SecurEau
Drinking Water

Grant agreement n°217976

Security and decontamination of drinking water distribution systems following a deliberate or accidental contamination

Portugal France Germany United Kingdom Latvia Finland

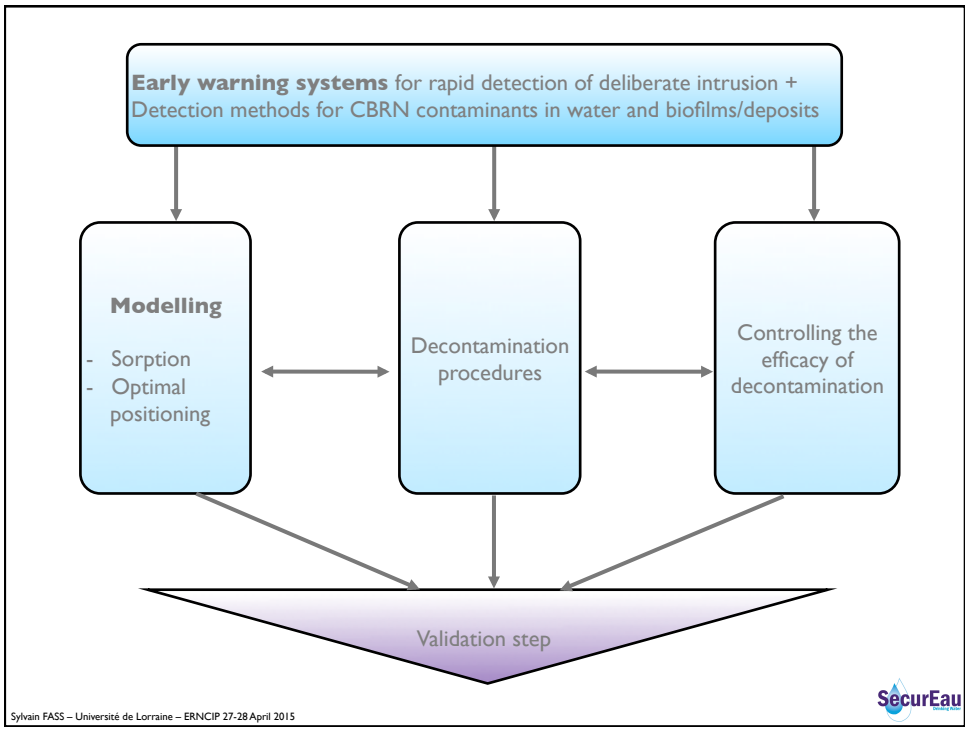
4 years, 6 countries, 14 partners -

Sylvain FASS, Université de Lorraine, Nancy, France

http://www.secureau.eu

SecurEau
Drinking Water

Universités	Public	Industriels
Lorraine, **F** Southampton, **UK** Porto, **P** Riga, **LV**	CNRS, CEA, Irstea, **F** THL, STUK, **FIN**	IWW, **G** Veolia Environment, **F** Monitoring Systems, **UK** Yorkshire Water Services, **UK** Veolia Water Central, **UK**


