Development of the Safety Guide
Management of Radioactive Residues from Uranium Production and Other NORM Activities (DS459)

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Outline

- Background
- Proposed framework for management of NORM residues
- Uranium production and other NORM activities
- In-situ recovery of uranium production (ISR)
- Discussions
- Way forward
Background

• WS-G-1.2: Management of Radioactive Waste from the Mining and Milling of Ores (2002),

• WASSC 31 (June 2011) concluded that: WS-G-1.2 is to be revised at the light of the new requirements and developments.

• WASSC 32 (Nov 2011) and CSS 31 (March 2012) endorsed the DPP

• Proposed title: Management of Radioactive Residues from Mining, Mineral Processing, and other NORM related Activities
Background - Issues to be addressed (1/2)

- The inclusion of “in situ recovery”, as this has become a major resource recovery and process for uranium.
- NORM residues can include other contaminated objects, like pipes, scaling, sludge, etc.
- Risk based approach and graded approach to managing different residues, based on the wide range of activity levels in NORM residues.
- Regulation and management of mixed residues (i.e., containing radiological and non-radiological contaminants).
- Differences among some Member States in their regulation of NORM, which may or may not include uranium and thorium mine and milling residues.
Background - Issues to be addressed (2/2)

- General updates to document to reflect current IAEA terminology, definitions, references etc.
- Predisposal management of Radioactive Waste (GSR Part 5). For example, pre-treatment, treatment, storage, transport, and conditioning.
- Residues may contain other components which may be retrieved, and segregation of residue, reuse and recycle, and disposal should be addressed.
- Make connection to remediation or decommissioning, and how these activities can generate a waste or a residue in the context of NORM.
Status – Scope covered

- Uranium mining and processing
- Rare earth extraction
- Thorium extraction and use
- Niobium extraction
- Non-U mining – including radon
- Oil and gas
- TiO₂
- Phosphates
- Zircon and Zirconia
- Metal production (Sn, Cu, Al, Fe, Zn, Pb)
- Burning of coal etc.
- Water treatment – including radon

Transport
- Remediation
- Decommissioning
- Disposal
- Storage
- Reuse/Recycle
- Treatment
- Characterization
- Generation
- Construction
- Design
- Siting
- Planning

Liquid waste
- Manufactured items containing NORM
- Contaminated items
- Higher activity waste
- Bulk minerals processing residues other than uranium mill tailings
- In-situ leaching waste
- Waste rock, mineralized waste rock and similar residues
- Uranium mill tailings
Management scheme for NORM residue

- **Recycle into construction materials And disposal**

- **Case-by-case management of NRs**
  - < 1 Bq/g
  - But > 1 mSv/a

- **Regulated**
  - > 1 Bq/g
  - > 1 mSv/a

- **Out of scope**
  - < 1 Bq/g
  - < 1 mSv/a

- **Exempted**
  - > 1 Bq/g
  - < 1 mSv/a
Structure of DS459

1. Introduction
2. Governmental, legal and regulatory framework
3. System for regulatory control
4. Protection of people and environment
5. NORM residue types and management strategies
6. Safety assessment, radiological environmental impact assessment and safety case
7. Long term Management of Facilities and NORM Residues

References
Annex I. Origin and categorization of NORM Residues
Annex II. Reuse and Recycling of NORM Residues
Annex III. Sampling and determining radionuclide activity concentrations
Annex IV. Safety Assessment Steps
Annex V. Design and Construction Considerations for Tailing Management Facilities
Annex VI. Management Plans for uranium production
Annex VII. Additional publications relevant to NORM residues
NORM Residues – Concerned sectors

1. Uranium mining and processing
2. Rare earths extraction
3. Thorium extraction & use
4. Niobium extraction
5. Non-U mining – incl. radon
6. Oil and gas
7. TiO₂
8. Phosphates
9. Zircon & zirconia
10. Metals production (Sn, Cu, Al, Fe, Zn, Pb)
11. Burning of coal etc.
12. Water treatment – incl. radon
Exemption in Management of NORM residues

