

## **IMPACT OF ARSENIC IN DRINKING WATER ON HUMAN HEALTH**

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### **ABSTRACT**

In terms of its impact on human health, arsenic is unique in that most of the evidence linking it to diseases comes from epidemiological work; animal studies have not provided good models.. To date, we know that arsenic from drinking water can cause severe skin diseases including skin cancer; lung, bladder, and kidney cancers, and perhaps other internal tumors; peripheral vascular disease; hypertension; and diabetes. It also seems to have a negative impact on reproductive processes (infant mortality and weight of newborn babies). The toxicology of arsenic involves mechanisms that are still not completely understood, but it is clear that a number of factors can affect both individual and population-level susceptibility to the toxic effects of arsenic-contaminated drinking water.

**Keywords-** arsenic, health effects, drinking water, chronic exposure, arsenic metabolism.

### **INTRODUCTION**

The toxicological and human health effects caused by arsenic exposure were first described centuries ago, yet there are still many areas of inquiry that have not been elucidated, particularly with respect to the mechanisms of action of arsenic and the factors that may affect susceptibility to the damaging effects of this element and its compounds. . Excellent comprehensive reviews have been published within the last few years by the International Program on Chemical Safety of the World Health Organization (IPCS 2001) and by the US National Research Council (NRC 1999, updated in 2001).

#### **Early Reports of Health Effects –**

Descriptions of dermatological effects caused, Cases of lung cancer from occupational exposure to arsenic were described in the 1940s (IPCS 2001). In Argentina, the effects of arsenic were first reported in 1917 by Astolfi, and the term “Bell Ville Disease” was coined to describe frequent skin disorders found among residents of a town by that name in the province of Córdoba (detailed in Hopenhayn-Rich et al. 1996). Most case studies were based upon observations by local dermatologists, and the characteristic “arsenicosis” led to the term “HACRE”—HidroarsenicismoCrónico Regional Endémico (Regional Endemic Chronic Hydroarsenicism)— “Bell Ville Disease” was coined to describe frequent skin disorders found among residents of a town by that name in the province of Córdoba (detailed in Hopenhayn-Rich et al. 1996 the characteristic “arsenicosis” led to the term “HACRE”—HidroarsenicismoCrónico Regional Endémico (Regional Endemic Chronic Hydroarsenicism)—. Thousands of shallow “tube” wells were dug, which were free of the viruses, bacteria, and parasites found in rivers, therefore providing much cleaner water for human consumption.

### **Metabolism And Toxicity –**

The main forms of arsenic found in water used for human consumption and, to a lesser extent, in foodstuff are inorganic arsenic (In-As), occurring either as trivalent (As+3) or pentavalent (As+5) compounds. Other forms of arsenic, including organic compounds such as arsenobetaine or arsenocholine, are found in seafood. Sometimes these occur in relatively high concentrations, but they are much less toxic than the inorganic forms and are eliminated rapidly and unchanged through the urine. Ingested In-As is quickly absorbed from the gastrointestinal tract and passes through a series of steps while being metabolized through reduction reactions of pentavalent to trivalent arsenic forms, and methylation to monomethylarsonic acid (MMA) and then to dimethylarsinic acid (DMA).

### **Exposure Assessment –**

In order to assess the health effects of arsenic, it is essential to assess exposure as accurately as possible. The methods of assessment, accordingly, depend on the source of exposure. In particular, the methods for environmental measurements of inhaled versus ingested arsenic focus on air and dust content versus water and food., human biomarkers of exposure for both routes of entry into the body are similar, such as in urine, blood, hair, and nails. Finally, duration of exposure or cumulative exposure is usually estimated, and some studies have used this factor to correlate with health effects (IPCS 2001).

### **Results And Discussions**

Arsenic causes or increases the risk of numerous illnesses. Some of them have been repeatedly observed in different epidemiological investigations. Examples are skin damage including keratoses and skin cancer, internal cancers such as lung and bladder, and diseases of the vascular system. Other health problems, such as diabetes, cancers of other organs, and adverse reproductive outcomes have been observed, but the evidence is not yet conclusive, although it keeps increasing. In terms of carcinogenicity (NRC 1999; Schoen et al. 2004). Some of these mechanisms, such as oxidative stress to cells, could account for some of the noncancer negative health effects.