Early warning systems for rapid detection of deliberate intrusion +
Detection methods for CBRN contaminants in water and biofilms/deposits
Modelling
- Sorption
- Optimal positioning
Decontamination procedures
Controlling the efficacy of decontamination
Validation step
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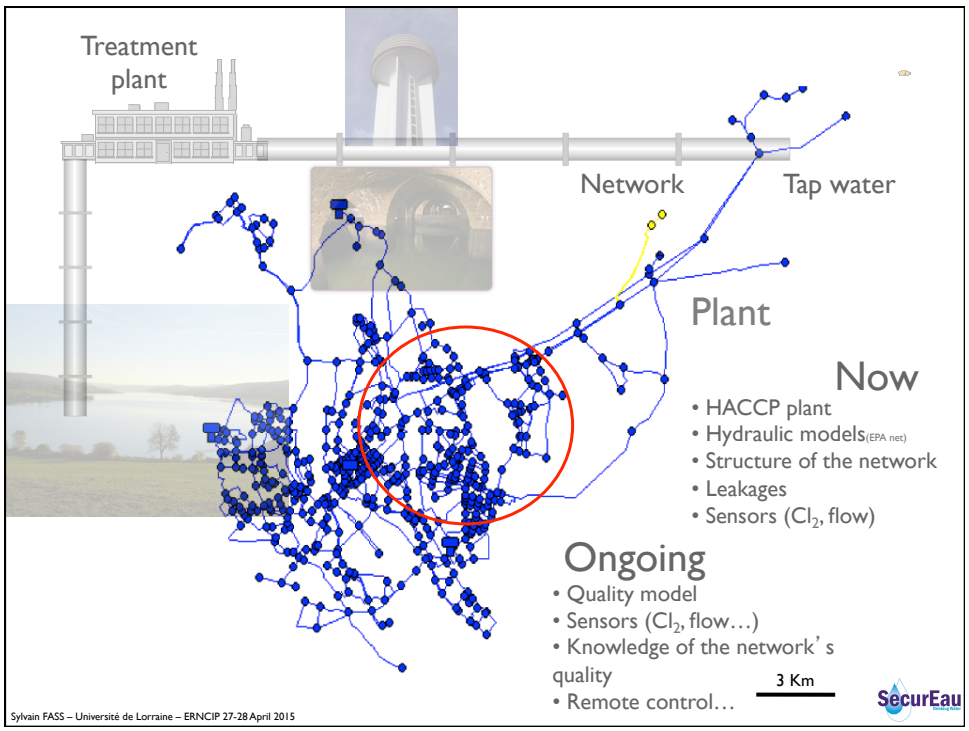
Treatment plant
Network
Tap water
Plant
Now
• HACCP plant
• Hydraulic models(EPA net)
• Structure of the network
• Leakages
• Sensors (Cl_2, flow)
Ongoing
• Quality model
• Sensors (Cl_2, flow…)
• Knowledge of the network's quality
• Remote control…
3 Km
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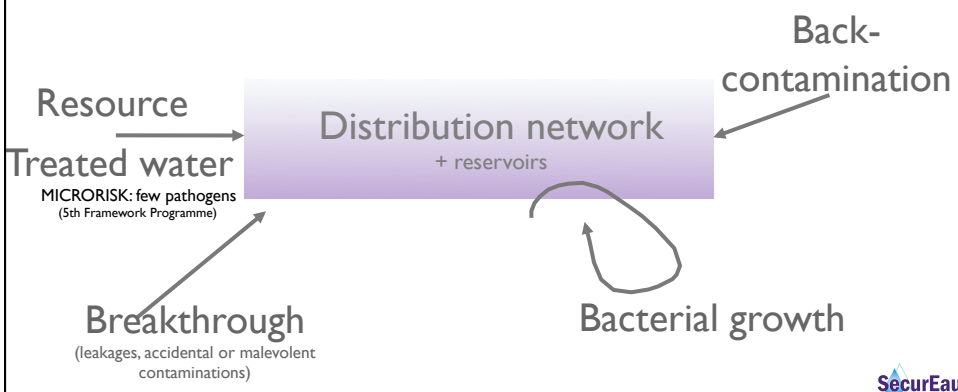
Vulnerabilities of the network



Some SecurEau answers

- New sensors
  - RN specific and non specific sensors (water phase)
  - Biofilm sensors
- Sentinel coupons (fixed phase)
- Mathematical modelling
  - Optimal sensors positioning
  - Optimal sentinel coupons positioning

Water

- Multi-parameter sensors
- RN specific sensors
- Sanitary conformity agreement
- Autonomy (1 year)
- Fully wireless (batteries and communication)

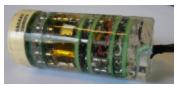
- Endetec (VERI)

  Pression, conductivité, Cl_2, T°

  Matière organique (UV)

- CEA

  Radionucléides



Water

- Commercial products
- Remote calibration
- Easy to install without stopping the water distribution

