Australian Specific Case Study: Dose and risk criteria for protection of people following the closure of a disposal facility for radioactive waste

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The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is the Australian Government's primary authority on radiation protection and nuclear safety.
• Code published in October 2018.
• Based on SSR-5, Disposal of Radioactive Waste (IAEA 2011).
• Over 200 comments received during consultation.
• Further clarification requested on:
  – How to apply risk targets?
  – How do risk targets and dose constraints relate?
• In 2019 ARPANSA developed a draft “Advisory Note” to strengthen stakeholder understanding of risk targets when implementing the requirements of the Code.
What is the Issue?

Why did we have this request for clarification?

• Dose criteria are universally applied for radiation protection purposes in planned exposure situations.
  – Regulators set dose criteria
  – Operators demonstrate compliance against dose criteria

• Dose criteria are commonly accepted as the sole concept of radiation risk.

• There is limited experience in applying the concept of separate risk criteria when considering the probability of a health effect in a population as a result of exposure to radiation. This is commonly expressed as the product of the probability that exposure will occur and the probability that the exposure, assuming that it occurs, will cause the specified health effect.
Draft Advisory Note

Our Approach

• Develop advice to support implementation of the Code.
• Target regulators, licence holders, licence applicants and interest groups.
• Style to be easy to read and available online.
• Provide clarification of process and terms with infographics to explain process.
• Link to IBP by reference to IAEA, ICRP and UNSCEAR documents.
Advisory Note at a Glance

Structure

• Summary
• Note to readers
• How is protection and safety achieved and demonstrated?
• What about disruptive events?
• Are there specific dose criteria and risk targets for optimisation and safety following the closure of a disposal facility?
• Can we link risk to dose?
• What is the benefit of a risk target?
• How confident can we be in dose and risk estimates?
• References
Key Messages

• Dose constraints are a regulatory requirement that guide optimisation of protection.

• Risk targets promote safety and guide implementation of best available technique (BAT) in the siting, construction, operation and closure of a disposal facility.

• Dose constraints and risk targets are complementary and can be used separately or in combination depending on the situation, the type of information available and the uncertainties involved.

• Dose and risk estimates in safety assessments assist decision makers and stakeholders, including members of the public, in comparing exposures and risks from waste disposal with risks from other activities.
<table>
<thead>
<tr>
<th>Event</th>
<th>Protective approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal evolution including reasonable foreseeable disruptive events</td>
<td>Redesign or consider other options</td>
</tr>
<tr>
<td>Severely disruptive events</td>
<td>Probabilistic and deterministic assessments</td>
</tr>
<tr>
<td>Human intrusion</td>
<td>Optimise and apply BAT to achieve protective target</td>
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</tbody>
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<table>
<thead>
<tr>
<th></th>
<th>10^{-6}</th>
<th>10^{-5}</th>
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<tbody>
<tr>
<td>Annual risk</td>
<td></td>
<td></td>
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<tr>
<td>Annual dose (mSv)</td>
<td>~0.01</td>
<td>1</td>
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RPS C-3 does provide guidance:

• The risk constraint or target can be formulated as the product of probability of the exposure (i.e. how likely it is that an exposure occurs in a given time period), and resulting harm should that exposure occur.

• Optimisation can also be applied to reduce the risk. Dose constraints and risk constraints or targets can be used in combination.

Constraints:

• Annual risk for health detriment for a member of the public to within the range $10^{-5}$ to $10^{-6}$ or less.
IAEA SSR-5

Scope includes:
A reasonable assurance also has to be provided that doses and risks to members of the public in the long term will not exceed the dose constraints or risk constraints that were used as design criteria.

Constraints:
• 0.3 mSv in a year or a risk constraint of the order of $10^{-5}$ per year.
Further advice described in clause 5.45:

“When estimating risk, it is necessary to describe the approach taken to determining risk and to identify clearly whether the probabilities of occurrence of events and processes and/or scenarios were assessed, how the uncertainty associated with each scenario was dealt with, and which scenarios were included in the risk evaluations.”
Advisory Note

• Provides a single resource to build a common understanding.
• Presents a better understating of limitations of approach and the degree of certainty in predictions of disruptive events when establishing a facility.
• Links national and international guidance.
• Potential opportunity to expand to other activates that apply risk targets.

Your feedback is welcomed
THANK YOU

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