Australian Government
Australian Radiation Protection and Nuclear Safety Agency

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RESRAD in Australia

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RESRAD training in Australia

A training course on the RESRAD suite of codes was held at Yallambie from **12-16 October 2015**. Two experts in the software, Charley Yu and Dave LePoire, from Argonne National Laboratory, USA, provided the training in **RESRAD (onsite), RESRAD-OFFSITE and RESRAD-BUILD**.

The training was provided for approximately 20 participants, with representatives from:

- ARPANSA – including RHS, OCEO and RSB
- state and federal government
- industry
- consulting

RESRAD training in Australia

Example – Contamination assessment at Melbourne University

- Legacy site - In the past building was used for radiation experiments, in particular using Ra-226
- Building and surrounding areas were surveyed
- Simple assessment using RESRAD-onsite to get an estimated of potential doses

Example – Contamination assessment at Melbourne University

Assumptions

- Contaminated Area – 10 m x 30m = 300 m^2
- Occupancy – 25% of the year in contaminated zone
- Contamination – 10 Bq / g Ra-226 (Nuclides are in equilibrium, including Pb-210)
- Density of soil and cover – 1.5 g / cm^3
- Radon emanation coefficient – 0.05

Depth of cover (m)	Depth of contamination (m)	External (mSv)	Inhalation (mSv)	Soil Ingestion (mSv)	Radon (mSv)
0	0.15	4.8	<0.001	0.008	3.5
0.1	0.15	1.5	<0.001	0.003	3.5
0.2	0.15	0.5	<0.001	<0.001	3.5
0	0.3	5.6	<0.001	0.008	5.1
0.1	0.3	1.9	<0.001	0.003	5.1
0.2	0.3	0.6	<0.001	<0.001	5.1
0	0.5	5.8	<0.001	0.008	6.1
0.1	0.5	2.0	<0.001	0.003	6.1
0.2	0.5	0.7	<0.001	<0.001	6.1

Example – Contamination assessment at Melbourne University

Potential doses to workers due to dust inhalation during building activities

Assumptions

- Dust level (nuisance limit) – 10 mg / m^3
- Contamination – 10 Bq / g Ra-226 (Nuclides are in equilibrium, including Pb-210)
- Breathing rate (light exercise) – 1.5 m^3 / h
- Breathing rate (heavy exercise) – 3.0 m^3 / h

Breathing rate	inhalation dose per hour (mSv / h)	Hours to reach 1 mSv (h)
Light exercise	0.001	1000
Heavy exercise	0.002	500

Example – Contamination assessment at Melbourne University

- If considered an existing exposure, doses were within an acceptable range ~ 10mSv
- As well know, technical aspects are only one part of the decision making process
- It was decided that site remediation with removal of material was the best course of action
- Interesting regulatory exercise. In this case ARPANSA is an operator, local Victorian agency is the regulator

Example – Contamination assessment at Melbourne University

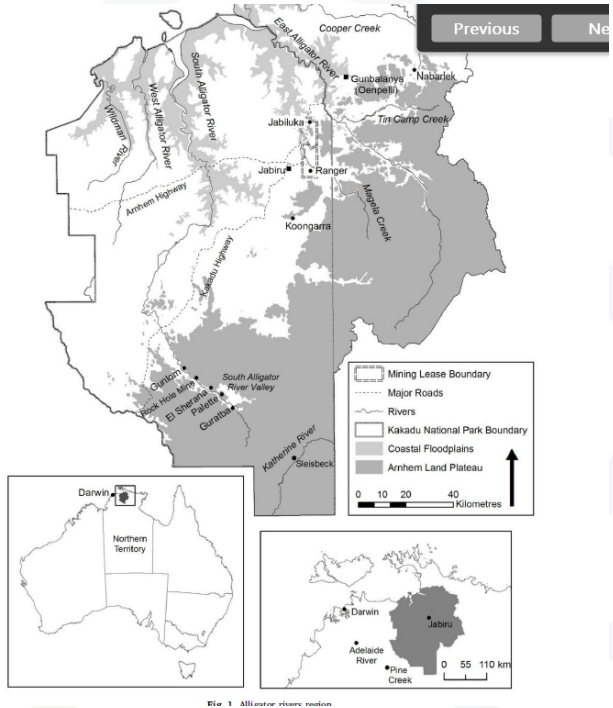
- Site was remediated. Material was packages in to drums.
- The drums are now stored at ARPANSA site
- Low-level waste. Hopefully one day disposed in a national facility

Example – Rehabilitation at Ranger Uranium mine

- Assessment undertaken by Department of Environment - Supervising Scientist, who are based in Darwin, NT.
- Modelling the dispersion of radon-222 from a landform covered by low uranium grade waste rock
- RESRAD-offsite was used
- Assess potential doses to local population
- https://www.sciencedirect.com/science/article/pii/S0265931X18302765

