WFD Lille 2010

Security, monitoring and decontamination of water distribution systems

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Water Poisoning: Not a New Subject

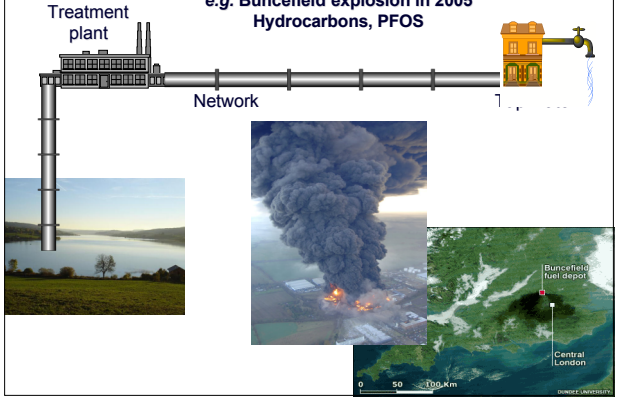
- 6th century BC, Assyrians poison the wells of their enemies with rye ergot
- Accusations of well poisoning and following pogroms against Jews in 12th century medieval Europe
- 1945, Romania: contamination with sewage of a large water reservoir

Drawing by Giovanni Sercambi: a Jew poisoning the Christian water supply by dropping some potion into the well

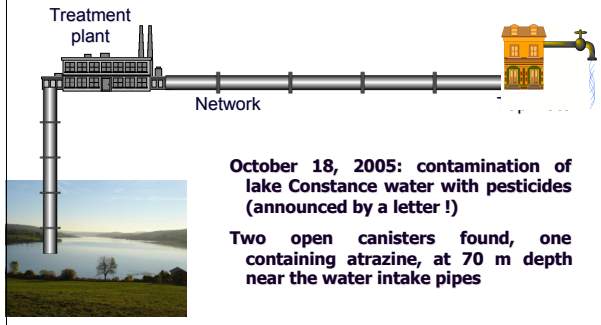
See the review by Gleick, 2005, Water and terrorism

Pollution by third parties affecting quality of groundwater

e.g. Buncefield explosion in 2005
Hydrocarbons, PFOS



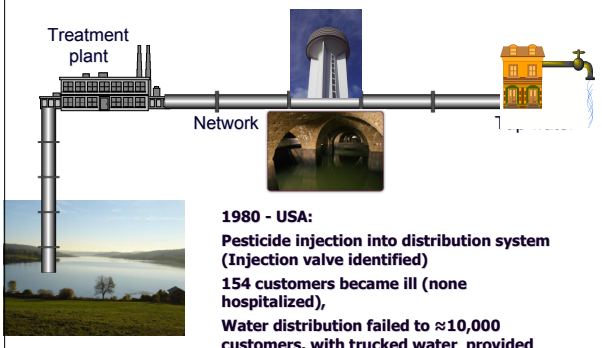
Deliberate contamination (1/2)



October 18, 2005: contamination of lake Constance water with pesticides (announced by a letter !)

Two open canisters found, one containing atrazine, at 70 m depth near the water intake pipes

Deliberate contamination (2/2)



1980 - USA:

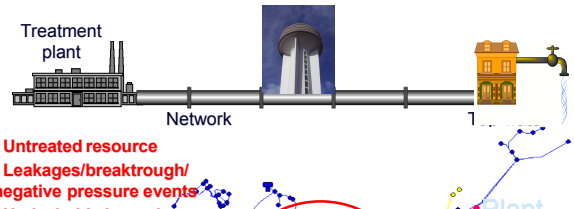
Pesticide injection into distribution system (Injection valve identified)

154 customers became ill (none hospitalized),

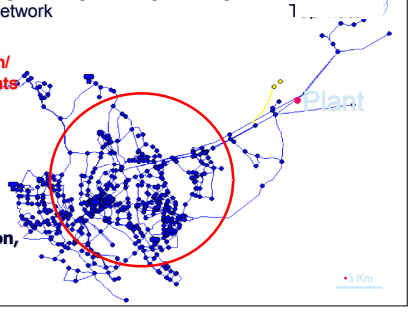
Water distribution failed to ≈10,000 customers, with trucked water provided

