Results of the HMO pilot plant – radionuclide removal

Taavi Vaasma[1], Siiri Suursoo[1], Maria Leier[1], Juri Bolobajev[2], Nele Nilb[3]

[1] Institute of Physics, University of Tartu (UT)

[2] Department of Materials and Environmental Technology, Tallinn University of Technology (TalTech)

[3] Viimsi Water Ltd.

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COMING UP...

- **Pilot plant and experiment setup**
- **Radionuclide removal by HMO technology**
  - Water
  - Filter material
  - Backwash water

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THE PILOT PLANT

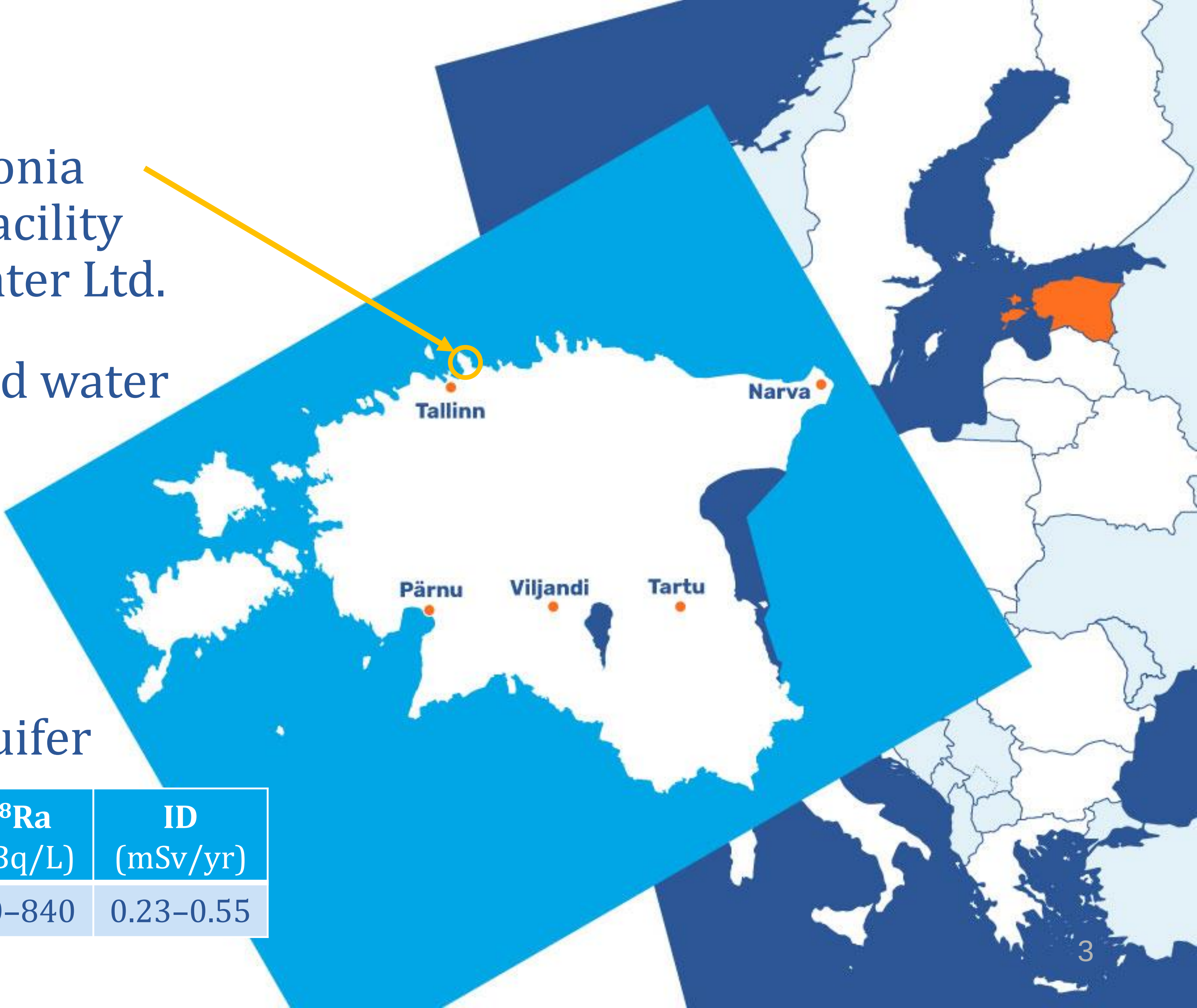
- Situated in Viimsi, Estonia in a water treatment facility operated by Viimsi Water Ltd.

