Radiological measurements and clearance of materials and buildings at a uranium extraction plant

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Contamination at Ranstad
- Contamination of natural uranium from the processing of the uranium holding (300 ppm) local shale
  - Some contamination from the processing of process wastes from uranium fuel fabrication.
- Contamination associated with handling of shale
  - Uranium and daughter nuclides basically in equilibrium
- Contamination associated with uranium extraction
  - Uranium and build up of daughter nuclides for 40 years.

Subject of the presentation
- The application of existing regulations for clearance on the Ranstad case.
- Shortcomings of existing regulation.
- Discussion of possible ways to find practical solutions.

Basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation (BSS)

Requirements among other things on
- Reporting
- Authorization
- Authorization and clearance for disposal, recycling or reuse.

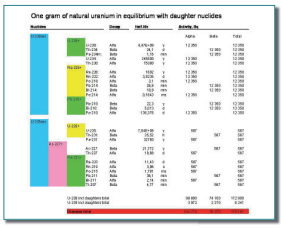
Simplified explanations of concepts
- Exclusion
  - Radiation from naturally occurring radioactive materials in most cases excluded from BSS requirements
- Exemption
  - Minor amounts of radioactive materials holding low activity or low activity concentrations exempted from BSS requirements.
- Clearance
  - The removal of BSS requirements for radioactive materials which have been under regulatory control.

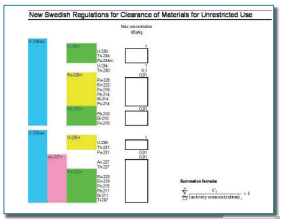
New Swedish regulations for clearance
- To be issued next year.
- Regulations for clearance of
  - Materials including waste oil, hazardous waste, tools and equipment
  - Buildings and premises.

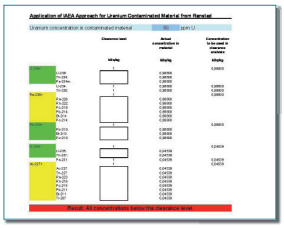
Basis for new regulations
- EU RP 122, Practical use of the concepts of clearance and exemption – part 1, guidance on general clearance levels for practice.
- EU RP 113, Recommended radiological protection criteria for the clearance of buildings and building rubble from the dismantling of nuclear installations.
- The effective dose expected to be incurred by any member of the public as a result of clearance is of the order 10 µSv or less in a year.

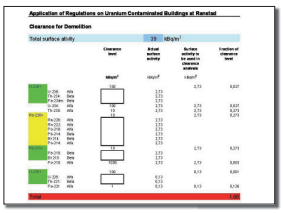
Comments on new regulations in a uranium extraction plant perspective
- If used, the new regulations result in unreasonable results.
  - 0,4 ppm uranium would be the maximum uranium concentration in material to be cleared for unrestricted use.
  - 300 ppm uranium in local shale
  - Approximately 100 ppm uranium in leaching residues already disposed of at Ranstad.
  - Approximately 5 ppm uranium in Swedish granite.
  - Application of the new regulations would impose very tight restrictions for uranium associated with the uranium production while at the same time imposing no restrictions for the sometimes much higher concentrations of naturally occuring radioactivity in the building materials.
  - Removal of material with very low concentration of radio-activity would possibly introduce higher risks than the risk of leaving the material as it is.

Dismantling of the Ranstad uranium mill
- 200 tons of uranium produced 1965–1969.
- Remaining buildings to be decontaminated and cleared during the next few years.
- Some buildings will be demolished.
- The radiological contamination has been mapped.
- Planning of the decontamination and dis-mantling is going on.









Concluding remarks
- Application of clearance regulations based on EU RP 122 Part 1 for the dismantling and demolition of a uranium extraction plant like Ranstad leads to unreasonable results.
- An approach like the one presented in the IAEA Safety Guide No. RS-G-1.7 is needed.
  - A common set of rules for exclusion, exemption and clearance.
  - Rules applicable for bulk amounts of material.
  - Different approaches for radionuclides of natural and artificial origin respectively.

IAEA safety guide
- Safety guide No. RW-G-1.7
  - Application of the concepts of exclusion, exemption and clearance
- An attempt to define a common set of rules for exclusion, exemption and clearance.
  - To be used for bulk amounts of material.
- Different approaches for radionuclides of natural and artificial origin respectively.

Effective doses of the IAEA approach
- Natural radionuclides
  - The effective dose expected to be incurred by individuals as a result of clearance is unlikely to exceed 1000 µSv in a year.
  - No summation formula for nuclides
- Artifial radionuclides.
  - The effective dosse expected to be incurred by any member of the publiuc as a result of clearance is of the order 10 µSv or less in a year.
  - Summation formula

Comments on the IAEA approach
- Clearance for unrestricted use of uranium contaminated material from Ranstad holding less than 80 ppm uranium.
  - Approximately 200 times higher than the new regulations would permit
- Occurrence of daughter nuclides is of no concern as long as daughter nuclides are in equilibrium or less abundant.

Measuring at the Ranstad site.

Clearance of Ranstad buildings
- New Swedish regulations are based on the 10 µSv criterion.
- Most buildings to be cleared for demolition.

Comments on clearance of Ranstad buildings
- Clearance for demolition below 39 kBq/m²
- Uranium contamination in 2 mm thick surface layer of concrete
  - 39 kBq/m² corresponds to approximately 50 ppm of uranium in the surface layer.

Using the IAEA approach for clearance for demolition
- IAEA dose criterion: The effective dose expected to be incurred by individuals as a result of clearance is unlikely to exceed 1000 µSv in a year.
- By using the IAEA approach, clearance levels 100 times higher than those of the new regulations would in theory be permitted.
- Please observe that the new Swedish regulations and the IAEA approach are based on different dose calculation models.