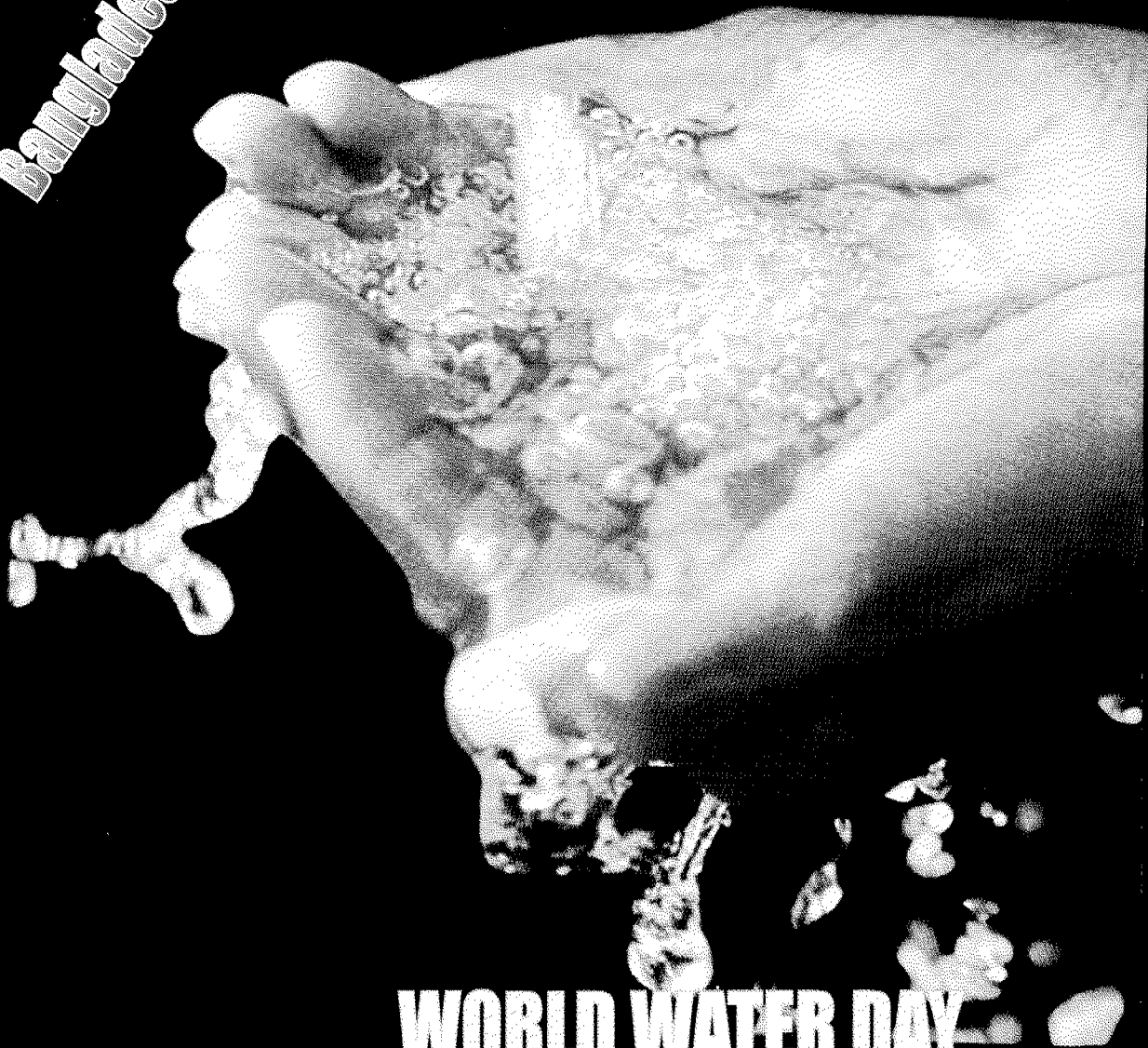


822 BD02

Safe Water
For All
Bangladesh Perspective

**WATER
FOR
DEVELOPMENT**



WORLD WATER DAY

22nd MARCH 2002



822 - BD02 - 17375

The WHO Environmental Health Programme supports the Government of Bangladesh and its associated institutions, as well as civil society, in capacity building for environmental health. Since 1972 WHO has mainly concentrated its assistance in environmental health in capacity building for water supply, sanitation and hygiene promotion, through the Department of Public Health Engineering.