- Target values in treated water

Fe (µg/L)	Mn (µg/L)	ID (mSv/yr)
≤ 200	≤ 50	≤ 0.10

- Raw water from Cambrian-Vendian aquifer

Fe (µg/L)	Mn (µg/L)	^{226}Ra (mBq/L)	^{228}Ra (mBq/L)	ID (mSv/yr)
40–420	50–230	240–620	360–840	0.23–0.55



THE HYDROUS MANGANESE OXIDES PROCESS

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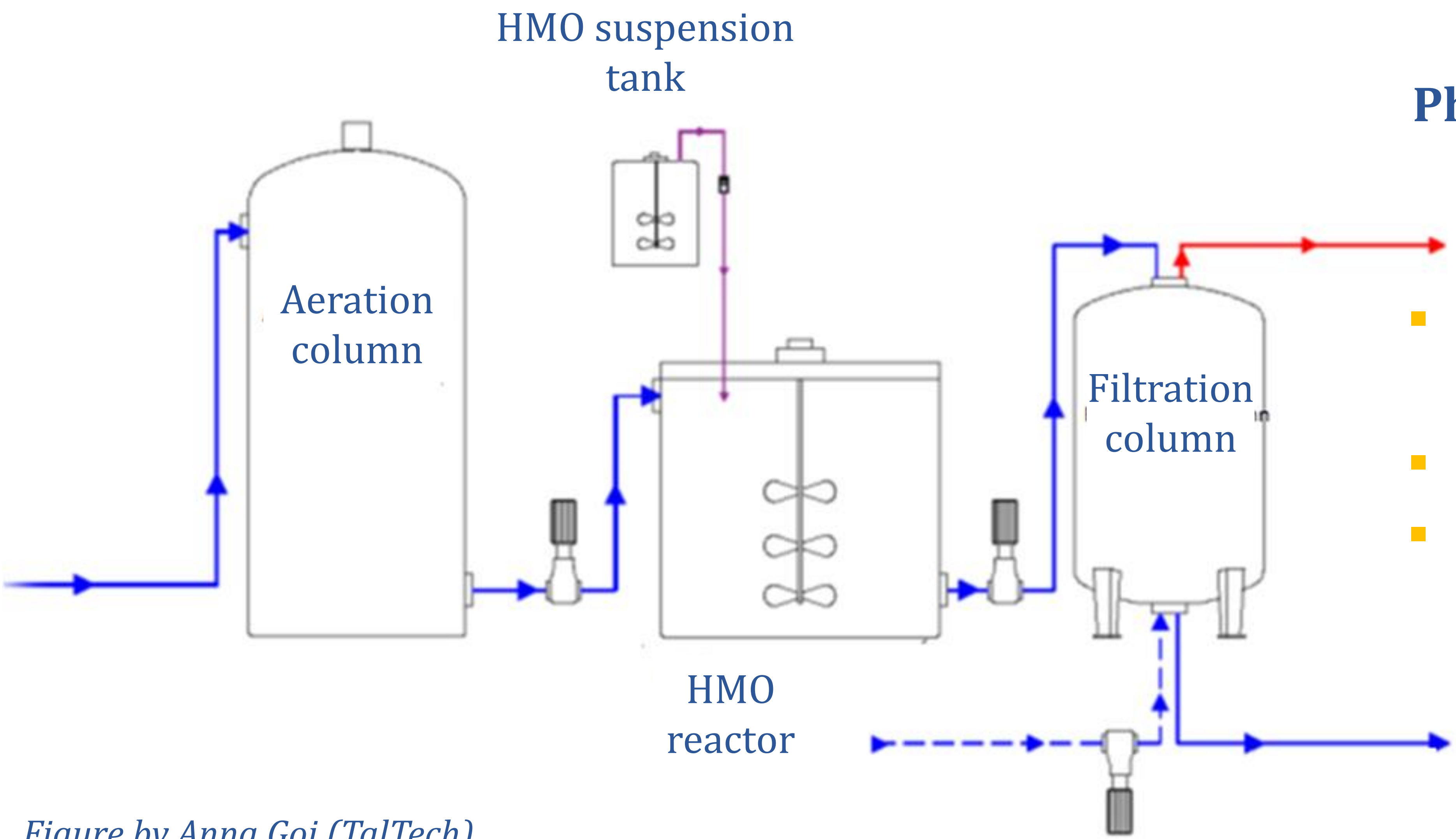

Phases to be monitored for radiological parameters:

- Clean water – the filtrate
- Filter material
- Backwash water

Figure by Anna Goi (TalTech)

EXPERIMENTAL SETUP

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Best removal rates in **lab-scale experiments**:

