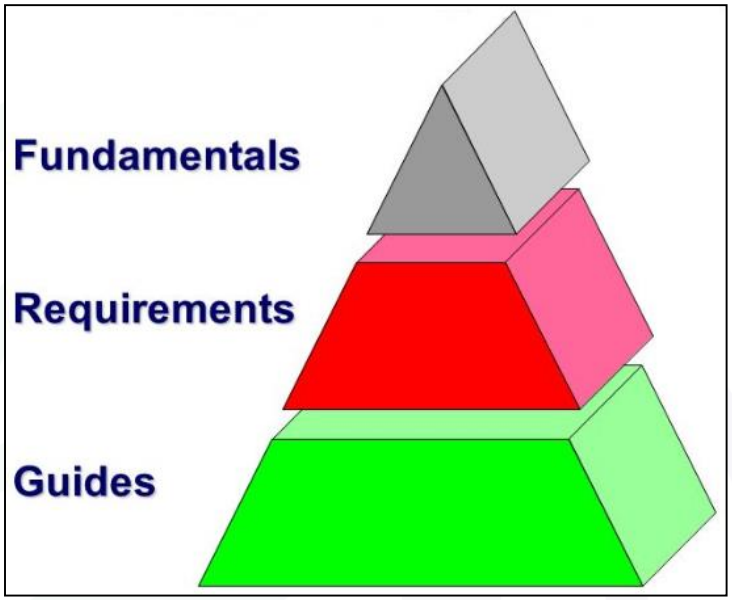
Australia's Radiation Protection Standards

- ARPANSA's Radiation Health Committee recommended revising RPS1 as a result of international developments

- Precipitated a general review of RPS hierarchy
- **Aim**: Align RPS with international series of documents – specifically with IAEA

IAEA Safety Standards Hierarchy

- **Safety Fundamentals**
  - Fundamental safety objectives – basis for the safety requirements
- **Safety Requirements**
  - Requirements that need to be met for protection of people and the environment
  - Can be general or practice specific
- **Safety Guides**
  - Guidance on how to meet the safety requirements
  - Can also be general or practice specific

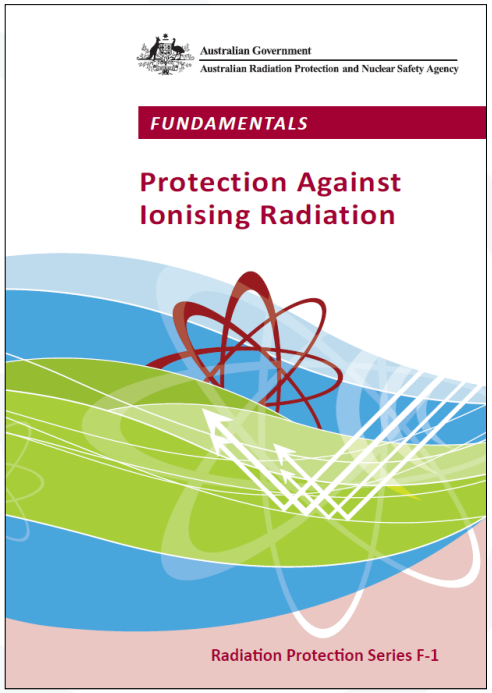


Alignment of categories

IAEA Hierarchy	New RPS Categories
Safety Fundamentals	Fundamentals
Safety Requirements General and specific	Codes
Safety Guides General and specific	Safety Guides

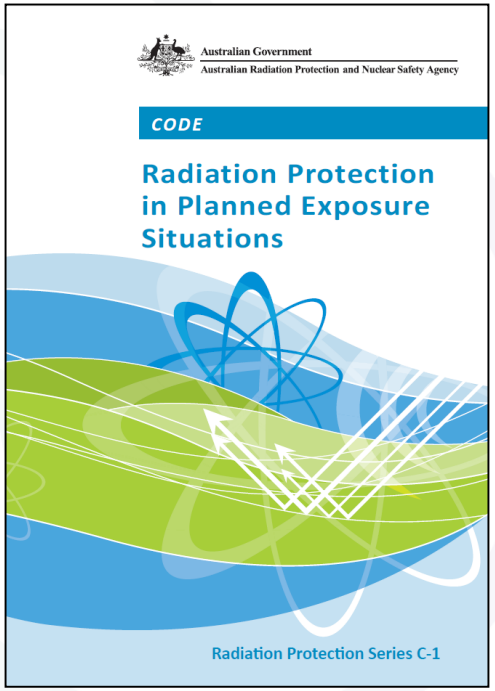
ARPANSA's Radiation Protection Series – New Structure

