

# Telediagnosis: a new concept for rapid assessment of accidental or intentional water resource contamination

**Estelle Baurès**

**Bertrand Vergne, Benoît Roig, Olivier Thomas**

- **NWQMC, 8TH NATIONAL MONITORING CONFERENCE** -

- **APRIL 30, MAY 4, 2012, PORTLAND OR** -

## EHESP

- Provides initial training for public sector managers and inspectors in the health and welfare services (e.g. hospital director)
- Provides higher education in public health, in close partnership with other institutions

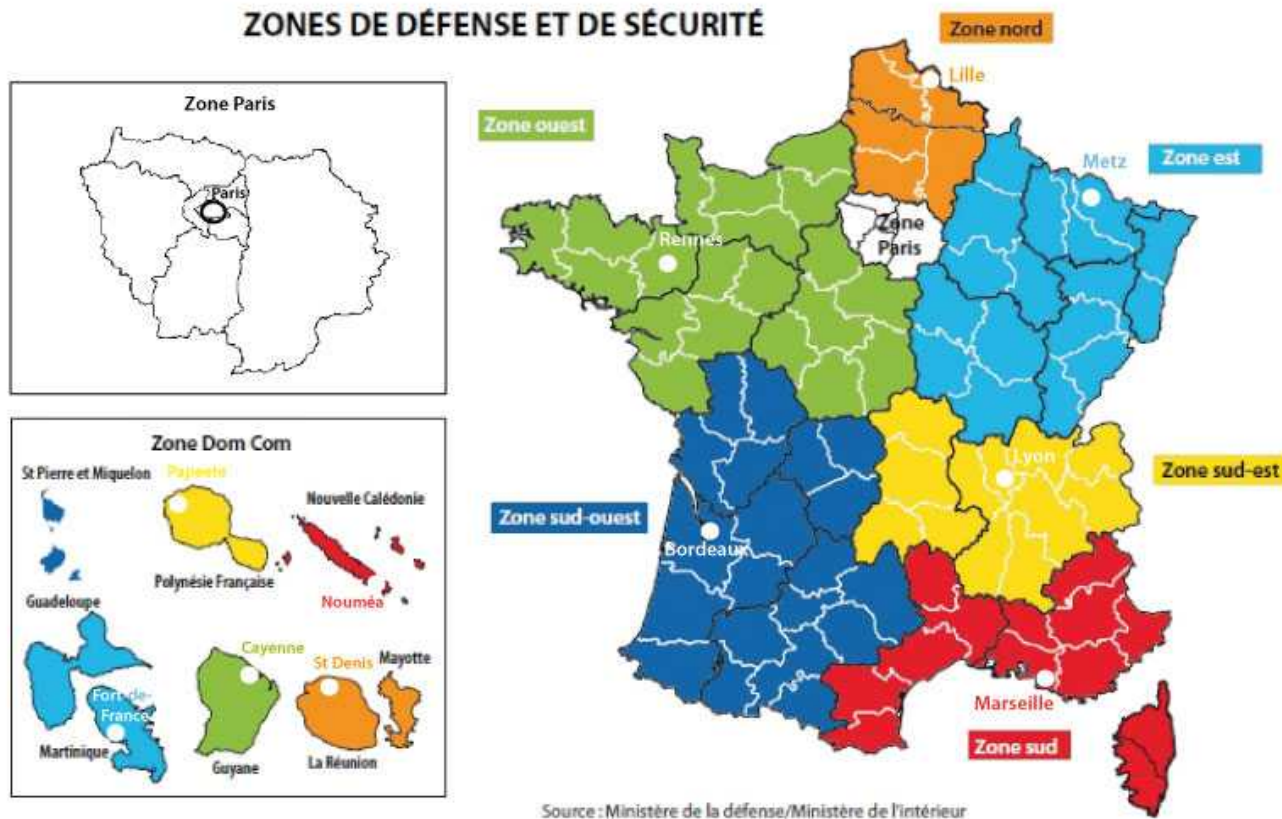
## LERES

- Approved for the sanitary control of water and effluents by Ministries of Health and Env.
- Research : Physico-chemistry, microbiology, micropollutants, biodiagnosis
  - Analysis in laboratory, sampling and in-situ measurement
  - Water & Indoor environment (air and dust)

