

The evolution of drinking water purification technology at Viimsi drinking water treatment plant

Nele Nilb (Production Manager)

AS VIIMSI VESI

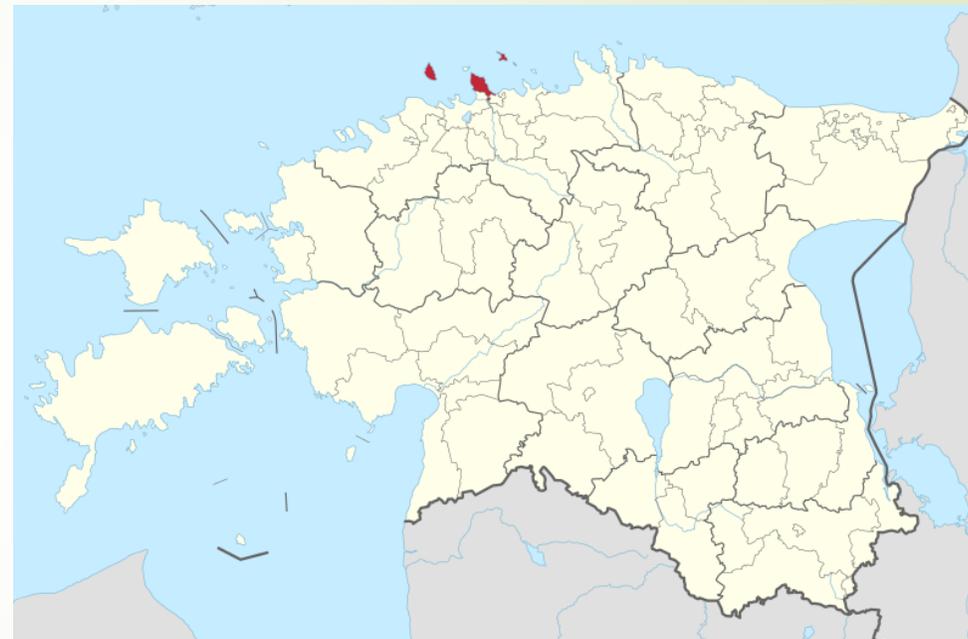
Viimsi

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AS Viimsi Vesi

- AS Viimsi Vesi is a water company in Northern Estonia.
- In Viimsi has ca 21 000 inhabitants.
- Viimsi Vesi has 24 employees.
- Viimsi Vesi is owned by Viimsi municipality.