In recent years, support has focused on the development of water quality surveillance systems, through provision of support for the four DPHE zonal laboratories, training, pilot projects and fellowships. The management information system shows clearly that it is imperative to give more attention to operation and management, and water quality aspects of the growing number of Pourashava drinking water supply system.

The detection of arsenic in groundwater has given rise to a diverse package of support measures covering analytical, technical and health aspects of arsenic mitigation. Access to safe drinking water may have fallen to around 80% from 97% coverage due to contamination of drinking water with arsenic. WHO collaborates with the Government and together with other development partners to remedy this situation.

Access to adequate sanitation is around 40% nationally. In conjunction with inadequacies in hygiene behavior, poor sanitation forms a serious threat to health, leading to an excess of diarrhoeal disease burden. Therefore, improvement of sanitation for high-risk and vulnerable groups among the rural and urban population is critical.

During the 1990s the importance of environmental factors on health has become increasingly clear. The WHO supported Healthy City programme attempts to address the linkage between health and environment through partnership between Pourashava authorities, NGOs and civil society, using situation analysis for participatory action in solid waste management, school health, aspects of primary health care, vector control, urban development planning etc. Expansion of these health promotion concepts to other settings is planned.

Capacity building in other areas of Health and Environment is supported through programmes on chemical safety and hazardous waste management (hospital waste management), air pollution and vector borne disease control. Studies are supported to obtain evidence for health risks associated with environment degradation (e. g children and environmental health). These programmes are undertaken in support of the Department of Environment and the Directorate General of Health Services.

Food safety and good practice in the preparation and storage of foodstuff is supported through awareness raising, support to the central laboratory of the Institute of Public Health and through capacity building of sanitary inspectors at the Upazilla level.

World Health Organization

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WATER FOR DEVELOPMENT

WORLD WATER DAY 2002

Edited

Han A. Heijnen

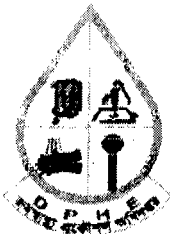
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22 March 2002

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DPHE-WHO Programme



Sustainable Development and Healthy Environment

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Preface

This souvenir is published as part of the celebrations of World Water Day 2002. The global theme of this World Water Day is "Water for Development". The national seminar on World Water Day 2002, organized by the NGO Forum for Drinking Water Supply and Sanitation, in consultation with the Department of Public Health Engineering and the World Health Organization, will focus on "Safe Water for All: Bangladesh Perspective".

In line with the national theme, several sector partners and individuals have contributed a variety of papers on water, sanitation and hygiene, in English and Bangla. We have attempted to provide a broad overview of the activities undertaken by various stakeholders to address a wide range of critical issues to consumers and the country for health and economic impact.

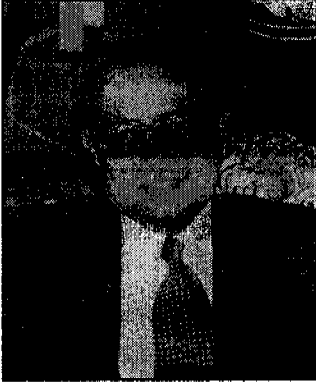
Clearly, this souvenir gives only a glimpse of a varied and dynamic sector that includes many active stakeholders in government, NGOs, sector support institutions and development partners. As we see a convergence of sector development inputs as expressed in the recent formation of a Forum for Coordination and Policy Implementation chaired by the Secretary Local Government Division, and with broad sector representation; it may well be possible in future to make this type of souvenir a regular annual publication, offering an inventory and presentation of the many activities that are undertaken and supported in water supply and sanitation.