### **Magnitude of The Problem:**

The Global Perspective-Arsenic is probably the environmental contaminant that is responsible for the highest risks of morbidity and mortality worldwide, both because of its toxicity and the number of people exposed. Unlike other chemical contaminants that are found in limited locations or only in restricted areas around a point source, dangerously high levels of arsenic have been identified in many water supplies around the world. Moreover, in some affected areas, such as in India, Bangladesh, Taiwan, and possibly China (Sun 2004), the sizes of the exposed populations are very large. Globally, many millions of people currently drink water containing unacceptably high arsenic levels, which are responsible for increases in a wide range of illnesses. In many countries, water supplies are still not routinely tested for arsenic, although as testing becomes more widespread, more and more locations of arsenic contamination are being discovered. Finally, in some high-risk areas, we are probably only seeing the “tip of the iceberg.” Several studies suggest that there is a long latency period between exposure to arsenic and the development of internal cancers, sometimes forty years or more.

## References

- Borgõno JM, Vicent P, Venturino H, Infante A (1977) Arsenic in the drinking water of the city of Antofagasta: epidemiological and clinical study before and after the installation of a treatment plant. *Environmental Health Perspectives* 19: 103-105
- Chen CJ, Kuo TL, Wu MM (1988) Arsenic and cancers (letter). *Lancet* i: 414-415
- Chen YC, Su HJ, Guo YL, Hsueh YM, Smith TJ, Ryan LM, Lee MS, Christiani DC (2003) Arsenic methylation and bladder cancer risk in Taiwan. *Cancer Causes & Control* 14: 303-310
- Chowdhury UK, Biswas BK, Chowdhury TR, Samanta G, Mandal BK, Basu GC, Chanda CR, Lodh D, Saha KC, Mukherjee SK, Roy S, Kabir S, Quamruzzaman Q, Chakraborti D (2000) Groundwater arsenic contamination in Bangladesh and West Bengal, India. *Environmental Health Perspectives* 108: 393-397
- Ferreccio C, Gonzalez C, Milosavjevic V, Marshall G, Sancha AM, Smith AH (2000) Lung cancer and arsenic concentrations in drinking water in Chile. *Epidemiology* 11: 673-679
- Hopenhayn C, Ferreccio C, Browning SR, Huang B, Peralta C, Gibb H, HertzPicciotto I (2003) Arsenic exposure from drinking water and birth weight. *Epidemiology* 14: 593-602
- Hopenhayn-Rich C, Biggs ML, Fuchs, Bergoglio R, Tello EE, Nicolli H, Smith AH (1996) Bladder cancer mortality associated with arsenic in drinking water in Argentina. *Epidemiology* 7: 117-124
- Hopenhayn-Rich C, Biggs ML, Smith AH (1998) Lung and kidney cancer mortality associated with arsenic in drinking water in Cordoba, Argentina. *International Journal of Epidemiology* 27: 561-569
- Vahter M (2000) Genetic polymorphism in the biotransformation of inorganic arsenic and its role in toxicity. *Toxicology Letters* 112-113: 209-217
- Vahter M (2002) Mechanisms of arsenic biotransformation. *Toxicology* 181-182: 211-217
- Wu MM, Kuo TL, Hwang YH, Chen CJ (1989) Doseresponse relation between arsenic concentration in well water and mortality from cancers and vascular diseases. *American Journal of Epidemiology* 130: 1123-1132
- Yang CY, Chang CC, Tsai SS, Chuang HY, Ho CK, Wu TN (2003) Arsenic in drinking water and adverse pregnancy outcome in an arseniasis-endemic area in northeastern Taiwan. *Environmental Research* 91: 29-34
- Yu RC, Hsu KH, Chen CJ, Froines JR (2000) Arsenic methylation capacity and skin cancer. *Cancer Epidemiology Biomarkers & Prevention* 9: 1259-1262
- Zaldívar R (1974) Arsenic contamination of drinking water and food-stuffs causing endemic chronic poisoning. *Beitr Path Bd* 151: 384-400