44th Meeting of the Waste Safety Standards Committee

13 – 16 November 2017

Agenda Item W5.3
Draft Safety Guide DS459: Management of Radioactive Residues from Uranium Production and Other NORM Activities (Revision of WS-G-1.2)
– Update on the status and issues for discussion –

Zhiwen Fan and John Rowat
Waste and Environmental Safety Section
Division of Radiation, Transport and Waste Safety (NSRW)
Outline

• Status of development of DS459
  – First review by Safety Standards Committee
  – Member States comments
  – TM on Application of the Graded Approach to Safety for Management of NORM Residues

• Planned activities supporting application of DS459

• Issues for discussion
  – Fraction of 1 mSv/a
  – Application of specific clearance
  – Application to existing facilities and activities

• Suggestion
Status of Development of DS459

• First review of the draft publication by the review Committees in June 2016
• Large majority of the comments were clear and well justified, based on the practices in the Member States
• Committee involved: WASSC, RASSC
  – 260 comments from 5 MSs and EC:
    – 206 (80%) accepted
    – 24 (9%) accepted with modifications
    – 30 (11%) rejected
  – Editorial + Clarification + Terminology = 178/260 (68%)
Status of Development of DS459

- WASSC 41 (June 2016) endorsed for 120 day MS comments until 7 December 2016
- 275 comments from 11 MSs
- 248 (90%) accepted and accepted with modifications
- 27 (10%) rejected:
  - Beyond the scope of the document
  - Fraction of 1 mSv/a
  - Citation and reference
Application of graded approach (1/3)

- TM on Application of the Graded Approach to Safety for Management of NORM Residues, Vienna, 19 - 23 June 2017
- Twenty three participants representing sixteen Member States and the ICRP
Application of graded approach (2/3) - Recommendations of the TM

- Development of a report that collates the methods for **characterization and safety assessments** for NORM residues in Member States and identify good practices.

- Providing advice on a standard way of determining **impacts from radon** (more particularly the decay products of radon) in relation to NORM.

- Consider the challenge of the relationship between **dose limits, exemption criteria and dose constraints** and provide further clarification where appropriate in relation to NORM and NORM residues.
Application of graded approach (3/3) - Recommendations of the TM (Cont.)

- Guidance setting out when it is appropriate to use blending as a management option for NORM residues through collecting and reviewing practices that may be occurring in Member States.

- Consider the following options for the application of the questionnaire;
  - As a web based application
  - Attach as an annex to DS459
  - Distribute to Member States
  - Inform the proposed document “Application of the Graded Approach to the Safe Management of Naturally Occurring Radioactive Material (NORM) Residues”
Structure of DS459

1. Introduction
2. Overview of NORM Residues
3. Governmental, legal and regulatory framework
4. Protection of people and the environment
5. System for regulatory control
6. Strategies for NORM residue management
7. The safety case and safety assessment for NORM residues management
8. Safety consideration for long term Management of NORM Residues

Appendix A. Special considerations of residues from uranium production
Appendix B. Residue management plan for uranium production
Appendix C. Decommissioning plan for uranium production facility

References
Annex I. Example residue be assessed for possible regulatory control
Annex II. Questionnaire for survey of NORM residues management
Annex III. Application of the graded approach to the management of NORM residues
Annex IV. Reuse and Recycling of NORM Residues
Annex V. Sampling and determining radionuclide activity concentrations
Annex VI. Bibliography
Activities with residues of concern

- Uranium mining and processing
- Rare earths extraction
- Thorium extraction & use
- Niobium extraction
- Non-U mining
- Oil and gas
- TiO$_2$
- Phosphates
- Zircon & zirconia
- Metals production (Sn, Cu, Al, Fe, Zn, Pb)
- Burning of coal etc.
- Water treatment
- Processing, reuse/recycle
- Storage and disposal
- Decommissioning/closure
- Plus +++

Growing interaction between operator and regulatory body

Out of scope → Evaluation of national situation → NORM Practices → Notification → Exemption → Exempted Practice → Registration → Authorization

Authorization:
- NORM Practices with Authorization
  - Clearance
  - Reuse/recycle Landfill
System for Regulatory Control

