## I. Brief snapshot of the plant

<table>
<thead>
<tr>
<th>Design capacity</th>
<th>50,000 PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual loading</td>
<td>38,000 PE</td>
</tr>
</tbody>
</table>

### Biological wastewater treatment
- **Street 1**
  - High-performance activated sludge process (C-decomposition)
  - Slurry tank
  - Trickling filter (nitrification)
- **Street 2**
  - Anaerobic tank (P-elimination)
  - Anoxic tank (upstream denitrification)
  - Aerobic tank (C-decomposition, nitrification)
  - Slurry tank
- **Street 1 + Street 2**
  - Fixed bed reactor (denitrification)
  - P precipitation by Fe³⁺
  - Filtration

### Sludge treatment
- No primary sludge
- Thickened waste activated sludge
- Co-substrate

### Separate waste activated sludge thickening
- Filter band (operating 24 hours)

### Anaerobic sludge stabilization
- 1 digester, 4,000 m³, mesophilic
- HRT: 40 days

### Degradation of volatile solids (VS)
- 40% of VS as per cent of dry solids (before the preliminary trial)

### Digested sludge dewatering
- Centrifuge

### Sludge disposal
- Incineration
II. Objective of the ultrasound sludge disintegration
- Improve volatile solids degradation
- Increase biogas production
- Reduce polymer consumption in sludge dewatering

III. Preliminary trial of the ultrasound disintegration system
- Test phase of eight months (November 2007 – June 2008)
- 50% of the total TWAS flow were treated with 1 ULTRAWAVES US unit 5 kW, operating 24 hours per day (Figure 1)

IV. Results
- Volatile solid degradation
  - Degradation of the volatile solids was improved from 40% to 46%
  - Decrease in volatile solids disposal of 170 kg/d
- Biogas production (Fig. 2)
  - 20% increased biogas production
  - Elevated a production of 276 m³/d
- Reduction of polymer consumption for sludge dewatering
  - From 10 kg to 8 kg polymer / t TR

V. Payback time
Based on these results, the payback time for the ultrasound installation is calculated with 3 years.

VI. Full-scale installation
In May 2009 the ULTRAWAVES ultrasonic system was implemented on WWTP Ahrensburg and since is in operation 24 hours per day.
Figure 1: Scheme of sludge treatment on WWTP Ahrensburg

Figure 2: Comparison of total and specific gas production before, during and after the US test

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