Activity concentration vs surface contamination in Dutch Radiation protection legislation

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Introduction

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Program

- Generic release limit in Dutch Nuclear law
- Applicability release limits
- Determining surface contamination
- Challenges
- Opportunities
Oil&Gas industry

• High safety awareness
• Standard measures in place for the protection against:
  • Benzene
  • Mercury
  • Other heavy metals

Benzene and mercury contaminations require similar controls to NORM

TOTAL'S GOLDEN RULES

1. High-risk situations
2. Traffic
3. Body mechanics and tools
4. Protective equipment
5. Work permits
6. Lifting operations
7. Powered systems
8. Confined spaces
9. Excavation work
10. Work at height
11. Change management
12. Simultaneous operations or co-activities
1. Activity concentration
2. Surface contamination

Generic release limits for activity concentration

Table A part 2 Decree on radiation protection (Besluit basisveiligheidsnormen stralingsbescherming Bbs)

Per nuclide from the $^{238}\text{U}$ and $^{232}\text{Th}$ decay chain:

- $< 1 \text{ kBq/kg}$ = Release
- $1 \text{ kBq/g} < 10 \text{ kBq/g}$ = Registration
- $> 10 \text{ kBq/g}$ = License

1 kBq/kg $^{210}\text{Pb}$ cannot be efficiently detected on a contamination monitor.
Consequence:
All materials, sludge, sand, dust, filters etc. need to be sampled and send to the laboratory for gammaspectrometric analyses.

<table>
<thead>
<tr>
<th>Monsternummer</th>
<th>Detector</th>
<th>Geometrie</th>
<th>Acquisitietijd</th>
<th>Datum analyse</th>
<th>Medewerker A+ RTD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 [b97619]</td>
<td>LabSOCS</td>
<td>14995 s</td>
<td>6-11-2019</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Analysegegevens gammaspectrometrie</th>
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<tbody>
<tr>
<td>Oorsprong</td>
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<tr>
<td>-----------</td>
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<tr>
<td>U-238 vervalreeks</td>
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<td></td>
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<tr>
<td></td>
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<tr>
<td>Th-232 vervalreeks</td>
</tr>
<tr>
<td></td>
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<tr>
<td>Overige nucliden</td>
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<td></td>
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</table>

License required
Surface contamination in the Regulation
(Article 3.17 - Verordening Basisveiligheidsnormen stralingsbescherming (Vbs) applicability of activity concentration limit opposed to activity concentration

Article 3.17: Regulatory control is applicable for practises with NORM if the activity concentration of the material does not give a correct indication of the health risk and in addition the surface contamination with NORM has a total Beta-activity that is equal to or higher than 4 Bq/cm²

Limit for surface contamination: 4 Bq/cm²

Seems simple...........

Above this limit a license is required

Graded approach?
Determining surface contamination

Further explanation

**Regulatory control**
- Metal scrap travels around the world
- Limits for regulatory control differ between countries

**The surface contamination**
- Definition Regulation "surface contamination with NORM":
  Presence on the surface of an object consisting of non-radioactive solids, from fixed or non-fixed natural sources with an average mass per surface area of less than 1 g/cm²
- How to determine surface contamination art. 4.40 and 4.41 Regulation
  Conditions for release:
  **Determine the surface contamination of any accessible surface**
Any accessible surface

1. Accessible surface of an object **without further or destructive intervention** in that object;

Seems simple
Measure inlet and outlet
no rise in contamination value.....

Release????
Any accessible surface

2. or surface of an object that is accessible or becomes accessible when opening or disassembling that object for use, maintenance or repair, for product or material use or for product or material reuse;

Also at a contractors yard who does not have a Nuclear law registration or license to obtain NORM

Consequence:
Dismantle completely

Risk factors:
- Vessel contains sludge (> 1 g/cm²)
- Not all accessible places are measured
Practices

- User is not always the owner of the contaminated item
- Use in the future cannot always be foreseen

Scrap metal can be:
- Melted
- Cleaned (decontaminated) for re-use
- Processed for re-use (sawing, grinding, welding)
- Dumped

Determining surface contamination

Making a fence: Sawing, grinding and welding

Cleaning with High Pressure Water

Possibility sludge > 1 Bq/g
Activity concentration of the material does not give a correct indication of the radiological risk

How to determine if activity concentration is the correct indication for risk?
Factors to consider:
- Nuclides
- Total activity
- which practices will be performed on or with the items
- can scale come loose during handling of the item

These factors can turn into an elaborate study on its own.
Determining surface contamination

**Activity concentration** or **surface contamination**

Different approaches to same object.

**What effort does it take to get a sample**

- Scraping the surface to take sample (activity concentration)
- Measuring surface (surface contamination)

<table>
<thead>
<tr>
<th>Background (cpm)</th>
<th>Measurement (CPM)</th>
<th>Surface contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>42 cpm</td>
<td>225 cpm</td>
<td>1.25 Bq/cm²</td>
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</tbody>
</table>

**GAMMA SPECTROMETRY ANALYSIS** - Based on measurement of individual nuclides

<table>
<thead>
<tr>
<th>ISOPOE</th>
<th>UNITS</th>
<th>Value (Bq/g)</th>
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<tbody>
<tr>
<td>Ra-226</td>
<td>Bq/g</td>
<td>1.06 ± 0.06</td>
</tr>
<tr>
<td>Ac-228</td>
<td>Bq/g</td>
<td>1.62 ± 0.07</td>
</tr>
<tr>
<td>Pb-210</td>
<td>Bq/g</td>
<td>12.38 ± 0.09</td>
</tr>
<tr>
<td>Th-228*</td>
<td>Bq/g</td>
<td>0.58 ± 0.008</td>
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Challenges

**Regulation**
- Lack of clarity in regulation
- Lack of uniformity in regulation between countries

**Economical**
- How to influence the scrap market
- Cross boarder acceptance of scrap from Oil&Gas and Geothermal companies

**Perception**
- Dose rate above background radiation level
  - ≠ Radioactive contaminated by law and vice versa
- Awareness and trust scrap companies needed

Image IAEA
Opportunities and challenges

• A lot of metal scrap is released by decommissioning
• Incentive for optimal circular re-use of material
• Adopting a graded approach and revision of the surface contamination rule allows easier re-use of objects with a higher measurement value
Take home messages

Regulations force us to clean non-risk contaminations.

This goes against the ALARA principle

We are open to idea’s
Please share your experience with waste management in your country
Questions?

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