Operators intended to conduct NORM related activities

- Notification

Residues used for construction materials

- Construction materials
  - YES
  - Construction material criteria

- No

Disposal of bulk amounts of residues

- Screening Assessment

  - Below: U, Th. 1 Bq/g
    - K, 40 Bq/g

  - No

- YES

  - Out of scope

- No

Management of other residues

- Below 1 mSv/yr

  - YES

  - Exemption/Clearance

  - No

- Registration

  - Design and optimization

  - Safety Assessment

    - Below 1 mSv/yr
    - YES
    - Registered NORM residues

    - No

- Licensed NORM residues
Planned activities supporting application of DS459

- **TECDODC on Application of the Graded Approach to the Safe Management of Naturally Occurring Radioactive Material (NORM) Residue is being developed**
- **TM on Safety Assessment for long term management of radioactive residues from uranium production, 18-22 June 2018, Vienna (safety assessment and characterization)**
- **Technical Meeting of the Establishment of a Regulatory Forum for Safe Management of Uranium and Naturally Occurring Radioactive Material Residues, 12-16 Nov 2018, Vienna (A platform to enhance knowledge sharing and communication)**
Issue No. 1 Comments on Fraction of 1 mSv (1/2)

Comments:

- Constraint of a fraction of 1 mSv as the 1 mSv/y is defined as limit for public dose

GSR Part 3

- 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.
3.22. For some planned exposure situations, the regulatory body should set dose constraints or source constraints, where appropriate.

4.16. If several radiation facilities and activities are located at the same site, the dose constraints for public exposure should take into account all sources of exposure that could be associated with activities at the site, leaving an appropriate margin for foreseeable future activities at the site that may also give rise to exposure.

4.19. The potential for public exposures in excess of the dose constraint arising from possible future re-development of, or unplanned intrusion into, closed NORM residue management facilities, should always be considered, and appropriate institutional controls prepared.
Issue No. 2 Application of specific clearance (1/2)
Issue No. 2 Application of specific clearance (2/2)

- Where the activity concentration of any radionuclide in the uranium decay chain or the thorium decay chain is greater than 1 Bq/g, or the activity concentration of 40K is greater than 10 Bq/g (GSR Part 3, 3.4 (a)).

- Activity concentrations of radionuclides of natural origin: each radionuclide in the uranium decay chain or the thorium decay chain 1 Bq/g (GSR Part 3, Table I.3)

- When the decay chain is not in equilibrium

- Current exemption and clearance scheme in the Netherlands for NORM:
  - Pb-210 = 100 Bq/g; Ra-226 = 1 Bq/g
  - Licensable NORM > 10 times of exemption level
<table>
<thead>
<tr>
<th>Uranium mining and processing</th>
<th>Planned exposure situations, which are facilities and activities developed under the regulatory control</th>
<th>Existing exposure situations, which are facilities and activities existing <em>that were never subject to regulatory control or that were subject to regulatory control but not in accordance with the requirements of these standards</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rare earths extraction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thorium extraction &amp; use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Niobium extraction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-U mining</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil and gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TiO₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zircon &amp; zirconia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals production (Sn, Cu, Al, Fe, Zn, Pb)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burning of coal etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing, reuse/recycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage and disposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decommissioning/closure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plus +++</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Issue No. 3 Application to existing facilities and activities (2/3)

• **Generic**: 1.13 This Safety Guide is principally directed towards the management of residues, i.e. planned exposure situations, the activities for new generation, reuse and recycle, long term management and disposal. It also applies to residues arising from the proposed decommissioning and remediation activities associated with those facilities.

• **Specific**: case by base

• **Sample**: Offshore oil/gas decommissioning
## Issue No. 3 Application to existing facilities and activities (3/3)

<table>
<thead>
<tr>
<th>Decommissioning strategy</th>
<th>Residues</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total dismantle and transfer to onshore</td>
<td>Scrap metals, scales</td>
<td>Management framework for NORM residues, cost, difficult to implement for old facilities</td>
</tr>
<tr>
<td>Part dismantle</td>
<td>Scrap metals, scales</td>
<td>Management framework for NORM residues</td>
</tr>
<tr>
<td>In-situ disposal</td>
<td>No residues</td>
<td>Dumping of radioactive waste in the water, if NORM waste is defined as RW</td>
</tr>
</tbody>
</table>
Suggestion

• To develop a document to provide information and practices in Member States dealing with decommissioning of NORM related facilities

• A good basis for application and future development of IAEA safety publication for NORM residues and other NORM related activities