

### Measurement chain of Heavy Metals: A generic micro-system for implementation of the European Water Framework Directive

*Develop and validate a new analytical compact concept, integrating all the analytical chain, since the sampling and treatment of water sample until data transmission, including its detection and quantification*

**Continuous monitoring of the four WFD/2000 priority metals in water bodies**  
**Cd < 0,08 µg/L ; Hg < 0,05 µg/L ; Ni < 20 µg/L ; Pb < 7,2 µg/L**

### INTEGREAU's objectives 2007- 2011

- **Demonstrate** the feasibility of a generic micro-system, integrating a micro fluidic for sample filtration and concentration with a micro-detection module (Cd, Hg, Ni and Pb)
- **Define** in situ qualification methodology for the micro-system
- **illustrate** the INTEGREAU's concept validity, taking metal models: Cd, Hg, Ni & Pb (WFD/2000)

### Electrocatalytic Mineralization + Micro-fluidic Concentration + Electrochemical Detection (ASV) Lab-on-a-chip for heavy metal assessment in water

Water Sample

Filtration Mineralization

Extraction Concentration

Detection BDD

Data processing

#### Extractive concentration of dissolved metals

Flat microfluidic structure, with silanized silicon micro-pillars and fluidic stabilization of the double immiscible flow

#### Anodic stripping voltammetry on BDD micro-cell

Intensity (µA) vs Potential (V) Voltammogram on thin film of BDD (Cd, Ni, Pb, Hg = 45 nM)

	Our results	WFD EQS-MAC
Cd	0,04	0,08 (class 1)
Pb	1,1	7,2 (EQS-AA)
Ni	0,40	20 (EQS-AA)
Hg	0,5	0,07

Table 1 shows detection limits obtained (µg/L) with our BDD micro-cell, and the Environmental Quality Standards (EQS) expressed as a maximum allowable concentration (EQS-MAC) or as annual average value (EQS-AA) for priority substances in surface water, according Water Framework Directive (WFD).  
 Detection limits of our micro-cell allows determination cadmium, nickel and lead, with a sensitivity suitable for concentration levels required by WFD. Only detection limit for mercury is too high.  
 Our microfluidic module for sample concentration will allow to reach the detection limit required.

**Next step: validation in an experimental flume (OTHU) of modules put together, then our microsystem will be designed for various pollutants**

**Expected result: a lab-on -chip for continuous monitoring of dissolved priority metals, applicable to other micro-organic or mineral pollutants**

### INTEGREAU's Partners

