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Susanne Schomburgk, Hubert Leprond

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TECHNICAL FACT SHEETS ON THE RELEVANCE OF INDUSTRIAL GROUNDWATER MONITORING NETWORK: A TOOL FOR PRIORITY ACTIONS AND POLLUTION MANAGEMENT

S. Schomburgk⁽¹⁾ and H. Leprond⁽²⁾

(1) BRGM, 3, av. C. Guillemin, 45060 Orléans Cedex 2, France. S.Schomburgk@brgm.fr

(2) BRGM, 3, av. C. Guillemin, 45060 Orléans Cedex 2, France. H.Leprond@brgm.fr

ABSTRACT

The French Mediterranean coastline with a length of 1000 km includes about 120 environmentally-sensitive industrial facilities. More than a half of these facilities are responsible for soil or groundwater contamination; with a groundwater monitoring network of nearly 1000 points, a high quality monitoring should be expected.

The water department of the French geological survey (BRGM) supports the local authorities to control groundwater quality in environmentally-sensitive facilities, supervised by the French regional directorate for environment. A global perspective on good chemical status can only be obtained if monitoring is based on the local environment and the expected contamination.

The BRGM developed a technical fact sheet on the relevance of the industrial groundwater monitoring network, designed for the regional authorities to define further priority actions with environmentally-sensitive facilities.

A fact sheet presents environmental information in a standardised manner: industrial background information, local hydrogeology, and the availability of analyses data as well as the cartography of the monitoring network distribution. The relevance of specific groundwater monitoring network is given as well as the adequacy of the monitoring frequency and the prescribed substances. Data statistics enable to highlight missing data or a lack of available data.

The crossed viewpoints of hydrogeology and contaminated sites provide fact sheets with an indicator of monitoring relevance, quality and comprehensiveness, to define further priority actions. They can also provide inputs for the environmental monitoring that is required for any new facility applying for a permit. A majority of test facilities presented lacks of monitoring in terms of evaluation of contamination extension and evolution, responsible for organic micro-pollutants close to drinking water supplies.

Key words : environmentally-sensitive industrial facilities, industrial groundwater monitoring, contamination extension, organic micro-pollutants

1. INTRODUCTION

Contamination of groundwater bodies by environmentally-sensitive industrial facilities is one of the principal causes of degradation of water resources close to industrial areas. This phenomenon is a major drawback for water use for drinking water supply in regions where water quality degradation superpose to a general quantitative limitation of freshwater availability, notably in coastal aquifers.

A national wide project has been undertaken in 2007 for the French Ministry in charge of the environment, permitting to better control groundwater quality in environmentally-sensitive facilities (*Koch-Mathian and Chery, 2013*). The types of contamination are diverse and complex situations with multiple substances from different facilities are frequently encountered.

The water department of the French geological survey (Bureau de recherche géologique et minière, BRGM) supports the local authorities with advices, local studies and tools in order to control groundwater quality in environmentally-sensitive facilities. Environmental permits (Prefectoral order in France) for which the industrial facility has to apply (under the IPPC

directive), regulate the industrial groundwater monitoring network, the frequency and the list of substances and types of analyses (supervised by the French regional directorate for environment, DREAL). Nevertheless, a frequent supervision is asked by the numerous analyses reports. To take into account a global perspective on groundwater good chemical status, we need to answer the question: Is the actual monitoring based on the environment and the present or former contamination? In order to find an efficient answer to this question, the DREAL of Alsace and the BRGM water division decided to develop a technical fact sheet on the relevance of industrial groundwater monitoring network.

2. STATE OF GROUNDWATER MONITORING AND INDUSTRIAL CONTAMINATION ON THE FRENCH MEDITERRANEAN COASTLINE

The Mediterranean coastline with a length of 1000 km includes about 120 environmentally-sensitive facilities in a coastal width of 10 km; more than half of these facilities are known for soil or groundwater pollution. With a groundwater monitoring network of nearly 1000 points, a high quality monitoring should be expected.

Figure 1 is based on recent data (2006-2016) on the water quality in environmentally-sensitive facilities, extracted from the national groundwater database ADES (<http://www.ades.eaufrance.fr>) and integrated in a GIS. For a better presentation of monitoring of the presented zone, a classification of facilities was undertaken based on the number of observation points and the presence of chlorinated volatile organic compounds (CVOC, concentrations above 3 microg/L).