## IRSET

- 250 p. devoted to environmental and occupational health
- LERES is the main research & technology plat form of IRSET

## A special mission in the «Biotox-water» network: laboratory of the french west defense area



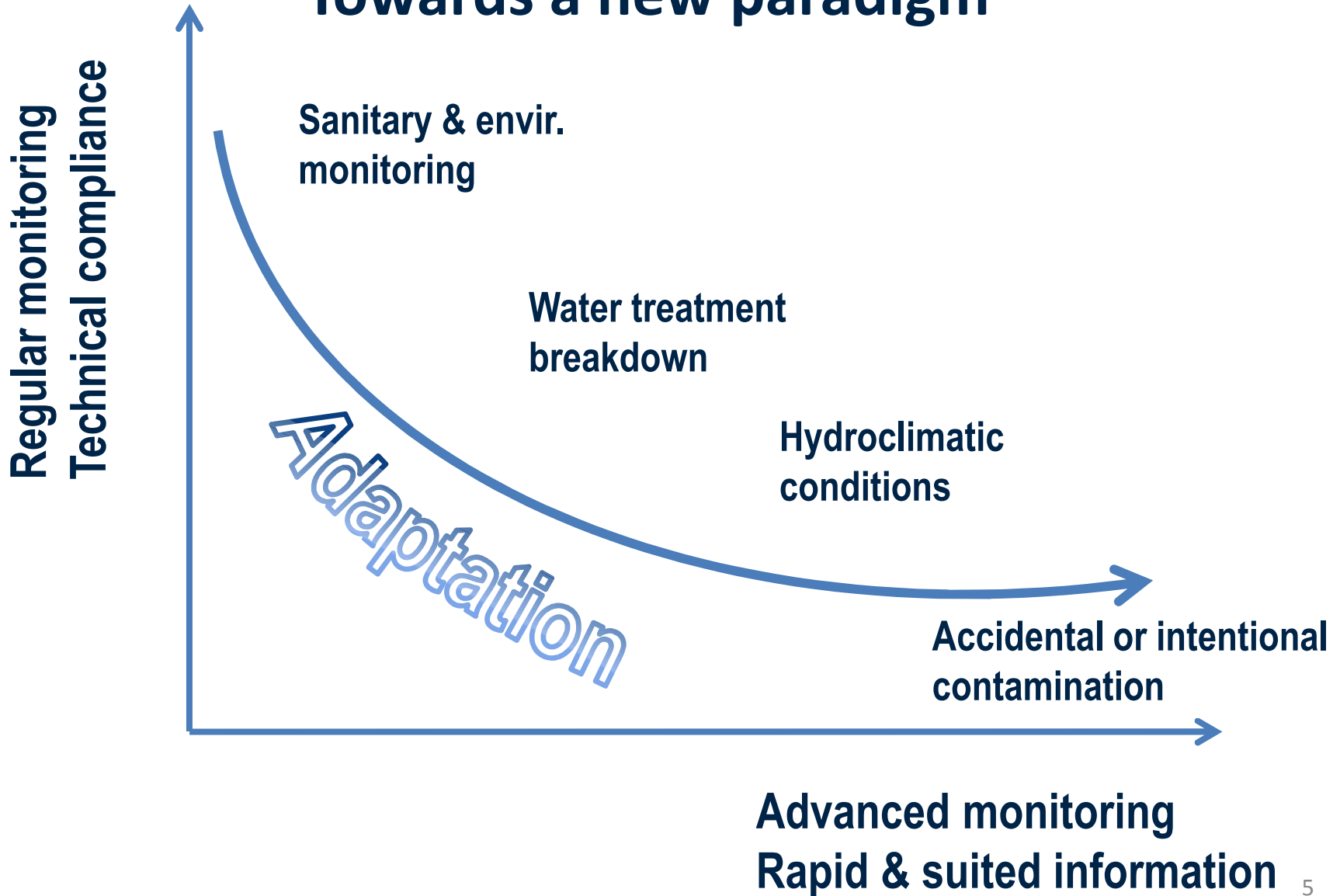
→ Accidental or intentional contamination: from source to distribution

