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, μSv/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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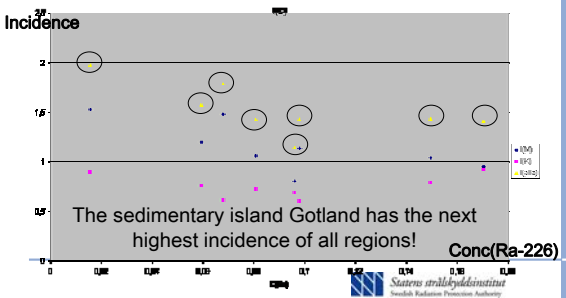
Regional average well water Ra concentration vs. skeleton cancer incidence (Nat. Board of Health & Welfare)
Conc. not adjusted for the different fractions of large water treatment systems, obviously important in counties with large cities



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Scenario 15 - disposal

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

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Scenario 15, cont.

Activity per year to the disposal facility

Nuclide	Water conc.	Deposited
U (-238 and -234)	1,4 Bq/l	0,3 GBq
Ra-226	0,1 Bq/l	20 MBq

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Scenario 15, Cont.

Disposed in Borlänge disposal site in Dalarna after 100 y

Nuclide	To disposal site per year	To the site 100 years	Spec. activity All waste
U (-238 + -234)	0,3 GBq	30 GBq	4 Bq/ kg
Ra-226	20 MBq	2 GBq	0,3 Bq/ kg

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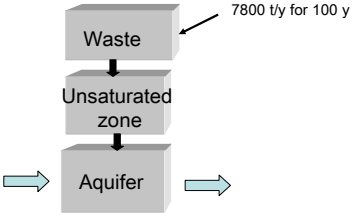
Scenario

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



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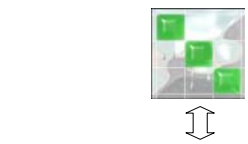
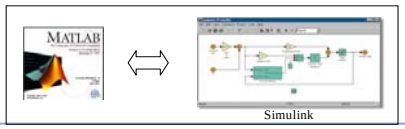
Calculated by Ecolego

a Matlab Toolbox

GUI





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Scenario 15 (SX) low doses

Pb-210

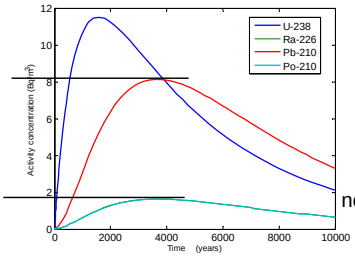
0,008 Bq/l

= 4 µSv/y

Po-210

0,002 Bq/l

= 2 µSv/a



Dilution not decay!

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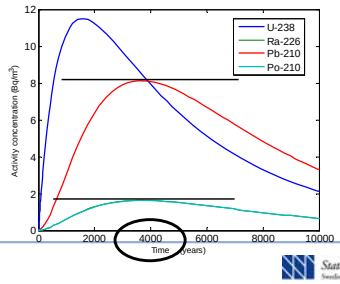
Information conservation, another issue

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



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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