- Mn – 81%
- Fe – 90%
- Ra – 86%

Schemes tested on the pilot plant:

a) Aeration →
HMO oxidation →
Filtration [gravel–sand–anthracite],
periodic dosing (8h per day)

b) Aeration →
HMO oxidation →
Filtration [gravel–sand–anthracite],
continuous dosing (24h per day)

WATER – RADIUM REMOVAL EFFICIENCY

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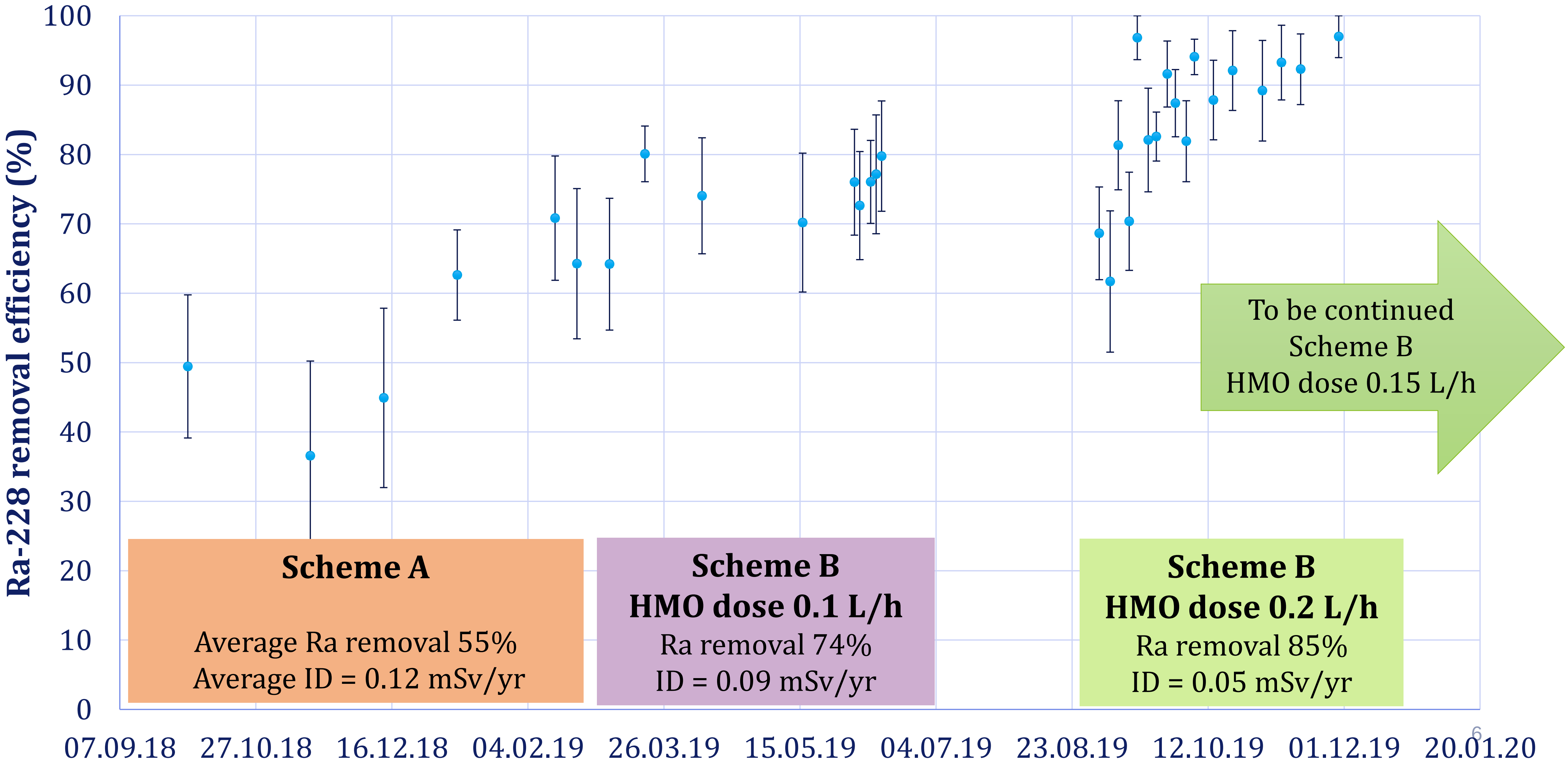
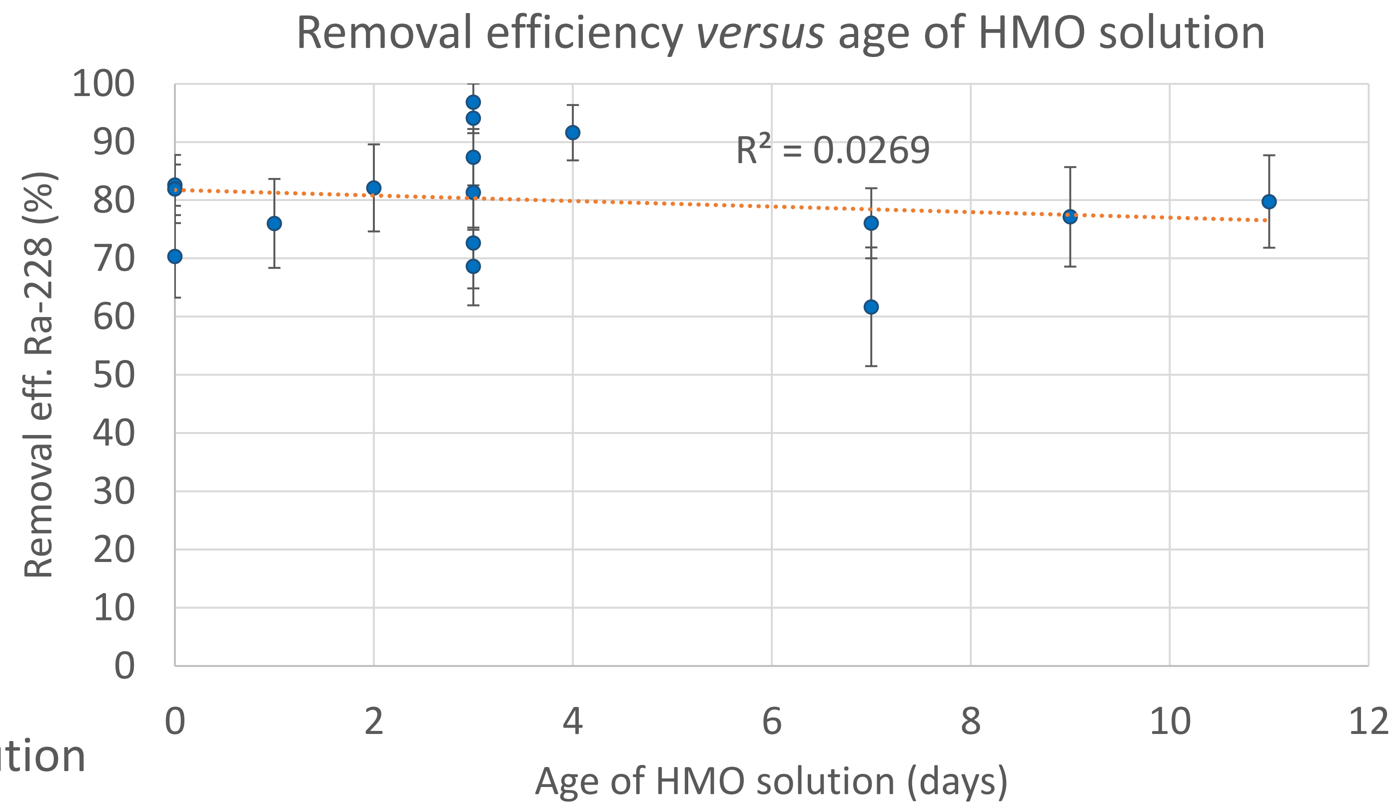
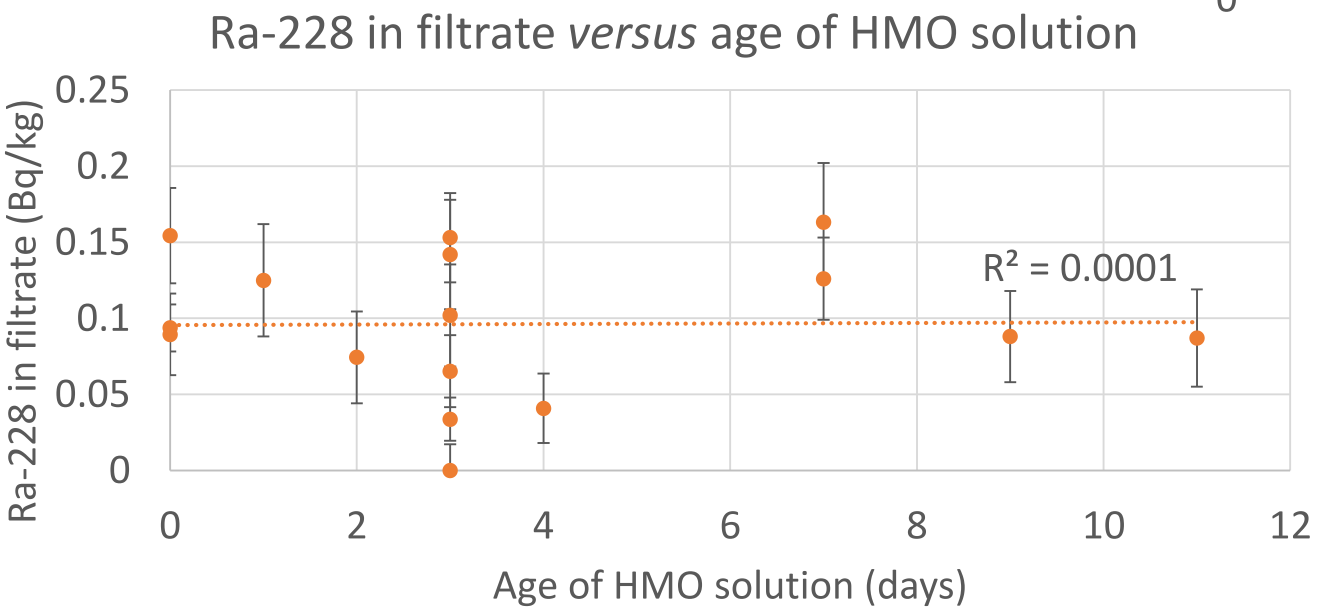