# WQ monitoring / intentional or accidental contamination?

- Sampling and laboratory analysis? => delay
- Remote sensing? => limited
- On site measurement? => delay/limited

→ Needs for technical adaptation

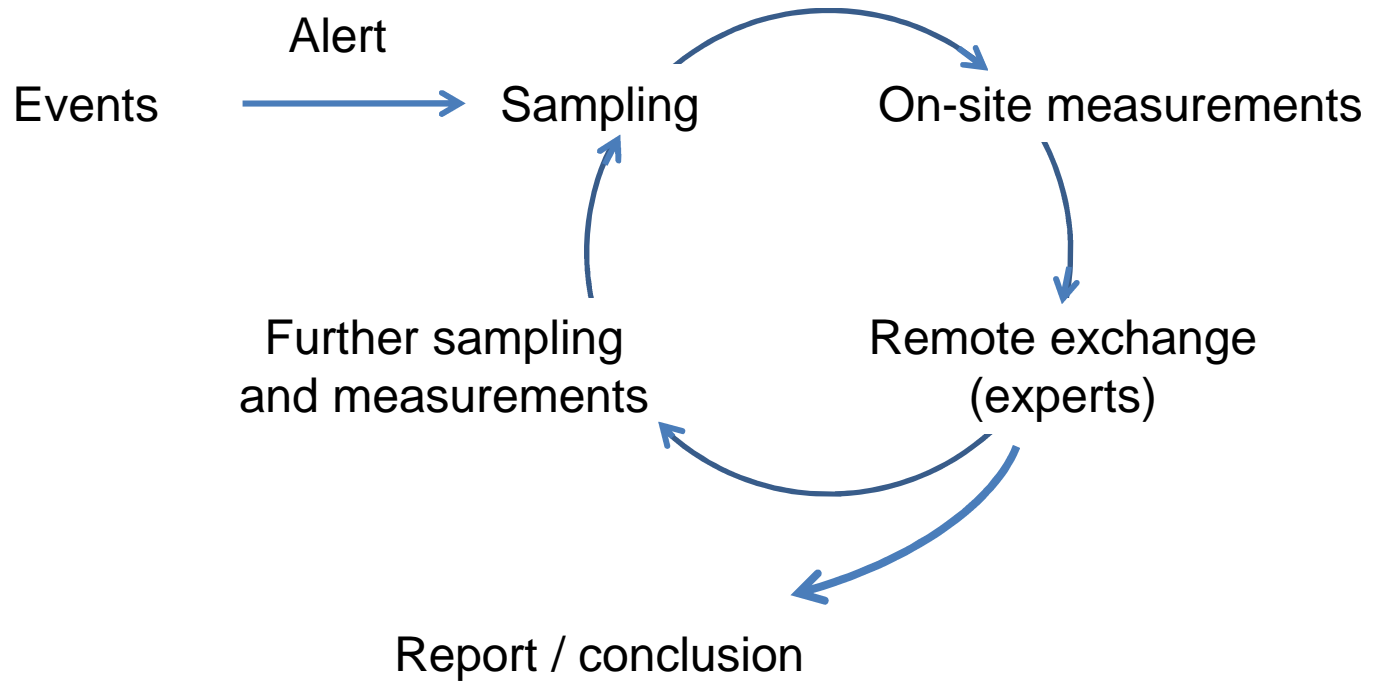
## Towards a new paradigm



# Accidental or intentional contamination

- **Several scenarios considering**
    - Pollutant nature (known or unknown)
    - Location contamination (source, treatment, storage, distribution)
  
