



Strål
säkerhets
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Swedish Radiation Safety Authority

Remediation and release of the Ranstad uranium mining and milling site

– *Principal radiation protection issues*

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Henrik Efraimsson

Swedish Radiation Safety Authority

henrik.efraimsson@ssm.se



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



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

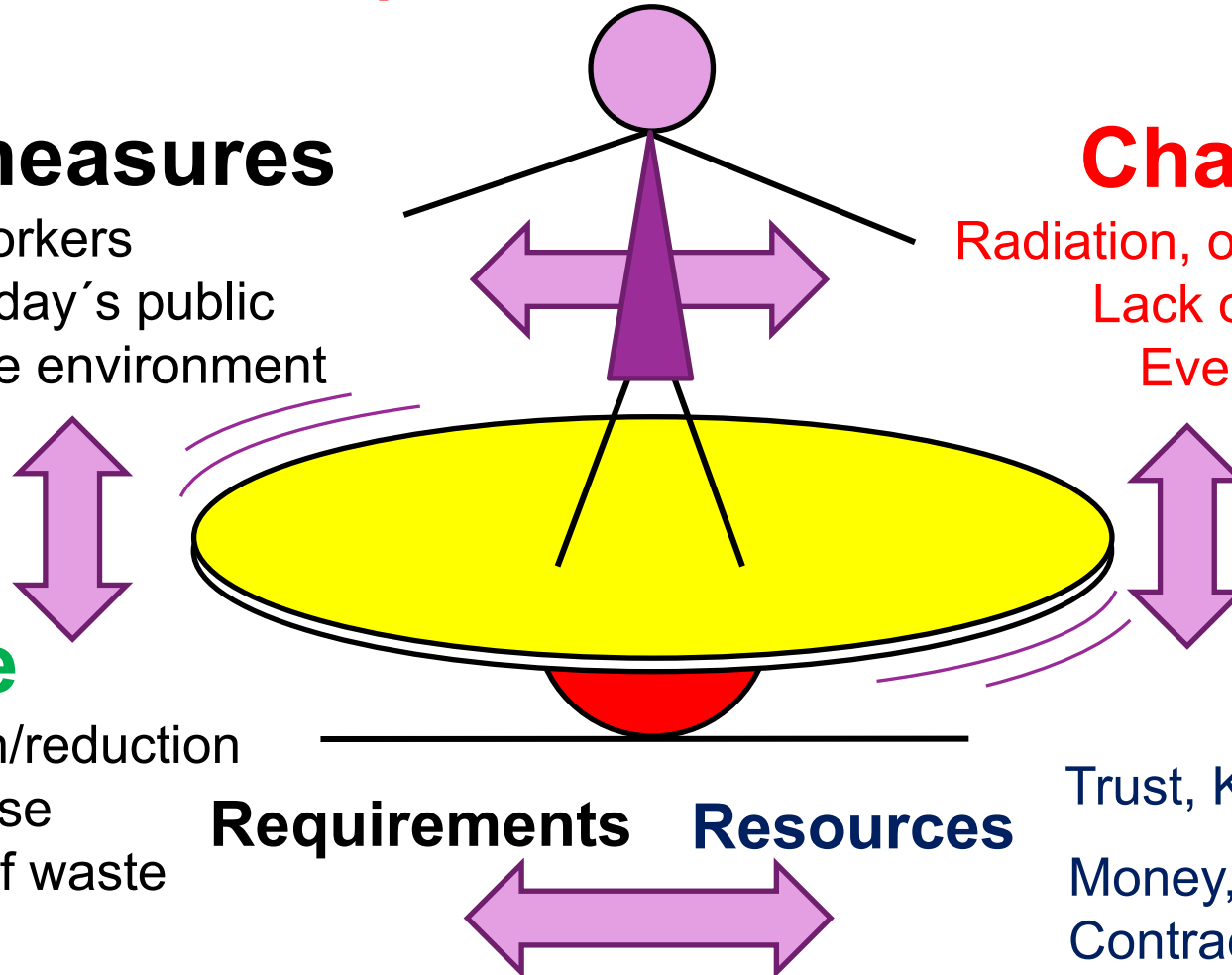
Risk elimination/reduction
Enable future use
Safe disposal of waste

