

There's Nothing NORMal about Training Course Development

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There's nothing NORMAl about training course development

ARPS 2021 Conference

Science. Ingenuity. Sustainability.

Training course development

The numerous goals and issues to consider...

- Radiation safety training courses in general
- Our new NORM RSO training course

Training courses in general

- Measurable learning objectives
- Modularisation
- Regulatory recognition against licence conditions
- Regulator course assessment criteria



Measurable learning objectives

This is foundational to training, but our other training development goals were a good prompt to re-check objectives...

Setting measurable learning objectives

- That is, how do you quantitatively measure that the training participant now 'understands' a concept?
- Instead measure if they can 'do' something – demonstrate, explain, define, identify, list, calculate, etc

Modularisation

	Course	Duration
	Safe Use of X-Ray Equipment	1 day
Users	Safe Use of Industrial Gauges	1 day
	Radiation Safety for Laboratory Workers	1 day
	General Radiation Safety Officer	3 days
RSOs	Industrial Radiation Safety Officer	3 days
	NORM Radiation Safety Officer	5 days
	Advanced Radiation Safety Officer	5 days
Emergency Response	Radiological and Nuclear Emergency Response and Preparedness	5 days

Modularisation

Modularisation of course content, for a number of reasons:

- Consistency and version control when developing and updating common content used across multiple courses
- Identifying core/common vs specific content makes it easier to customise course material when required for specific clients, or for new course offerings
- Allows the training team to utilise our Health Physicist guest lecturers more efficiently across multiple courses
- Ensures that course material that meets regulator's course assessment criteria is consistently used in multiple courses, as relevant

Licence recognition

Obtaining formal recognition against licence conditions from regulators

- Different licences in different jurisdictions
- Which regulators actually publicise lists of recognised courses/course providers?
- Which regulators allow training providers to submit courses for assessment?
 - Can providers access the assessment criteria?

NSW EPA	LICENCES BASED ON SOURCE & RISK LEVEL	SXR	SIG	SLW
APPARATUS Low-risk licences	IA12: Use radiation apparatus for calibration and quality assurance purposes	Y		
	IA19: Use portable x-ray fluorescence (XRF) radiation apparatus for analysis	Y		
	IA41: Use radiation apparatus for detection of concealed item	Y		
APPARATUS Medium-risk licences	IA7: Use radiation apparatus for industrial gauging (not installed in fixed position)	Y		
	IA8: User radiation apparatus for scientific and research purposes	Y		
	IA10: Use radiation apparatus for installing and/or servicing radiation apparatus	Y		
SUBSTANCE Low risk	S12: Use radioactive substances for calibration and quality assurance purposes		Y	Y
	S30: Use radioactive substances for density/moisture determination		Y	
	S35: Use sealed source devices for borehole logging		Y	
SUBSTANCE Medium-risk licences	S7: Use radioactive substances for industrial gauging.		Y	
	S8: Use radioactive substances for scientific or research purposes			Y
	S36: Use radioactive substances for radiopharmacy			Y
SUBSTANCE High risk licences	S10: Use radioactive substances for installing and/or servicing devices containing a radioactive substance.		Y	Y

Regulator course assessment criteria

Course assessment criteria – NSW EPA:

- Core knowledge requirements for all courses
- Licence specific requirements
 - Which licences we want recognition against, if any
- Gap analysis of pre-existing course content against the regulator's assessment criteria, and development or updating of material where necessary

