



**WORKSHOP ON THE PROTECTION OF
GROUNDWATER AS A SOURCE OF
DRINKING WATER IN KARST AREAS**

**MALINSKA, ISLAND KRK,
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THE WORKSHOP ON THE PROTECTION OF GROUNDWATER AS A SOURCE OF DRINKING WATER IN KARST AREAS

The Workshop took place on 14-15 April 2008 in Malinska, island Krk, Croatia.

It was jointly organized within the framework of the programme of work for 2007-2009 of the Protocol on Water and Health by the Croatian Ministry of Regional Development, Forestry and Water Management, the Croatian Geological Survey, Croatian Water, the Public Health Institute and the joint UNECE and WHO/EURO secretariat of the Protocol on Water and Health, in collaboration with the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The Netherlands Ministry of Housing, Spatial Planning and the Environment also financially supported the workshop organization.

The workshop was attended by experts from Albania, Austria, Bosnia and Herzegovina, Croatia, Georgia, Germany, Hungary, Kazakhstan, Lithuania, Romania, Slovenia, Switzerland, Tajikistan and Turkey.

Representative of the International Groundwater Resources Assessment Centre and of the Mediterranean Programme of the World Wide Fund for Nature also participated.

The workshop consisted of the following three sessions:

- **Session 1:** Physical, geological and hydrological conditions of karst aquifers and their implications for the protection of drinking water
- **Session 2:** Monitoring the quality and quantifying and predicting impacts of water use on karst aquifers
- **Session 3:** Management and protection of karst aquifers

In the first session, hydrogeological features of the karst areas in different countries were presented.

- Croatia declared a goal of providing 90% of the population with access to public drinking water supply by 2015, with sanitation systems to be improved by 60%.
- The example of the shared aquifer between Slovenia and Croatia that meets the drinking-water needs of about 400 000 people highlighted the importance of transboundary aquifers for Croatia.

The main problem of karst aquifers is the absence of surface flows to discharge waste water, the high aquifer susceptibility to accidental pollution and the extremely limited possibility of interventions (there is a high risk of microbiological contamination of spring water in karst areas).

In Croatia,

- **the groundwater quality is in general very good**
- **a substantial area of the territory is declared protection zone which can lead to landuse conflicts**
- **An increased turbidity and microbiological pollution during first rains after long dry periods are problematic and also availability of water during the summer, small population size, low density and inconvenient morphology.**

In Albania and other countries in transition the main reasons of karstwater pollution are, as follows:

- Lack of appropriate waste treatment facilities
- Lack of waste water treatment plants
- Lack of industrial water treatment plants
- Presence of dangerous hot spots from abandoned industrial plants
- Insufficient responsibility and preparation of the administrative water bodies.

In several presentations the importance and difficulties of appropriate monitoring techniques for karst aquifers were highlighted.

- **Geographic information system (GIS), an important technique for vulnerability assessment**
- **SINTACS, a technique for groundwater vulnerability mapping (used in Slovenia)**

And finally, the need for enhanced methods for the definition of vulnerability zones, including nitrate vulnerable zones was highlighted (suitability of the SINTACS-method was discussed).

SINTACS cannot be used for the delineation of protection zones.

The second session dealt with "Monitoring the quality and quantifying and predicting impacts of water use on karst aquifers".

It was presented a flooding event in Hungary and its circumstance and implications. The flood took place in June 2006 and affected the health of around 10 000 people.

Reasons for this outbreak included, as follows:

- Illegal waste dumping and wastewater discharged without treatment
- Lack of contingency plans to deal with extreme weather events
- Delay in sampling due to the holiday period
- Mistakes in judging the severity of the incident
- Lack of a reservoir capacity for the municipal water supply
- Inadequate monitoring of the supply systems and inadequate chlorination system
- Lack of quick testing methods for microbiological contamination

Croatia has had relatively little water-related outbreaks of diseases-26 in the period 1992-2006, about 1700 people affected. 15 out of the 26 outbreaks occurred in karst areas and most were related to non-community systems or individual water supply systems.

The main sources of water-borne diseases in the Croatian coastal area are inadequate water disinfection and water supply directly from the source.

Croatian water quality monitoring system was considered as insufficient because data on outbreaks are not reported systematically and there is no registration at the place where the outbreaks occurs but the place where the medical treatment is sought.

Drinking water supply on the Croatian islands represents a significant challenge (over 1000 islands, 66-inhabited, only 9 of all inhabited have their own water resources).

Presenters proposed to improve water supply a permanent desalination plants or temporary transportable plants as well as rainwater harvesting.

There was one presentation on efforts to involve school children in water safety plans through hands-on experiments related to water supply, assesment of karst water vulnerability and performance of basic chemical and microbiological analysis.

Residents education is very important, because in Croatia for example, sinkholes are often used in rural karstic areas to dump trash or household hazardous wastes and residents should understand that it can have significant consequences.

Also, a presentation on the survival of viruses in karstic fractured rock environment dealt with the importance of viral pathogens and their pathways in karstic rocks.

The presenter called for the recognition of viruses (particularly Norwalk-line viruses) as specific health hazards in karst areas requiring specific measures in the protection zone.

The final session, "Management and protection of karst aquifers" dealt with the new WHO approach of water safety plans which will be incorporated into the EU drinking water legislation and national approaches to protect recharge areas for drinking water.

It encompasses health-based targets based on evaluation of health concerns, water safety plans that include system assessment, operational monitoring and management plans as well as a system of independent surveillance.

It was highlighted the needs for further research and guidance in the existing WHO drinking water guidelines, especially related to karst aquifers and the significant expected impacts of climate change (decrease in precipitation and increased saline intrusion).

In Slovenia, a protection zones are legalized at the state level (reformed in 2004).

The three types of protection zones impose different restrictions on the use of fertilizers, plant protection products and construction of buildings and other facilities and also wastewater discharge and treatment.

In Croatia, decisions on the 6 types of protection zones are made by county assemblies.

The Swiss regulations with regard to protection of karstic aquifers include provisions for both prevention and treatment of pollution (i.e. groundwater protection through protection zones, groundwater management, surveillance of water quality and drinking water treatment).

The drinking water treatment is adapted to the aquifer type.

Bavaria in Germany has a policy requiring that groundwater should be clean enough to be used without further treatment ("decontamination" of treated wastewater takes place before the reinfiltration of the effluent in aquifer recharge zones).

Declaring a protection zones involves the publications of the plans by the administration, a period where affected persons can hand in objections, public hearings and the publication of the decision.

➤ **PI method (evaluation of protective function and consideration of fast runoff components) was used for vulnerability mapping.**

They have undertaken a particular efforts to protect karst aquifers from pollutants resulting from accidental pollution on motorways (sealing of lane basis by bituminous subbase and sealing of dewatering pipes and manholes). They constructed two kinds of basins at the side of the motorway:

➤ **retention basin to take up contamination**

➤ **Restriction basin to allow continuous infiltration**

Finally, it was concluded that 25% of the world's population depends on karst aquifers for their daily drinking-water supply (Ref. www.isarm.net)

It was underlined the importance of information management, awareness, motivation, institutional frameworks and operation means for transboundary aquifer management and drinking water protection.

The presentations are available on the following website:

http://www.unece.org/env/water/meetings/karst_groundwater_workshop_Croatia.htm



Thank you for your attention