I am thankful to the Hon' ble President, Hon' ble Prime Minister and Hon' ble Ministers of Local Government, Rural Development and Cooperatives; Health and Family Welfare; and Water Resources for kindly consenting to contribute some inspiring messages. Their messages clearly demonstrate our common concern for equitable distribution, access and use of water supply and sanitation for improved health, and greater economic and development impact.

It is my privilege to thank all who have made this publication possible. In particular I like to thank Mr. S.M.A. Muslim, Chief Engineer, DPHE and his senior colleagues for their encouragement and prompt response to the challenge. Similarly, NGO Forum through its Executive Director Mr. S.M.A. Rashid and Sr. Advocacy & Information Officer Mr. Joseph Haidar and Mr. Md. Taufiqul Arif, Senior Programme Officer, DPHE-WHO Project and his colleagues have assisted in many ways to make this publication possible.

Lastly, I would like to thank the advertisers and WHO for financing the production of this Souvenir.

Han A. Heijnen
Editor
22 March 2002



بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ



রাষ্ট্রপতি

রাষ্ট্রপতি

গণপ্রজাতন্ত্রী বাংলাদেশ

ঢাকা

০৮ চৈত্র ১৪০৮

২২ শে মার্চ ২০০২

বাণী

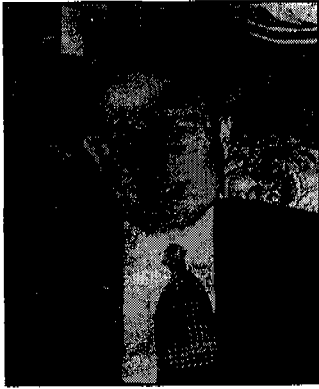
বিসমিল্লাহির রাহমানির রাহিম

মানুষের কল্যাণে নিরাপদ পানি, কার্যকরি পয়ঃনিষ্কাশন ও পরিচ্ছন্ন পরিবেশের উপর গুরুত্ব আরোপ করে 'বিশ্ব পানি দিবস' পালনের উদ্যোগকে আমি স্বাগত জানাই। এ বছরের প্রতিপাদ্য 'উন্নয়নের জন্য পানি' অত্যন্ত তাৎপর্যপূর্ণ।

পরিমিত পরিমাণ নিরাপদ পানি স্বাস্থ্যরক্ষা ও উন্নয়নের জন্য অত্যন্ত প্রয়োজন এবং উদ্যোগ গ্রহণকারী সংস্থা হিসাবে আন্তর্জাতিক পরমাণু শক্তি সংস্থা জনগণের অর্থনৈতিক, সামাজিক ও স্বাস্থ্যের টেকসই উন্নয়নে পানির ভূমিকার উপর গুরুত্ব আরোপ করেছে। সম্প্রতি আন্তর্জাতিক পরমাণু শক্তি সংস্থা আইসোটপ প্রযুক্তির সাহায্যে বাংলাদেশে ভূগর্ভস্থ পানির উৎপত্তি ও এর সময়কাল নির্ণয় করেছে। এর ফলে ভূগর্ভস্থ পানির অবস্থা সম্পর্কে প্রয়োজনীয় তথ্য পাওয়া যাবে এবং এর ব্যবহার সম্পর্কে প্রয়োজনীয় সিদ্ধান্ত গ্রহণ করতে সহায়ক হবে। এছাড়া, নিয়মিতভাবে পানির গুণাগুণ পরীক্ষা ও পর্যবেক্ষণ কার্যক্রম আমাদের পানি সম্পদকে দূষণের হাত থেকে রক্ষা করতে সাহায্য করবে যা টেকসই অর্থনৈতিক, স্বাস্থ্যগত ও সামাজিক উন্নয়নে ব্যবহার করা যাবে।

আমি এ দিবসের কর্মসূচীর সর্বাঙ্গীন সাফল্য কামনা করছি।

অধ্যাপক এ কিউ এম বদরুদ্দোজা চৌধুরী



بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ



PRESIDENT
PEOPLE'S REPUBLIC OF BANGLADESH
DHAKA
22 March 2002

Message

Bismillahir Rahmanir Rahim

I welcome the observance of 'World Water Day' focussing on safe water, sanitation and hygiene for the welfare of the people. This year's theme "Water for Development", is very significant.