Challenges

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

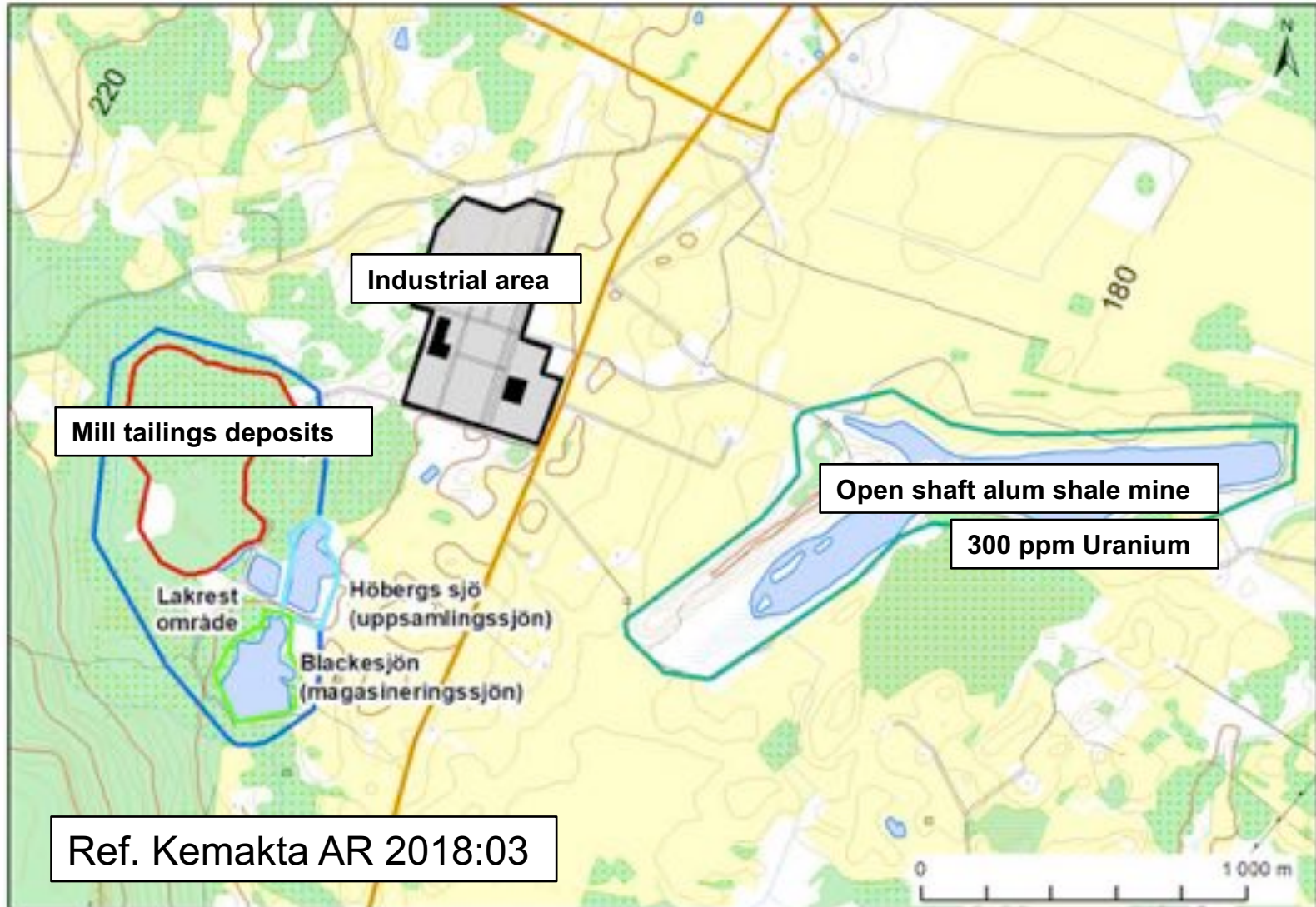
Trust, Knowledge
Money, Facilities,
Contractors, ...

Requirements Resources



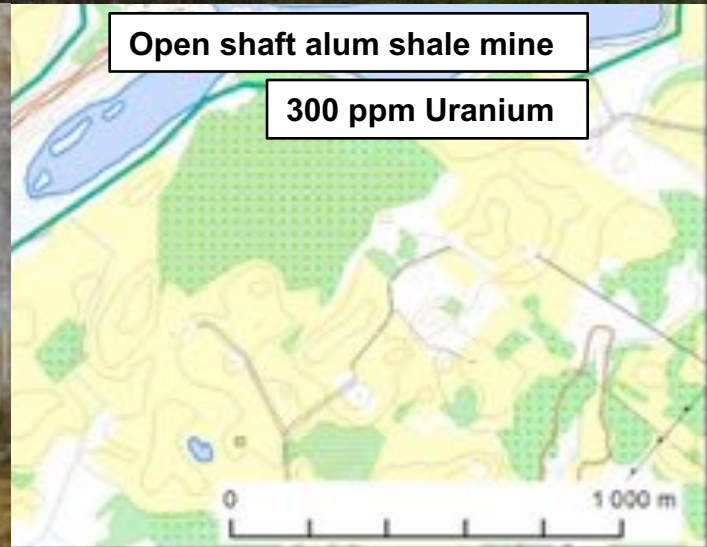
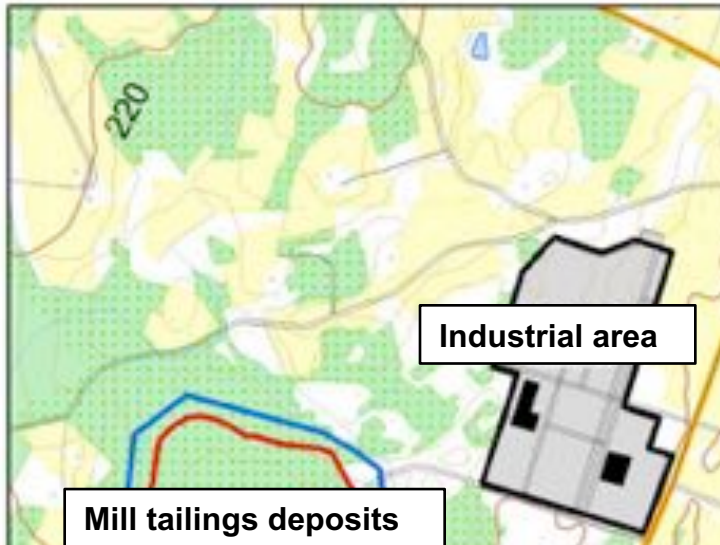


