Summary of data concerning the quality of the reclaimed water produced at the Blanes Reclamation Plant (Costa Brava, Girona, Catalonia)

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Location of the municipality of Blanes

Southern tip of Girona province, NE Catalonia, Spain

Tordera river delta  
WWTP & Reclamation plant  
Desalination plant
Why reuse in Blanes?

• Aquifer of the lower Tordera river overdrafted due to the increasing demand (urban, industrial and agricultural) and due to severe drought (1998-2002). Decline in the water table and loss of quality due to seawater intrusion.

• Measures undertaken by the Catalan Water Agency (ACA) to reverse the situation:
  – Establishment of a plan for the regulation of aquifer extractions
  – Construction of a 10 million m$^3$/year desalination plant
  – Construction of a water reclamation facility at the Blanes WWTP to recharge the aquifer instead of discharging secondary effluent into the sea (3 million m$^3$/year)
  – Promotion of internal recycling in local industries

The Blanes Reclamation Plant

• Extended aeration biological plant with chemical phosphorus removal
• Title-22 tertiary treatment (700 m$^3$/h), with coagulation, flocculation, sedimentation, filtration and a wide range disinfection, performed by a combination of UV (maximum UV dose estimated at 189 mJ/cm$^2$) and chlorine (210 min contact time at peak flow)
• In operation since 2003
• Current disinfection settings: UV dose approx. 80 mJ/cm$^2$ + 1ppm Cl$_2$ (210 mg Cl$_2$.min/L)
• Current uses: aquifer recharge and agricultural irrigation

UV disinfection system and reclaimed water used for surface aquifer recharge
Monitoring in the Blanes reclamation plant

• Routine monitoring
  – From daily to three times a week: basic parameters (SS, turbidity, pH, EC, etc.), nutrients (N and P) and *E. coli*

• Advanced monitoring (monthly)
  – Between Jan 03 – Mar 04: heavy metals, pesticides, polycyclic aromatic hydrocarbons (PAHs), other faecal indicator microorganisms and parasitic helminth eggs.
  – Since Mar 04: TOC, clostridia, somatic bacteriophages, *Legionella* and trihalomethanes, including disinfection by-products.

Summary of the results (I)

• Between Jan 03 and May 07, the Blanes reclamation plant has produced 14.3 million m$^3$ of reclaimed water, of which almost 12.6 million m$^3$ have been used for the recharge of the lower Tordera aquifer (88%).
• The basic quality criteria of the Catalan Water Agency for aquifer recharge (SS < 10 mg/l; turbidity < 2 NTU, *E. coli* < 200 cfu/100 ml, TOC < 16 mg/l, parasitic helminth eggs < 1/10 litres, total N < 10 mg N/L, total P < 2 mg P/L) have been consistently achieved during this period.
• Turbidity is the parameter that has represented a real challenge so far P90 values of the annual set of data between 2.0 and 2.6 NTU between 2003 and 2006.

Water produced by the Blanes reclamation plant (N/DN + Title-22) and used for the recharge of the lower river Tordera aquifer by percolation, 7 July 2005

Summary of quality in 2006
(Percentile 90 of the annual set of data):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nitrogen</td>
<td>9.8 mg/l</td>
<td>150</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>2.4 mg P/l</td>
<td>149</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>4 cfu/100 ml</td>
<td>120</td>
</tr>
</tbody>
</table>
Summary of the results (II)

- All the *Legionella* tests performed have shown absence as a result (< 50 cfu/L) in 40 consecutive monthly samples of reclaimed water and in 39 of secondary effluent.

- Concentration of trihalomethanes has been found to be well below the limit imposed by Spanish drinking water regulations (100 µg/L).

- Calculations of the direct operational costs of the Blanes reclamation plant, integrated in the O&M structure of the southern Costa Brava, give a relative cost below 0.06 €/m³.

Conclusions

- The construction of the water reclamation facility in Blanes has allowed the recovery of approx. 3 million m³/year for the recharge of the aquifer that were formerly discharged into the sea.

- The WWTP and the Title-22 facilities produce a reclaimed water of enough quality to be used for the aquifer recharge by percolation at a very reasonable cost.

- The combination of UV and chlorine has been observed to produce a wide range disinfection that protects public health better than any of the two agents used alone – unless very high doses are applied-. (For more detailed information see the paper by Montemayor *et al.* in the UV Disinfection session of Thursday morning).
Thank you for your attention!
Questions?