Safe and adequate water is essential to health and development. The lead agency, the International Atomic Energy Agency (IAEA), has emphasized water as an intrinsic element of sustainable development for all to achieve their economic, social and health aspirations. The isotope hydrology applications used by IAEA to determine the time-limit and origin of ground water in Bangladesh have recently provided us with information necessary to understand better the geo-hydrological conditions that will help to determine our groundwater use. Regular water quality analysis and monitoring will help protect our water resources and make them available to all for sustainable economic, health and social development.

I wish the programmes of the World Water Day all success.

Professor A Q M Badrudduja Chowdhury.



১৫



প্রধানমন্ত্রী

প্রধানমন্ত্রী

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

০৪ চৈত্র ১৪০৮

১৮ মার্চ ২০০২

বাণী

২২ মার্চ বিশ্ব পানি দিবস। বিশ্বের অন্যান্য দেশের ন্যায় বাংলাদেশেও দিবসটি বিশেষ গুরুত্ব সহকারে পালিত হচ্ছে জেনে আমি আনন্দিত। এবারের বিশ্ব পানি দিবসের মূল প্রতিপাদ্য বিষয়- “উন্নয়নের জন্য পানি”। এবারের প্রতিপাদ্য বিষয় নির্বাচন যথাযথ ও সময়োপযোগী হয়েছে বলে আমি মনে করি।

উন্নয়ন ও উৎপাদন এবং জনস্বাস্থ্য সুরক্ষার জন্য নিরাপদ পানি একান্ত অপরিহার্য। আজকের বিশ্বে পানি ও উন্নয়ন ওৎপ্রোতভাবে জড়িত। একদিকে সুপেয় পানির চাহিদা বাড়ছে। অপরদিকে দূষণ ও অপব্যবহারে নিরাপদ পানির সরবরাহ হ্রাস পাচ্ছে। বাংলাদেশসহ বিশ্বের অনেক দেশে আর্সেনিক সমস্যাও রয়েছে। আর্সেনিক সমস্যা নিরসনের উপায় উদ্ভাবনে ইতিমধ্যে দেশে একটি আন্তর্জাতিক কর্মশালা অনুষ্ঠিত হয়েছে। কর্মশালার সুপারিশ অনুযায়ী আর্সেনিক আক্রান্ত এলাকার জনগণকে রক্ষার জন্য প্রয়োজনীয় পদক্ষেপ গ্রহণ করা হবে।

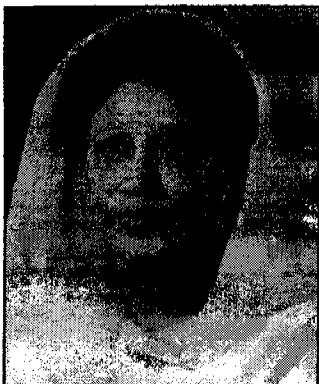
এ বছর বিশ্ব পানি দিবস পালনের বিশেষ তাৎপর্য রয়েছে। এবার বিশ্ব পানি দিবস পালনের এক দশক পূর্ণ হলো। এবারই আবার টেকসই উন্নয়নে বিশ্ব শীর্ষ সম্মেলনও অনুষ্ঠিত হতে যাচ্ছে।

পানি সম্পদের সুরক্ষা ও উন্নয়নে জাতীয় পর্যায়ে সরকার সচেষ্ট রয়েছে। আমি আশা করি, পানি দিবস পালনের মাধ্যমে জনগণের মধ্যেও এ বিষয়ে সচেতনতা বৃদ্ধি পাবে।

আমি বিশ্ব পানি দিবস - ২০০২ এর সকল কর্মসূচির সাফল্য কামনা করি।

আব্লাহ হাফেজ, বাংলাদেশ জিন্দাবাদ।

খালেদা জিয়া



Prime Minister

Government of the People's Republic of Bangladesh

04 Chaitra 1408

18 March 2002

Message

The 22nd of March is World Water Day. I am delighted to know that this day will be observed in Bangladesh with special importance, like elsewhere in the world. This year's theme is "Water for Development". I feel that the selection of the theme has been proper and timely.