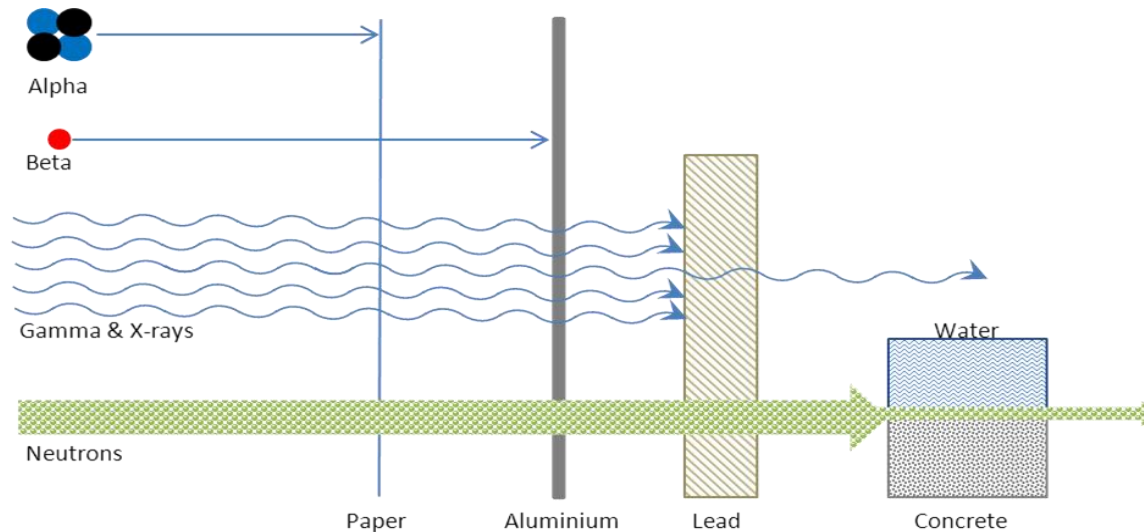
NORM RSO training course

- Common content vs NORM-specific content
- Painful issues



Common course content

- Existing course content to include
 - Core knowledge and common concepts
 - Common RSO training course content

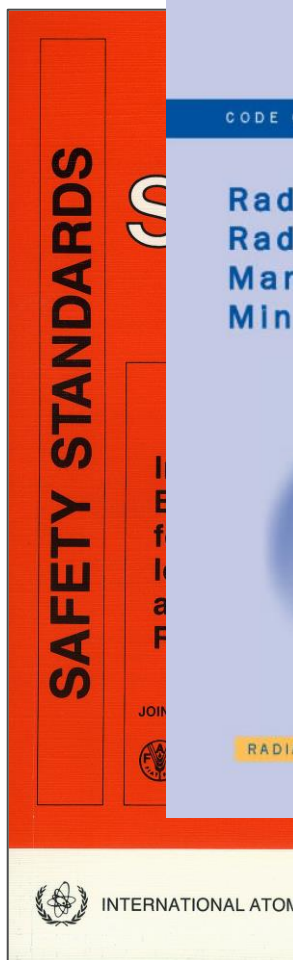


NORM-specific content

- NORM decay chains
- Relationship between activity and mass
- Ingrowth, decay, and secular equilibrium
- Exposure pathways
- Dose estimation and calculation per exposure pathway
- Dealing with dust
- Dealing with radon
- Contamination clearances
- Radionuclide department in processing
- NORM waste management