RESULTS – WATER

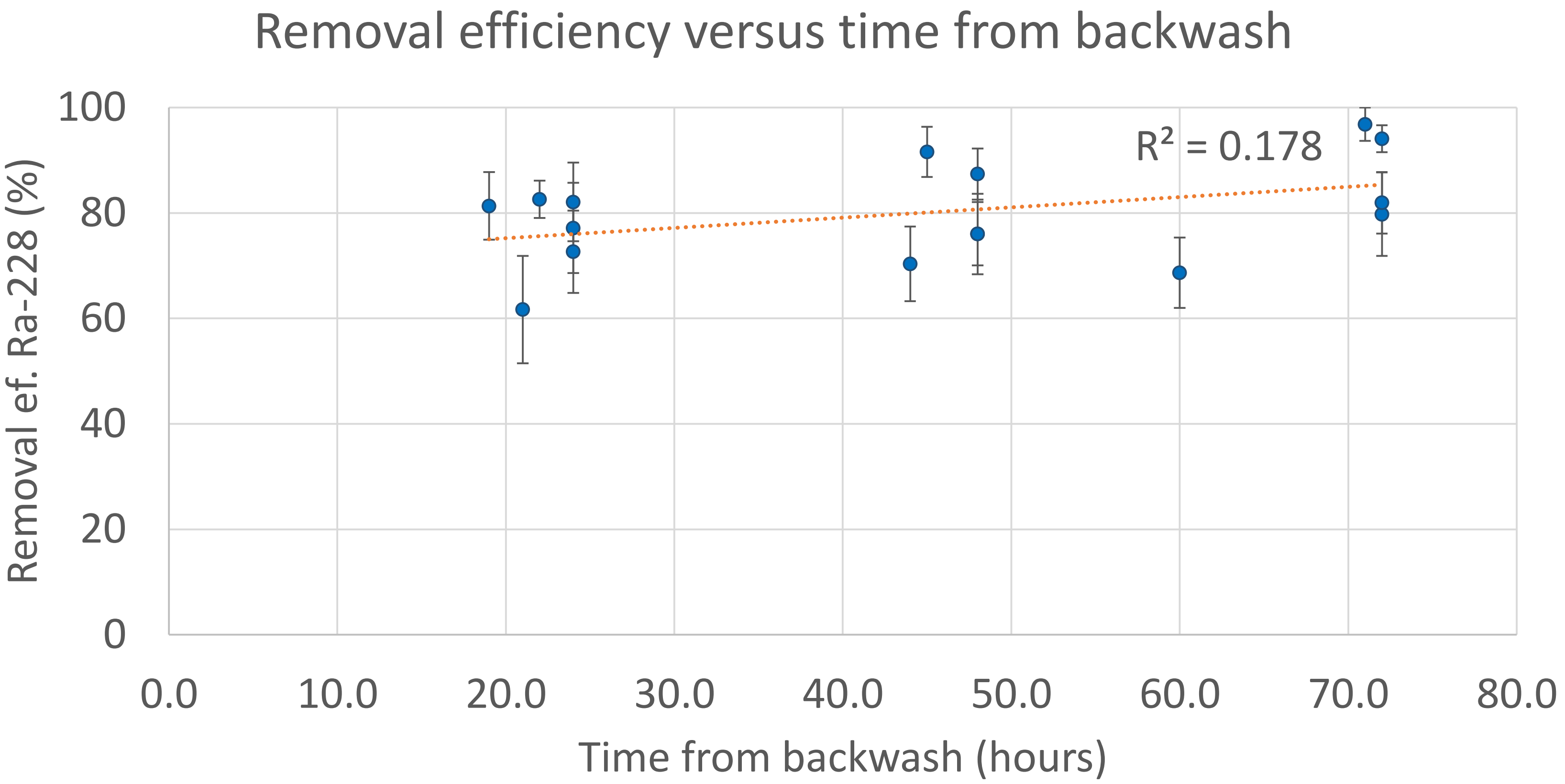
Effect of HMO solution aging on removal efficiency?