Seven months were required for complete decontamination

VULNERABILITIES



- Untreated resource
- Leakages/breaktrough/ negative pressure events
- Undesirable bacteria growth
- Back-contamination from the faucet
- Intentional contamination: any location, time, duration, and strength



Potential deliberate contaminants: CBRN

- Chemicals
- Biological
- Radionuclides

More than **1,000** potential contaminants

EU regulation

Around **40** parameters

Organics
Metal
Microorganisms
pH, chlorine, T°…

	Samples (2007)	
Paris (2,000,000 inhab)	≈3,200	<10 /day
Nancy (300,000 inhab)	426	≈1/day

SécurEau

An operational/decision response

SécurEau

Early warning system
Change in water quality
Deviation 3 sigma
Notification

Validation
Specific off line analysis

Decontamination procedures

Validation
Specific off-line analysis

Treatment of waste

EU and national, past and on-going programmes

***Care-S** (FP5 2002)*
***Care-W** (FP5 2001)*

***Techneau** (FP6 2006)*

***WeKnow / Clued'Eau + Microrisk + Safer + Toxic** (FP5 2001 - 2004)*

***Watersafe** (PSAR 2006)*

***TENAWA** (Euratom 1996)*

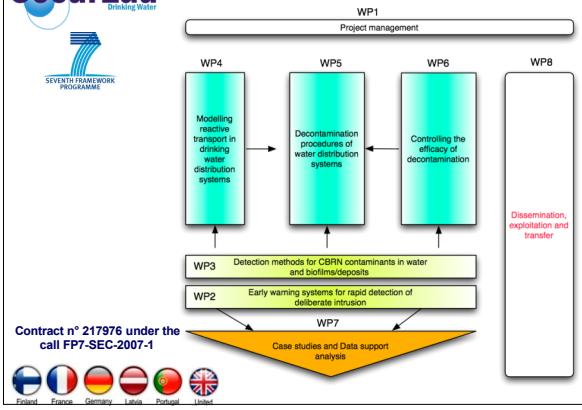
***SecurEau** (FP7 2009)*

***Euranos** (FP6 Euratom 2004)*

Biocom (F) ; Status (G)
AquaSafe (P) ; Vigireseau (F)

SécurEau
Drinking Water

SEVENTH FRAMEWORK PROGRAMME



Contract n° 217976 under the call FP7-SEC-2007-1

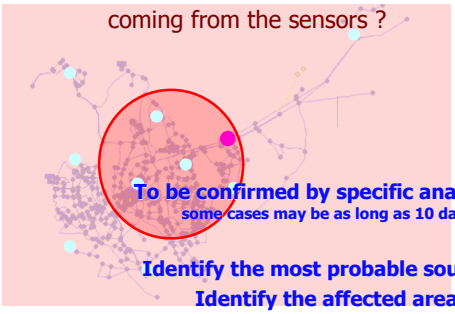
Finland France Germany Latvia Portugal United

Desired Characteristics of Early Warning Systems

- provide a rapid response
- exhibit a significant degree of automation *(1 year energy autonomy)*, including automatic sample archiving *(function continuously)*, sanitary conformity
- require low skill and training
- demonstrate sufficient sensitivity
- permit minimal false-positives/false-negatives
- exhibit robustness and ruggedness to continually operate in a water environment
- allow remote operation and adjustment
- allow for third party testing, evaluation, and verification
- Cost of on-line multi-parameter sensors: Estimated unit cost: 3k€. It allows to install around 40 sensors for a 200 km network !

SécurEau

How can we use the information coming from the sensors ?