Example – Rehabilitation at Ranger Uranium mine

- Mine site is located in NT
- Mining and milling on site for past 40 years
- Current Mine schedule:
  - Cease operations by 2021
  - Remediated by 2026



Example – Rehabilitation at Ranger Uranium mine

- Modelled as a series of 1km x 1km sources
- Based on hypothetical remediated landform, with waste rock used as cover to create the landform
- Weather data for site was collated from many years of data to create STAR file

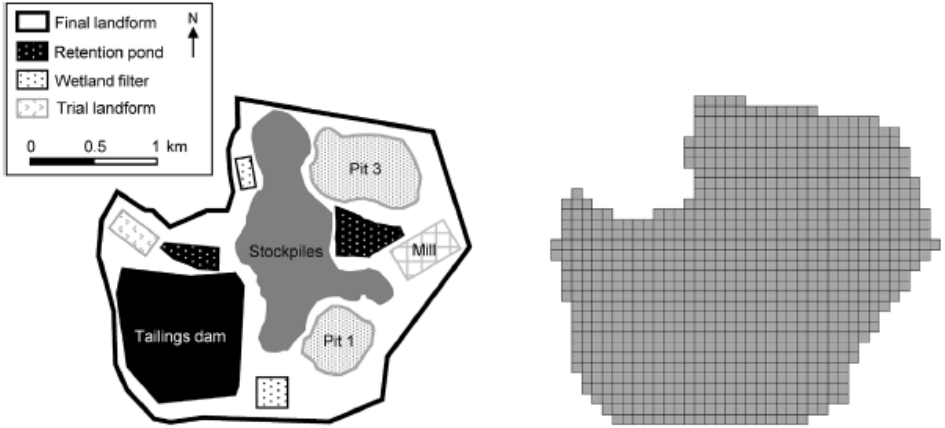
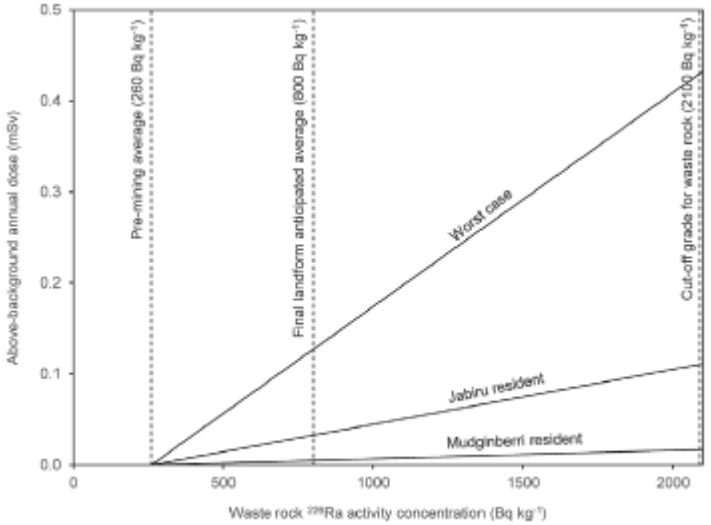


Fig. 2. Conceptual landform overlaid on existing mine site features (left) and its representation in the modelling (right).

Example – Rehabilitation at Ranger Uranium mine

- New ICRP 137 dose factors for Radon were used
- Predicted doses for various scenarios
  - Dose increase may be measureable at some population areas, but is within general variations of natural background
  - Not predicted to be able 1 mSv per year for any populations
  - No observable adverse health effects predicted



Future uses of RESRAD in Australia

- Assessment of waste facilities, assist with determining Waste Acceptance Criteria/Activities
  - Private facility such as Tellus holdings – long term disposal
    - Sandy ridge facility - http://www.tellusholdings.com/project_sandy_ridge.html
    - Have used RESRAD for some aspects of their current proposed facility
      http://www.tellusholdings.com/pdf/2016/sr-per/sr-per_a-14_radiation-assessments.pdf
  - National Radioactive Waste Management Facility
    - ARPANSA would likely undertake an independent assessment of an application. This may include a RESRAD assessment to look at potential doses to surrounding population
    - https://radioactivewaste.gov.au/
  - Off-shore oil-gas decommissioning
    - Lots of pipes with NORM scale, impact on environment needs to be assessed

Benefits of RAMP

- RESRAD is now part of a greater systematic program in RAMP.
- User groups such as this one
  - Find out what is happening with RESRAD.
- Provides a mechanism for ARPANSA to engage with other users in Australia.
  - RESRAD is used by other state agencies
  - Currently, at least to my knowledge, there is no Australian User group for RESRAD or formal communication between users

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THANK YOU

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