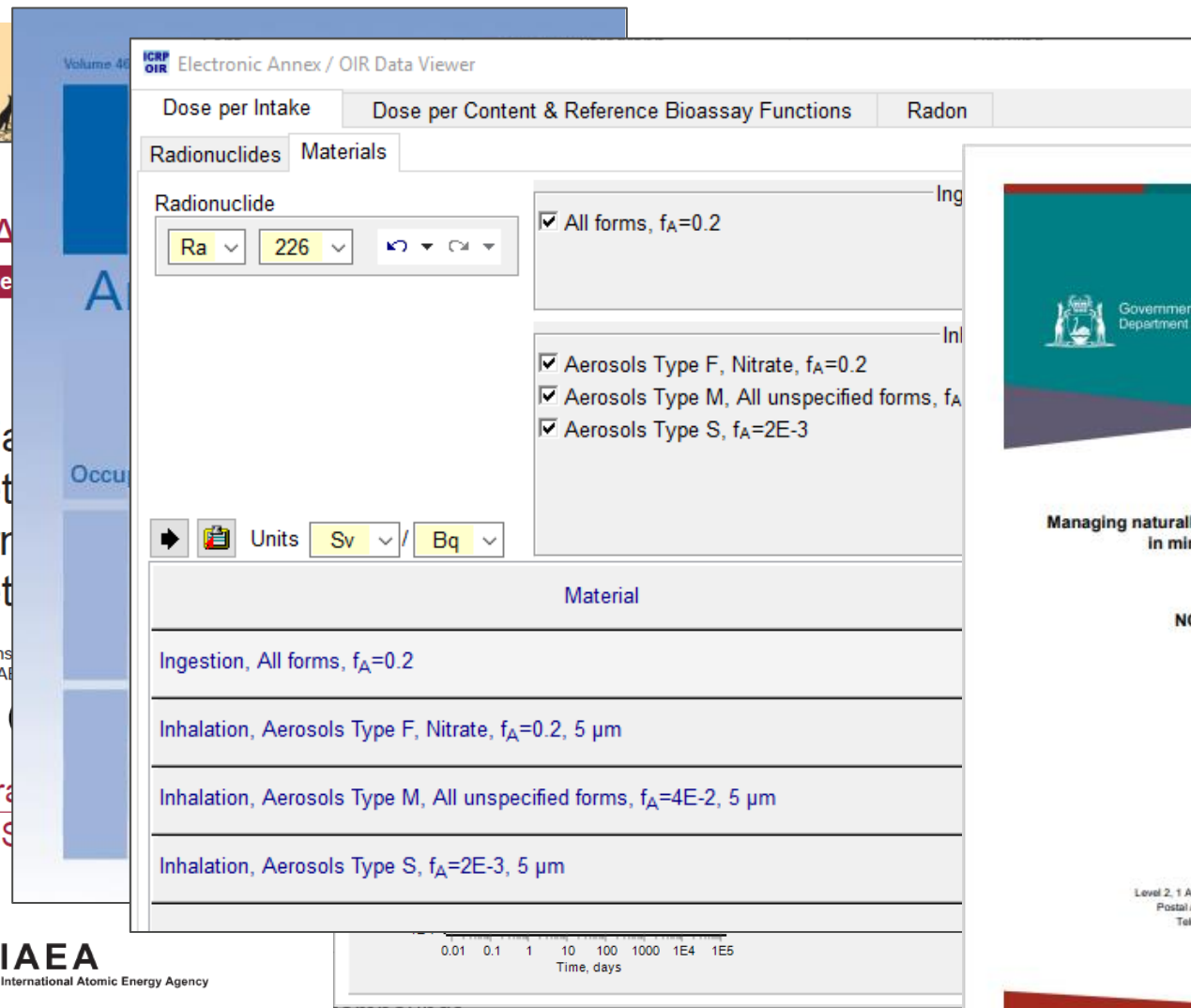


Painful issues



SAFETY STANDARDS

INTERNATIONAL ATOMIC ENERGY AGENCY



ICRP OIR Electronic Annex / OIR Data Viewer

Dose per Intake | Dose per Content & Reference Bioassay Functions | Radon

Radionuclides | Materials

Radionuclide: Ra 226

All forms, $f_A=0.2$

Aerosols Type F, Nitrate, $f_A=0.2$

Aerosols Type M, All unspecified forms, $f_A=4E-2$

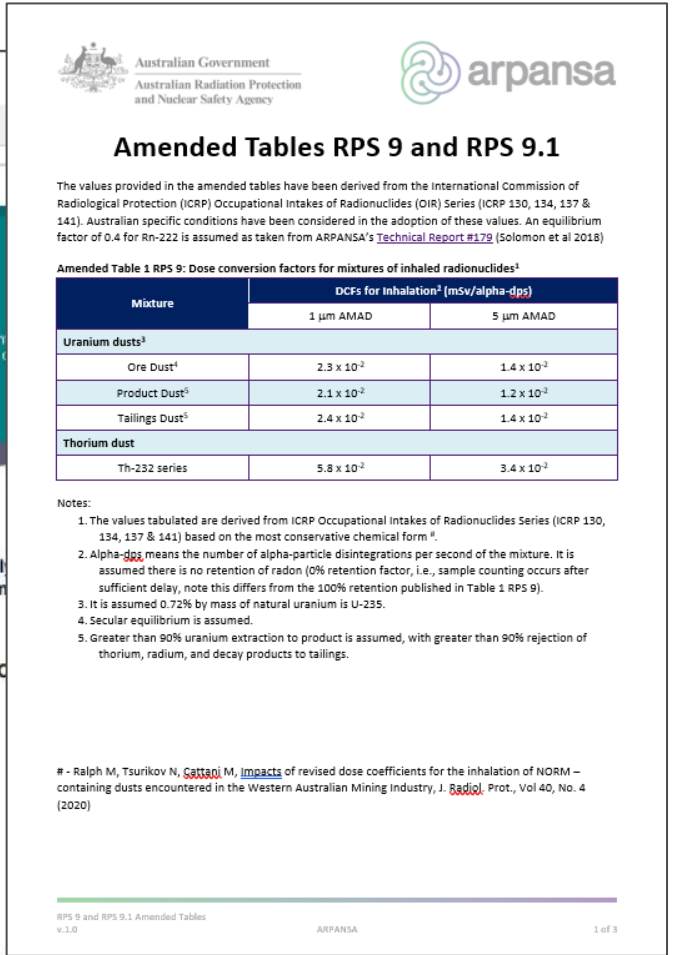
Aerosols Type S, $f_A=2E-3$

Units: Sv / Bq

Material

- Ingestion, All forms, $f_A=0.2$
- Inhalation, Aerosols Type F, Nitrate, $f_A=0.2$, 5 μm
- Inhalation, Aerosols Type M, All unspecified forms, $f_A=4E-2$, 5 μm
- Inhalation, Aerosols Type S, $f_A=2E-3$, 5 μm

Time, days: 0.01 0.1 1 10 100 1000 1E4 1E5



Australian Government
Australian Radiation Protection and Nuclear Safety Agency

Amended Tables RPS 9 and RPS 9.1

The values provided in the amended tables have been derived from the International Commission of Radiological Protection (ICRP) Occupational Intakes of Radionuclides (OIR) Series (ICRP 130, 134, 137 & 141). Australian specific conditions have been considered in the adoption of these values. An equilibrium factor of 0.4 for Rn-222 is assumed as taken from ARPANSA's [Technical Report #178](#) (Solomon et al 2018)

Amended Table 1 RPS 9: Dose conversion factors for mixtures of inhaled radionuclides¹

Mixture	DCFs for Inhalation ² [mSv/alpha-dps]	
	1 μm AMAD	5 μm AMAD
Uranium dusts³		
Ore Dust ⁴	2.3×10^{-2}	1.4×10^{-2}
Product Dust ⁵	2.1×10^{-2}	1.2×10^{-2}
Tailings Dust ⁵	2.4×10^{-2}	1.4×10^{-2}
Thorium dust		
Th-232 series	5.8×10^{-2}	3.4×10^{-2}

Notes:

- The values tabulated are derived from ICRP Occupational intakes of Radionuclides Series (ICRP 130, 134, 137 & 141) based on the most conservative chemical form⁶.