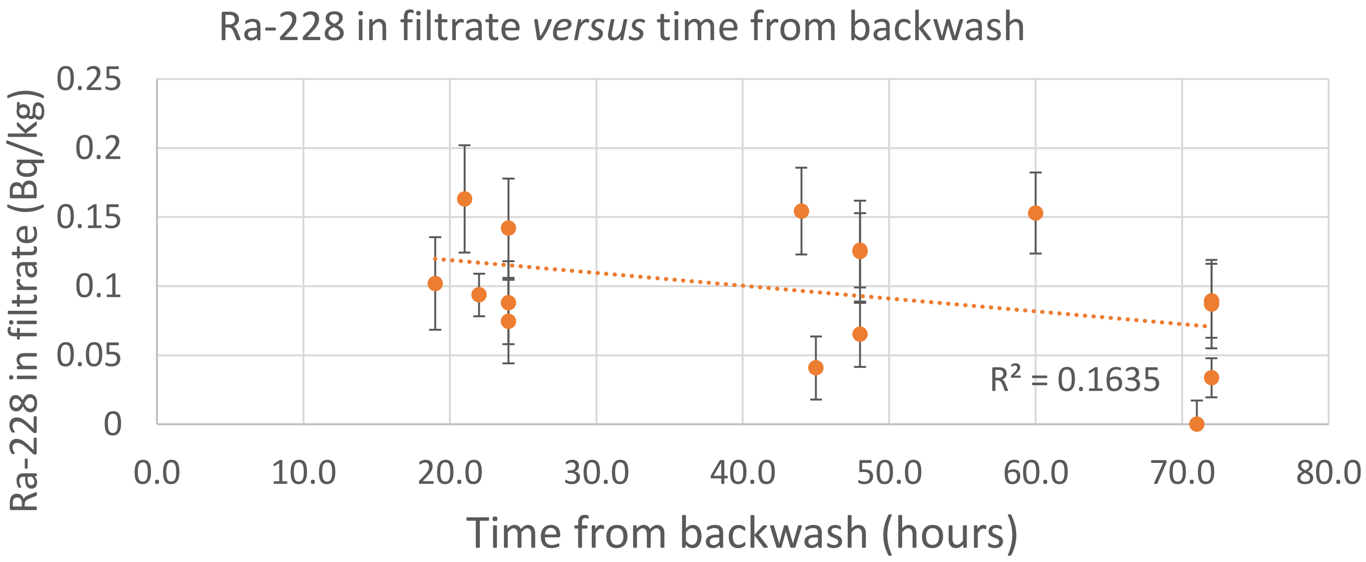




RESULTS – WATER

Time from backwash *versus* removal efficiency?