- **Fundamentals**
  - Set the fundamental principles for radiation protection
  - Explanatory and non-regulatory style
  - Not intended for direct adoption into regulation
  - Principally covering ionising radiation at the moment but intended to include NIR



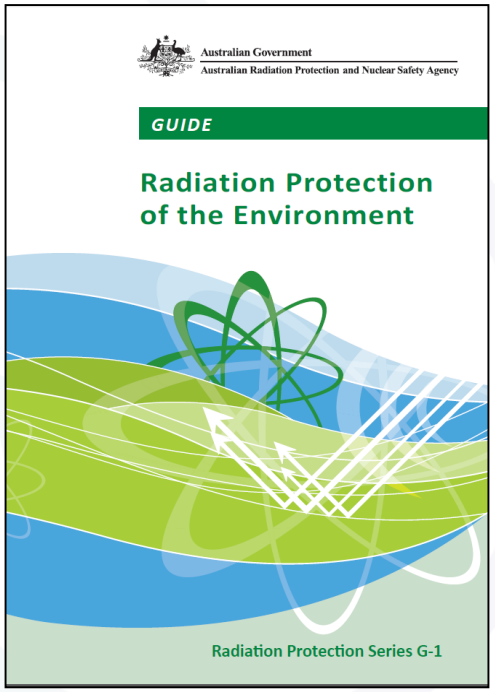
ARPANSA's Radiation Protection Series – New Structure

- **Codes**
  - Prescriptive in style – may be directly referenced by regulation
  - Contain the 'must' statements
  - Will cover both ionising and non-ionising radiation (as separate documents)



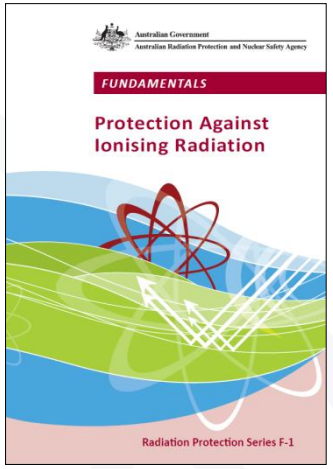
ARPANSA's Radiation Protection Series – New Structure

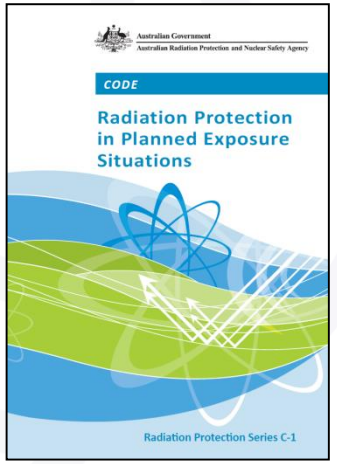
- **Safety Guides**
  - Recommendations and guidance on how to comply with Codes
  - Best practice advice
  - Explanatory in style
  - Contain the 'should' statements



Revision of RPS1

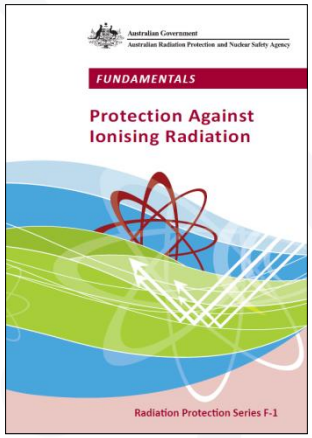
- **Proposed structure**:
  - A Fundamentals document
    - containing the fundamental principles for radiation protection
    - underpins the radiation protection philosophy for subsequent Codes
  - A Code covering planned exposures
    - prescriptive in style – may be directly referenced by regulation
    - contains the ‘must’ statements





Revision of RPS1
Fundamentals for Protection Against Ionising Radiation

- A unified approach to protection recognising both safety and security
- Influences
  - Based on SF-1
  - Incorporates the logic contained in ICRP103
  - Recognises the imperative to have security considered in the development of radiation protection and nuclear safety