GSR Part 3

• 3.1(f) the mining and processing of raw materials that involve exposure due to radioactive material;
• 3.4 (a) Exposure due to material in any practice specified in para.3.1 where the activity concentration in the material of any radionuclide in the uranium or thorium decay chains is greater than 1 Bq/g or the activity concentration of 40 K is greater than 10 Bq/g.
• I-4. For radionuclides of natural origin, exemption of bulk amounts of material is necessary considered on a case by case basis by using a dose criterion of the order of 1 mSv in a year, commensurate with typical doses due to natural background levels of radiation.
System for Regulatory Control

Other facilities and activities and scoping criteria

Notification

Used in construction materials

Construction material requirements

≥ 1 Bq/g

Screening Assessment

* Meet dose criterion

YES

Exemption

Registration or License

Authorized management options
- Clearance
- Reuse and recycle
- Disposal in landfill
- Disposal as radioactive waste
- Long term management facility

NO

License

Uranium production

* Dose criterion can be in the order of 1 mSv/y or other that is defined by the regulatory body.
Clearance for management of NORM residues

• **I-13.** Clearance may be granted by the regulatory body for specific situations, on the basis of the criteria of paras I-10 and I-11, with account taken of the physical or chemical form of the radioactive material, and its use or the means of its disposal. Such clearance levels may be specified in terms of activity concentration per unit mass or per unit surface area.

• **p.109, Footnote 65** For example, specific clearance levels may be developed for metals, rubble from buildings and waste for disposal in landfill sites.
Clearance options

- Clearance for reuse and recycle in construction materials (SSG32)
- Clearance for reuse and recycle in other purposes (1 mSv/yr based)
- Clearance for disposal in land (1 mSv/yr based)
- Authorized discharge (DS442)
- Authorized disposal as radioactive waste (SRS 5)
- Authorized disposal in NORM management facility

DS459 NORM Residues
Options for long term management

NORM Waste

- Large volume
  - Specialist facility

- Medium volume
  - Mixed land fill

- Small volume
  - Radioactive waste disposal
Uranium production and other NORM activities

• A title change was proposed and endorsed at the WASSC 38 (November 2014)
• Old title: Management of Radioactive Residues from Mining, Mineral Processing and other NORM Related Activities
• Current working title for DS459: ‘Management of Radioactive Residues from Uranium Production and other NORM Related Activities’
  • Weigh the importance of uranium production
  • Consider the practical situations in MSs
## In-Situ recovery of uranium production (ISR)

<table>
<thead>
<tr>
<th>Open-pit</th>
<th>Underground</th>
<th>ISR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big volume of tailings which cause significant concerns</td>
<td>Significantly potential risk of groundwater</td>
<td></td>
</tr>
<tr>
<td>Large stockpiles of waste rock, sub-economic ore and/or overburden</td>
<td>Much smaller waste rock production volumes</td>
<td>Large volume of waste water</td>
</tr>
<tr>
<td>Potential for waste water, drainage and seepage to cause environmental problems</td>
<td>Waste sludge and evaporate salts of high specific activity but small volume</td>
<td></td>
</tr>
</tbody>
</table>

- To address the safety of ISR appropriately, development of a specific safety report for ISR was proposed at WASSC 38 (November 2014)
- The document is under development.
Application of criteria for long term management of NORM residues

- **Residues of Uranium Production**: SSR Part 5: 2.15(b) a disposal facility (considered as a single source) is so designed that the calculated dose does not exceed a dose constraint of **0.3 mSv in a year** or a risk constraint of the order of $10^{-5}$ per year.

- **Residues of Other NORM Activities**: GSR Part 3: I-12(c) For radionuclides of natural origin in residues that might be recycled into construction materials or the disposal of which is liable to cause the contamination of drinking water supplies, the activity concentration in the residues does not exceed specific values derived so as to meet a dose criterion of the order of **1 mSv in a year**, commensurate with typical doses due to natural background levels of radiation.
Exposure situation applicable to some reuse and recycle

- *p. 30 Footnote 17*: A situation of exposure due to radionuclides of natural origin in food, feed, drinking water, agricultural fertilizer and soil amendments, construction materials and residual radioactive material in the environment is treated as an existing exposure situation regardless of the activity concentrations of the radionuclides concerned.

- *p. 109 Footnote 64*: Regulatory control of construction materials is addressed in Section 5 as an existing exposure situation.

- ? New construction materials and agricultural fertilizer
Way forward

• Given its scope and nature, this is a complex SG
• The draft Safety Guide DS459 will be submitted for review in early 2016
Thank you