

Water safety in Finland

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Water safety in the world

- One billion people lack of safe drinking water
- 500 milj. illness cases/year due to contaminated drinking water
- 1.5 milj. death cases/year due to contaminated drinking water



Water resources in Finland

- Surface waters (235 km³)
 - 187,888 lakes (>3000 m²)
 - 25,000 km rivers
 - Shallow lakes (mean value <7m)
 - Sensitivity against pollution
- Ground waters
 - Formation of g.w. approx. 5 milj. m³/vrk
 - Usage approx. 15%
 - Aquifers: small, shallow, plenty
 - Uneven distribution of ground waters
 - Not available adequate volumes for the largest cities

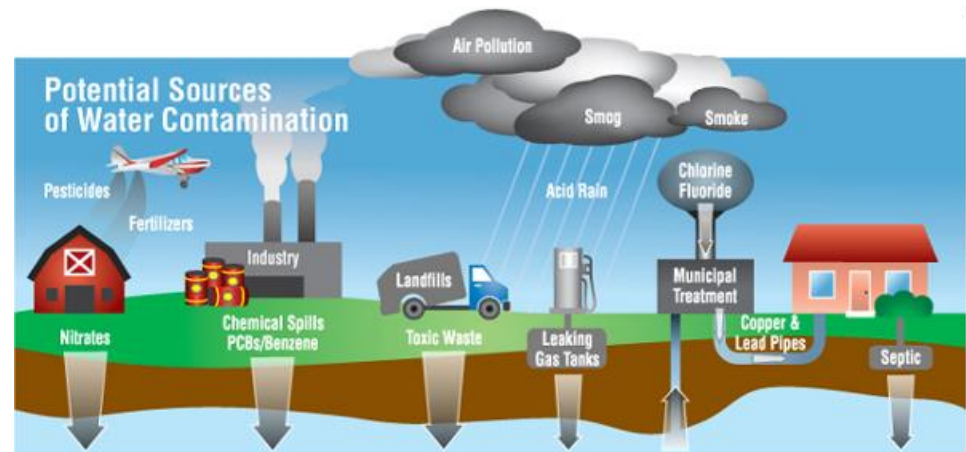
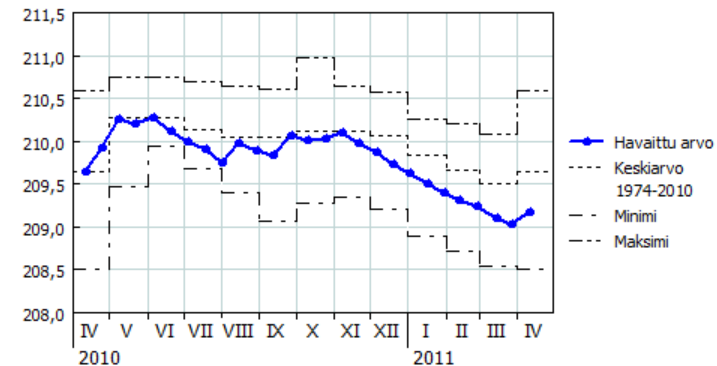
Contamination sources for surface waters

- **Human settlement**
 - Sewage: urban and rural waste water sources
 - Agriculture (cattle)
 - Industry – less in water, more as aerosols (legionella)
- **Zoonotic sources**
 - Domestic animals (cattle etc.) and wildlife
 - Surface run-offs (pintavalumat)
- **Waterborne organisms**
 - Microbial growth in the DW networks
 - Algae growth

Typical hazards in ground waters

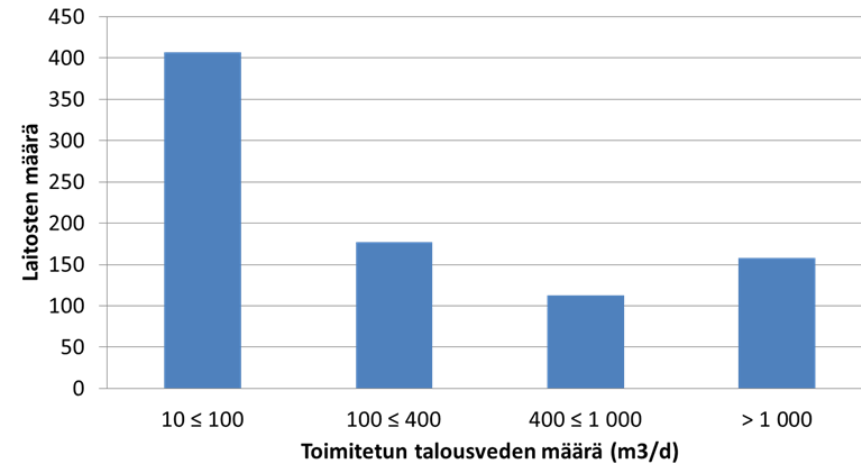
- Nature
 - Natural impurities in soil
 - Surface run-offs which may infiltrate in aquifer
- Human pollution
 - Waste materials/waste waters
 - Urban/rural settlements
 - Agriculture
 - Industry
 - Traffic

