Contaminants mobility in dam sediments after dewatering

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BRGM, 3 av Claude Guillemin, BP 36009, 45060 Orléans Cedex 2

i.girardeau@brgm.fr

To achieve good status of rivers in 2015 (objective of the Water Framework Directive), the French Ministry of Environment has set up a national action plan to restore the ecological continuity of streams (MEEDDM, 2009). In this context, the French State has decided to dismantle two hydroelectric dams. Previous studies have shown that a part of the sediments behind the dam contains significant amounts of metals (Cr, Ni, Cd, Zn…) and cyanides. These contaminants are potentially related to a surface treatment plant located upstream in the watershed.

Sediments changes due to dewatering is an unknown process which has to be considered regarding to the leaching potential of contaminants present in the matrix. A study has thus been undertaken to describe and to characterize the effects of oxidation on the contaminants mobility contained in the future dewatered sediments. The study also aimed at providing recommendations for technical management measures during the demolition work. The study was performed in two steps. The first was to characterize the sediment and its pore water in its current state (under water in anoxic conditions). For this, sealed sediments cores were collected. Pore water was then sampled at different depth of the cores with soil moisture samplers. Analyses were conducted on water and on the corresponding solid.

The second step of the study was to characterize the contaminants mobility due to dewatering, by simulating "accelerated aging" in the laboratory. For this, aliquots of a representative sample of sediment were subjected to alternate cycles of wetting and drying. These cycles reproduce the natural conditions the sediments will meet once emerged (however with a higher frequency) (Piou, 2005).

Results confirm the presence of trace elements and cyanides in solids. Most of metal concentrations correlate well with total organic carbon. The speciation of contaminants is probably mainly controlled by organo-mineral complexes and sulfur species, which are relatively stable under reducing conditions but very unstable under oxidizing conditions. Moreover, the results obtained on pore water show a very low solubility of contaminants in sediments currently under water.

Experimental work shows that the contaminants mobility increased during oxidation. The solubility is particularly higher during the transition phase: changes from anoxic to oxic conditions. However, secondary phases able to fix metals appear quickly and therefore limit their leaching. A decrease in Kd parameter (distribution coefficient between liquid and solid phase) and an increase of the Cation Exchange Capacity for trace elements are observed.

Pending final results, the recommendations could be the following:

- During the erasing of the dams, the leachates may have to undergo a water treatment during the sediments stabilization phase under their new oxidizing conditions.

- It could be also recommended to conduct a downstream water monitoring to ensure the stability of the new system.

REFERENCES

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