

## Halogenated hydrocarbons in Austrian Groundwater – first results of a new water quality monitoring system

Grath, J.<sup>A</sup>, Schwalger, K.<sup>B</sup>, Chovanec, A.<sup>A</sup>, Nagy, W.<sup>A</sup>, Schicho-Schreier, I.<sup>A</sup>

<sup>A</sup> Federal Environmental Agency, Spittelauer Lände 5, A – 1090 Vienna, Austria;

<sup>B</sup> Federal Ministry of Agriculture and Forestry, Dept. for Federal Water Management Register, Stubenring 12, A – 1010 Vienna, Austria.

### *Introduction*

Based on the amendment of the Federal Act on Water Law and the Federal Act on Hydrography a groundwater monitoring system was installed in 1991. The monitoring system is organized by the Department for Federal Water Management Register of the Federal Ministry of Agriculture and Forestry, the Federal Environmental Agency and the nine provincial authorities /1/,/2/. The costs are met by federal (2/3) and provincial (1/3) authorities.

The main goal of the monitoring network is to create a data base for:

- the assessment of the necessity of groundwater remediation measures,
- the elaboration of reports which are helpful for designing the environmental policy,
- the evaluation of the long term development of the groundwater quality,
- the efficiency control of remediation measures.

A pilot study was carried out /3/ to find a way of implementing the austrian monitoring system. First results of the groundwater quality data are presented in /4/.

### *Design of the monitoring network*

The chosen monitoring wells are situated in the Austrian quaternary groundwater regions. There are a lot of important groundwater bodies; due to the geographic situation of Austria these regions are stressed by intensive use, e.g. agriculture, industry, traffic.

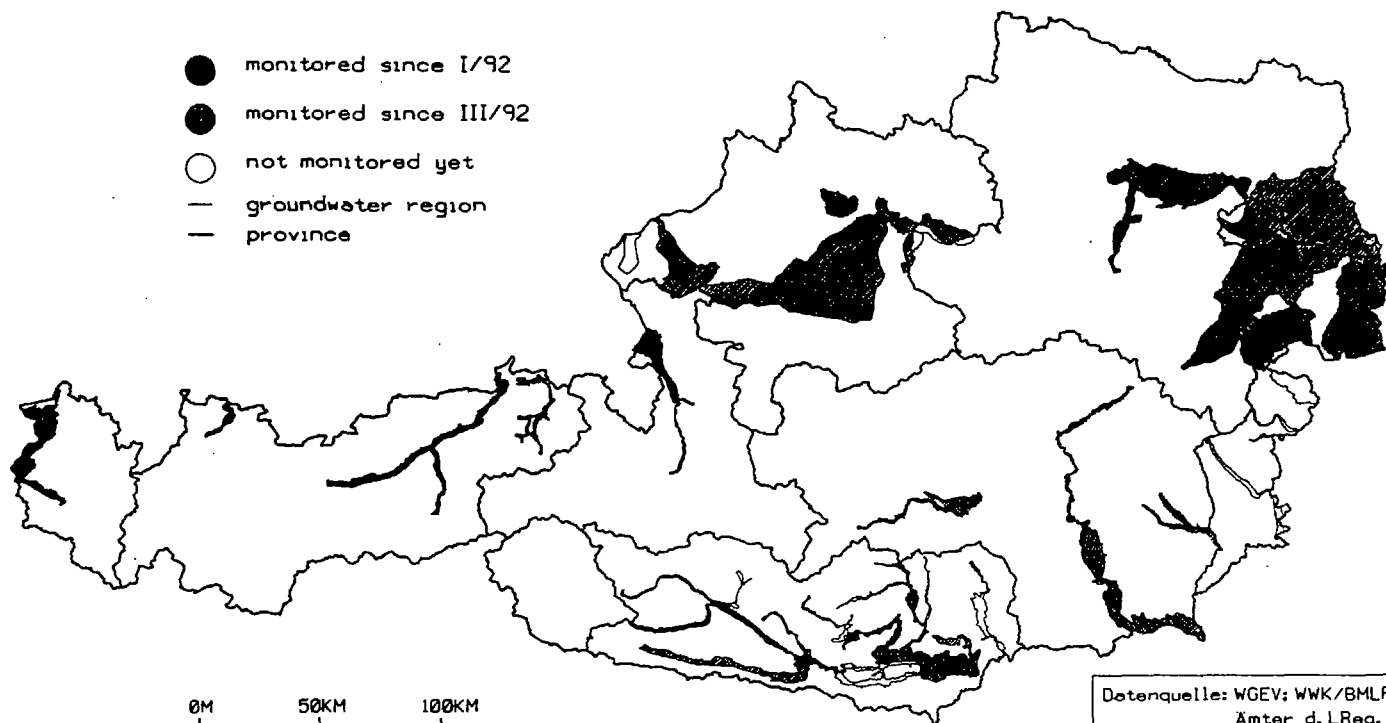
At the beginning, in 1991, the investigation programme covered about 800 wells. Today there are about 1500 and till 1996 there will be about 2000 sampling sites. Thus, on average there will be one monitoring well per ten square kilometers.

The investigation programme comprises about 60 physical/chemical parameters. The sample frequency is four times a year. Apart from hydrogeochemical parameters (including conductivity, temperature, hardness, sulfate, chloride) nitrate, nitrite, ammonium, heavy metals, a large number of pesticides and halogenated hydrocarbons such as tetrachloroethene, 1,2-dichloroethane, trichloroethene, 1,1,1-trichloroethane, trichloromethane, tetrachloromethane and 1,1-dichloroethene are analyzed.