FILTER – RADIONUCLIDE ACCUMULATION

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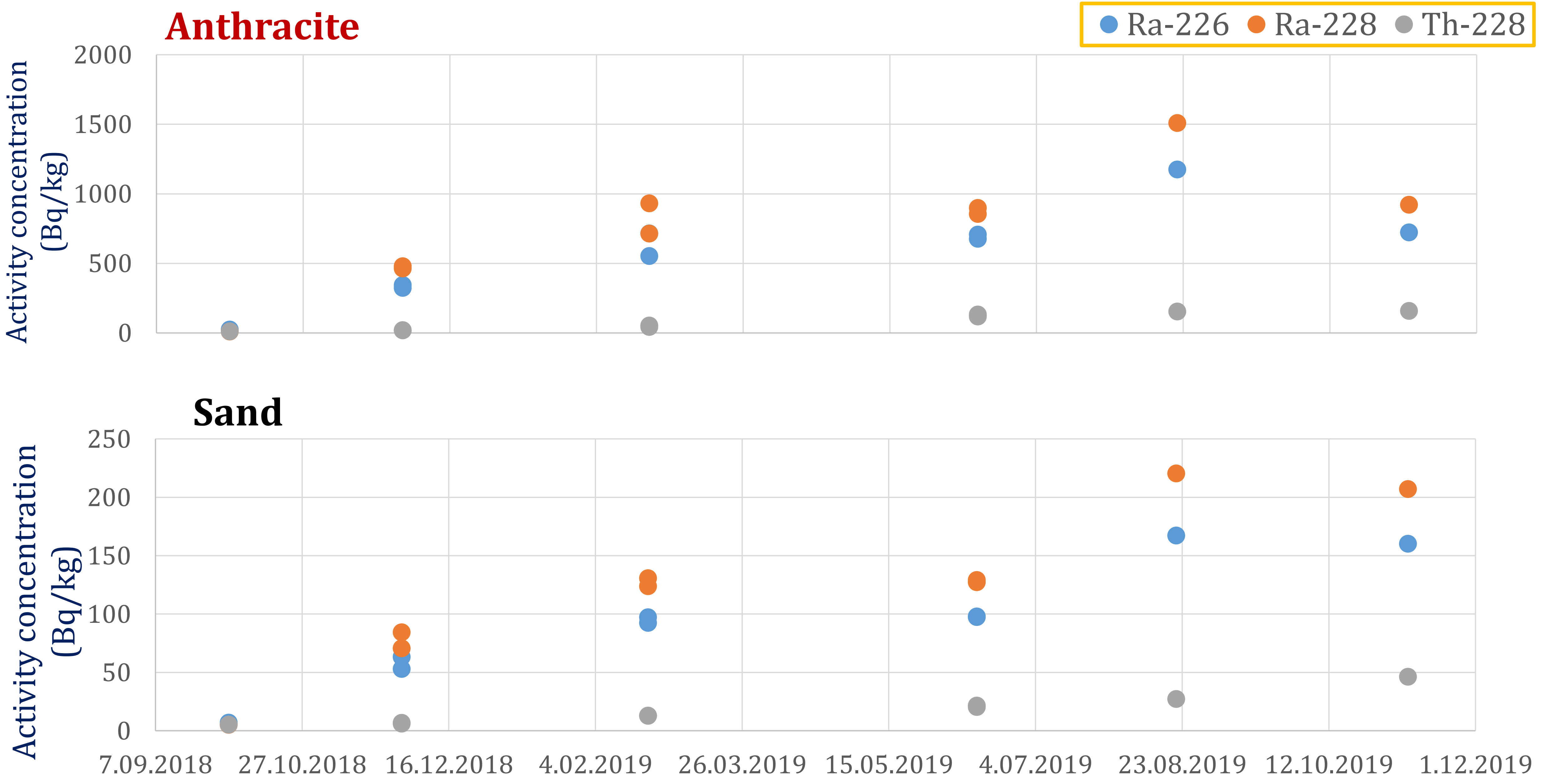

RESULTS – FILTER MATERIAL

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Accumulation rate of ^{226}Ra and ^{228}Ra in filter material

	Filter material	^{226}Ra ($Bq/kg\ yr^{-1}$)	^{228}Ra ($Bq/kg\ yr^{-1}$)
Pilot plant	Sand	160	210
	Anthracite	730	950
Current technology in Viimsi Water	*Filtersorb®FMH*	*1400*	*1860*
	Zeolite	*3400*	*4760*

