Mitigating Geogenic Contamination in Drinking Water

This year, the interdisciplinary Eawag research team Water Resource Quality (WRQ) will release useful tools to help mitigate arsenic and fluoride contamination in drinking water. Annette Johnson and the WRQ team[1]

Groundwater has long been used for the provision of drinking water for urban and rural populations. The second half of the 20th century has seen a rapid growth in groundwater use since the introduction of mechanised pumping. Indeed, the Millennium Development Goal 7c, aiming to halve the number of people without access to safe drinking water by 2015, could not have been achieved in 2012 without its use. Even though groundwater can supply safe drinking water free from pathogens, its quality can be affected by natural or geogenic contaminants leached from the aquifer's rocks and sediments. Arsenic and fluoride pose the most serious health threat. To date, an estimated 200 million people worldwide, or roughly 5 % of those using groundwater for drinking, are known to be affected. With currently over half the world's population relying on groundwater as a drinking water source, and with increasing pressure on water resources, this number is likely to rise.

In poor urban and rural settings, the provision of drinking water free from geogenic contamination proves to be a real challenge. Provision of water from alternative sources, precluding the need to treat the water for geogenic contaminants, is a preferred option, both by government agencies and consumers, though treatment for microbial contamination may still be necessary. Such a policy can also make use of existing governance structures. However, water treatment for geogenic contaminants cannot be avoided in some cases. While centralised water treatment is cost-effective, both in terms of infrastructure, maintenance and staffing, it is not always feasible, particularly for rural communities.

The WRQ research project

Together with local partners, the transdisciplinary water research team "Water Resource Quality" (WRQ) at Eawag has worked on arsenic mitigation in Bangladesh and fluoride mitigation in the Ethiopian Rift Valley. It has developed tools for both regional assessments, i.e. location and extent of the contamination, and mitigation assessments. It provides potential contamination maps and webtools for users to develop their own maps, as well as practical guidance to water sampling and analysis presented in a manual targeting practitioners.

The mitigation framework consists of a set of tools to identify, plan and implement mitigation measures to combat geogenic contamination in drinking water (Fig. 1). Central to the framework is the integration of expertise from the social and natural sciences. The framework is divided into two parts that complement and interact with each other.

- Regional assessment and planning are essential steps to identify priority regions, the presence of possible alternative water resources, the regional risk of geogenic contamination of drinking water and even the possibility of alternative dietary sources. It is aimed at the needs of government agencies and international NGOs with trained staff or funds for consultants.
- On a local scale, where water treatment is being considered, it is necessary to assess the different options not only in technical terms, such as costs, efficiency, simplicity, electricity requirements, availability of materials and know-how etc., but also in terms of institutional support and local acceptance. Potential users are local authorities, NGOs and communities interested in solving their specific small-scale problem, e.g. a contaminated water supply in their town or village. Here the level of required detail is more crucial, and guidance for cost-effective and socially acceptable mitigation measures necessary.

The products

An important task of the project has been the development of modelling methods to predict areas with a high probability of groundwater contamination by arsenic or fluoride. We have developed an online geodatabase where users can visualise our arsenic and fluoride contamination maps, including a range of other data layers. Registered users will have the possibility to upload their own data to the system and generate probability maps of their region of interest (www.wrq.eawag.ch).

For more localised problems, useful information has been compiled on how to deal with geogenic contamination in a handbook for practitioners. It includes guidelines on water sampling, available treatment technologies and highlights the necessity of initiating behavioural change in affected communities. The manual will be available in digital format, including relevant weblinks and attached resources.

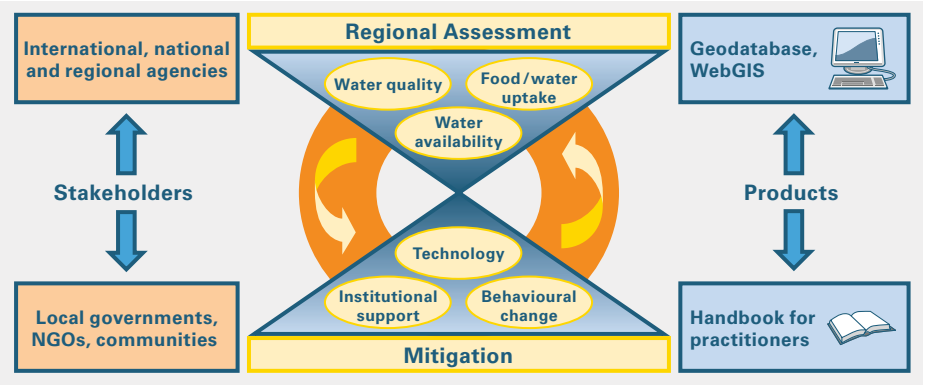

Figure 1: Elements of the mitigation framework.

[1] Eawag/W+T/Sandec/SIAM, Switzerland
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