Geophysical Research Abstracts
Vol. 13, EGU2011-8411, 2011
EGU General Assembly 2011

Dissolved radon in well waters in Hamadan, Iran.

Gavin Gillmore (1), Tadeusz Przylibski (2), and Naghi Jabarivasal (3)

(1) Kingston University, Geography, Geology and the Environment, Kingston-upon-Thames, United Kingdom (g.gillmore@kingston.ac.uk, 020 8547 7497), (2) Zakład Geologii I Wod Mineralnych, Instytut Gørnictwa, Wydział Geoinzynierii, Gørnictwa I Geologii, Politechnika Wrocławska, Poland (tadeusz.przylibski@pwr.wroc.pl), (3) Archaeological, Geographical and Environmental Science, University of Bradford, UK (N.Jabarivasal@bradford.ac.uk)

This work was undertaken as part of a research project on indoor radon in Hamadan city, Iran. This projects initial results were report by Gillmore and Jabarivasal (2010a,b) who noted raised indoor radon (222Rn) levels in some homes in the region of up to 364 Bq m-3 with a mean value of 80 Bq m-3 (some Schools and Hospitals in the city having considerably higher radon concentrations). As part of the investigation into the source of that radon measurements were made in the atmosphere down boreholes near the surface of both active and non-active water wells (28 wells in total). High concentrations, with a maximum of 36,600 Bq m-3, were noted suggesting that radon enriched groundwaters could play a role in the transportation of radon. Hamadan has many qanats, springs, semi-deep and deep wells. These wells are driven into sandy and gravelly alluvial fans that sit on a variety of bedrocks, from granitic and metamorphic materials to karstic limestones. It was decided that an investigation of dissolved (as opposed to atmospheric) radon was necessary in these wells, which were closely associated with homes and were sometimes used as drinking water supplies (as well as for irrigation).

Taking into account 222Rn concentration results one can say that these waters are of two types according to Przylibski's classification (2005): radon-poor waters (containing between 1.0 and 9.99 Bq/dm3 222Rn; Bq/dm3 = Bq/L) and low-radon waters (containing between 10 and 99.99 Bq/dm3 222Rn). 222Rn concentration is below the reference level of 100 Bq/dm3 – a value suggested by the European Commission - so there is no need to take any action to remove radon from these waters before its transport to pipelines and households (Commission Recommendation, 2001). The WHO (2008) advice is in a similar vein. However, we would recommend that activity concentration of 222Rn in these wells should be monitored and if necessary controlled at least once a year and that the waters, where 222Rn activity concentration was higher than 40 Bq/dm3 even twice a year to be sure that 222Rn activity concentration is always below 100 Bq/dm3.

226Ra concentration is low (below 0.05 Bq/dm3) in waters of all the intakes (wells). This suggests that water from all wells is rather shallow in terms of circulation, with contemporary infiltration and low mineralization of groundwater. The origin of 222Rn dissolved in the investigated water is such that the main source is from reservoir rocks. The concentration of 222Rn activity depends on 226Ra concentration in these rocks close to the wells and the density of fissures and pore spaces enabling radon to escape from mineral grains and crystals and dissolve into the groundwater flowing through these reservoirs. We can be certain then, that the source of 222Rn dissolved in the investigated groundwaters are not the ions of 226Ra2+ dissolved in these waters. The origin of 222Rn dissolved in groundwaters from Hamadan (Iran) is typical for groundwaters of low mineralisation and shallow circulation, as demonstrated by Przylibski in the Sudetes (SW part of Poland, Europe) (Przylibski, 2000, 2005).

References.

Commission Recommendation of 20 December 2001 on the protection of the public against
exposure to radon in drinking water supplies. 2001/928/EURATOM.

Gillmore, G., Jabarivasal, N., 2010a. A reconnaissance study of radon concentrations in Hamadan city, Iran. Nat. Hazards Earth Syst. Sci., 10, 857-863, 2010.

Gillmore. G., Jabarivasal, N., 2010b. A study of atmospheric radon gas concentrations in water extraction wells of Hamadan, western Iran. Geophysical Research Abstracts, Vol. 12, EGU2010-1797, 2010, EGU General Assembly 2010.

Przylibski T. A., 2000. Size estimation and protection of the areas supplying radon to groundwater intakes. Archives of Environmental Protection, Vol. 26, No. 1, pp. 55-71.

Przylibski T. A., 2005. Radon. Specific component of medicinal waters in the Sudety Mountains. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław. (in Polish).

WHO, 2008. Guidelines for drinking-water quality. Third edition incorporating the first and second addenda. Vol. 1, Recommendations. World Health Organization, Geneva.