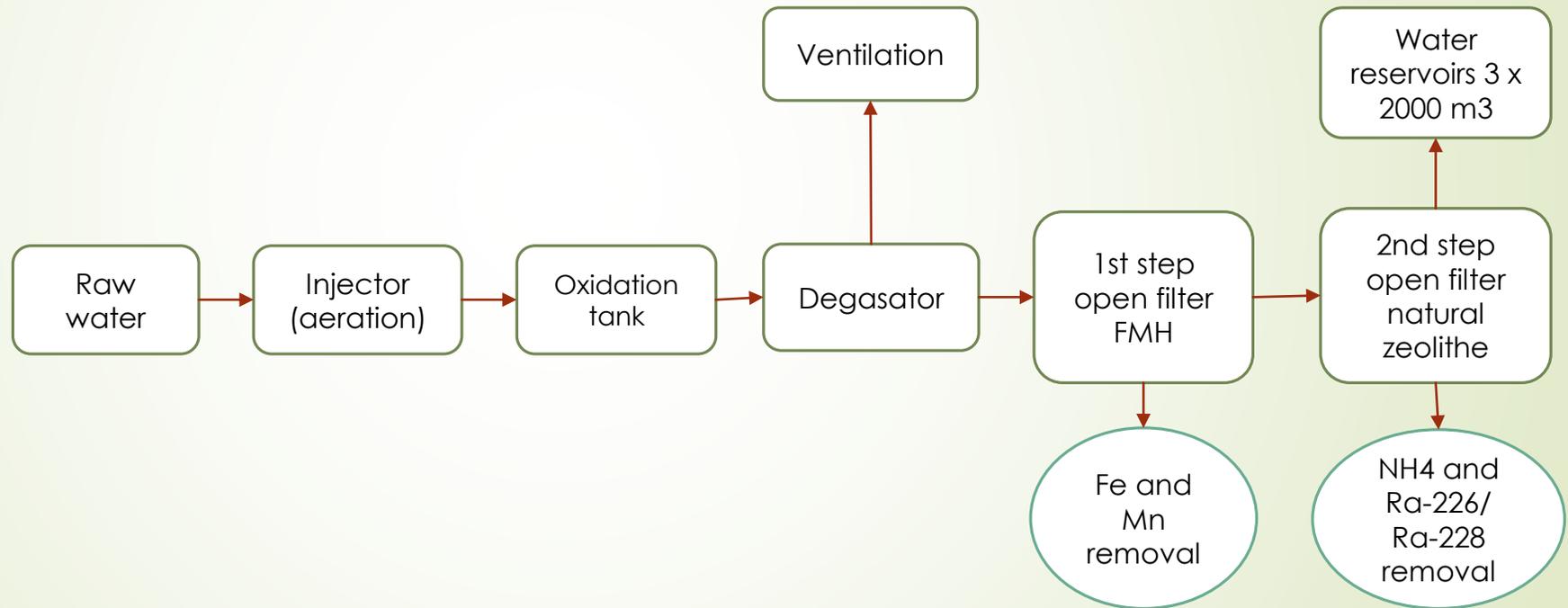


Viimsi water treatment plant



- ▶ Viimsi Water Treatment Plant started to operate in **February 2012** with the aim of purifying the water to the required standard.
- ▶ Water quality problems were iron, manganese, ammonium and radionuclides.
- ▶ The water is pumped from 80-100 m Cm-V wells (11 pieces). In addition, there are 13 reserve wells.
- ▶ The water treatment plant purifies water ca **3,300 m³/d**. In summer ca 4200 m³/d.

Water purification technology in Viimsi water treatment plant - scheme





Water purification technology in Viimsi water treatment plant - description

- ▶ The water is pumped to a water treatment plant, where it is divided between five parallel treatment lines.
- ▶ Raw water is aerated with air, which oxidizes iron and manganese.
- ▶ The air-enriched water then passes through a special degasser, GDT, to help remove gases dissolved in the groundwater.
- ▶ This is followed by a two-stage pressure-free (opened) filtration system.
- ▶ The first filtration step is a high dolomite-based and manganese dioxide coated material (FMH) which is well suited for the removal of iron, manganese and also ammonium and radionuclides.
- ▶ In the second filtration step, the filter is filled with natural zeolite, which has been used to almost completely remove radium and ammonium.
- ▶ Purified water is diverted to reservoirs, where it is pumped to consumers.
- ▶ Thanks to the water treatment plant, the drinking water leaving the station fully meets the requirements for drinking water.



Water radioactivity

- ▶ Viimsi Vesi was the first water company in Estonia to purposefully remove radionuclides from drinking water.
- ▶ AS Viimsi Vesi takes raw water from 11 wells of the Cambrian-Vendian aquifer, which are 80-120 m deep.
- ▶ The Cambrian-Vendian aquifer contains natural radionuclides. Our water is characterized by Ra-228 and Ra-226 isotope contents.
- ▶ Based on the results of the analysis of these isotopes, the indicative dose of raw water reaching Viimsi Water Treatment Plant is 0.31 mSv / a.
- ▶ The parametric value of 0.1 mSv / a is based on the assumption that a person drinks two liters of water per day.
- ▶ Before the Viimsi water treatment plant was completed, a series of pilot tests were carried out.
- ▶ Natural zeolite is used to remove radionuclides (cleaning efficiency over 90%).
- ▶ This purification technology ensures that the indicative dose of water leaving the purification plant is below the parametric value.
- ▶ However, the problem was that the zeolite adsorbed the radionuclides and the filter material became radioactive over time (NORM waste).
- ▶ Another problem is that the filter material has an effective life cycle of only a few years.



AS Viimsi Vesi in research

- ▶ 2012-2015 „Optimisation of radionuclides removal technology from groundwater, investigation of radioactive waste production and estimation of related radiation risks from water purification plants“ funded by SA Archimedes (European Regional Development Fund)
 - ▶ 2016-2017 project „Development of health risk assessment methodology to optimise radiation protection in the presence of radionuclides in drinking water and feasibility studies for NORM-free water treatment“ funded by Estonian Environmental Investment Center
 - ▶ 2017-2020 EU Life Environmental and Resource Efficiency program project ALCHEMIA „Toward a Smart & Integral Treatment of Natural Radioactivity in Water Provision Services“ (LIFE)
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NORM waste

- ▶ There was no NORM waste management practice in Estonia.
- ▶ The aim was to dispose of NORM waste to a landfill for final storage.
- ▶ Started a 5 year process of making various radiation safety assessments and applying for permits.
- ▶ As Viimsi Vesi needed to reconstruct one of the water treatment lines, we removed from filter material that had already become NORM waste from two filter tanks.
- ▶ Today, we have been able to take this NORM waste to the landfill.



Future...

- ▶ Next year probably we will start the reconstruction of the water treatment plant because the existing filter tanks are corroded and the existing water treatment system produces NORM waste.
- ▶ We plan to implement open aeration system and HMO technology as it is the best available technology for radionuclide removal.
- ▶ **BUT the question remains, is it even necessary to remove radionuclides from the water and make a major investment?**



Thank you!

Nele Nilb
nele@viimsivesi.ee

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