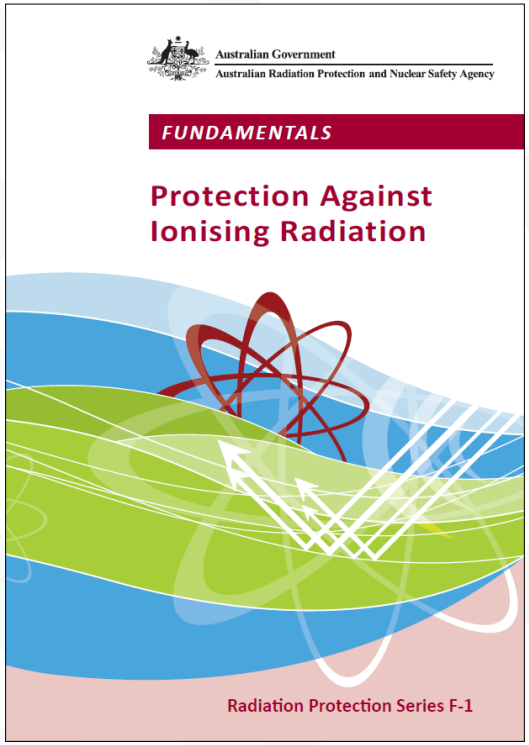


Revision of RPS1
Fundamentals for Protection Against Ionising Radiation

- Draft prepared and submitted for public comment – July-August 2013
- Comment incorporated where appropriate
- RHC approved revised version in November 2013

Revision of RPS1
Fundamentals for Protection Against Ionising Radiation

- *Fundamentals for Protection Against Ionising Radiation (2014)* published in February 2014 as RPS F-1
- Adopted principles outlined in IAEA *Fundamental Safety Principles SF-1*



Revision of RPS1

Code for Radiation Protection in Planned Exposure Situations

- **Late 2014:** Drafting finalised on proposed RPS publication *Radiation Protection in Planned Exposure Situations* – to be designated 'C-1' in the Radiation Protection Series
- **Early 2015:** OBPR agreed that changes proposed for C-1 were not significantly different to RPS1, machinery in nature or international obligations
- **21 April 2015:** Posted on ARPANSA website for public comment

Revision of RPS1

Code for Radiation Protection in Planned Exposure Situations

- Considerable amount of comment received – 63 pages!
- Total of 17 submissions
- Range of responders including:
  - State/Territory regulators
  - Mining
  - Universities
  - Peak bodies
  - Others

Revision of RPS1

Code for Radiation Protection in Planned Exposure Situations

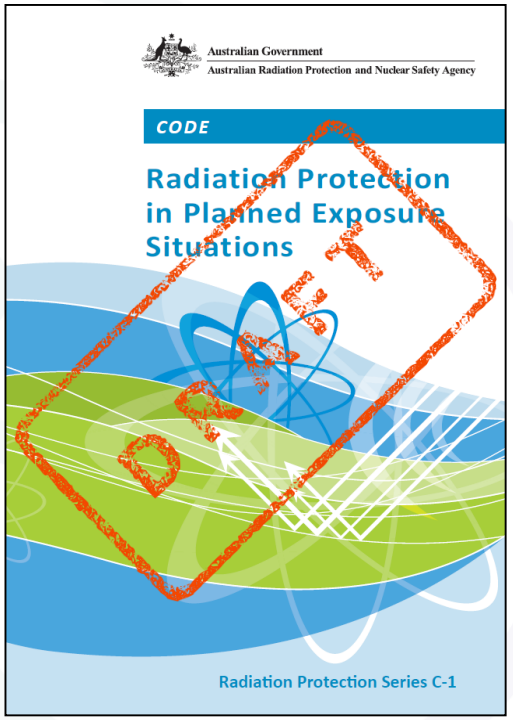
Some of the concerns

- Conflict with requirements in other existing codes
- Changes not adequately costed
- Compliance with RPS1 ***not*** mandatory in some jurisdictions
- Requirement for Radiation Management Plan too onerous for 'low end users' i.e. not a graded approach
- Clarification and defining of many words and phrases required

Revision of RPS1

Code for Radiation Protection in Planned Exposure Situations

- **Late 2015-early 2016:** Redrafted to resolve issues
- **September 2016:** Posted on ARPANSA website for second round of public comment
  - 21 pages of public comment received
  - Issues resolved
- **December 2016:** Published as RPS C-1



