Wastewater treatment in the Slovak Republic – status and perspectives
Slovak Republic - demography

- 5 429 036 inhabitants
- 2 891 municipalities
  - 138 towns
  - 2 753 villages
- 54.5% inh. in towns
- 45.6% inh. in rural
Connection on public water supply

%  
50 60 65 70 75 80 85 90 95 100

Connection on public water supply
(2015)
Specific water consumption in household

<table>
<thead>
<tr>
<th>Year</th>
<th>Liter/inh. day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>190</td>
</tr>
<tr>
<td>1995</td>
<td>170</td>
</tr>
<tr>
<td>1999</td>
<td>150</td>
</tr>
<tr>
<td>2003</td>
<td>130</td>
</tr>
<tr>
<td>2007</td>
<td>110</td>
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<tr>
<td>2011</td>
<td>90</td>
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Connection on sewerage

![Bar chart showing the increase in connection on sewerage from 1960 to 2015.](chart.png)

- **1960**: 20%
- **1970**: 25%
- **1980**: 30%
- **1990**: 40%
- **2000**: 50%
- **2010**: 60%
- **2015**: 70%
Connection on sewerage
Connection on sewerage in Europe

![Bar chart showing the percentage of connection on sewerage in different European countries. The countries are arranged from left to right as follows: Slovakia, Czech, Hungary, Poland, Portugal, Spain, Greece, France, Belgium, Netherlands, Luxembourg, Germany, Danmark, Ireland, G.Britain, and Sweden. The percentage ranges from 45% to 98%.]
Lenght of sewerage

km


0 5000 10000 15000 20000 25000
Goals for Slovakia

• **Until 2010** to connect on sewerage and biological treatment systems all settlements with more than 10 000 inh.

• **Until 2015** to connect on sewerage and biological treatment systems all settlements with more than 2 000 inh.

• **Until 2015** to connect on sewerage and biological treatment systems all settlements with less than 2 000 inh. with drinking water sources

• **Until 2015** to connect on sewerage and biological treatment systems all settlements with less than 2 000 inh. with sewerage or WWTP under construction.
Communities and WWTPs
Actual technologies WWTPs

- **Large WWTPs > 10 000 pe**
  - Ca 60 WWTPs for 2.5 mil. inhabitans
  - Mechanical pre-treatment (screens, grit chamber)
  - Primary sedimentation tank
  - Activated sludge with
    - nitrification,
    - denitrification
  - phosphorus removal (bio-P or precipitation)
  - Controlling of processes ($O_2$, $NH_4$, $NO_3$, $PO_4$)
  - Anaerobic sludge digestion with energy biogas utilization
Actual technologies WWTPs

- **Small WWTPs < 10 000 pe**
  - Ca 600 small WWTPs for 1.0 mil. inhabitants
  - Mechanical pre-treatment (screens, grit chamber)
  - Without primary sedimentation tank
  - Activated sludge with aerobic sludge stabilization
    - nitrification,
    - denitrification
    - phosphorus removal (precipitation)
    - Controlling of processes (O₂, NH₄)
  - Sludge tank accumulation
Actual technologies WWTPs

- **Domestic WWTPs < 50 - 500 pe**
  - Ca 5000 small WWTPs for 50 000 inhabitants
  - For houses, small hotels without connection on sewerage
  - Activated sludge with aerobic sludge stabilization
    - Nitrification (denitrification)
    - No phosphorus removal
### Requirements for effluent quality

<table>
<thead>
<tr>
<th>p.e.</th>
<th>COD (mg/l)</th>
<th>BOD (mg/l)</th>
<th>SS (mg/l)</th>
<th>N-NH4 (mg/l)</th>
<th>Ntot (mg/l)</th>
<th>Ptot (mg/l)</th>
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<td>&lt; 50</td>
<td>40</td>
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<td>51 - 2 000</td>
<td>135</td>
<td>30</td>
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<td>2 001 – 10 000</td>
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<td>25</td>
<td>20</td>
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<td>10001 – 25 000</td>
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<td>20</td>
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<td>15</td>
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<td>&gt; 100 000</td>
<td>90</td>
<td>15</td>
<td>20</td>
<td>5</td>
<td>10</td>
<td>1</td>
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<tr>
<td>In river</td>
<td>35</td>
<td>7</td>
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<td>1</td>
<td>9</td>
<td>0.4</td>
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Study on water technology

- **Slovak University of Technology in Bratislava**
  - Civil Engineering Faculty SUT
    - Drinking water technology, sewerage,
  - Faculty of Chemical and Food Technology SUT
    - Drinking water technology, wastewater technology
      sludge technology, anaerobic treatment, Mechanical
      pre-treatment (screens, grit chamber)
    - Research on wastewater technology, co-operation
      with praxis (our former students)
    - Projects of wastewater treatments (micropolutants,
      sludge management, nutrient removal...)


Our book on water analyses

- **Basic useful analyses for**
  - Drinking water
    - pH, hardness, NH4-N, NO3-N, COD$_{Mn}$, dissolved solids,
    - Basic parameters for drinking or surface water quality
    - To recognize easy pollutants in wells, rivers
      - NH4-N – sewage, urine
      - NO3-N – fertilisers,
  - Wastewater
    - pH, temperature (physical parameters)
    - COD$_{Cr}$, BOD$_5$ (organic pollutants),
    - Suspended solids, dissolved solids, total solids
    - Nitrogen and phosphorus (eutrophication)