The water samples are mostly analyzed by private laboratories. Quality assurance plays an important role within this monitoring programme. Therefore laboratory comparison tests, laboratory control visits and some other control instruments are used to provide high data quality.

QUARTERNARY GROUNDWATER REGIONS SURVEYED BY THE  
AUSTRIAN MONITORING SYSTEM

- monitored since I/92
- monitored since III/92
- not monitored yet
- groundwater region
- province



296

## Results

	<=DL		>DL-6 µg/l		>6-10 µg/l		>10 µg/l		Maximum	
Period Substance	I/92	II/92	I/92	II/92	I/92	II/92	I/92	II/92	I/92	II/92
Tetrachloroethene	547	598	169	126	7	8	15	14	163 µg/l	130 µg/l
1,2-Dichloroethane	737	745	0	0	0	0	1	1	64 µg/l	76 µg/l
Trichloroethene	636	650	92	91	5	1	5	4	38 µg/l	24 µg/l
1,1,1-Trichloroethane	617	625	115	118	1	0	5	3	59 µg/l	239 µg/l
Trichloromethane	672	696	65	48	1	2	0	0	9 µg/l	6.6 µg/l

	<=DL		>DL-1.8 µg/l		>1.8-3 µg/l		>3 µg/l		Maximum	
Period Substance	I/92	II/92	I/92	II/92	I/92	II/92	I/92	II/92	I/92	II/92
Tetrachloromethane	728	690	9	52	0	2	1	2	16.2 µg/l	16.1 µg/l

	<=DL		>0.2-0.3 µg/l		>0.3 µg/l		Maximum			
Period Substance	I/92	II/92	I/92	II/92	I/92	II/92	I/92	II/92		
1,1-Dichloroethene	721	740	-	-	10	3	7	3	4.2 µg/l	6.2 µg/l

Tab. 1.: Chlorinated Hydrocarbons in the groundwater (Austria) sample series I/92 and II/92 (number of monitoring wells: 738 in I/92 and 746 in II/92); DL=detection limit-laid down in "Wassergüte-Erhebungsverordnung" (BGBl.338/91)

	Groundwater threshold level <sup>a</sup>	Drinking water standard <sup>b</sup>
Tetrachloroethene	6 µg/l	10 µg/l
Tetrachloromethane	1.8 µg/l	3 µg/l
1,1-Dichloroethene	0.2 µg/l	0.3 µg/l
1,2-Dichloroethane	6 µg/l	10 µg/l
Sum of halogenated Hydrocarbons (16 reference subst.)	18 µg/l	30 µg/l

Tab. 2.: Groundwater threshold levels and drinking water standards  
<sup>a</sup> Grundwasserschwelienwertverordnung (BGBl. 502/91)  
<sup>b</sup> Österr. Lebensmittelkodex Kapitel B1 "Trinkwasser" (1989)

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The results (table 1) show that the Austrian threshold levels and the Austrian drinking water standards (table 2) are exceeded only by a few values, but the maximum concentrations detected in those few values are high. The reason for this fact lies in the physical/chemical properties of the halogenated hydrocarbons. They are heavier than water, have a lower kinematic viscosity and a lower surface tension. Therefore they can pass the unsaturated zone faster than water. Sometimes they sink also through the saturated zone to the clay layer. Due to their persistence they can stay there for a long period.

Chlorinated hydrocarbons are distributed in the aquifer as contamination plumes with high concentrations. These contamination plumes, however, can be detected only in some cases by the Austrian monitoring network described above. Therefore, areas in which the concentrations of chlorinated hydrocarbons are between the detection limit and the threshold level must also be subjected to further investigations, to locate the sources of contamination.

## **References**

- /1/ Schimon W., Schwaiger K., Grath J., (1992): Erhebung der Grundwassergüte nach dem Hydrographiegesetz, Eine Zwischenbilanz, GWW 46, 3
- /2/ Schimon W., Grath J., Schwaiger K., (1993): Österreichischer Grundwasserkataster – Von der Pilotstudie zu Routinevollzug, Österreichische Wasserwirtschaft, Heft 1/2 1993
- /3/ Grath J., Philippitsch R., Bonani M., Zethner G., Eilmsteiner W., Malina–Seltenhammer E., Lorbeer G., Seif P., Schmid I. (1992): Grundwassergüte Tullner Feld – Pilotstudie, Beitrag zum Österreichischen Grundwasserkataster Umweltbundesamt Wien Monographien Bd. 30
- /4/ Schwaiger K., Schimon W., Grath J., Nagy W., Bonani M., (1993): Erhebung der Grundwassergüte in Österreich gemäß Hydrographiegesetz, Beobachtungsjahr 1991/92, Stand des Vollzuges, Vorauswertung Nitrat, Halogenkohlenwasserstoffe und Pflanzenschutzmittel, Bundesministerium für Land- und Forstwirtschaft, Wasserwirtschaftskataster

## **Basic legal regulations:**

Bundesgesetzblatt für die Republik Österreich 252/90: Wasserrechtsgesetz Novelle 1990

Bundesgesetzblatt für die Republik Österreich 338/91: Wassergüte– Erhebungsverordnung (WGEV)

Bundesgesetzblatt für die Republik Österreich 502/91: Grundwasserschwellenwertverordnung

Österreichischer Lebensmittelkodex Kapitel B1 "Trinkwasser" (1989)