

## **FATE OF ARSENIC IN THE ENVIRONMENT**

A compilation of papers presented at the International Symposium on **Fate of Arsenic in the Environment** organized by Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh and The United Nations University, Tokyo, Japan with assistance from ITN Centre, Bangladesh.



*Edited by:*

**M. Feroze Ahmed** Ph.D.  
Professor  
Department of Civil Engineering,  
BUET, Dhaka-1000, Bangladesh,

**M. Ashraf Ali** Ph.D.  
Associate Professor  
Department of Civil Engineering,  
BUET, Dhaka-1000, Bangladesh

**Zafar Adeel** Ph.D.  
Academic Programme Officer  
Environment and Sustainable Development,  
The United Nations University, Tokyo, Japan

**Bangladesh University of Engineering and Technology, Dhaka  
The United Nations University, Tokyo**

## **Fate of Arsenic in the Environment**

A compilation of papers presented at the International Symposium on **Fate of Arsenic in the Environment**. The workshop is jointly organized by International Training Network (ITN) - Bangladesh University of Engineering and Technology (BUET), and Environment and Sustainable Development (ESD) Programme -The United Nations University (UNU), Tokyo, Japan.

The factual information and views expressed in the papers are those of the authors, not of the editors nor of the Universities they belong.

*Published by:*

ITN Centre, BUET on behalf of the Bangladesh University of Engineering and Technology and The United Nations University.

February, 2003

**ISBN 984-32-0507-3**

Copyright © 2003 by Publisher. This publication or any part of it can be reproduced in any form with permission of any of the publisher.

*Printed by:* Mati ar Manush,  
173, Fakirapool (1<sup>st</sup> Floor), Dhaka-1000  
Tel: 0171-661841  
*Cover by :* Color Graphic

## Contents

Authors and Title	Page
<b>Preface</b>	vii
<i>M. Mosaferi, M. Yunesian, A. Mesdaghinia, A. Nadim, S. Nasser and A. H. Mahvi</i> <b>Arsenic Occurrence in Drinking Water of I.R of Iran: The Case of Kurdistan Province</b>	1
<i>M. Ashraf Ali, A. B. M. Badruzzaman, M. A. Jalil, M. Delwar Hossain, M. Feroze Ahmed, Abdullah Al Masud, Md. Kamruzzaman and M. Azizur Rahman</i> <b>Fate of Arsenic Extracted With Groundwater</b>	7
<i>Mohammad Aktarul Islam Chowdhury, M. Feroze Ahmed and M. Ashraf Ali</i> <b>Influence of Upstream Sediment on Arsenic Contamination of Groundwater in Bangladesh</b>	21
<i>Anitha Kumari Sharma and Jens Christian Tjell</i> <b>Can Water Storage Habits Influence the Cancer Risk of Drinking Arsenic Contaminated Water?</b>	37
<i>Maheswari Nair, T. Joseph, K.K. Balachandran, K.K.C.Nair and J. S. Paimpillil</i> <b>Arsenic Enrichment in Estuarine Sediments – Impact of Iron and Manganese Mining</b>	57
<i>S. M. Imamul Huq, Anisur Rahman, Nazma Sultana and Ravi Naidu</i> <b>Extent and Severity of Arsenic Contamination in Soils of Bangladesh</b>	69
<i>M. Ashraf Ali, A. B. M. Badruzzaman, M. A. Jalil, M. Delwar Hossain, M. Feroze Ahmed, Abdullah Al Masud, Md. Kamruzzaman and M. Azizur Rahman</i> <b>Arsenic in Plant-Soil Environment in Bangladesh</b>	85

<i>A. T. M. Farid, K. C. Roy, K. M. Hossain and R. Sen</i> <b>A Study of Arsenic Contaminated Irrigation Water and its Carried Over Effect on Vegetable</b>	<b>113</b>
<i>Hiromi Hironaka and Sk. Akhtar Ahmad</i> <b>Arsenic Concentration of Rice in Bangladesh</b>	<b>123</b>
<i>Md. Zahangir Alam and Md. Mujibur Rahman</i> <b>Accumulation of Arsenic in Rice Plant from Arsenic Contaminated Irrigation Water and Effect on Nutrient Content</b>	<b>131</b>
<i>H. K. Das, D. A. Chowdhury, S. Rahman and Obaidullah, M. U. Miah, P. Sengupta and F. Islam</i> <b>Arsenic Contamination of Soil and Water and Related Bio-hazards in Bangladesh</b>	<b>137</b>
<i>M. Ashraf Ali, A. B. M. Badruzzaman, M. A. Jalil, M. Feroze Ahmed, Md. Kamruzzaman, M. Azizur Rahman and Abdullah Al Masud</i> <b>Fate of Arsenic in Wastes Generated From Arsenic Removal Units</b>	<b>147</b>
<i>A. B. M. Badruzzaman</i> <b>Leaching of Arsenic from Wastes of Arsenic Removal Systems</b>	<b>161</b>
<i>M. Fakhurul Islam, M. Moklesur Rahman and Sad Ahamed</i> <b>Leaching of Arsenic from Iron Oxide Impregnated Brick Sands (Shapla Filter Media) Using Common Chemicals and Water</b>	<b>181</b>
<i>Md. Abdur Rouf and Md. Delwar Hossain</i> <b>Effects of Using Arsenic-Iron Sludge in Brick Making</b>	<b>193</b>

## Preface

Groundwater is extensively used for domestic, agricultural and industrial purposes, but presence of high concentration of arsenic in alluvial aquifer in many countries is a matter of great concern. Millions of people are exposed to high levels of arsenic from drinking tubewell water and thousands are suffering from arsenic poisoning but little is known about the fate and transport of arsenic in the environment. The widespread use of groundwater for irrigation suggests that ingestion of irrigated crops could be another major exposure route for arsenic. Besides, phyto-toxicity due to increased arsenic in soil/water and its long-term impact on agricultural yield is another major concern. Besides naturally occurring arsenic, arsenic-rich wastes generated from a wide range of arsenic removal systems are another cause of concern. In the absence of any clear guideline for safe disposal, such wastes are often disposed in the open environment. The leaching and pollution potential of these wastes need to be clearly understood in order to devise safe disposal options. The BUET-UNU Symposium is organized to discuss some of these issues.

This publication is a compilation of papers presented at the BUET-UNU International symposium on *Fate of Arsenic in the Environment*. The papers broadly described the fate of arsenic extracted through tubewell water and transported with surface water, its presence in water-soil-plant environment and food chain. The leaching characteristics of arsenic from arsenic-rich sludges were also discussed in the papers. We hope that this publication of BUET-UNU symposium will be useful to the scientists, engineers, researchers, policy planners and decision-maker working for arsenic mitigation in the arsenic affected countries.

The editors would like to express their sincere thanks and gratitude to all the contributors of this publication and others who directly or indirectly helped to publish this document.

**M. Feroze Ahmed**  
**M. Ashraf Ali**  
**Zafar Adeel**