Structure

Foreword

1. Introduction

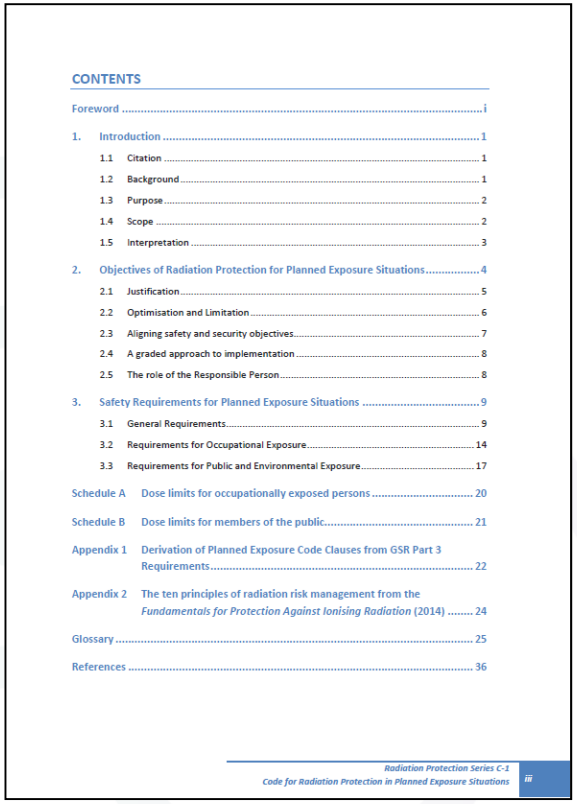
- Includes citation, purpose, scope etc.

2. Objectives of radiation protection for planned exposure situations

- Justification, optimisation, limitation, aligning safety and security objectives, graded approach to implementation and the role of the Responsible Person

3. Safety requirements for planned exposure situations

- General requirements, occupational exposure, public and environmental exposure



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Appendix 1 Derivation of Planned Exposure Code Clauses from GSR Part 3 Requirements 22

Appendix 2 The ten principles of radiation risk management from the *Fundamentals for Protection Against Ionising Radiation* (2014) 24

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Structure (cont)

Schedule A

- Occupational dose limits

Schedule B

- Public dose limits

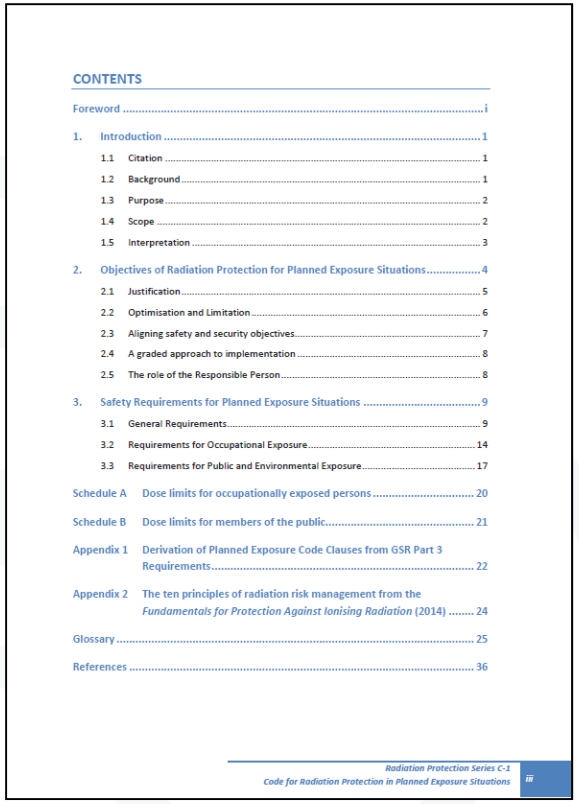
Appendix 1

- Table cross-referencing RPS C-1 clauses with related clauses in GSR Part 3

Appendix 2

- The 10 principles of radiation risk management from RPS F-1

Glossary and references



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So what's new?

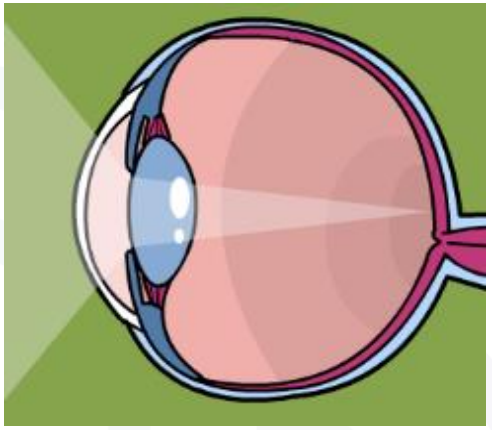
Radiation Management Plan

- New across the board
  - Many categories already have this in place from previous codes
  - Exceptions were dentists, industrial radiography, borehole logging, baggage inspection equipment etc.