Pohjaveden korkeus - Groundwater level 0=N60 + 0.00M
1103 PUDASJÄRVI Haisuvaara



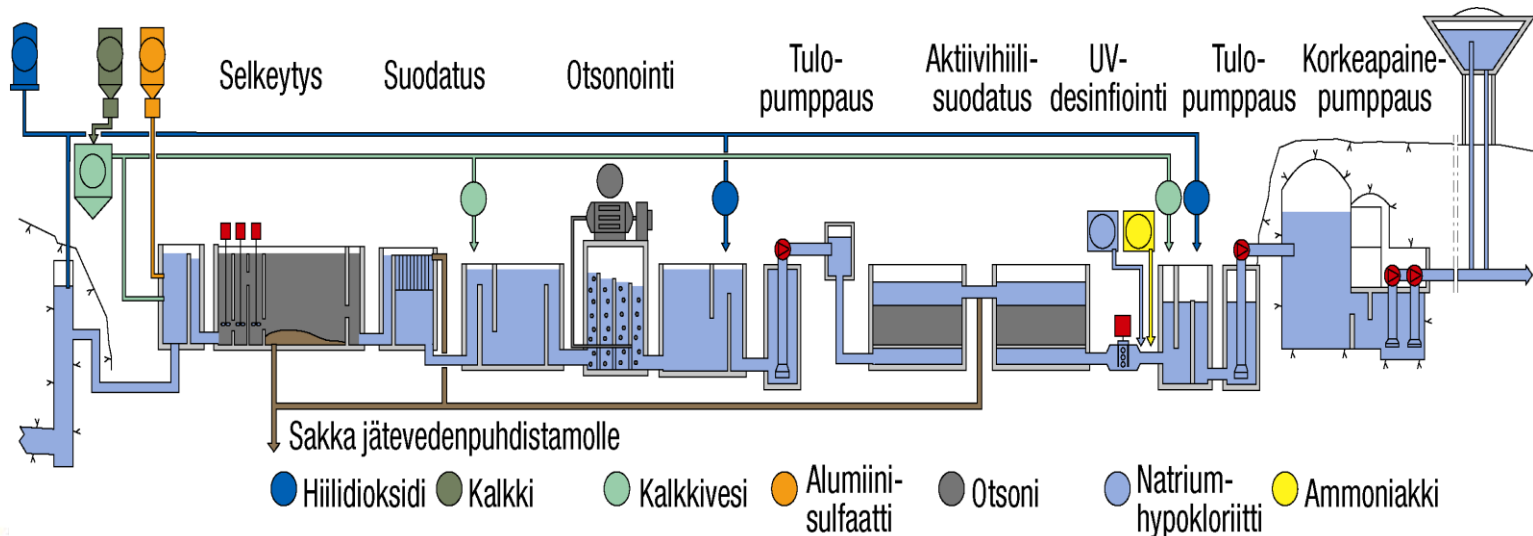
Water services in Finland

- Centralized water services cover approx. 4.7 milj. citizens in Finland
- Raw water sources
 - Surface water 39 %
 - Ground waters and artificial ground water 61 %
- Total around 1,500 water works serving more than 50 consumers
 - 10 biggest water works serve 25% of Finland's population
- Private wells: approx. 600,000 citizens



Surface water works

- Usually multi-barrier water treatment
- Disinfection always applied
- Most of the facilities are large → efficient water monitoring system
- Only few waterborne outbreaks
- Precipitation most important step for removal of microbes (95 to 97% removal)



Artificially recharge and ground water works

- Over 1,400 water plants
- Most of the small (<500 customer) water production units
- Alcalization usually the only water treatment method
- Usually no disinfection
- Limited water quality monitoring



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Aging of water in pipelines

- Water is not wine – aging do not improve its quality
- Both chemical and microbial alterations in water quality are unavoidable due to aging processes
 - Changes in temperature + physico-chemical alterations
 - Are the changes acceptable ?
 - Responsibilities: water works (main pipelines) vs. customers (indoor pipeline installations)
- In Finland: majority of the water quality problems are related with raw waters. Role of distribution network is also important and significance is increasing due to aging of pipeline infra (probability of leakages will increase)

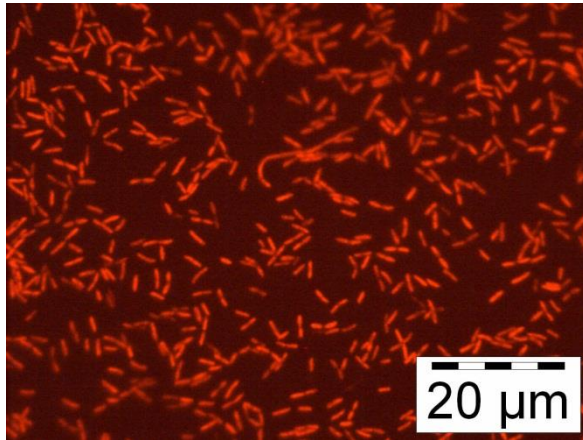
Legionella bacteria

- At least 61 named *Legionella* species belong now to *Legionella* genus, in addition 40 new still unnamed possible species have been isolated

(Ref. Ratcliff R. The challenge of complexity. The 6th International Conference on Legionella, Oct 16-10, 2005, Chicago, IL, USA, www.legionellaconf.org).