The Ranstad mining and milling facilities





The Ranstad mining and milling facilities





The milling facilities 12 years ago



The leaching facility

The sorting facility

The leaching facility

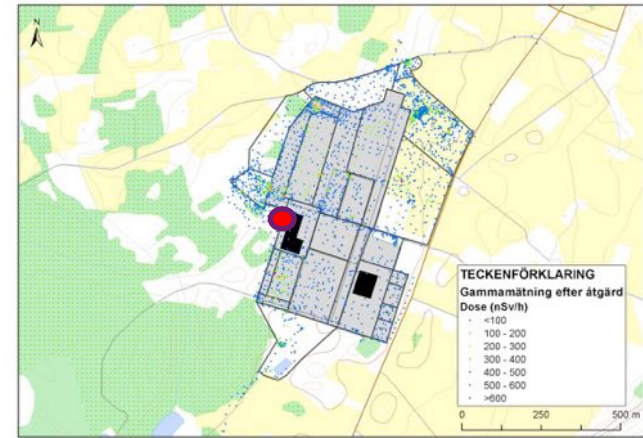


Demolition of the leaching facility 2017



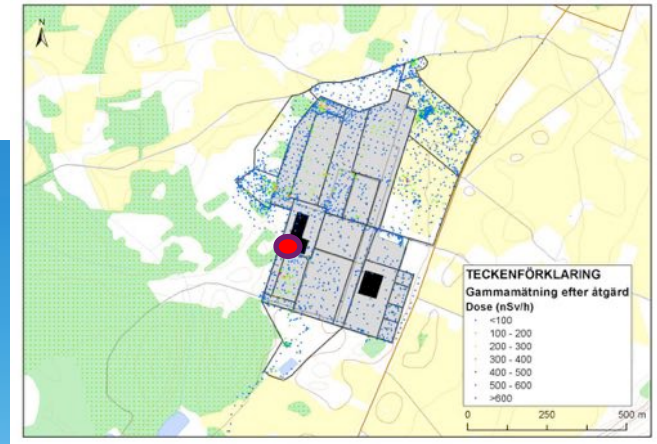


Restored area after demolition, May 2018



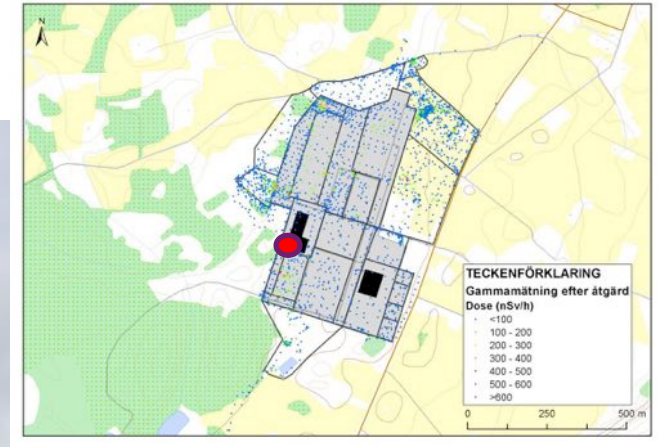


The site in May 2018