To be confirmed by specific analysis (in some cases may be as long as 10 days)

Identify the most probable source(s)

Identify the affected areas

Modelling hydraulic and reactive transport / Accurate location of the sensors / softwares to predict both the fate of the contaminants along the network and, inversely, to back-track the possible sources of contamination

The need for off-line specific methods:

On-line sensors not specific of most potential deliberate contaminants

Tool-box of independent methods for CBRN

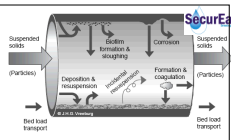
Increase sensitivity (concentration steps, amplification, …)

Robust methods not sensitive to matrix effect

Applicable both to water, sediments, biofilms and pipe walls

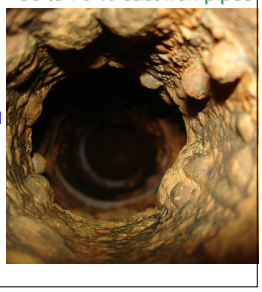
Rapid ?

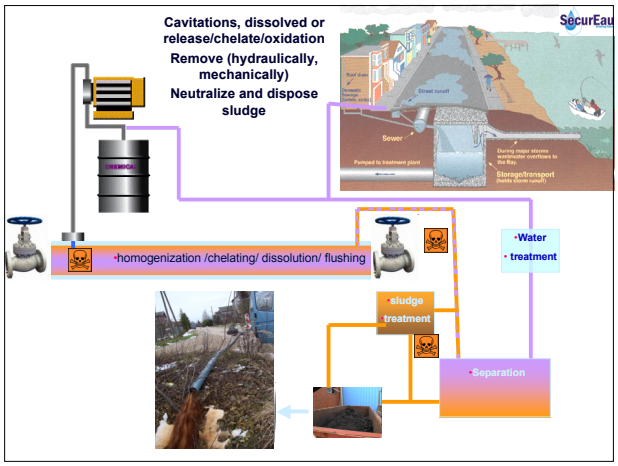
Decontamination: some challenges

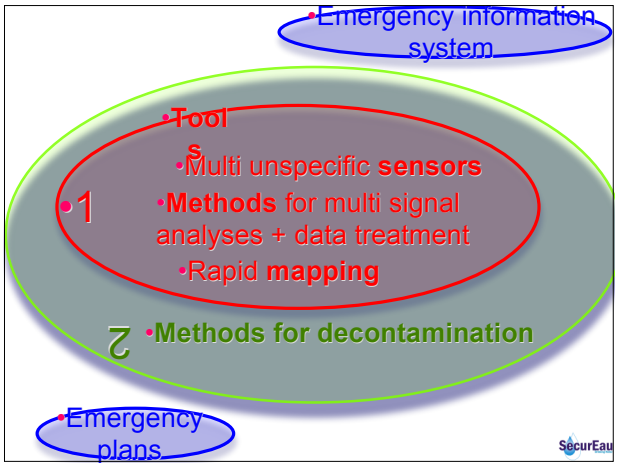


- A tenacious attachment of CBRN agents to the biofilm deposits which may be integrated with corrosion and scale deposits
- Several of potentially used agents by terrorist (e.g. spores) are very resistant to disinfection when adsorbed in biofilm and corrosion products, thus generally used *in situ* treatment and flushing should be optimized
- The material of pipes and types of CBRN are varied, thus the methods proposed should be universalized to make them effective and applicable
- Very large part of networks can be polluted (if injected on major transit mains)
- Huge amount of water should be disposed
- The cleaning process should not take too long (months including final control ?) and relatively simple
- After cleaning the networks should be safe to use

50 to 70 % cast iron pipes







SecurEau Drinking Water

If an attack does really take place what is the decision maker going to do ??

- **Provide tools** for an **immediate** action during / after the contamination for the European **consumer benefit**
- Protection of the exposed populations
- Efficient decontamination activities
- Rapid restitution of a safe water distribution system

•http://www.secureau.eu

•Contract n° 217976 under the call FP7-SEC-2007-1

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