

Paper Number: 1574

Groundwater Pollution with Organoarsenic Compounds and

Sustainable non-polluted Groundwater Utilization for the Irrigation in the Paddy Fields

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Groundwater used for drinking in an apartment building in Kamisu City, Ibaraki Prefecture, Japan, was found to contain diphenylarsinic acid (DPAA). The DPAA appears to have been an ingredient in a toxic gas weapon developed by the former Japanese Army. The characteristics of acid poisoning include brainstem-cerebellar and cerebral symptoms [1].

Phenylarsonic acid (PAA), which may be a degradation product of DPAA, was subsequently detected in the groundwater. Both organoarsenic compounds were detected in the groundwater and the topsoil layer of nearby paddy fields. To achieve sustainable utilization of groundwater without contamination with these compounds, a pumping and observation well system was established as described below.

Three highly permeable aquifers have developed in the area, at different levels with a lower and upper aquifer intercalated between them. The groundwater in the middle and upper high permeable aquifers was not polluted by either organoarsenic compound, and pollution was found only in the lower high permeable aquifer.

The screens used in the agricultural pumping wells were set from the middle high permeable aquifer to the upper high permeable aquifer, and the screens in the observation wells were set from the upper part of the lower aquifer, which overlays the lower high permeable aquifer containing polluted groundwater, to the lower part of the middle high permeable aquifer. As a result of monitoring the concentration of total arsenic including organoarsenic compounds such as DPAA and PAA, and the groundwater volume, we were able to pump and utilize pollution-free groundwater sustainably from the range of the middle high permeable aquifer to the upper high permeable aquifer in irrigating paddy fields[2].

Reference: [1] Ishii Kazuhiro et al. (2004): American Annals of Neurology, vol. 56, no. 5, pp. 741-745,
[2] Tomoyo Hiyama et al. (2013) PMUG, Japan. Vol.9 (1/2):1-8