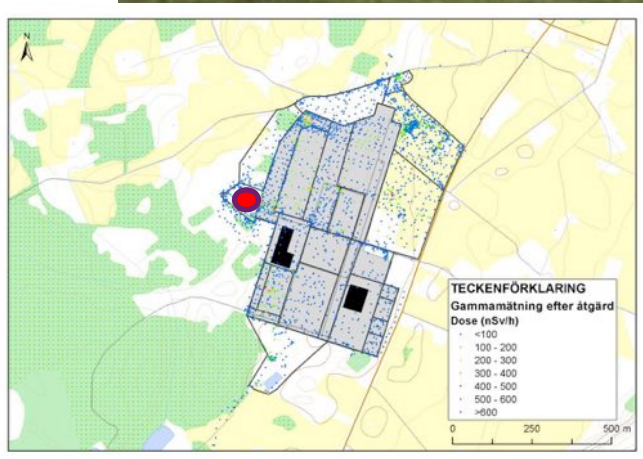


The site in August 2018



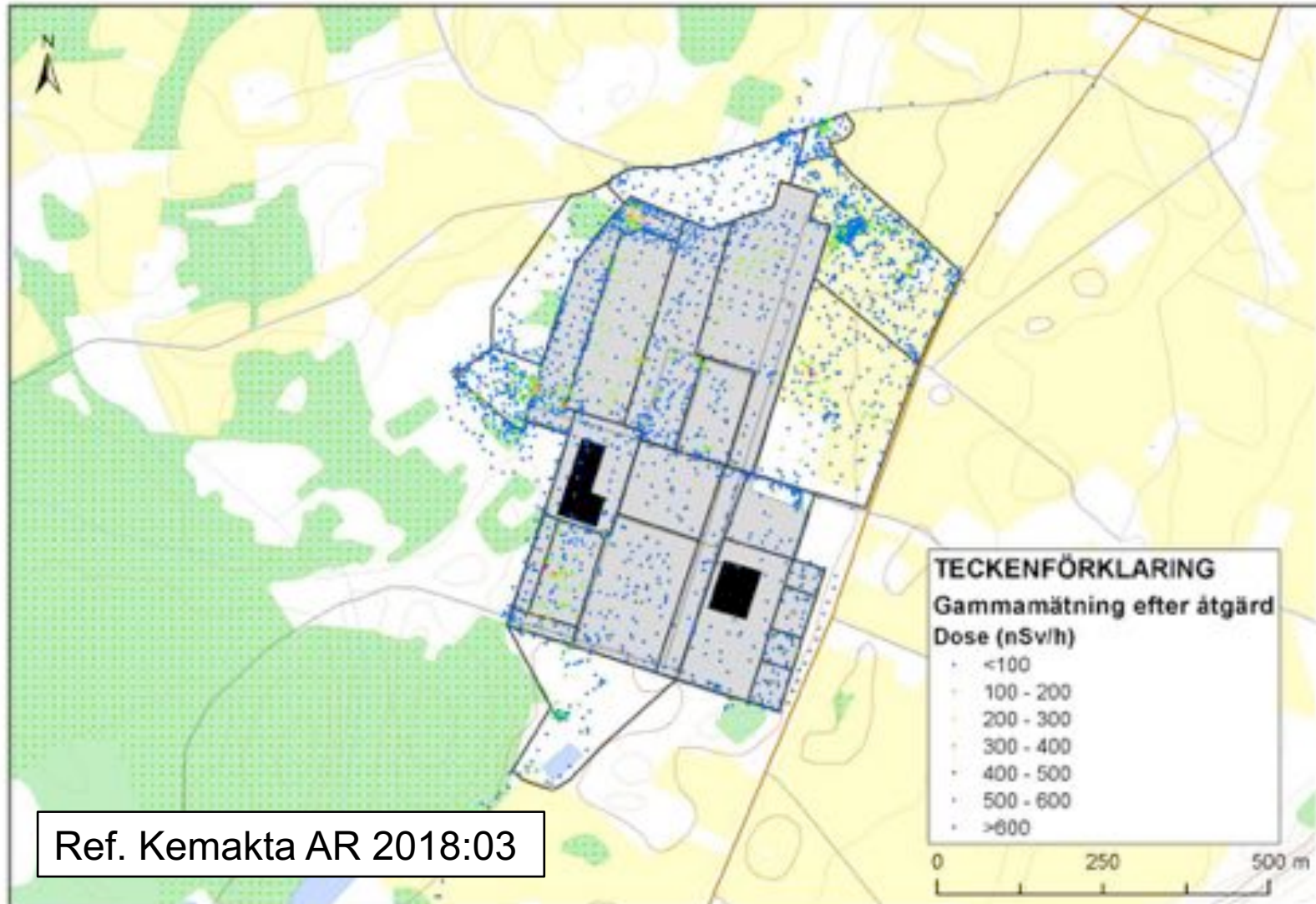


Restored disposal area, August 2018





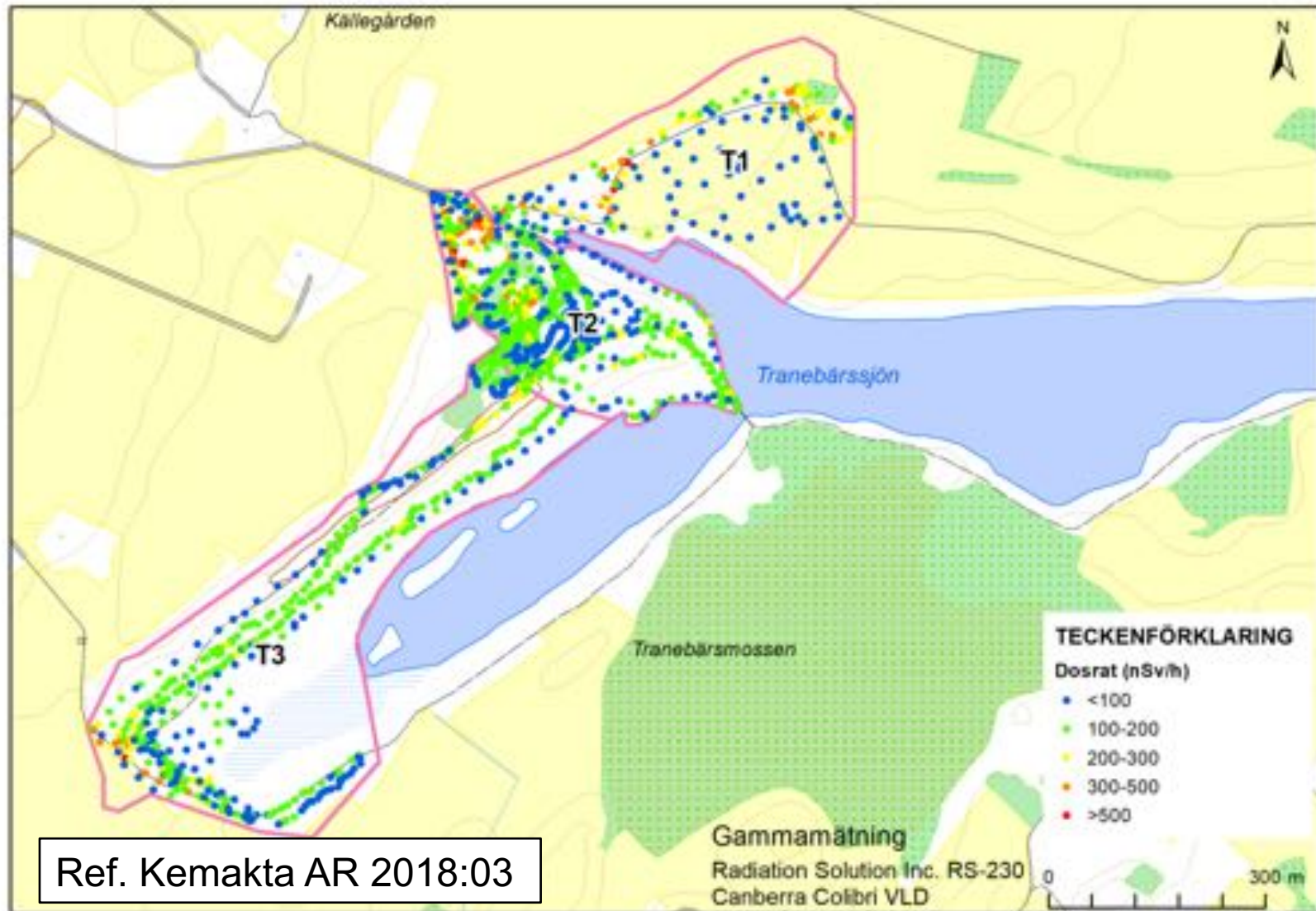
Dose rates, industrial area with surroundings