Early detection of any abnormal change of the water quality

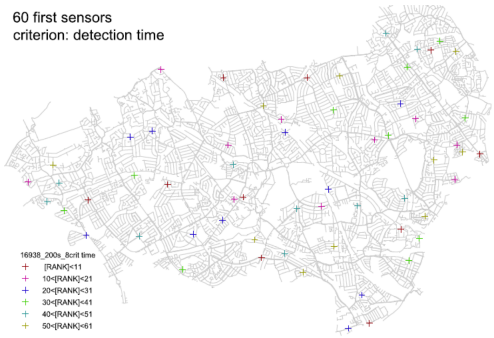
Kapta™ 3000 AC4 specifications (commercial product)

Parameter	Range	Resolution	Fidelity	Maintenance	Precision	Response time
Active chlorine	0–2.5 mg/L	0.01	± 5%	The multi-parameter probe should be replaced once a year.	± 10%	<30 s
Conductivity (µS/cm)	100–1,000	1	± 5%		± 5%	Not reported
Pressure	1–10 bars	1 mbar	± 2%		± 10%	Not reported
Temperature	0–40°C	0.1°C	± 5%		± 5%	<15 s/°C

Kapta™ 3000 OT3 specifications (pre-industrialization)

Parameter	Range	Resolution	Fidelity	Maintenance	Precision	Response time
Organic matter TOC equivalent	0.1-10 mgC/L	0.1 mgC/L	± 5%	The multi-parameter probe should be replaced once a year.	± 10%	<6 s
UV absorbance (254 nm)	0.01-0.3 AU/cm	0.01 UA/cm	± 5%	dito	± 10%	<6 s
Turbidity equivalent	2-50 NTU	1 NTU	*Not evaluated*	dito	*Not evaluated*	<6 s

Optimal location of water quality sensors



- 60 sensors
- If contamination :
  - Average time for detection: 3.5 h
  - 1.5 ‰ volume not detected
  - 3‰ population in danger

Optimal location of water quality sensors

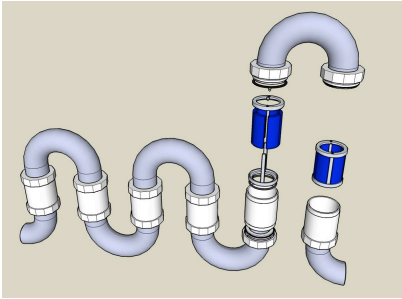
Mathematical treatment	Availability	Work to be done for the models to be used in other distribution systems	Status
Generation of contamination events by a Monte Carlo process, to train the model	C source code + executable + link with the Epanet DLL (***)	Need an INP (**) file for the network model and the accurate hydraulics	The software is free of charge. No access right for the source code. Contact: Irstea
Formulation of a multi-stage INLP (*) problem	Executable available	Need the generation of contamination events described previously	The software is free of charge. No access right for the source code. Contact: Irstea

* INLP Integer Non-Linear Programming ---- ** INP is an Epanet ASCII format file ---- *** DLL Dynamic Link Library

Sentinel coupons
(application : surface)

Wall

- Characterisation of the deposits on the coupons
- Identification (of the sorbed contaminant)
- Evaluation of the efficacy of the decontamination methods



