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METHANE IN GROUND WATERS AND THE RELATED PROBLEMS AT WATER WORKS IN HUNGARY

BY ANDRÁS ALTNÖDER AND ERIKA HUTTER

In some areas of Hungary the ground water contain large quantities of gas, such as hydrocarbons, particularly methane,nitrogen, carbon dioxide,etc. Of these methane presents the greatest hazards. In the course of water withdrawal, treatment and use the separating methane may mix sith atmospheric oxygen to form an explosive mixture.

In order to meet the rapidly growing water demands wells yielding gaseous water have been connected in growing numbers to public water works. Attention to the problems and hazards presented by these wells has been focussed by the explosions causing severe accidents in recent years.

With the aim of preventing further explosions and accidents the National Water Authority has implemented obligatory work safety regulations, specifying the highest tolerable methane content at 0.8 Nlit/m^3 of water to be conveyed in pipelines, prescribing quality analyses on waters obtained from producing wells, as well as the need of de-gassing. A nation-wide competition was announced inviting methods and designs of de-gassing equipment.

This prompt action prevented further accidents. In this manner the quality- and safety criteria specified by the water sector require especially careful gas analyses on the waters withdrawn from gaseous wells, or aquifer formations and thus on the various strata under the basins in Hungary.

In compliance with the administrative measures, the Water Management Institute has coordinated on a nation-wide basis the gas-content analyses on ground waters and assessed the results obtained. The progress made and the conclusions arrived at have been summarized and published in annual reports.

The data for assessment were submitted in 1980 by 13 sampling- and analytical laboratories. The techniques and equipment of sampling and analysis are specified in the official regulations. The laboratories have been checked continuously for the accuracy of results and for compliance with the regulations.

Thus far round 20 000 results of gas analyses on 7 to 8 thousand wells are available.

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RESULTS, CONCLUSIONS

The Tertiary and Quaternary sediments filling the Hungarian basin contain methane gas in many locations. The amount and distribution of the gas is variable geographically and over depth.

According to the data published in the literature and obtained analytically, the gases accompanying the ground waters are of different origin and provenance. Thus the waters in the vicinity of the surface contain mainly marsh gases, which are still in the process of formation, whereas the gases dissolved in the deep ground waters are methanes either of local origin, or emerging from petroelum bearing rocks and moving along the formations by diffusion. The geological features /faultlines, folds/ and structure /loose, heterogeneous rock cover/ may promote the diffusion and migration of gases. In some areas gas indications are encountered with high frequency along the structural lines.

For a better understanding of the problem, the results of gas analyses performed in the country have been represented cartographically to indicate the variations of the gas content in the ground waters affected by withdrawal.The gas content has been mapped for the successive horizons, yielding thus a clear picture of good horizontal and vertical resolution about the quantitative- and qualitative regularities of methane gas occurrences.

As to be seen therefrom, under the rolling terrain to the West of the Danube /Transdanuvia/ the areas yielding methane-gas containing ground waters form an apparently scattered, disperse patterns. Even from the relatively few data available in this area it seems safe to conclude that methane occurrences are mostly associated with deep structural surfaces.

Although more extensive information is available in the area to the East of the Danube, the data provided less opportunity, e.g. in the Great Plains, for an as detailed and positive structural-topographic, morpho-tectonic classification as in Transdanuvia /concerning alone a certain general uniformity of the basin development process/. However, some area units and pairs of structural differences could be identified, which were pronounced enough to be regarded as representative areas with specific geological features and definite boundaries in space. The ridge area of Ujkigyós, Békés County and the debris cone of the Körös rivers, the Hajduság Ridge, etc. could be quoted as examples.

Practically no, or but very little gas is present in the well waters in the mountain areas /Northern Range, Transdanuvian Range, Mecsek Range/. Traces of gas have been encountered along the mountain perimeters, in the tectonic boundary belts.

It is concluded finally that one type of ground water, which is an important source of water supply in Hungary, namely the artesian waters contain methane

gas in excess of the limit values specified in the standard specifications, over a major proportion of the area of their occurrence /over about two-thirds, of the territory of the country/, particularly in areas with a positive hydraulic gradient.

The main experiences gained with de-gassing the water withdrawn are as follows:

- Of the different types of de-gassing equipment installed so far, some proved ineffective in normal routine use /experiments are still under way/.

- On new water works projects the incremental cost of de-gassing /construction+operation/ are insignificant /a few per cents only/ relative to the construction and operation costs of the whole water works.

- When installing de-gassing equipment at existing water works, the modifications required for connection present most of the problems and costs.

- Following the installation of de-gassing equipment and as a consequence of de-gassing, the iron- and manganese content of the water was often observed to precipitate in the distribution network, and bacterial contamination in the originally perfect water could be detected.

Since round 40 per cent of all subsurface waters withdrawn is artesian water, this is used almost exclusively to meet the demands for water of drinking quality and owing to their extensive occurrence and adequate protection from external pollution, the artesian waters play an important part in domestic water supply development projects, and, therefore attention will have to be concentrated on the analysis and assessment of their methane content in the future as well.

Future tasks

- Examination in the light of the data collected thus far of the present information gathering system for its potential application to the more detailed assessment of the geological conditions and causes of methane content is the subsurface waters, further, determination of the additional data and methodological improvement of processing evaluation required /representative areas/.

- Investigation into the potential impacts of human activities /withdrawal, hydrocarbon mining, etc./ on the causes, changes, or occasionally removal of the gas content.

- Exploration of the consequences /appearance of iron, manganese, bacteria/ incident to de-gassing, development and testing methods suited to the elimination thereof.