

Risk Assessment of Fluoride and Arsenic in Groundwater

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【Abstract】

To clarify the human health risk for drinking groundwater, environmental scientists, folklorists, and villagers were observed the groundwater quality and interviewed residents' lifestyles in Inner Mongolia. Based on the fieldwork survey, human health risk analysis, and scenario analysis have been conducted. Different from the Mongolia, the land was become separated by the fence in each family in Inner Mongolia. As the result, the fence prevent nomad to move anywhere and people began to heavily rely on the groundwater as a domestic water. During summer campaign in 2015, in Inner Mongolia, major ion (F^- , NO_3^-), and heavy metals (Hg, As, Al, V, Mn, Co, Ni, Cu, Zn, Se, Mo, Cd, Sb, and Pb) concentration in groundwater ($n=35$), river water ($n=10$), and tap water ($n=1$) were observed. In order to perform risk analysis and scenario analysis, hearing survey was conducted. We used our observation result to calculate hazard quotient ratios by means of a probabilistic risk assessment method. The results indicated that they drink groundwater every day, there may be risk concern in F^- (average 2.51 ± 1.80 (min. 0.07- max 7.70) mg/L) and As (average 6.49 ± 9.64 (min. 0.31- max 47.0) $\mu\text{g/L}$). Result from the scenario analysis, if they use snow as a drinking water in winter, then they can reduce their risk concern.

※ This report is a summary of Nakazawa K., Nagafuchi O., Uchralt Otede, Ji-qun Chen, Kanefuji K., and Shinozuka K. (2020).

【Introduction】

Mongolian plateau is also the area where people rely on the groundwater for living. In Mongolia (outer Mongolia), nomads move over *the* land accompany with their livestock in order to using groundwater, river water and snowmelt. Authors has been conducted the survey to clarify the groundwater quality level in Mongolian Plateau (outer Mongolia, South Gobi region) continuously, and have been reported that F^- and NO_3^- concentration of some groundwater sample exceeded WHO drinking water quality guideline (F^- : 1.5 mg/L, NO_3^- : 50 mg/L) (WHO, 2013) (Nagafuchi et al., 2014). Also, we have been conducted the ground water quality survey more broadly than the Nagafuchi et al., 2014 research paper in South Gobi. It revealed that the non-carcinogenic human health risk of F^- and As caused from the drinking water may concern (Nakazawa et al., 2016). In this paper, NO_3^- was not categorized the human health risk concern level however, some ground water samples showed high NO_3^- concentration. It reveals that NO_3^- contamination in groundwater was caused from the livestock waste. This is because numerous livestock visits well and drink groundwater and waste around the well. If more and more nomad and their livestock visit wells, then it may become risk concern. In Outer Mongolia, F^- , As and NO_3^- were become to understand the risk concern element.

【Distribution of Items】

Distribution of each items in ground water is shown in Fig.1 and Fig.2. Coefficient of Variance (CV) in each items in ground water widely varied from 21.0 to 125 %. Based on these result of ground water, we will conduct the non-carcinogenic risk analysis.

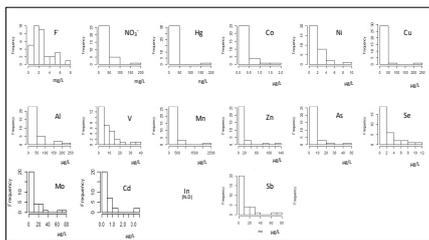


Fig1 Concentration histogram of each item in groundwater ($n=35$)

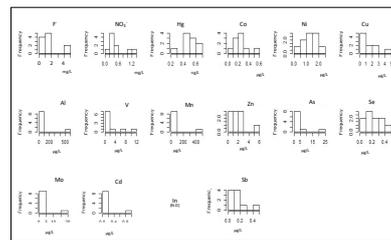


Fig.2 Concentration histogram of each item in river water ($n=10$)

【Risk Assessment】

The local government has been digging the wells and provide water purification system for some low-income families. However, they do not use water purification system because, they cannot get enough quantify of water for daily life water. However, if this system works well, this is one choice to reduce human health risk concern caused from ground water. In addition, they have another choice such as using rainwater or born char (WHO 2006). They usually eat lamb in Inner Mongolia, therefore, they will be able to gather the lamb born easily. One option for them to reduce F^- concentration in groundwater may be to use water purifier using lamb born char (WHO 2006). Father research should be needed to reduce human health risk concern.

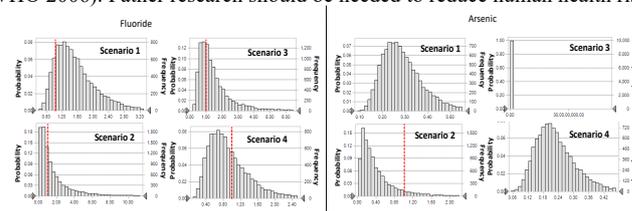


Fig3 Probabilistic distribution of HQ with scenario analysis in A village

【References】

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3. Nagafuchi O., Nakazawa, K., Okano, K., Osaka, K., Nishida, Y., and Hishida, N Hydrochemical characteristics of the Mongolian plateau and its pollution levels, *Inner Asia*, **16**, 429-443, (2014).