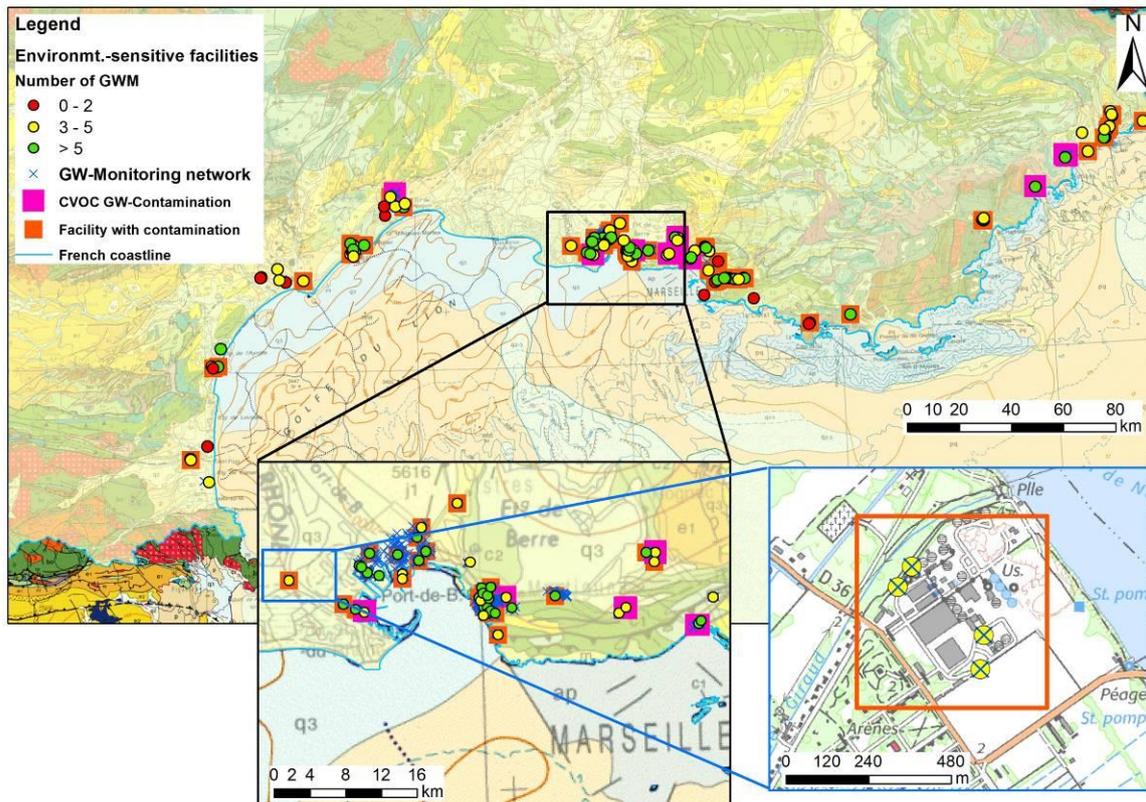


Figure 1: Groundwater monitoring of environmentally-sensitive facilities on the French Mediterranean coastline and facilities with contamination, i.e. chlorinated volatile organic compounds (CVOC)

The first statistical analysis demonstrates that more than 15 % of the facilities present less than the minimum of 3 monitoring wells on their site according to groundwater monitoring standards. The national data base shows for half of the monitoring wells very few analyses, more than 80 % of the monitoring wells indicate a frequency of 1 analysis per year.

3. TECHNICAL FACT SHEETS ON THE RELEVANCE OF INDUSTRIAL GROUNDWATER MONITORING NETWORK

The technical fact sheets have been established with environmentally-sensitive facilities of different environments and monitoring networks in the Alsace region (*Schomburgk S., 2016*). They gather environmental information including industrial background information, local hydrogeology, environmental issues and the availability of analyses data as well as the cartography of the monitoring network distribution. Long term monitoring with an appropriate monitoring network highlight the evolution of contamination in space and time by means of the national groundwater database supplying water quality data of various data providers in France.

This data gathering enables the view on:

- the relevance of the specific groundwater monitoring network like the well depth, its screened portion in comparison with the local aquifer system, the position of the observation well with respect to the local groundwater flow direction, often influenced by pumping stations or changing surface water levels;
- the adequacy of the actual monitoring frequency, in order to represent high and low groundwater levels and its chemical evolution according to the density and the solubility of pollutants;
- the adequacy of the interpretation of water quality evolution in relation with natural and anthropic impacts like groundwater recharge, its changing level and pumping;
- the adequacy of the actual prescribed substances with the facility activities and possible related pollutants.

