

## Conclusions

The Health Board studied pollutants which can be associated with the oil shale sector in a hundred public water supply networks in Ida-Viru and Lääne-Viru counties. In total, 45,793 consumers are supplied by those public water supply networks that were included in the sample. The layers to be included in the sample were selected by looking at the results of a 2015 study that was conducted by the University of Tartu and the Health Board which concluded that groundwater bodies in the Ordovician and Quaternary layers should be studied further.

Based on information that is available to the Health Board, a total of 133,947 consumers in Ida-Viru County (which forms 99.4% of all consumers) and 39,283 in Lääne-Viru County (88.8% of all consumers) had access to compliant water. This study focussed on parameters which are not subject to self-checking pursuant to existing legal requirements, but which may potentially be connected to the oil shale sector.

Even though the concentration of petroleum products in the drinking water that was subjected to study is not hazardous to health according to the results of that study, the observation requires further attention. In 67% of the water supply networks that were studied the results of the petroleum product analysis remained below the detection limit. In the remaining water supply networks, concentration levels ranged from the detection limit of  $<15\mu\text{g/l}$  to  $170\mu\text{g/l}$ . A total of 5,671 permanent consumers come in contact with a petroleum product concentration which exceeds the detection limit. Even though nineteen of the findings originate from the Ordovician-Cambrian groundwater body in the Eastern Estonian basin (groundwater body No 5), this finding cannot be described as significant within the framework of this study. This conclusion is based on the fact that 50% of public water supply networks that were included in the sample originate in this groundwater body, and petroleum products were discovered on a proportional basis in those water supply networks that also receive water from other groundwater bodies. When taking into consideration the fact in the analyses that the water odour was at normal levels, as well as the fact that the acceptability of the water for the consumer decreases before the pollutant concentration exceeds any level that could have an impact on consumer health, there is no reason to believe that the water could be hazardous to human health.

Barium concentration levels in the analyses ranged from the detection limit of  $<0.004\text{mg/l}$  to a maximum of  $2\text{mg/l}$ . The median level for the analyses was  $0.125\text{mg/l}$ , and there were three water supply systems in total in which the barium concentration levels exceeded  $1\text{mg/l}$ . A total of 5,759 consumers are supplied with water in which the barium concentration levels exceed the median of this study by a factor of ten.

In the case of calcium, only 51% of all water supply systems exceed the recommended limit. However, this affects 37,087 consumers. The median calcium concentration levels in public water supply networks was at  $40.4\text{mg/l}$ . In the case of magnesium the opposite applies. Even though 55% of water supply networks exceed the recommended levels, this only affects 8,738 consumers in total. The magnesium concentration levels in the public water supply networks was at  $22.4\text{mg/l}$ . In four water supply networks both of those indicators were below the detection threshold ( $5\text{mg/l}$  and  $2\text{mg/l}$  respectively). Even though excessive removal of water hardness should have the most significant impact on the levels of concentration of those substances, results indicate that in certain situations only the concentrations of one of those substances may be below the recommended levels.

Based on microbiological analyses there were no permanent micro-organism findings in public water supply networks which would indicate the penetration of surface water into the public water supply network.

Based on the substance concentrations that have been detected in the study, it is not possible to claim that the oil shale sector has had an impact on the drinking water in the public water supply networks. Even though petroleum products can be associated with the oil shale sector, it is possible in the case of these substances that the findings originate from other human-induced sources (such as residual pollution or pollution from the distribution network).

Based on the results of the study, it may be stated that the drinking water which is being supplied to consumers in those water supply networks that have been analysed is indeed safe for consumption from the perspective of those parameters that can be associated with the oil shale sector. However, in the case of some indicators, it should be kept in mind that even though there exist conflicting opinions, some water supply networks should improve their situation from the perspective of some of those parameters which may potentially become hazardous in the longer term or if the concentration levels fluctuate.

## Recommendations

In those water supply networks in which the barium concentration levels in the analyses have exceeded 1mg/l - which is ten times above the median concentration level - we recommend that further studies be conducted in order to identify the potential causes of the elevated barium concentration levels in these water supply networks. Keeping in mind the barium levels that have been found in those public water supply networks, we recommend extending a targeted study that will analyse barium concentration levels across the entirety of Estonia.

As petroleum products do not originate from the natural environment, the Health Board recommends that further analyses be conducted in terms of petroleum products in those water supply networks in which the findings have exceeded the detection threshold in order to rule out any impact on human health and to identify the sources of pollution. From the perspective of the quality of groundwater, nineteen findings were significant, with those findings being identified in the Ordovician-Cambrian groundwater body of the Eastern Estonian basin (groundwater body No 5), as this Ordovician-Cambrian groundwater body should not contain any petroleum products at all. If necessary and if any doubts remain (following a repeat analysis of the drinking water), further groundwater studies should be conducted using the same bored wells or a study should be conducted regarding the technical integrity of the structure of those bored wells (by means of using geophysical methods, including video examination), if the petroleum product concentration levels remain elevated.

From the perspective of calcium and magnesium levels, the Health Board recommends that water supply networks check for excessive water hardness removal. In order to supply healthy drinking water, we advise that checks are made to ensure that the concentration of those substances in the water exceed 40mg/l and 20mg/l respectively. This advice is especially directed to those four water supply networks in which the concentration levels of both substances remained below the detection threshold.