Magnitude of arsenic pollution in the Mekong and Red River Deltas - Cambodia and Vietnam

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Abstract: Large alluvial deltas of the Mekong River in southern Vietnam and Cambodia and the Red River in northern Vietnam have groundwaters that are exploited for drinking water by private tube-wells, which are of increasing demand since the mid-1990s. This paper presents an overview of groundwater arsenic pollution in the Mekong delta: arsenic concentrations ranged from 1-1610 μg/L in Cambodia (average 217 μg/L) and 1-845 μg/L in southern Vietnam (average 39 μg/L), respectively. It also evaluates the situation in Red River delta where groundwater arsenic concentrations vary from 1-3050 μg/L (average 159 μg/L). In addition to rural areas, the drinking water supply of the city of Hanoi has elevated arsenic concentrations. The sediments of 12-40 m deep cores from the Red River delta contain arsenic levels of 2-33 μg/g (average 7 μg/g, dry weight) and show a remarkable correlation with sediment-bound iron. In all three areas, the groundwater arsenic pollution seem to be of natural origin and caused by reductive dissolution of arsenic-bearing iron phases buried in aquifers. The population at risk of chronic arsenic poisoning is estimated to be 10 million in the Red River delta and 0.5-1 million in the Mekong delta. A subset of hair samples collected in Vietnam and Cambodia from residents drinking groundwater with arsenic levels > 50 μg/L have a significantly higher arsenic content than control groups (< 50 μg/L). Few cases of arsenic related health problems are recognized in the study areas compared to Bangladesh and West Bengal. This difference probably relates to arsenic contaminated tube-well water only being used substantially over the past 7 to 10 years in Vietnam and Cambodia. Because symptoms of chronic arsenic poisoning usually take more than 10 years to develop, the number of future arsenic related ailments in Cambodia and Vietnam is likely to increase. Early mitigation measures should be a high priority.

Author Keywords: Ammonium; An Giang province; Arsenic groundwater pollution; Bassac River; DOC; Dong Thap province; Hair; Hanoi; Health risk; Iron; Kandal province; Manganese; Phnom Penh; Reductive dissolution; Urine

Index Keywords: Arsenic; Concentration (process); Health risks; Sediments; Water supply; Arsenic groundwater pollution; Reductive dissolution; Urine; Groundwater pollution; arsenic; ground water; arsenic; delta; dissolution; drinking water; groundwater pollution; health risk; poisoning; water supply; well water; article; Cambodia; correlation analysis; evaluation; liquefaction; priority journal; reduction; risk assessment; sedimentation; Viet Nam; water pollution; Arsenic; Arsenic Poisoning; Cambodia; Environmental Monitoring; Geologic Sediments; Hair; Humans; Rivers; Rural Population; Vietnam; Water Pollutants, Chemical; Water Supply; Asia; Bangladesh; Cambodia; Eurasia; Hanoi; India; Mekong Delta; Red River Delta; South Asia; Southeast Asia; Viet Nam; West Bengal

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