  - **Rapid decision and action are required**
    - To preserve the integrity of the resource
    - To ensure the pollutants detection
    - To maintain the efficiency of the treatment systems
- To manage the risk to deliver a contaminated water to the population**

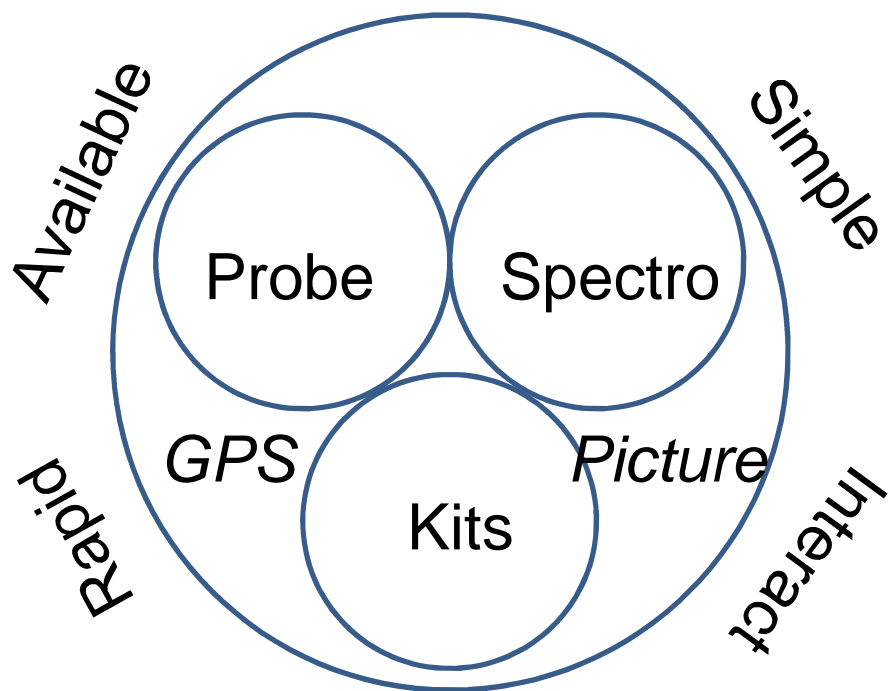
# Operational concept Telediagnosis





## Technical concept


# Measurement and communication system (MCS)





# MCS characteristics



- Optical component: UV and fluorescence spectro.
  - Organic compounds (substances family with chromophoric group), 95% of contamination
- Multiparameters probe 
  - Physico-chemical parameters (pH, conductivity, turbidity, dissolved O<sub>2</sub>, redox potential)
- Colorimetric kits (strips)
  - Rapid and easy to use / to complete the previous analysis
- Digital camera with GPS
  - Contamination and sampling points geo-location

# Telediagnosis implementation - 1

## 1- Spillage – known substance – visible discharge

Truck, tank or container presence near a water resource

- volume and duration of discharge known :
- relevant sampling point
- assessment of contamination
- diagnosis confirmed by the MCS: rapid decision

## 2- Intentional contamination suspected – non visible discharge

Water tower breaking

- use of MCS all components (UV-fluo, probe, ...)
- optimization of the sampling points choice
- research of contaminant(s)

## Telediagnosis implementation - 2

### 3- Water quality damaged with physical or biological signs

Contamination source unknown and non-visible

→ use of MCS all components (UV-fluo, probe, ...)