- Alpha-dps means the number of alpha-particle disintegrations per second of the mixture. It is assumed there is no retention of radon (0% retention factor, i.e., sample counting occurs after sufficient delay, note this differs from the 100% retention published in Table 1 RPS 9).
- It is assumed 0.72% by mass of natural uranium is U-235.
- Secular equilibrium is assumed.
- Greater than 90% uranium extraction to product is assumed, with greater than 90% rejection of thorium, radium, and decay products to tailings.

- Ralph M, Tsurikov N, Cattao M. Impacts of revised dose coefficients for the inhalation of NORM - containing dusts encountered in the Western Australian Mining Industry, J. Radiol. Prot., Vol 40, No. 4 (2020)

RPS 9 and RPS 9.1 Amended Tables v.1.0 ARPANSA 1 of 3

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Painful issues

So, what's the problem?

- Which regulators are requiring the use of which DCFs?
- What mixed isotope DCFs are available?
- If an operation requires a different mixed isotope DCF that isn't provided, how to calculate it?
 - How accessible/understandable/usable is all of this reference material to new operators/RSOs?
- Issues of secular equilibrium or disequilibrium, radon retention, solubility, etc

Training development goals & issues

- Our radiation safety training courses in general
 - Measurable learning objectives
 - Modularisation
 - Regulatory recognition against licence conditions
- Our new NORM RSO training course
 - Identification and development of NORM-specific content
 - Painful DCF issues – annoying but unavoidable while recommendations & codes are in the process of being updated and regulators have not yet come to harmonisation on what is required

Thanks!



Any questions?



Australian Government



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