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*

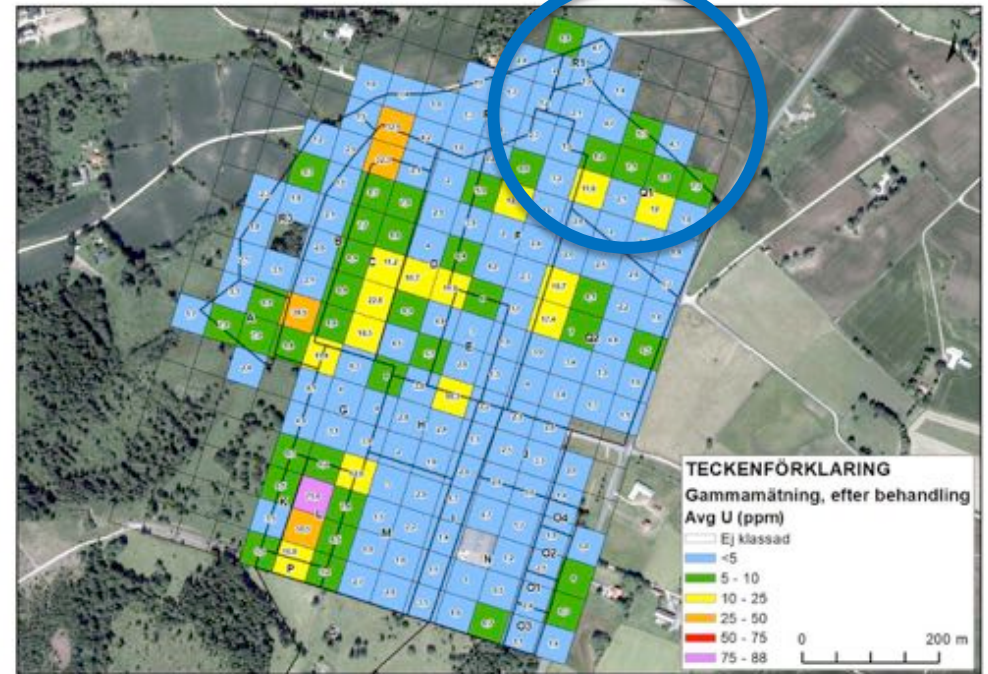
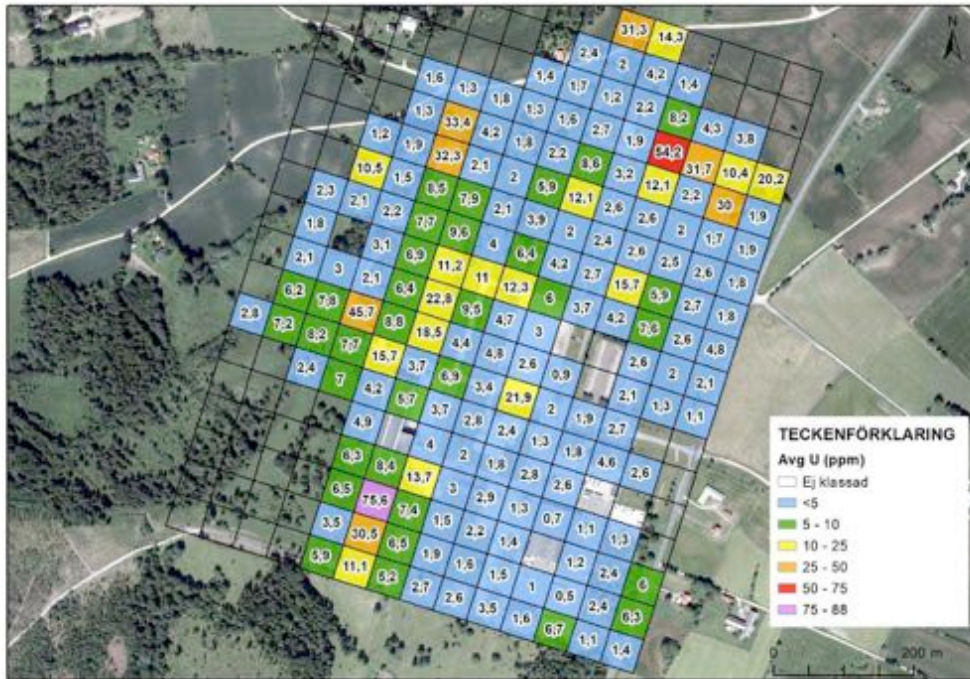
< 100 ppmU in the industrial area

