



# **Water supply risks and early warning systems**

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# Definition

A method to detect, characterize and report occurrence of pollutions in the water

- Automatic on-line measurements or
- working procedures

# Drivers for EWS

- Low raw water quality
- Afraid of terror attempts
- Risk and safety thinking

# Which type of water can be monitored?

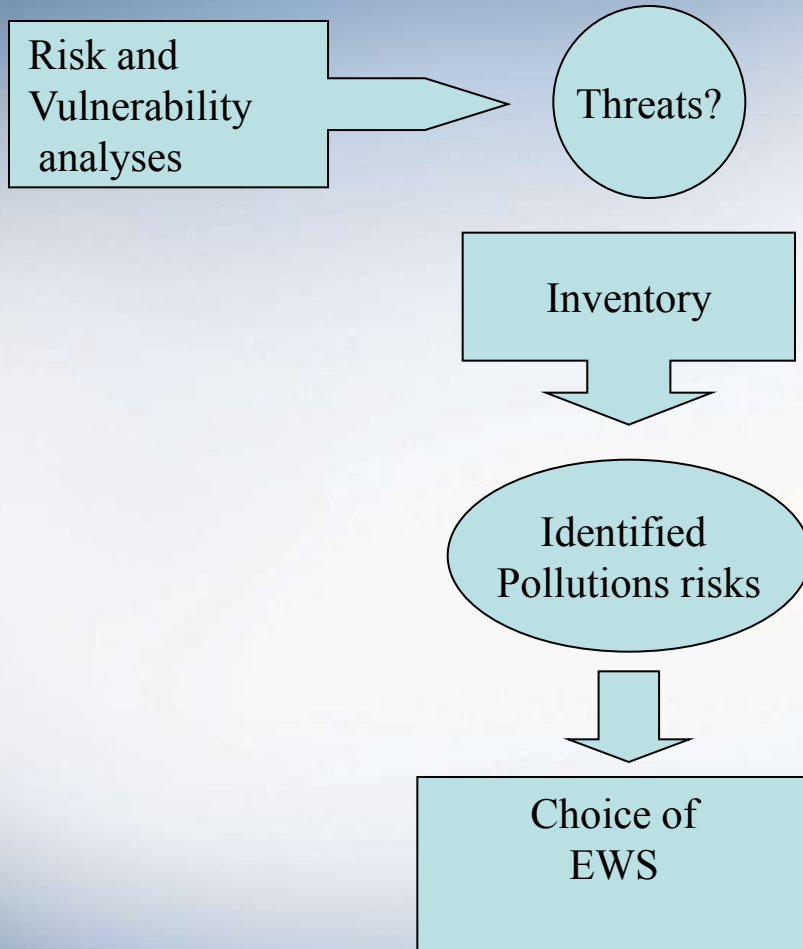
- Raw water – in the water catchment area
- Inside the water work
- In the water distribution network

⇒ Further away from the consumer – more can be done to prevent health risks

# Type of pollutants

- Acute
  - Accidents (oil leakage - traffic accident)
- Diffuse
  - Road salt infiltration (non-spot infiltration)

# Guidance to work with EWS



Depends on:

- Type of water source
- Activities in the area (natural/accidents/sabotage)

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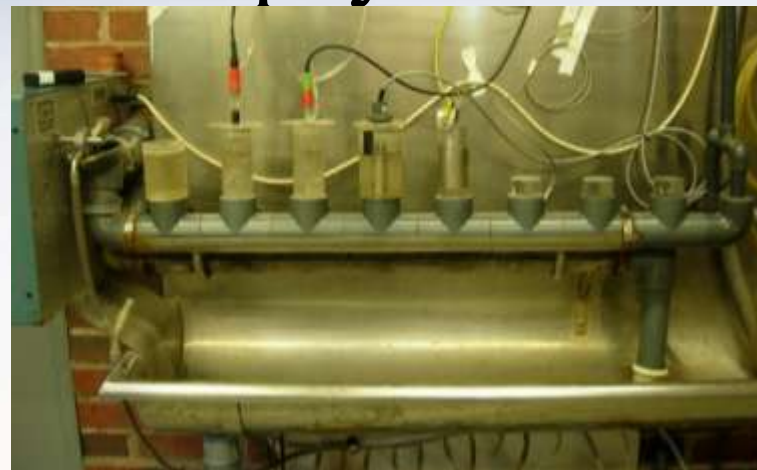
- Type of pollution risks
- Available recourses (economic and personnel)