→ first diagnosis of contaminant nature/ find a probable source

- unusual UV spectra = organic pollution
- high conductivity = mineral pollution
- high turbidity = biological pollution

→ **Concept of telediagnosis test and validation during several field exercises by implementing MCS**

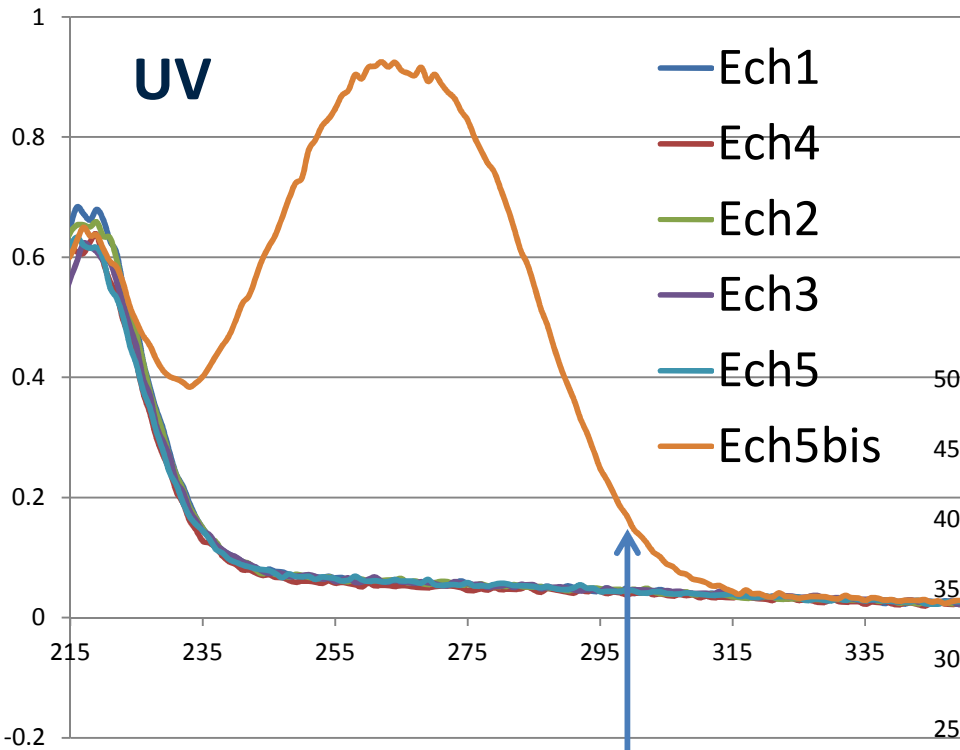


## 2010 field exercise in Brittany - France

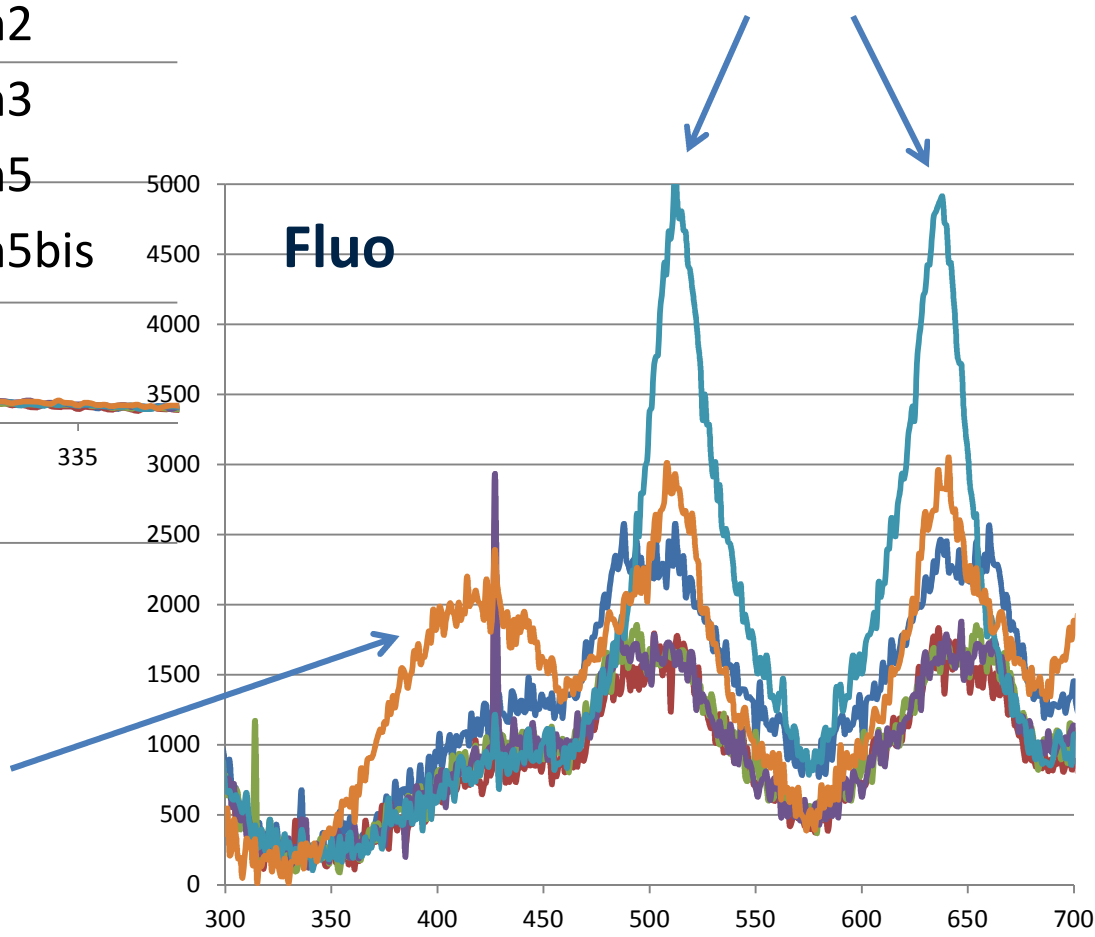
River contamination  
upstream of drinking  
water treatment plant



