MASS BALANCE OF PESTICIDES AT BRÉVILLES

RIVER BASIN MANAGEMENT ISSUE

Water Quantity						Water Quality		Alterations		Others
1	2	3	4	5	6	7	8	9	10	
C										

(1) Diffuse pollution by agriculture
(2) Salinisation
(3) Contaminated sediment and floodplain soils
(4) Large scale pollution due to past mining / industries activities
(5) Pollution by organic matter
(6) Emerging compounds
(7) Water scarcity
(8) Floods and low flow
(9) Hydromorphological alterations
(10) Soil erosion

C = System Characterisation
T = System Trend
M = System Monitoring
R = System Remediation, Mitigation

RIVER BASIN

Danube	Ebro	Meuse	Elbe	Brévilles	Others
	.			✓ - Spec	

Spec. : Results specific to selected River Basin

KEY FINDING TYPE

Understanding Processes (lab-scale)	Characterisation (field scale)	Modelling
	✓	

BENEFITS TO END-USERS

Technical		Management	Policy	
WFD Implementation	Research	River Basin	Compliance	Policy making
	✓			

INTRODUCTION

The objectives of FLUX 1 are to quantify solute fluxes in the soil-groundwater system including mass transfer from and into the atmosphere. This is carried out at the local and at catchment scale. Contaminants such as Persistent Organic Pollutants (POPs) and pesticides were monitored.

KEY ISSUES

Pesticides mass balance results were obtained for the Brévilles catchment, which is an agricultural area. Therefore, these results address the river basin management issue associated with *Diffuse pollution by agriculture*.

Results and data obtained in FLUX 1 about pesticides mass balance are mainly related to the system characterisation and more specifically related to the understanding of transfer of pesticides from the soil to the spring, the outlet of the catchment. It is important to note that these results are site-specific but useful to understand the pesticides transfer and trend in other hydrogeologic systems.

- ***System characterisation***: Quantities of pesticides applied by farmers at Brévilles and date of application are well known thanks to enquiries. Hundred of pesticides were applied at the Brévilles site but 2 molecules have specific interest: atrazine was applied up to 2000 and acetochlor from 2000, acetochlor being the molecule suggested as a substitution molecule for atrazine. The measurements of pesticides in soil, unsaturated zone and

groundwater enabled to improve the understanding of transfer of such contaminants:

- Atrazine: Atrazine is still present in groundwater (collected in several piezometers) and in the spring water, 9 years after the last application. These measurements coupled with flow measurements at the spring enable to quantify the flux of atrazine at the spring. The time series of atrazine suggested that Atrazine will be present at the spring for the coming years due to a slow response of the hydrogeologic system (long transfer time of water, retardation factor for pesticide compared to water, release from soil and/or unsaturated zone,…).
- Acetochlor and metabolites: The leaching of acetochlor and its two main metabolites deeper than the surface soil was demonstrated previously to Aquaterra project but these compounds have not been detected in groundwater and at the spring to date. The absence of pesticide detection can be explained by the following scenarios (listed from the most probable scenario to the less probable scenario):
  - Transfer time longer than the duration of the monitoring
  - Important dilution leading to concentrations lower than the quantification limit
  - Pesticides are adsorbed and retarded on the soil matrix and/or the unsaturated zone
  - Pesticides biodegrade to metabolites which are note expected and therefore not analysed for.
  - Pesticides leave the basin through another pathways (e.g. volatilisation)

Key parameters to quantify and understand fluxes include chemical parameters such as volatilisation, sorption and degradation rate.

RECOMMENDATIONS

Recommendations deriving from FLUXES 1 join the ones suggested in HYDRO 2 and BASIN 1. In particular, the evidence of slow transfer of pesticide in the continuum soil – unsaturated zone – aquifer acts in favour of a long term ***monitoring*** of groundwater quality, a follow up of pesticide leaching in the soil and additional research work in the fields of (bio)chemical knowledge of pesticide molecules.