DEVELOPMENT OF INDICATORS WITHIN DIFFERENT POLICY CONTEXTS FOR ENDEMIC ARSENIC IMPACTS IN THE PEOPLE’S REPUBLIC OF CHINA

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Abstract. Exposure of people to elevated naturally occurring arsenic concentrations (endemic arsenic) in drinking water and/or coal smoke has caused serious health problems at specific sites in China. The decision-makers at central or local government need much detailed information on each environmental-health problem but in a format suitable for planning and management purposes. This paper describes three conceptual indicator sets based on the pressure-state-impact-response framework that arranges the arsenic biogeochemical and human health issues within a policy context. Chinese data have been organised into descriptive indicators that report the past occurrence of endemic arsenism and response indicators that report on current actions. Many Chinese data have been incorporated into the two sets of indicators divided into pressure, state, impact and response parameters. A performance indicator set is also advanced for long-term future management of endemic arsenism in China but much essential data have not yet been calculated to enable these indicators to be adopted. A requirement for further necessary data collection for further indicator construction for more effective management is discussed.

Key words: arsenic exposure, China, drinking water, endemic arsenism, management indicators

1. Introduction

Studies at locations in inner Mongolia, Xinjiang, Ningxia, Guizhou and Shanxi, municipalities or provinces, of the People’s Republic of China have shown that exposure to high concentrations of arsenic has given rise to major health effects (Cao Shouren, 1996). These have arisen predominantly from the drinking of, and cooking in, arsenic ‘contaminated’ ground-water or ingestion of arsenic ‘contaminated’ food covered with smoke-particulates and inhalation of smoke from the combustion of high arsenic coal (Cao Shouren, 1996). The ‘arsenic-contaminated’ food arises as it is dried indoors with heat and smoke from open combustion (i.e. without a flue or chimney). The local high arsenic coal is the result of natural geochemical conditions (Cao Shouren, 1996). All the local people eat their own local food (dominated by crops) and the areas contain much poverty. The populations
are relatively static, with little immigration in or out of the villages. Exposures to elevated arsenic concentrations in water or coal smoke have given rise to endemic arsenism (non-cancer endpoint) or to various forms of arsenic-induced cancer including lung cancer, skin basalioma, bladder cancer etc. (Wang Lianfang, 1997; Liang Xiufen et al., 1999). The two different exposure pathways are illustrated in Figure 1.

Figure 1. Endemic arsenism causal chain in China

By now local governments have paid attention to endemic arsenism, and many management actions such as new drinking water sources, the re-design of local ovens, installation of chimneys to ovens have been proposed. Selenium supplementation has also been advanced. Mining, and especially smelting of ores containing arsenic in a number of provinces, can also give rise to arsenic-induced health effects, but are not considered in this paper.

The distribution of endemic arsenic-diseases in China has been mapped although new areas are still being discovered in various provinces where the element is an important health risk factor. There are also no accurate data on the total numbers of people affected although it is recognised that the incidence is much less than those affected by high fluoride intakes from consumption of fluoride-rich drinking water and burning of high fluoride coal, where an estimated 45 million have dental