Handling of Spent Water Filters containing uranium  
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Background  
A recent report from SSI on uranium i.a. in water from private wells, in combination with new EC uranium-recommendations, leads to interest in water filters, and questions about their disposal.

The problem of uranium in drinking water, compared to radon in dwellings

- <1 million now vs. 10 million then
- Lower doses (Rn gives the highest dose from drinking water from private wells)

15 scenarios were considered to assess doses from (spent) filters

Relating to
- Gamma radiation from filters
- Employees with potential for internal/external radiation exposure in connection with exchange of filters
- Work activities relating to waste management up to disposal
- Transport
- Exposure from water pathways in a distant future

Priorities

Private persons must be given a high priority in our information strategy  
Larger organizations, e.g. municipalities, with better internal information flow are easier to reach (anticipated many, but received few questions).

We looked first at
- gamma radiation from filters
- their disposal in normal municipal waste streams

Scenario 1 – gamma radiation

Assumptions
- A person near the sink is 1 meter from the filter
- Exposure 1000 hours a year = 3 hours /day
- The flow through the filter 200 l/day
- Ra-226 concentration 6 Bq/l (max measured in Sweden)

The yearly dose is about 0.1 mSv/y and the mean Ra-226 concentration 300 times lower than this. Other gamma exposure scenarios can also be disregarded as radiation protection problems.
Filter surface dose rate examples, $\mu$Sv/h

- 0.15
- 0.15
- 0.3
- 0.12
- 1.5
- 0.4
- 0.25
- 0.5

Max for Sweden 1-10 (hearsay 30)

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Regional average well water Ra concentration vs. skeleton cancer incidence (Nat. Board of Health & Welfare)

Conc. not adjusted for the different fractions of large water treatment systems, obviously important in counties with large cities.

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### Scenario 15 - disposal

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Measured or assumed</th>
<th>Source</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of drilled wells in the county</td>
<td>13 000</td>
<td>SGU</td>
<td></td>
</tr>
<tr>
<td>Percentage using wells</td>
<td>10%</td>
<td>SCB No of households per cap.</td>
<td>13 000 households</td>
</tr>
<tr>
<td>Fraction with filter</td>
<td>~10%</td>
<td>SSI</td>
<td>In Dalarna 2 of 56 wells = 4% of 13000= 520</td>
</tr>
</tbody>
</table>

### Scenario 15, cont.

Activity per year to the disposal facility

<table>
<thead>
<tr>
<th>Nuclide</th>
<th>Water conc.</th>
<th>Deposited</th>
</tr>
</thead>
<tbody>
<tr>
<td>U (-238 and -234)</td>
<td>1.4 Bq/l</td>
<td>0.3 GBq</td>
</tr>
<tr>
<td>Ra-226</td>
<td>0.1 Bq/l</td>
<td>20 MBq</td>
</tr>
</tbody>
</table>

### Scenario 15, Cont.

Disposed in Borlänge disposal site in Dalarna after 100 y

<table>
<thead>
<tr>
<th>Nuclide</th>
<th>To disposal site per year</th>
<th>To the site 100 years</th>
<th>Spec. activity All waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>U (-238 + -234)</td>
<td>0.3 GBq</td>
<td>30 GBq</td>
<td>4 Bq/ kg</td>
</tr>
<tr>
<td>Ra-226</td>
<td>20 MBq</td>
<td>2 GBq</td>
<td>0.3 Bq/ kg</td>
</tr>
</tbody>
</table>

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Scenario

Simulation starts when the waste has been deposited after 100 years.

7800 t/y for 100 y
Information conservation, another issue

If we needed to, would we remember and protect the municipal disposal site up to 4000 years?

Conclusions

- Leakage from the disposal to a drinking well does not constitute a problem from the radiation protection point of view
- Intrusion exposure scenarios for municipal disposal sites give higher doses than drinking well scenarios
- Information conservation = optimization = “Have I done all I can to limit doses?” (ICRP). (International archive related to the information delivered under the waste convention?)

Observe that

- Back flushing of filters is diluting – OK for NORM?
- Other radioactive waste (incl. NORM) currents may occur to the same disposal site