< 25 ppmU outside the industrial area

=> Restrictions on future use

2018

2019

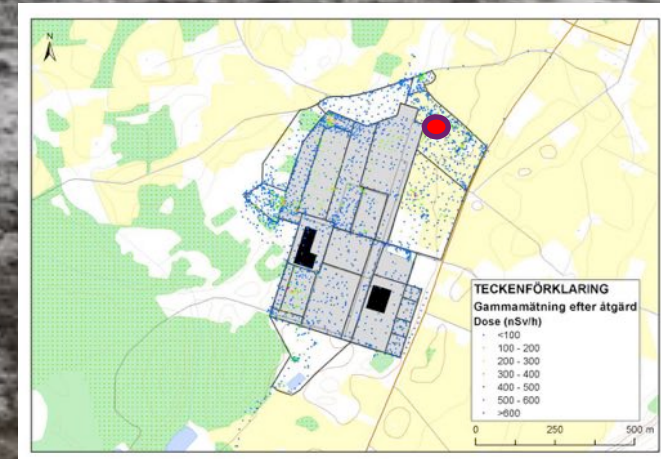


Ref. Kemakta AR 2018:03 ver. 2 and 3

Based on Ra-226, assuming equilibrium with U

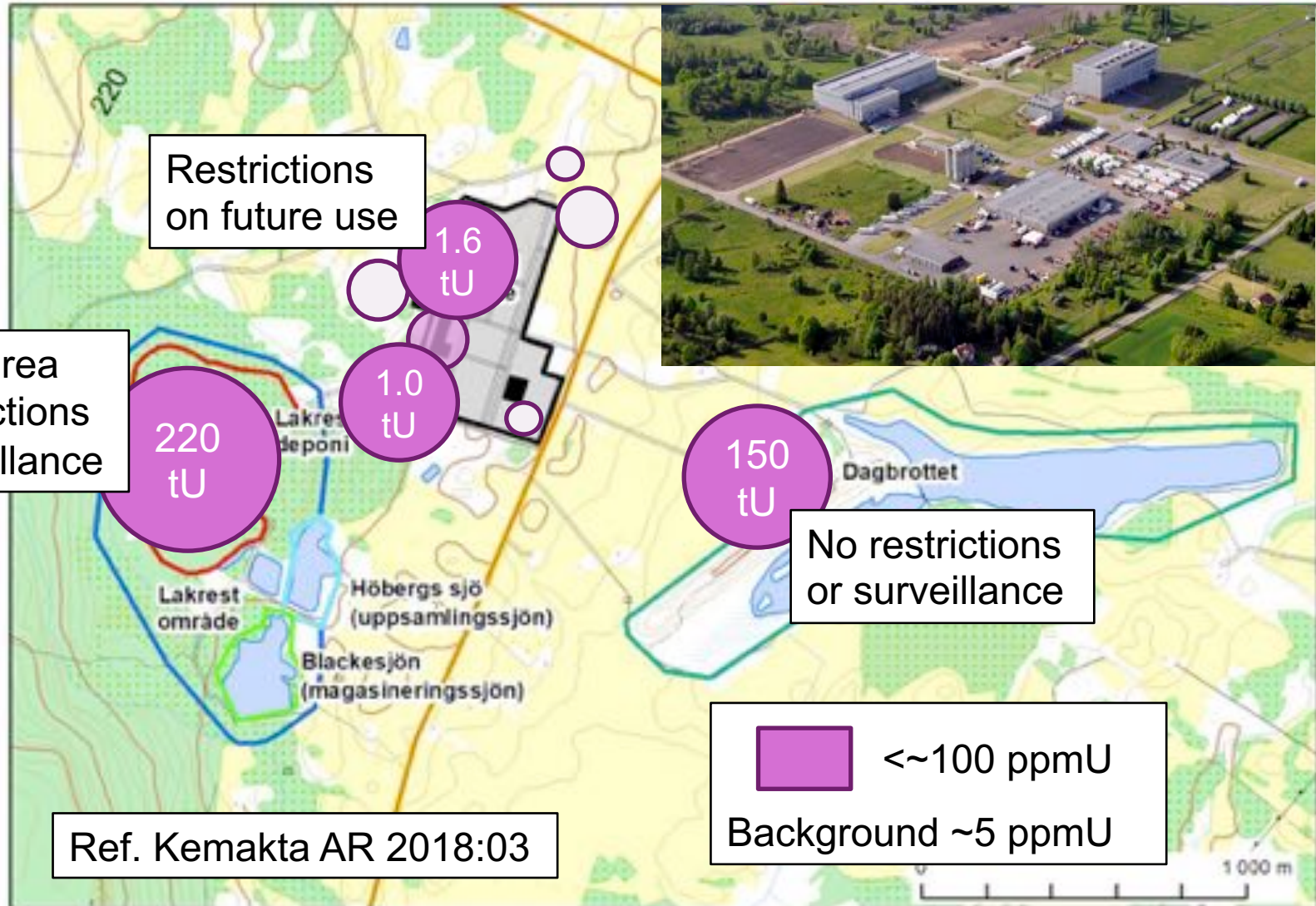


Outside the industrial area, December 2018





Remaining uranium contamination (2019)

