Tracers
Policy Brief #6

Environmental tracers are natural and man-made substances present in the environment that are used to improve our understanding of groundwater resources. Tracer tools are indispensable in sustainable management of groundwater resources because they support decisions aimed at preserving abundant supply of good-quality groundwater.

Tracer tools supplement conventional methods of hydrogeological field investigations

Tracers provide knowledge of groundwater pathways and fluxes for a wide range of groundwater management problems. Even a limited number of tracer analyses may provide information crucial for location of groundwater sources, estimation of groundwater volumes or identification of groundwater contributions to terrestrial ecosystems. Such tracer-based knowledge is often equivalent to results of long-term conventional hydrogeologic observations.

Tracer data improve numerical models used in groundwater management

Numerical models are computer programs used for simulating present and future impacts on groundwater bodies of groundwater abstraction and pollution and of climate and land-use changes. They are a basic and widespread tool in groundwater management. Testing and development of numerical models and of their predictive capabilities is supported with tracer data that provide synthetic information on pathways and timescales of groundwater flow.

Tracer tools are useful in assessing vulnerability of groundwater and related ecosystems to overexploitation and pollution.

Negative effects of groundwater pumping, of pollutant releases to the environment and of other man-made pressures affect quantity and quality of groundwater with some delay. Estimation of the time-lags associated with propagation of such adverse pressures to groundwater and to groundwater-dependent ecosystems can be based on tracer investigations. Groundwater dating, based on observations of environmental tracers, is a widely recognized tool used in groundwater vulnerability assessments and in predictions of future trends in groundwater pollution.

Legal setting

Use of tracer tools is explicitly not requested by any of the European Union legislation related to groundwater resources. However, requirements of the Water Framework Directive (WFD) and Groundwater Directive (GWD) with respect to setting the threshold values for pollutants and to assessing groundwater status, pollution trends and risks imply use of various methods for thorough understanding of groundwater bodies. Use of tracer tools for groundwater age determination is mentioned in this context in the Common Implementation Strategy Guidance Document No. 26 that supplements the WFD.
Recommendations

The WFD, the GWD as well as Common Implementation Strategy Guidance Documents (CIS GD) should explicitly indicate tracer techniques as tools for understanding of groundwater systems.

The CIS GD No. 18 should recognize importance of tracers in temporal characterization of groundwater systems.

The CIS GD No. 26 should list tracer techniques in a comprehensive way in chapter 4.1 among methods aimed at the development of conceptual models.

Publications from GENESIS

- Deliverable 2.2: Guidelines on flowpath characterization, groundwater dynamics and renewal

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