- *However*, required by item 5 of the National Standard section of RPS1 for all occupational categories! (5.1(f), (h) and (o))

Occupational eye dose

- Annual equivalent dose limit to lens of the eye reduced from 150 mSv to 20 mSv
  - (No change to public limit (remains at 15 mSv))



- International best practice – expectation to adopt
- Few occupations would get close – cardiologists and interventional radiologists perhaps

Other new items

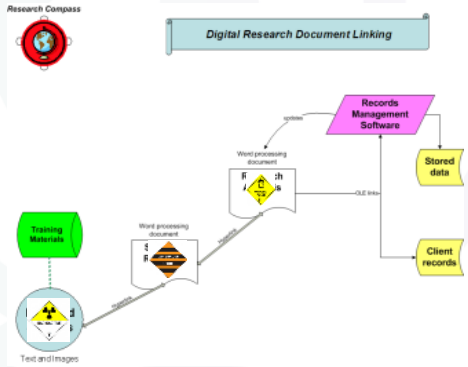
- Engage with other radiation users on same site
  - e.g, as a member of a site radiation management committee

- No previous equivalent

(clause 3.2.4)

Other new items

- Provide dose records to employee on request and at termination of employment (clause 3.1.24(b))
- Provide dose records to central record keeping agency (clause 3.1.24(c))
- Protection and safety are integrated into the overall management system (clause 3.1.9)



Other new items

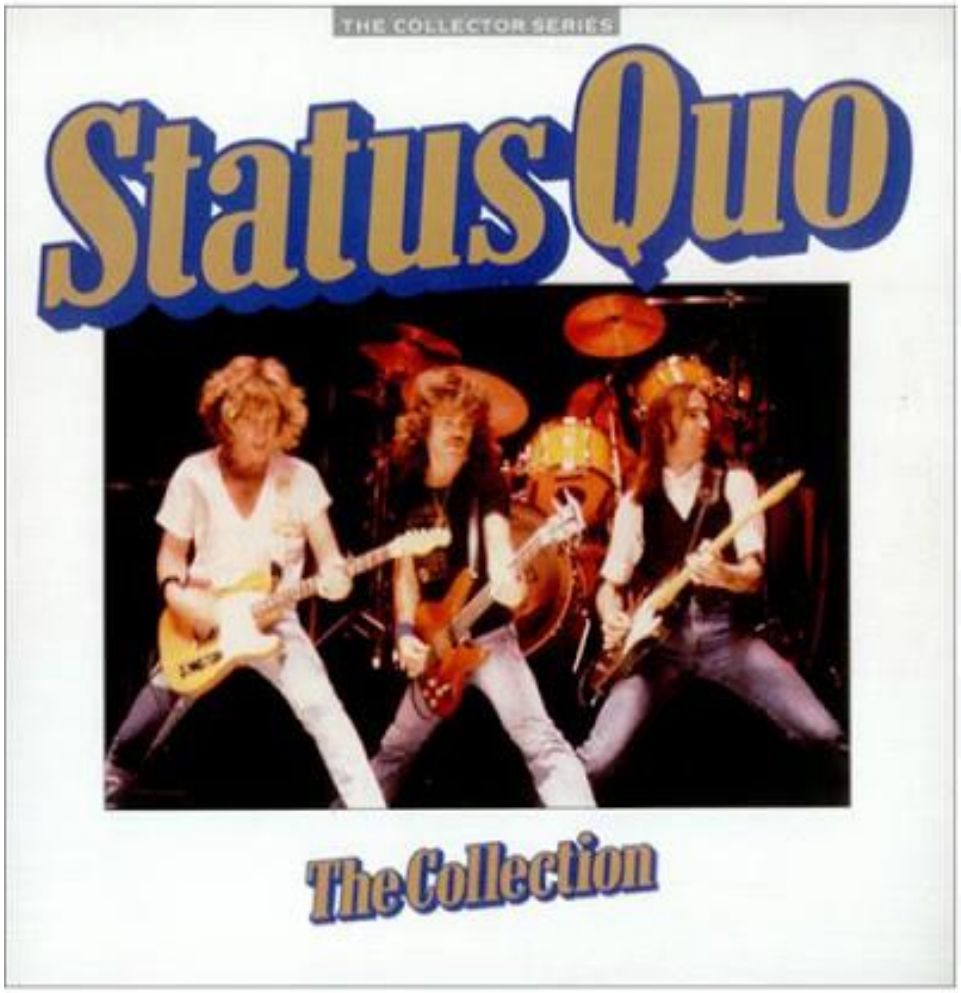
- Identify a Qualified expert – consulted on proper observance of the Code
- Can be an employee of the licence holder!