# UV and fluorescence monitoring and detection



**Detection of a sample contamination (acetone)**







**2011 field exercise  
« train crash »  
in a french railway  
station**



# Intervention of the surveillance team



Suspected  
contamination

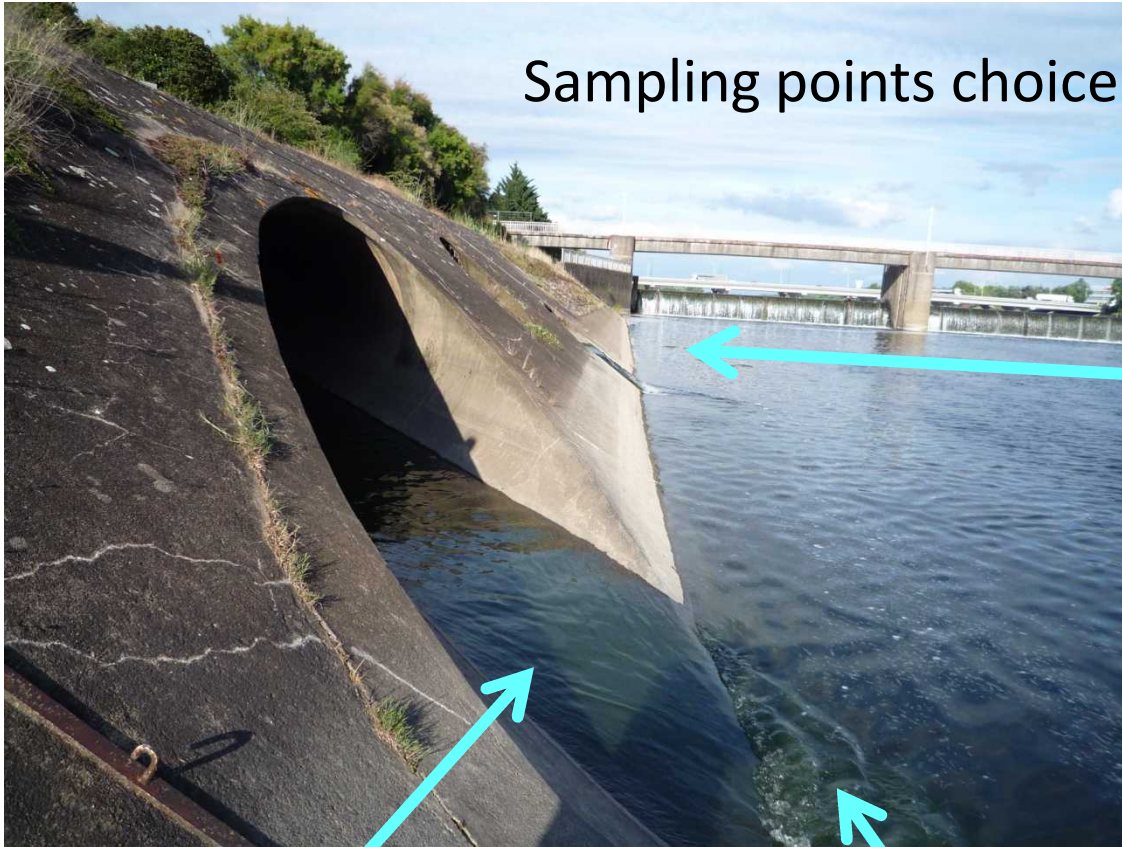
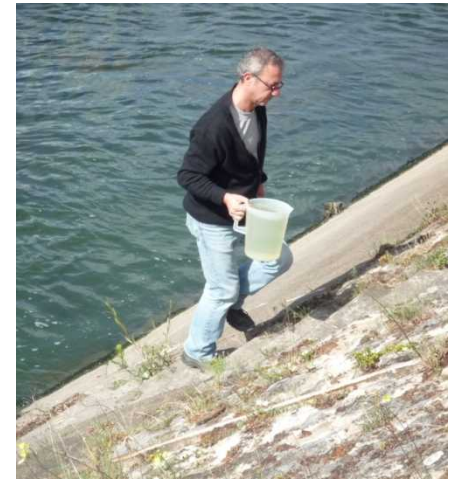