# Examples

# Continuous measurements of physical parameters

Examples of parameters

- pH
- Redox potential
- Conductivity
- Temperature
- Turbidity

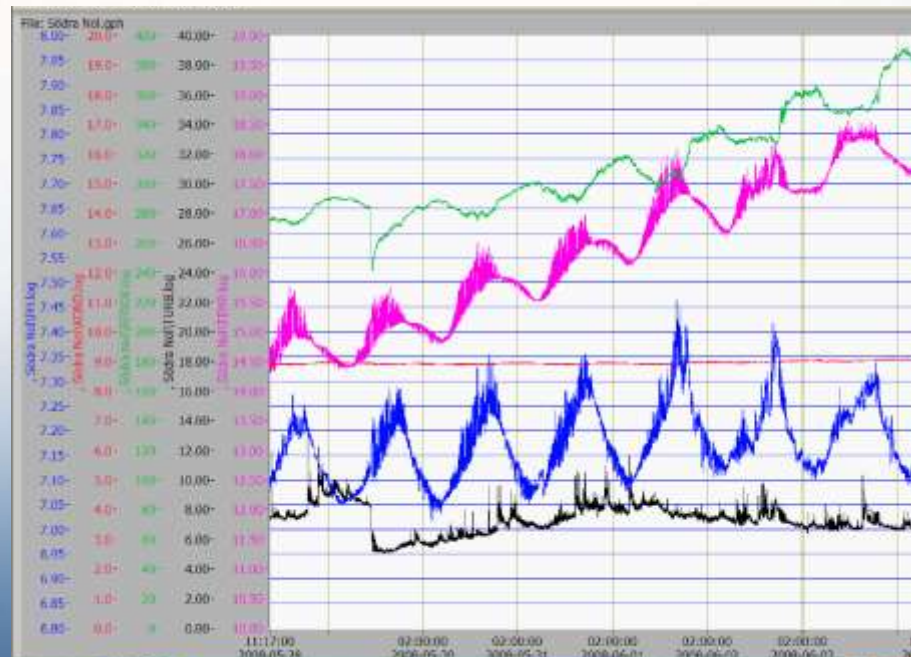


Indirect parameters

Interpretation of curves

Requires staff

Good Supervision





# Automatic control of E. coli

- Automatic sampling every 12th hours
- Cultivation and analysis: 12 hours
- Technology:
  - Fluorescence -spectrometer
- 2007
  - 60 times the raw water inlet was closed
- Not immediate response  
BUT quicker than ordinary sampling and analysis procedures
- Development of analysis method
  - Enzyme activity
- E. coli – indicator organism



# Smelling - Identification of petroleum

## Driver for system

- No petroleum in the water net work

## Tested water

- Raw water
- After rapid sand filtration
- Out going water from water work
- Tap water

## Function

- Continuous flow
- Spraying function
- 40-50°C

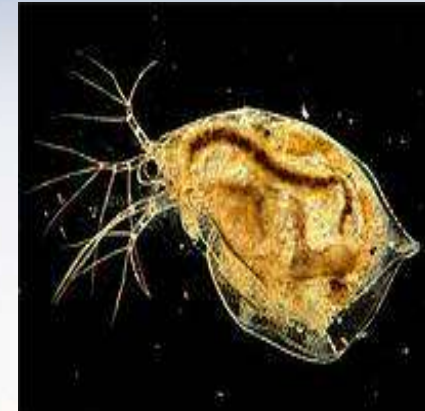
## Routines

- Every second hour the smell is tested





# Bio-monitors



- Commercial available
- On-line measurements
- Living organisms
  - From tox-tests
  - Daphnia
  - Fish

## Continuous optic analysis:

- Swimming height
- Swimming speed
- Number active organisms
- Distance between organisms



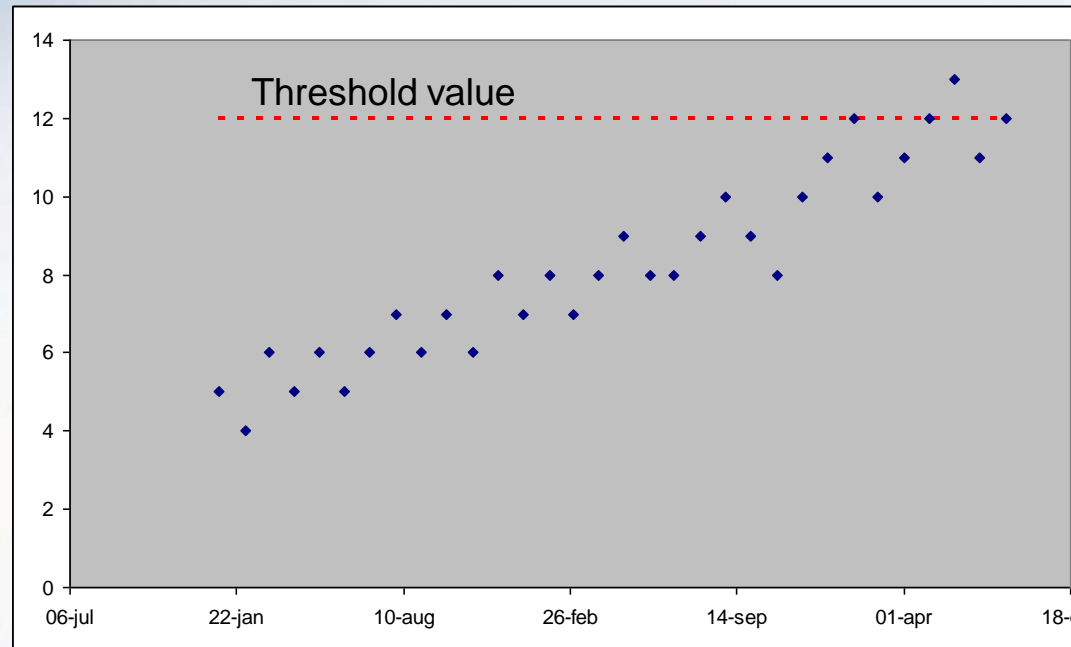
Daphnia Toximeter

# Optical instruments

- Are under development
- It should be possible to identify many different pollutants
- The questions are:
  - Detection level
  - Localization of probes
  - Choice of technology
    - Spectrofotometer – Fluorometer
    - Mg/l  $\Rightarrow$   $\mu$ g/l

# Trend analyses

- "Working procedure"
- Analyses of water quality samples
  - Compared with threshold value
  - Time series diagram



# Summary

- Possible to detect different kind of pollutants
  - Raw water
  - At water work
  - In water distribution system
- Variety of technologies or working procedures
- Choice of system should be based on:
  - Risk and vulnerability analyses
  - Identified pollutant risk
  - Available recourses