



Risk assessment of arsenic by human exposure of contaminated soil, groundwater and rice grain in the abandoned metal mine sites in Korea

J.S. Lee (1) and H.T. Chon (1)

(1) School of Civil, Urban and Geosystem Engineering, Seoul National University, Seoul 151-744, Korea, E-mail: jssoolee@snu.ac.kr

Environmental survey from some abandoned metal mine areas was undertaken on to assess the risk of adverse health effects on human exposure to arsenic influenced by past Au-Ag mining activities. Elevated levels of As were found in tailings from the studied mine areas (Dongil, Okdong, Dongjung, Dogok and Hwacheon mines). This high concentration may have a impact on soils and waters around the tailing piles. In order to perform the human risk assessment, chemical analysis data of soils, rice grains and waters for As have been used. Risk compounds deriving from mine sites either constitute a toxic risk or a cancer risk. Toxic risks are indicated in terms of a hazard quotient (H.Q.). H.Q. is ADD (average daily dose)/RfD (reference dose). A toxic risk exists for $H.Q. > 1$. To calculate the hazard index (H.I.) the ADD from identified pathways compared to the relevant RfD obtained from the US-EPA database IRIS is summed. The HQ values for As via the rice grain and groundwater consumption (ingestion) were significantly higher compared with other exposure pathways (soil ingestion and dermal contact of soil and water) in all metal mine areas. However, there were minimal soil and water dermal contact risks. The resulting HI values of As from the Dongil, Okdong and Hwacheon mine areas were higher than 5.0, and their toxic risk due to drinking water and rice grain was strong in these mine areas. The cancer risk of being exposed to As by the rice grain route from the Dongil, Okdong and Hwacheon mine areas was $5E-4$, $6E-4$ and $8E-4$, respectively. The As cancer risk via the exposure pathway of drinking water from these mine areas exceeded the acceptable risk of 1 in 10,000 for regulatory purposes. Thus, the daily intakes of groundwater and rice grain by the local residents from the Dongil, Okdong and Hwacheon mine areas can pose a potential health threat if exposed by long-term arsenic exposure.