Water reuse and water quality aspects in Europe

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Water reuse

- A process where water is used more than one time before it passes back into the natural water cycle.

- Recycled or reclaimed water are generally used as synonyms. The word used depends on the region.

Source: http://www.watereuse.org
Why is water reuse important?

- offers a **climate independent** water source
- allows communities to become less dependent on groundwater and surface water sources
- decreases the diversion of water from **sensitive ecosystems**
- reduces the nutrient loads from wastewater discharges into waterways, thereby **reducing and preventing pollution**
- used to **replenish overdrawn water sources** and rejuvenate or reestablish those previously destroyed

Source: [http://www.watereuse.org](http://www.watereuse.org)
Uses for recycled water

Direct uses

- Agriculture
- Energy
- Industry
- Urban

Indirect uses

- Irrigation
- Potable (Groundwater recharge)

Uses of recycled water

- **Irrigation**
  - Crops
  - Pastures
  - Trees (no contact of reclaimed water with fruit)
  - Industrial non-food crops, fodder, cereals
  - Golf courses
  - Woodland and green areas not accessible to the public
  - Private gardens
  - Urban areas
  - Ornamental flowers (no contact of reclaimed water with product)
  - Silviculture

- **Aquaculture**

- **Industrial**
  - Cleaning processes in food & non-food industry
  - Cooling towers and evaporative condensers
  - Washing of vehicles

- **Environmental**

- **Urban**
  - Supply to sanitary appliances
  - Ornamental ponds without public access
  - Street cleaning
  - Fire hydrants

- **Aquifer recharge**
  - Indirect potable use (example Belgium)
Virtual water footprint (Hoekstra, 2002)

- Green / blue / grey water in food

A pizza: 1260 liters
A kilo of bananas: 790 liters
A glass of wine: 110 liters

Source: waterinfood.it
Water use and reuse among European countries by application

- Reused water only presents a minor share of a country’s water demand!
- In most cases, less than 1%.

Purpose of water reuse

- To cover an existing water demand
- To supplement uses
- To replenish natural resources

Availability and sources of water in Germany

Water utilisation in Germany in 2007
Total available water resources:
188 billion cubic metres

- stream water: 1%
- water from lakes and reservoirs: 12%
- enriched groundwater: 9%
- water from bank filtration: 8%
- spring water: 9%
- groundwater: 61%

Total water consumption 17.2% (32.3 billion m³)

- Non-public water supply and wastewater disposal 27.2 billion m³
- Public water supply 5.1 billion m³
- Unused 155.7 billion m³

Reclaimed water is mainly used for additional purposes such as irrigation and environmental enhancement

The total reused wastewater volume in Europe: 2.4% of the treated effluent.

**Question:** What explains the wide range?

Extent of water reuse practice

- The implementation level follows the availability of water resources

Source: Bixio et al 2006b
Precondition for increasing water reuse: UWWTD

- Connections of households to WWT, especially in Southern and Eastern Europe

Projected distribution of reused water volume

- Countries with highest water stress at the forefront
- Requirements: Full implementation of the UWWTD

Legal framework: An overview of water reuse in the EU

Currently, no EU-wide guidelines exist that regulate water reuse: A lack of clear criteria

- Assessment of WFD “Blueprint to safeguard Europe’s water resources” (2012) highlights importance of water reuse for irrigation and in industry
- Several studies have been prepared for the EC on the topic
- Paving the way for an EU-level instrument including the possibility of a regulation establishing common standards in year 2015
Several EU directives limit the use of treated wastewater for specific purposes.
Urban Waste Water Treatment Directive (UWWTD)

- Water must have a threshold quality in order to be reused or discharged

**UWWTD - Article 12**
“Treated waste water shall be reused whenever appropriate. Disposal routes shall minimize the adverse effects on the environment.”

The EU Water Framework Directive (WFD)

**Objective:** Attaining “good ecological status” and "good chemical status" for Europe’s rivers, lakes, groundwater bodies and coastal waters

**Source:** UBA (2010)
# Legal framework: Reuse regulation in Member States

<table>
<thead>
<tr>
<th>Member state</th>
<th>Type of criteria</th>
<th>Comment</th>
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</thead>
<tbody>
<tr>
<td>Belgium: Flemish Regional Authority</td>
<td>Aquafin proposal to the government (2003)</td>
<td>• Based on Australian EPA guidelines</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Provisional standards (1997)</td>
<td>• Quality criteria for irrigation stricter than WHO standards</td>
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</tbody>
</table>
• WHO standards,  
• additional restrictions for irrigation techniques and set-back distances |
| Italy | Decree of Environmental Ministry 185/2003 | • Quality requirements for: agriculture, non-potable urban and industrial.  
• Flexibility for regional authorities  
• Standards are similar Californian and WHO regulation |
| Regional authorities: Sicily, Emilia Romagna and Puglia | Guidelines |  |
| Spain | Law 29/1985, BOE n.189, Royal Decree 2473/1985 | • Draft legislation with standard for possible applications of treated water  
• Standards similar to Californian regulation  
• Guidelines for irrigation  
• Follow WHO guidelines |
| Regional authorities: Andalucia, Balearic Is. and Catalonia | Guidelines from the Regional Health Authorities |  |
| Portugal | National Standard NP 4434 established recently | • Irrigation |

Sources: Bixio et al 2006, Marecos do Monte 2006
Why is water reuse risky? *Concerns highlighted in EU Directives*

- Pollution from chemical- or bio-hazardous substances from the **environment (soil, groundwater)** and/or produce
  - Discharge into receiving waters
  - Agricultural irrigation
  - Aquaculture

- **Health risks** for workers and consumer
  - Urban applications
  - Groundwater recharge
  - Indirect potable reuse
  - Recreational water use

- Harmful effects on the **biocenosis**
  - Environmental enhancement
Why is water reuse risky? *Health risks*

- It is difficult to quantify and characterise health risks through medical or toxicological studies.
- Dose-response data for human health effects are often lacking, especially for mixtures of pollutants.
- DEMEAU demonstrates bioassays for a rapid toxicological assessment of health risks.
Why is water reuse risky? **Soil-Aquifer Treatment (SAT)**

- 6 month retention time in subsurface, no dilution through other groundwater
- Pollutants or pathogens may not be removed or degraded

Source: Bastian, EPA
Is recycled/reclaimed water safe?

- Reclaimed water is highly engineered for safety and reliability
- The quality of reclaimed water is more predictable than many existing surface and groundwater sources
  - Reclaimed water is considered safe when appropriately used

Source: www.watereuse.org
Other issues to consider...

Energy? Additional energy required to treat wastewater for recycling, but ...the amount of energy required to treat and/or transport other sources of water is generally much greater.

Costs? High, due to the need for a separate distribution system and higher treatment efforts

Timing? Reuse may be seasonal in nature (e.g. irrigation, golf course, watering)

Water Quantity? Short-term negative effects on minimum flow conditions in rivers/lakes especially in Mediterranean regions

...
Conclusions

- Water reuse is an important and forward-looking water strategy

- Hindering factors
  - Clear EU-wide guidelines and/or regulations are needed
  - Benefits of water reuse are undervalued
  - Potable and wastewater are treated as if they were unrelated subjects
  - Open questions on health and environmental risks still need to be answered
Thank you for listening.

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