IWW

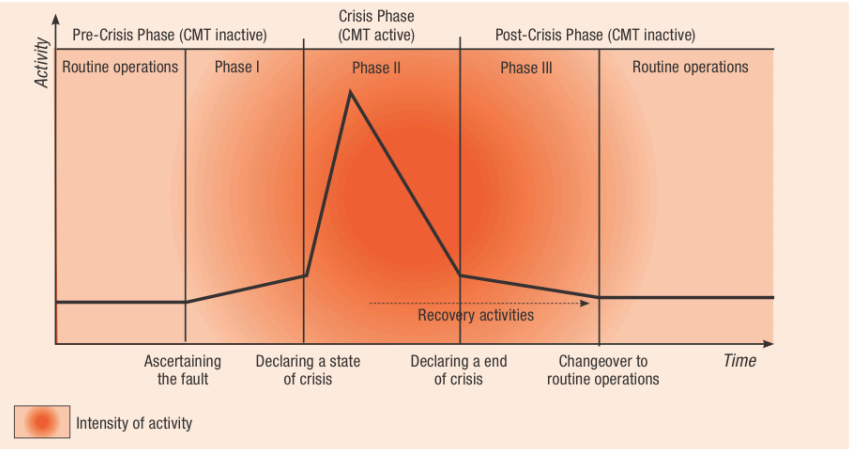
To be installed proactively

Optimal location of sentinel coupons

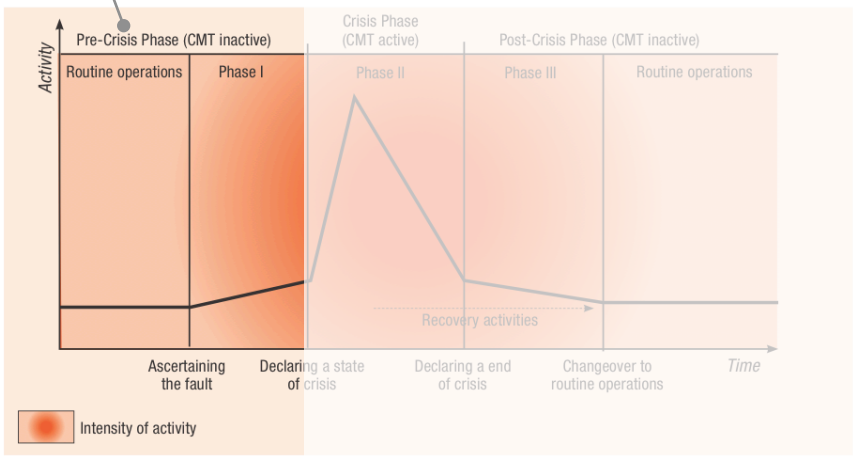
Mathematical treatment	Availability	Work to be done for the models to be used in other distribution systems	Status
ILP (*) formulation that is a maximum coverage problem	A C- code preparing the objective and constraint description ready to use with GLPK (***)	Need an INP (**) file for the network model (network topology) and the accurate hydraulics (node demand calibrated)	The software is free of charge. No access right for the source code. Contact: Irstea

* ILP Integer Linear Programming
** INP is an Epanet ASCII format file
*** GLPK Gnu Linear Programming Kit

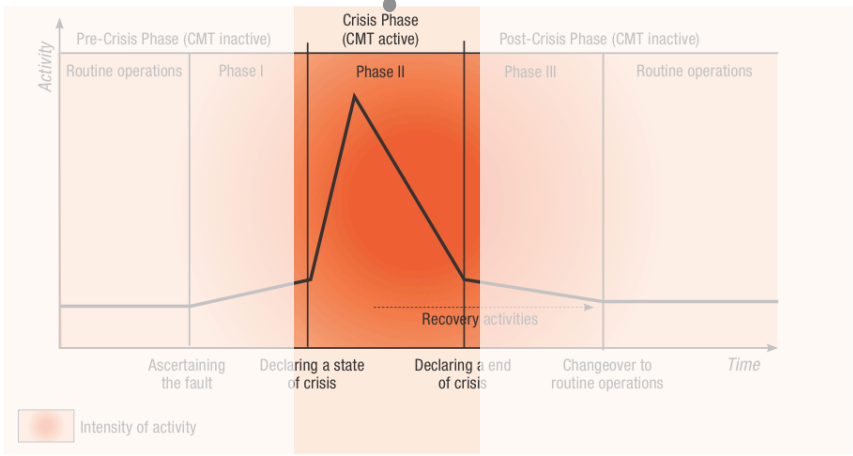
Crisis management (ISO 11830)



Earlier detection of any « abnormal event »
(network equipment: **sensors**, optimal **positioning**…)