(Clause 3.1.8)

Other new items

- Greater emphasis on protection of the environment

What hasn’t changed?

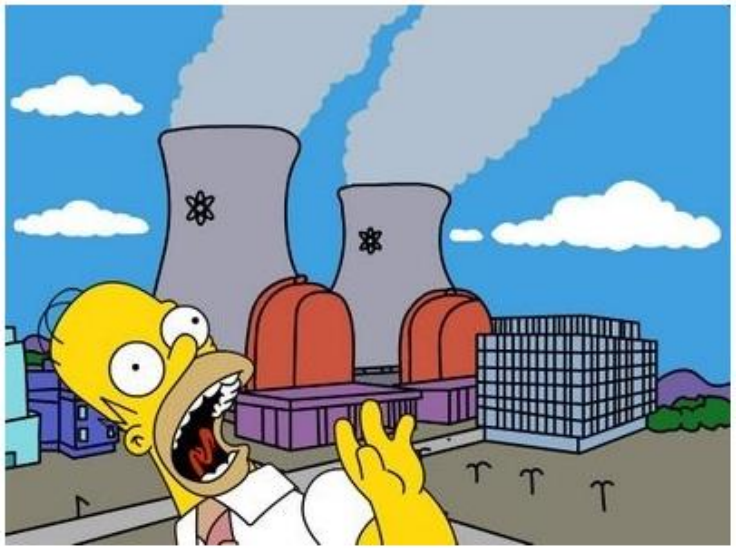


Dose limits

- **Occupational limit:**
  - 20 mSv per year averaged over 5 consecutive ~~calendar~~ years with no more than 50 mSv in any one year
- **Public Limit:**
  - 1 mSv in a year
- **Pregnant employee**
  - Embryo/foetus not to exceed 1 mSv during remainder of pregnancy (C-1) c/f afforded same level of protection as for public (RPS1)
- **Essentially the same as RPS1**

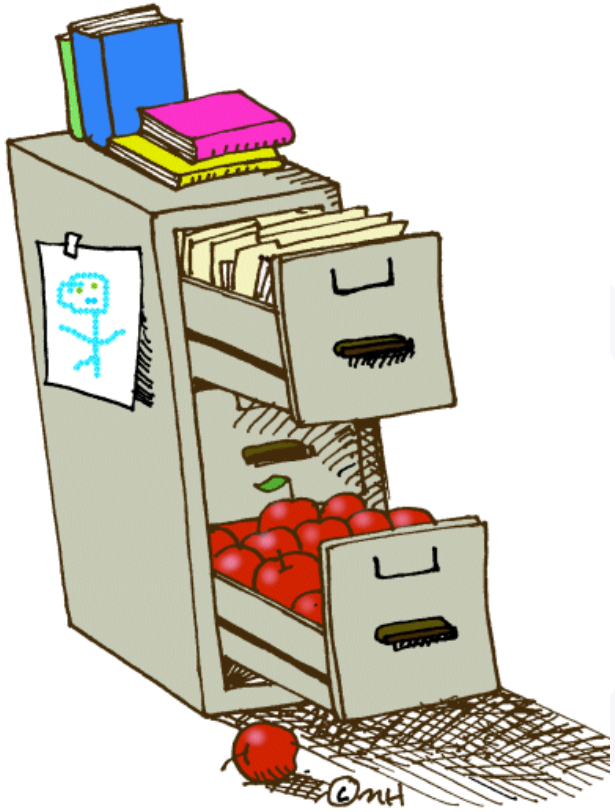
Prevention and Mitigation of Accidents

- What to consider beforehand
- What to do afterwards, i.e.
  - Investigating cause
  - Reporting
  - Remedying the situation
  - Preventing recurrence



Record keeping

- Employees' dose records:
  - Kept during working life of employee
  - 30 years after last dose assessment
  - At least until the employee reaches 75 (or would have)
  - Pass these records to regulator at termination of practice




Dear Past,
thank you for
all the lessons.
Dear Future,
I'm now ready.
QUOTEDIARY.ME

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

arpansa

THANK YOU

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