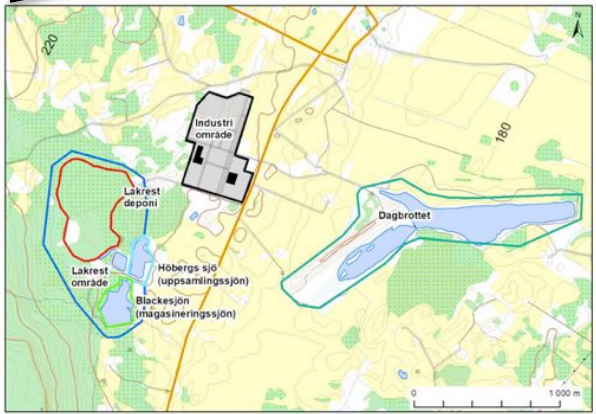
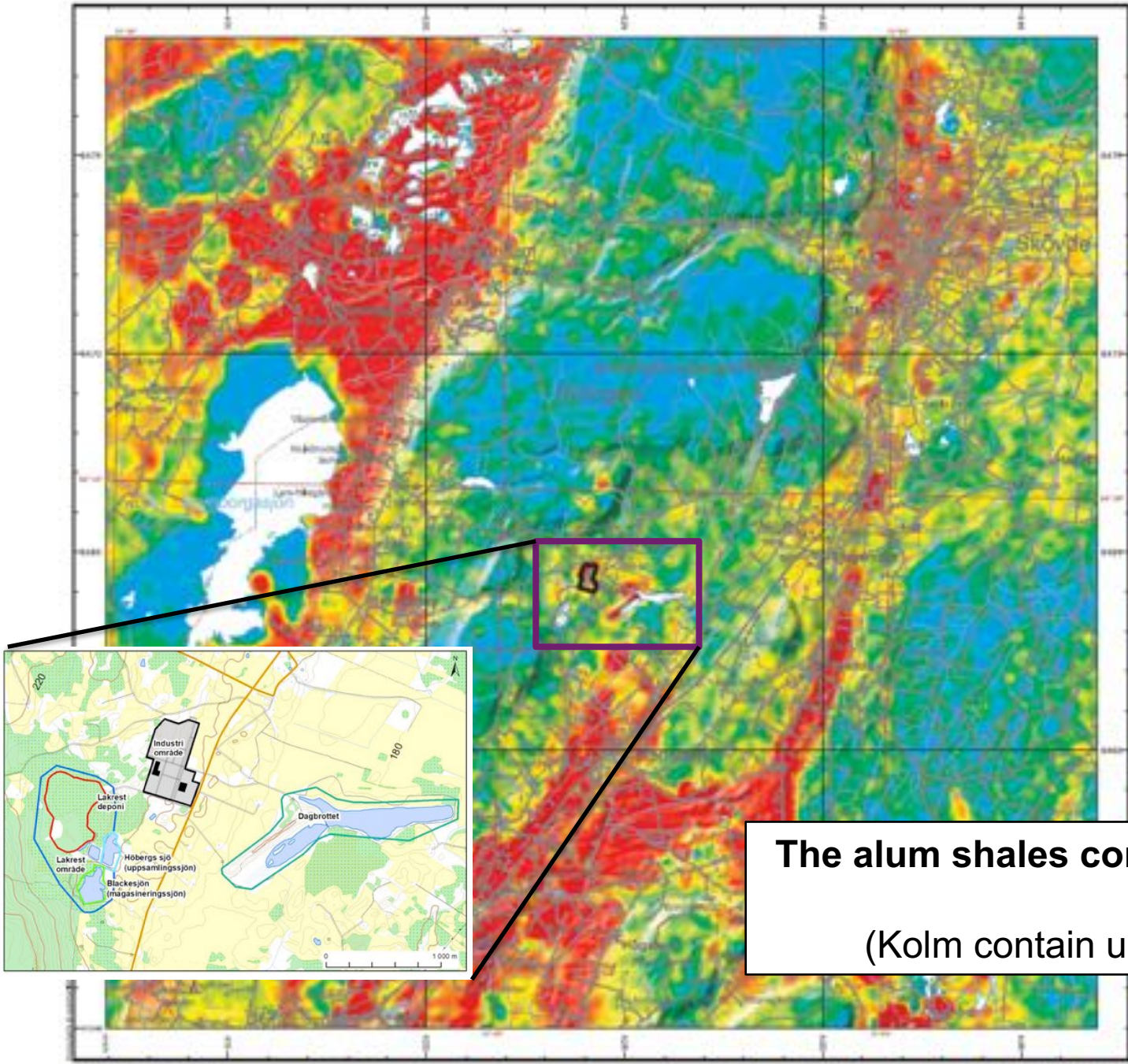
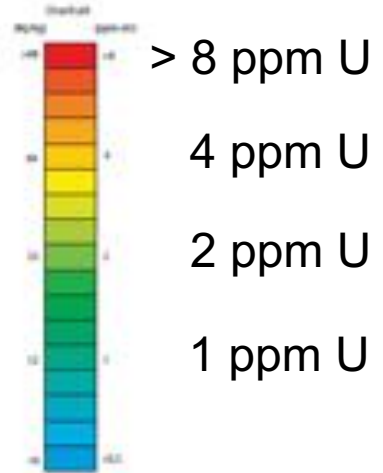


Data from 2003



Luften over Trondheim er satt i den beste tilstand for menneskelig helse. Forfaller vann og jord til vann er resultatet av naturlige prosesser som skjeer i jordens løse lag og i fjell og berg. Det naturlige jerninnholdet i atmosfæren er ca. 0,1 mg/m³. Det naturlige jerninnholdet i vann er ca. 0,1 mg/l. Det naturlige jerninnholdet i jord er ca. 10 mg/kg. Det naturlige jerninnholdet i berg er ca. 100 mg/kg.

Det er viktig å vite at jern er et grunnstoff som er viktig for menneskelig helse. Det er viktig å vite at jern er et grunnstoff som er viktig for menneskelig helse.



The alum shales contain up to 300 ppmU
(Kolm contain up to 5000 ppmU)



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!