Remediation and release of the Ranstad uranium mining and milling site

– Principal radiation protection issues

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Content

- Can radiation protection be optimised in decommissioning and remediation?
- The Ranstad nuclear decommissioning case
- Ranstad site release – a current issue!
Decommissioning vs. remediation

**Decommissioning** is typically the end of a planned exposure situation

- No justification needed for decommissioning measures and waste management
- Dose criteria for clearance of materials, waste disposal and site release 0.01–0.1 mSv/y

**Remediation** is typically a way of managing an existing exposure situation

- Justification needed
- Dose criterion ~1 mSv/y
Decommissioning and remediation

Requirements:
- Protection of workers
- Protection of today’s public
- Risk elimination/reduction
- Enable future use
- Safe disposal of waste

Resources:
- Money, facilities, contractors, …
- Knowledge
- Experience
- Trust
- Stakeholders

Start state
- Radiation
- Other hazards
- Cost, Time
- Events, Findings

Challenges
- Lack of trust
- Stakeholder involvement
- Lack of knowledge
- Characterisation

End state

Money, facilities, contractors, …
Knowledge
Experience
Trust
Stakeholders
Decommissioning and remediation

A continuous balance between the quality of the end state and the risks and consequences of the measures taken.

Decom measures
- Protection of workers
- Protection of today’s public
- Protection of the environment

End state
- Risk elimination/reduction
- Enable future use
- Safe disposal of waste

Requirements
- Trust, Knowledge
- Money, Facilities, Contractors, …

Resources
- Radiation, other hazards
- Lack of knowledge
- Events, Findings
- Lack of trust
- Cost, Time

Challenges
The Ranstad mining and milling facilities

Ref. Kemakta AR 2018:03
The Ransstad mining and milling facilities

Industrial area
Mill tailings deposits

Open shaft alum shale mine
300 ppm Uranium
The milling facilities 12 years ago
The leaching facility
Demolition of the leaching facility 2017
Restored area after demolition, May 2018
The site in May 2018
The site in August 2018
Restored disposal area, August 2018
Dose rates, industrial area with surroundings

Ref. Kemakta AR 2018:03
Dose rates, mining area

Ref. Kemakta AR 2018:03
Estimated average uranium contamination (50x50 m squares)  Calculated ref. value 25 ppmU

< 100 ppmU in the industrial area  < 25 ppmU outside the industrial area

=> Restrictions on future use

2018

2019

Ref. Kemakta AR 2018:03 ver. 2 and 3

Based on Ra-226, assuming equilibrium with U
Outside the industrial area, December 2018
Remaining uranium contamination (2019)

- Restrictions on future use:
  - 1.6 tU
  - 1.0 tU

- Disposal area with restrictions and surveillance:
  - 220 tU

- No restrictions or surveillance:
  - 150 tU

Background: ~5 ppmU

Reference: Kemakta AR 2018:03
The alum shales contain up to 300 ppm U

(Kolm contain up to 5000 ppm U)
Applying RP principles on Ranstad

Decommissioning of the milling facilities and remediation of the nearby contaminated areas was a planned exposure situation.

- Removal of as much contamination as reasonably achievable ("AMCARA").
- Site release criterion 0.1 mSv/y.
- In situ disposal => Restrictions on future use.
- Special considerations needed for potential future settlements (radon, vegetables, external exposure).

Ranstad mill tailings deposits and the open shaft mine were remediated 30 years ago and is now an existing exposure situation (?)
Conclusions

- It is not possible to optimise radiation protection in decommissioning and remediation. Instead, careful, informed and continuous consideration is needed, concerning both the end state (of site and waste) and the planned measures, based on analysis of risks and consequences.

- The decommissioning of Ranstad could have been more effective if the site and its surroundings would have been better characterised and the end state better considered at an earlier stage of the project.

- Ranstad site release will have to rely on future awareness of contamination (indoor Radon) and on consideration of the regional natural abundance of Uranium.
Thank you for your attention!