Hill et al., *2018. Journal of Radiological Protection, 38*

RADIUM REMOVAL BY BACKWASH LIQUID

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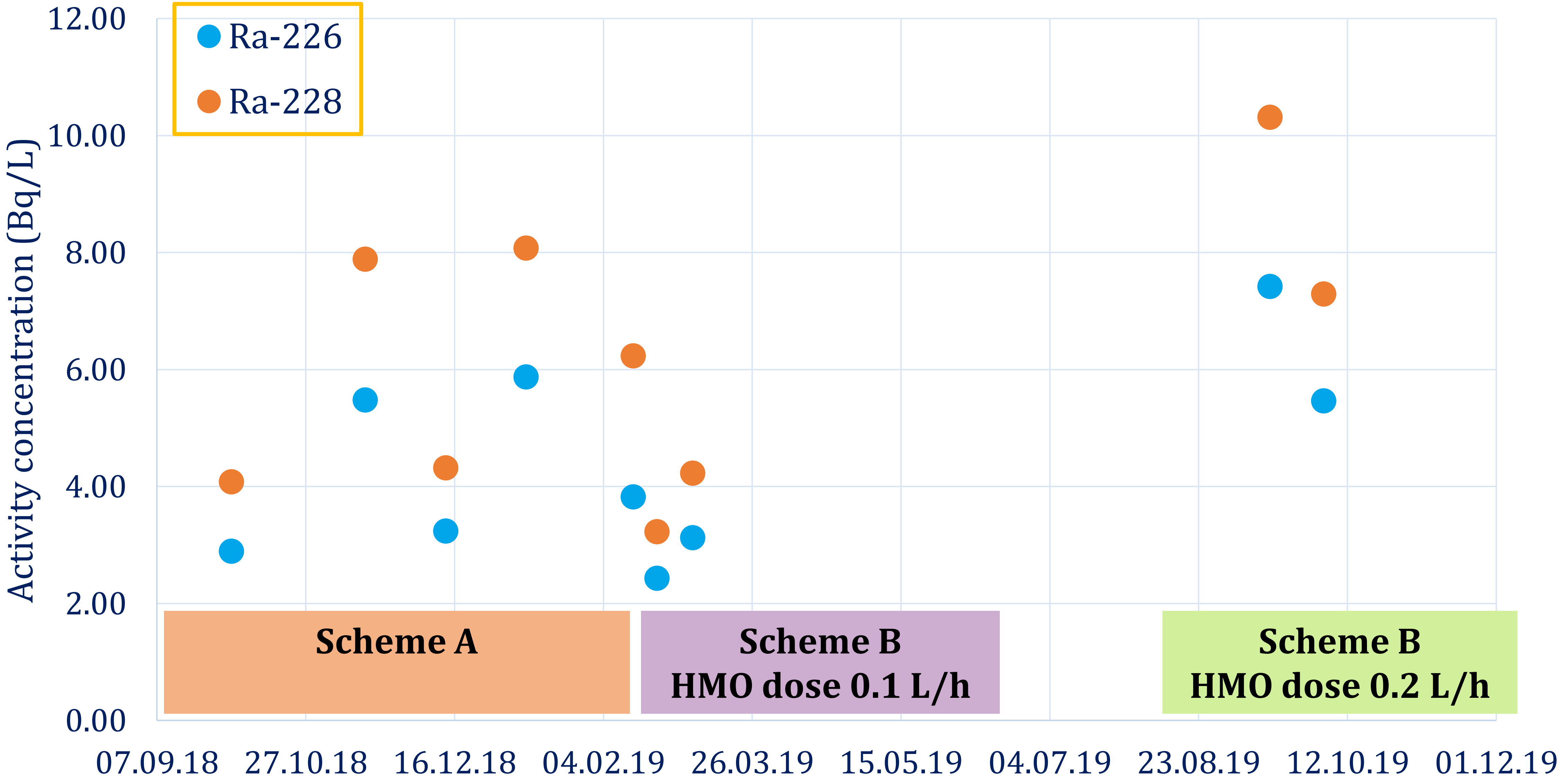
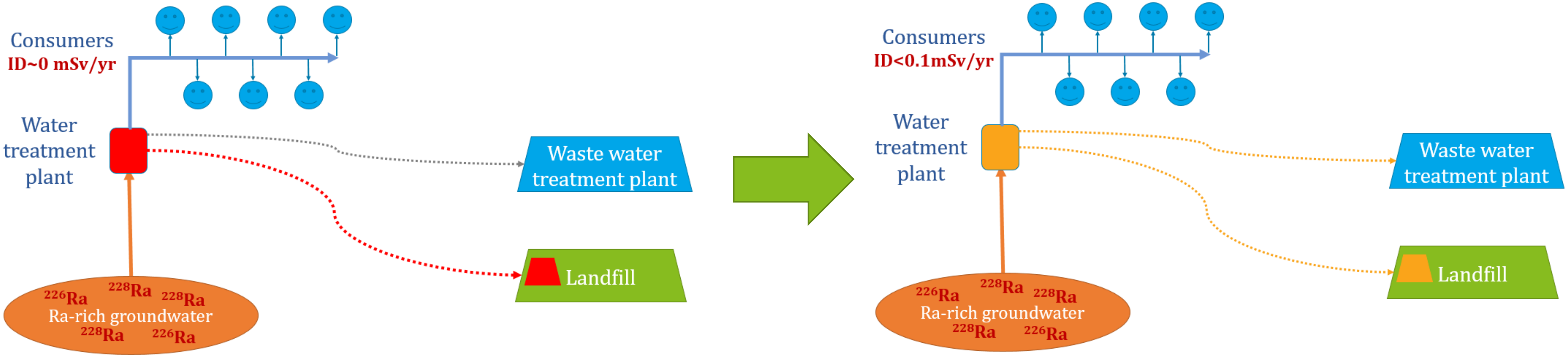


CONCLUSIONS

- NORM-free water treatment is difficult to achieve when using Cambrian-Vendian groundwater
- HMO – moving closer to an optimized solution



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Thank you!
Questions?

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