On-site  
measurements





# Sampling optimization



Sampling points choice

**Point 2**

In upstream  
for a differential diagnosis

**Point 3**

Confirm the pollution source

**Point 1**

Pollution suspected

# Remote exchanges

Quickly exchanges between field operators and experts in laboratory

Sample	On-site measurement	Data receipt	Intermediate report delivery
Point 1	9h57	10h01	10h14
Point 2	10h16	10h22	10h35
Point 3	11h02	11h05	Final report

Quickly data exploitation diagnosis delivery by the experts in laboratory

**Innovative and original tool by telediagnosis (remote assess)**

# Conclusion

- **Telediagnosis**

- Measure water quality characteristic parameters
- Quickly access to a relevant information on-site during an alert
- Establish a first diagnosis of contamination: presence & nature
- ***Remote exchanges with expert(s)***

- **MCS**

- Brings advantages in term of cost and rapidity
- Is not dedicated to replace conventional methods
- Accelerate the process of contamination identification for a more rapid decision making
- → ***Complementary system***
- → ***Inovative tool***

# Thank you !

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## Contacts

<http://leres.ehesp.fr/>  
[estelle.baures@ehesp.fr](mailto:estelle.baures@ehesp.fr)

[www.hocer.com](http://www.hocer.com)  
[bertrand.vergne@hocer.com](mailto:bertrand.vergne@hocer.com)

# Substances détectables

<b>Familles de substances détectables</b>	<b>Limite de détectabilité pour une abs. de 0,05 u.a. (mg/L)</b>
Aldéhydes et cétones	25 - 500
Sauf acétone	< 0,5
Amines et substances dérivées	0,2 – 2,0
Benzène et substances dérivées	0,2 – 2,0
Phtalates	0,2 – 5,0
Phénols et substances dérivées	0,2 – 2,0
Détergents	0,2 – 5,0
Pesticides	0,2 – 10,0
Hydrocarbures aromatiques polycycliques	0,1 – 0,5
Composés inorganiques	0,2 – 50,0