- At least 28 different *Legionella* species have been causing infections.
- The most often the infective species has been *Legionella pneumophila*.

- Serogroup 1 of *Legionella pneumophila* caused about 83 % of the infections in Europe in 2011-2015 (culture confirmed cases, Beauté et al, 2017)



Legionella pneumophila
cells

Sources of Legionellosis outbreaks



Cooling tower



Hot water



Cold water



Spa pool



Whirlpool bath



Humidifier



Waste water treatment plant



Nebulizer



Smog machine



Fountain



Evaporative condenser



Asphalt paving machine



Ice machine
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Car washing station



Hot spring



Health risks related to swimming pool waters

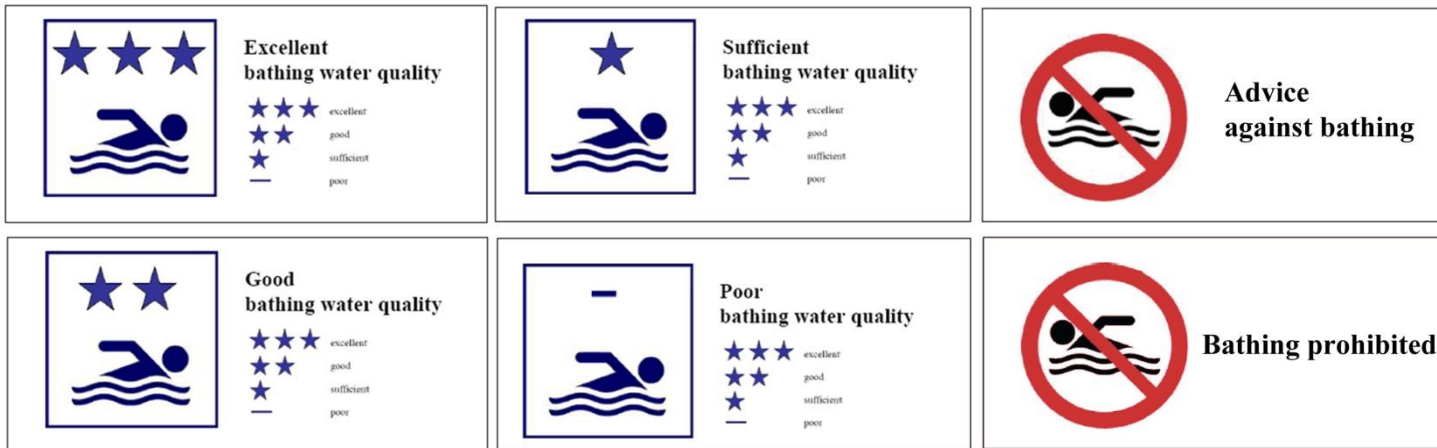
- Exposure to harmful factors in many ways
 - Skin contact to pool water and pool surfaces
 - Swallow of pool water
 - Indoor air, aerosols
- Exposure may cause different health problems, such as intestinal, eye, ear, respiratory and skin infections and allergy reactions

Assessment of the quality of bathing waters

- Based on the monitoring results of *E. coli* and intestinal enterococci describing faecal contamination of bathing water
 - Frequent monitoring of bathing water (health protection authorities)
 - Visual inspection of bathing water
- Classification of bathing water is carried out according to the results of 4 previous bathing seasons
- Bathing water categories are excellent, good, sufficient and poor

Bathing water management measures

- Public information at the bathing areas and in other appropriate media, such as Internet
 - Guidance, instructions, warning
 - Bathing prohibition, advice against bathing
- Responsibility of bathers



Links

- Ympäristöterveyden erityistilanteiden opas: http://www.stm.fi/julkaisut/nayta/-/_julkaisu/1537669
- www.thl.fi/vesi
- Tietoa vesiepidemioista:
http://www.thl.fi/fi_FI/web/fi/aiheet/tietopakettit/vesi/vesiepidemiat/toimintaohjeet
- WHO – Water Safety Planning:
 - http://www.who.int/water_sanitation_health/dwq/WSP/en/index.html
- Link to Vesiopas website:
 - http://fi.opasnet.org/fi/Arviointi_juomaveden_laadun_terveysvaikutuksista
- Opetusvideot klooriannoksen laskentaan ja kloorin mittaukseen (www.thl.fi / [YouTube](#))
- mobiilisovellus ”App” klooripitoisuuden laskenta ”[kloorilaskuri](#)”