Data statistics of monitored substances and their frequency highlight on more than half of the investigated facilities that data was missing or that there was a lack of data which should be available by the facility due to the prescriptions of the DREAL (*Blanc et al. 2014*).

For a large number of investigated facilities, the monitoring network was not sufficient in terms of screening depth, number of observation wells and their position downstream of potential contamination flags.

The fact sheet (Figure 2) permitted also to highlight the sites for which the local authorities needed to actualise the prescription in order to be in consistency with the new standards of well installation (*Lemière et al. (2001), Guerin and Quiot (2016)*).

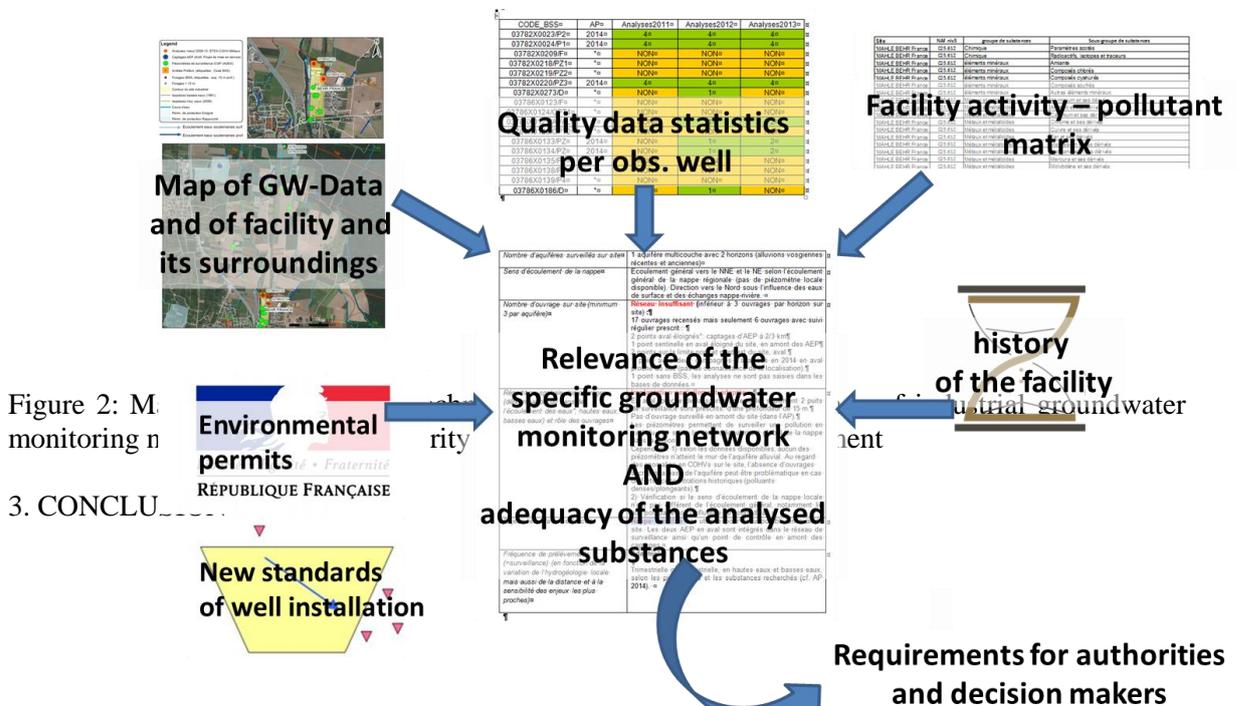


Figure 2: Monitoring network adequacy

The crossed viewpoints of hydrogeology and contaminated sites provide fact sheets with an indicator of monitoring relevance, quality and comprehensiveness. It is designed for the regional authorities to define further priority actions in collaboration with the environmentally-sensitive facilities in terms of new environmental permits and to prioritize the monitoring of environmentally-sensitive facilities with environmental issues.

The fact sheets of the test facilities in the Alsace region showed a high interest for the decision makers and the investigation is ongoing in 2017. In regions where water quality degradation superposes to a general quantitative limitation of freshwater availability, notably in coastal aquifers, this fact sheet evaluation can be a tool for priority actions and pollution management.

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