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Collaborative trial on groundwater sampling

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Introduction

The quality of data acquired through environmental monitoring programs (including those of the European Water Framework Directive) is a major challenge for reliable decisions to be taken to achieve good chemical and ecological status of water bodies. The acquisition of environmental data includes most of the time a step of collecting a representative grab sample of the studied water body. This crucial step of the analytical chain strongly influences the quality of the final result.

In laboratories, intercomparison exercises are widely used and are effective tools that enable participants to evaluate their performance. They also provide an estimate for a group of laboratories, of the variability of results that can be expected for the analyze of a single sample. This type of testing is rare or nonexistent so far for sampling activities.

Key Words: collaborative trial; sampling; groundwater ; quality ;

Presentation of the trial

The trial presented here was conducted by BRGM in collaboration with LNE under the work program AQUAREF 2009 with the support of ONEMA. This is a collaborative trial on groundwater sampling and on field physico chemical measurement. It is not a proficiency test. He had three goals:

- Observe and evaluate the practices of groundwater sampling to improve future guides, standards and specifications.
- Assess the impact of sampling on variability of results.
- Study the accuracy of field measurements (pH, conductivity, dissolved oxygen, temperature).

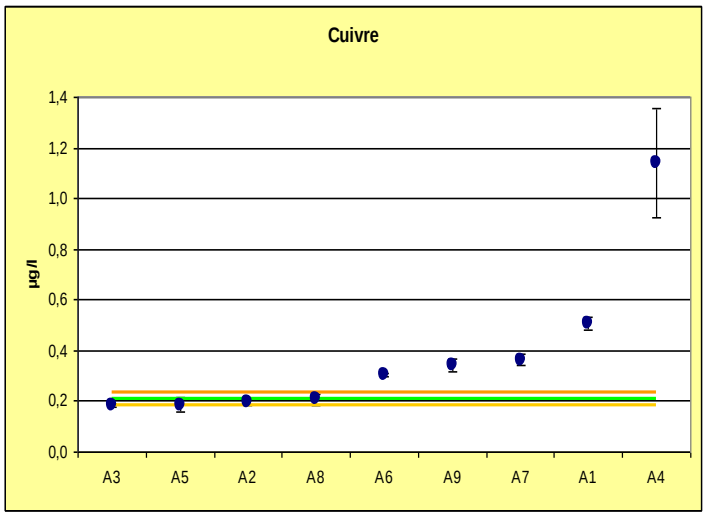
This test took place from 22 to 26 June 2009. It took place on a piezometer located in the city of La Chapelle Saint Luc in the suburbs of Troyes. During the week of the trial, 9 teams of samplers (laboratories and offices), selected first among regular samplers working with water agencies and among members of the national working group on sampling, conducted sampling during half a day according to their usual procedure (duplicate samples to analyze well defined chemical parameters). The samples were then given to BRGM for analysis (except analysis of volatile organic compounds at IPL). In parallel, LNE has tested the accuracy of the physico-chemical field measurements (pH, conductivity, dissolved oxygen, temperature).
Chemical parameters of the test are nitrates, six pesticides (atrazine, simazine, DIA, DEA, terbutylazine, deséthylterbutylazine), a volatile organic compound (Tetrachloroethylene) and fifteen trace elements (B, Ba, U, Cr, Zn, Cu, Al, Ni, Co, ...).

Discussion - Conclusion

The test has been discussed qualitatively and quantitatively. The quantitative aspect was approached through a questionnaire given to samplers and by the presence of observers on site during the test. Interesting information about the practices of sampling teams have been highlighted. They will be used to adapt national technical requirements for monitoring programs.
Regarding the quantitative aspect, the design of the test identified for each substance three types of variance: "analysis" (laboratory duplicate), "sampling" (sampling repeatability), "sampler" (Inter sampler effect). Most results show a main influence of “analysis” on the overall variability of results. Even for parameters often recognized as “difficult” regarding sampling conditions, such as volatile organic compounds, total observed variances are low (eg 7.6% for Tetrachloroethylene 2 ng / l).
Thus, under the conditions of this test (type of site, these samplers) the impact of sampling operations is small compared to the analytical variability.
The only parameters for which sampling effects are very large are some trace elements like Cu, Zn. For these elements, it is most likely contamination of samples that explain these results. However, it should be noted that these effects are observed for low concentrations measured at the site. The origins of these contaminations can be manifold (pipes, intermediate materials ...). The establishment of regular “field-blank” quality control seems essential to control in the future these problems of contamination.
It is proposed for this communication to describe the methodology used for this collaborative trial and to detail the qualitative and quantitative results that were obtained. The perspective for this type of test will also be discussed in terms of improving the overall quality of environmental measures.

References

Report available at : http://www.aquaref.fr/publications_prelevements



Participants results (A1-A9) for Copper