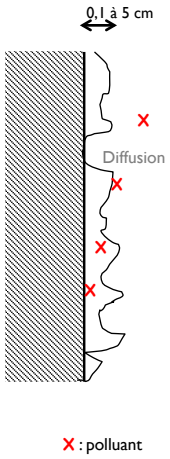
Definition of the contaminated zone
Determination of the contamination source
Analyses
Decontamination techniques



Decontamination…

Wall

- Wall: contaminants attachement / sorption => difficult decontamination



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Decontamination procedures

Wall

- Flush – Mix air + water
- Cavitation
- Ice/stone pigging

- Chlorine shock
- Complexants
- Alternation NaOCl – NaOH – NaOCl (99% spores)
- Heterogeneous Fenton Fe + H_2O_2, 1 hour (100%) (organic compounds)

- UL
- VERI
- IWW
- UPORTO
- RTU
- STUK
- THL

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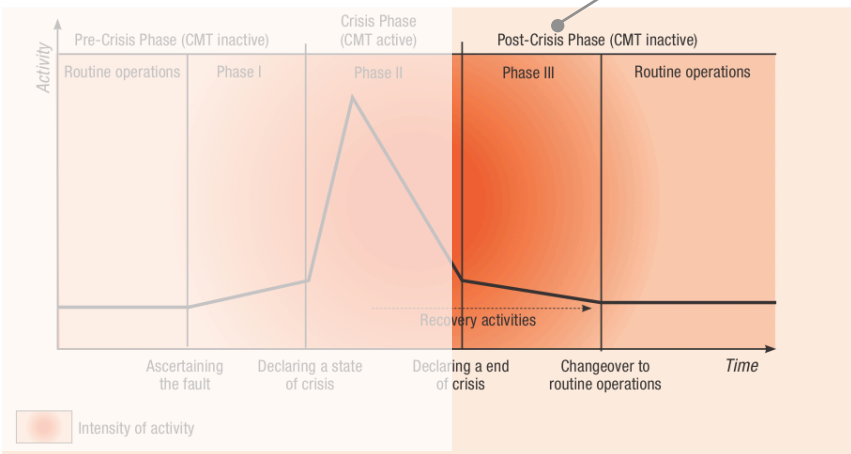
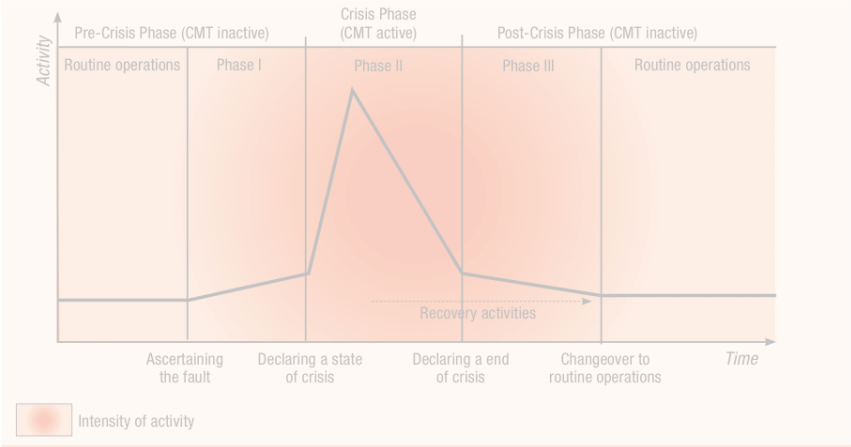
Assessment of the cleaning : if OK, routine operations



Most of data obtained and solutions to problems are applicable to everyday life of practitioners, not just for an attack



Conclusion

- Sensors (water) and sentinel coupons (walls)
- Models (optimal positionning – contamincation source – contaminated zone)
- Cleaning strategy (combination of cleaning methods)
- Most of data obtained and solutions to problems are applicable to **everyday life of practitioners**, not just for an attack

Latest news

- Real scale test in France (Francophonie games, Nice, 2013) and in UK (Olympic games, 2012)
- 800 sensors sold in 16 countries (Sept 2014)
- Abandonment for the RN sensor (no market at time)

- **http://www.secureau.eu**

- Public Deliverables
- Participants contacts