Geophysical Research Abstracts
Vol. 15, EGU2013-11207, 2013
EGU General Assembly 2013

Mean Residence Time and Emergency Drinking Water Supply.

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Immediately after securing an endangered population, the first priority of aid workers following a disaster is the distribution of drinking water. Such emergency situations are reported from many parts of the world following regional chemical or nuclear pollution accidents, floods, droughts, rain-induced landslides, tsunami, and other extreme events. It is often difficult to organise a replacement water supply when regular water systems with short residence times are polluted, infiltrated or even flooded by natural or man-made disasters. They are either unusable or their restoration may take months or even years.
Groundwater resources, proven safe and protected by the geological environment, with long residence times and the necessary infrastructure for their exploitation, would provide populations with timeous replacement of vulnerable water supply systems and make rescue activities more rapid and effective. Such resources have to be identified and investigated, as a substitute for affected drinking water supplies thereby eliminating or reducing the impact of their failure following catastrophic events.
Even in many areas such water resources with long residence times in years or decades are difficult to find it should be known which water supply facilities in the region are matching these requirements to allow in emergency situation the transport of water in tankers to the affected regions to prevent epidemics, importing large quantities of bottled water. One should know the residence time of the water supply to have sufficient time to plan and install new safe water supply facilities.
Development of such policy and strategy for human security – both long term and short term – is therefore needed to decrease the vulnerability of populations threatened by extreme events and water supplies with short residence times. Generally: The longer the residence time of groundwater in the aquifer, the lower its vulnerability.
The most common and economic methods to estimate Mean Residence Times (MRTs) of the raw water of drinking water supplies is the measurement of the water-isotopes (oxygen-18, hydrogen-2 and tritium (3H)). The traceability and the quality oft he lumped model calculation is based on the quality and the density of input (meteorological) stations in the region with monthly measurements. In addition, noble gas measurements in the groundwater (helium-3, krypton-85) and of industrial tracer gases (chlorofluorocarbon (CFC) and sulphurhexaflorid (SF6)) are important tools to estimate the MRTs of the raw water in the aquifers.
To exclude the presence of small amounts of very recent waters, which are in cases of accidents some times heavily polluted, the raw water is tested for natural radionuclides (beryllium-7 or sulphur-35) with very short half-life or artificial fluorescence tracers.
In addition, the estimate of the MRTs of groundwater is an essential part of the vulnerability assessment of drinking water supplies due to climate change impacts (frequency of droughts and floods in the recharge area) and offers a valuable tool to specify a sustainable water abstraction.
The applicability of this approach was tested in several springs and groundwater monitoring wells used for raw water abstraction for drinking water supply in Austria.