

Comparison of the radiological hazard potentials of high-activity sealed radioactive sources, nuclear facilities and fusion facilities

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Project ReFus

The objective of the pilot project ReFus is to develop concepts for the legal and technical regulation of fusion facilities in Germany

Comparison of facilities with radioactive inventories

For a graded approach in the regulatory framework, criteria are needed to differentiate between different requirements on safety provisions and safety assessments

To develop such criteria, it is important to compare the radiological hazard potential of fusion facilities to that of other facilities:

- Regulated by radiation protection regulation framework
 - High-activity sealed radioactive sources (HASS) in Germany
- Regulated by nuclear regulation framework
 - Nuclear power plants
 - Research reactors
 - Casks for spent fuel elements

Task

- Need to compare
 - different facilities
 - different activity levels (orders of magnitudes)
 - different radionuclides (therefore different dose coefficients, half-lives)
- Estimate radioactive inventory of fusion facilities (tritium, activated/contaminated dust, activated corrosion products) based on current concepts

Approach

- Based on established method in radiation protection
- Avoid complex analysis methods, because it should be used at the beginning of the safety assessment process

Definition of comparison metric

Sum of multiples of the exemption level EL of the activities A of each nuclide i as defined in the German Radiation Protection Ordinance

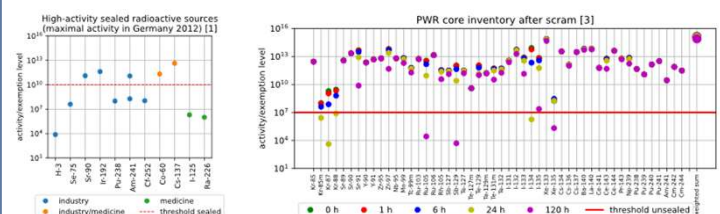
$$\sum_i \frac{A_i}{EL_i}$$

Exemption level specifies upper limit for license-free handling of a radionuclide (based on reference scenarios with effective dose < 10 μ Sv)

Literature

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Examples for inventories



Fusion

- Licensing limits for ITER (4 kg tritium, 1000 kg dust)
- Literature survey (EU DEMO):
 - Byproduct of neutron multipliers: Po-210
 - Estimates for dust (~1000 kg, radionuclide composition)
 - Activated corrosion products