Access to safe water is very important to protect public health, and ensure development and productivity. In today's world water and development are closely inter-linked. The demand for safe drinking water is increasing. While, its supply is increasingly falling short of requirement due to its misuse and contamination. Arsenic in groundwater is a problem in many countries of the world including Bangladesh. An International Workshop on Arsenic Mitigation was held recently to innovate ways and means to overcome the problem. On the basis of recommendations of the workshop necessary measures will be taken to protect the people of the arsenic affected areas.

This year's observance of the day has special significance. It marks the 10th anniversary of the World Water Day. The World Summit on Sustainable Development will also be held this year.

At the national level, the Government is trying hard to protect water resources and ensure development. I hope that the people will become more aware of these matters through observance of the day.

I wish all the programmes of the World Water Day 2002 a success.

Allah Hafez, Bangladesh Zindabad.

Khaleda Zia

Translated by
Md. Taufiqul Arif
WHO, Dhaka



মন্ত্রী

স্থানীয় সরকার, পল্লী উন্নয়ন ও সমবায় মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
২২ শে মার্চ ২০০২

বাণী

বাংলাদেশ প্রাচুর্যময় পানি সম্পদে সমৃদ্ধ। এখানে যথেষ্ট বৃষ্টিপাত হয় এবং এখানকার নদী-নালা, খাল-বিল, হাওড় ও ভূগর্ভে প্রচুর পানি চলাচল করে। তা সত্ত্বেও প্রায়ই পানীয় জলের স্বল্পতা দেখা দেয়, কারণ আমরা নিরাপদ পানি চাই এবং বছরের বিভিন্ন সময়ে যখন যতটুকু প্রয়োজন ঠিক ততটুকু চাই।

“উন্নয়নের জন্য পানি” বিশ্ব পানি দিবস ২০০২ এর প্রতিপাদ্য বিষয়টি আমাদের জাতীয় উন্নয়ন চিন্তা-চেতনার সাথে বেশ সঙ্গতিপূর্ণ। পল্লী এলাকার ৯৭% মানুষের জন্য জীবাণুমুক্ত পানি সরবরাহ ও মহামারি আকারে ডাইরিয়ার বিস্তার নিয়ন্ত্রণের মত উজ্জল সাফল্যকে ভূগর্ভস্থ পানিতে আর্সেনিকের উপস্থিতি মারাত্মক প্রশ্নের সম্মুখীন করেছে। আমরা সবার জন্য নিরাপদ খাবার পানি সরবরাহ নিশ্চিত করার লক্ষ্যে আন্তরিকভাবে চেষ্টা করছি যা কেবলমাত্র জীবাণুমুক্ত নয়, ক্ষতিকর রাসায়নিক পদার্থমুক্তও হবে। বর্তমান সরকার সূচিত জাতীয় উন্নয়নের বর্তমান ধারা অব্যাহত রাখার লক্ষ্যে আমাদেরকে সম্ভাব্য স্বল্পতম সময়ের মধ্যে এই আর্সেনিক সমস্যার কার্যকর সমাধান বের করতে হবে।

বিশ্ব পানি দিবস ২০০২ উপলক্ষে আমি আশা করি যে, আমাদের বিজ্ঞানী, প্রকৌশলী, চিকিৎসক, নীতি নির্ধারক ও বিভিন্ন উন্নয়ন প্রকল্প বাস্তবায়নকারীগণ সামগ্রিকভাবে পৃথিবীর অন্যান্য দেশের সহকর্মীদের সাথে এ বিষয়ে মতামত বিনিময়ের সুযোগ গ্রহণ করবেন এবং এর সমাধানের লক্ষ্যে কার্যকর প্রক্রিয়া খুঁজে বের করবেন যা বাস্তবায়ন যোগ্য হবে এবং ফলশ্রুতিতে আমাদের উন্নয়ন অর্থবহ ও টেকসই হবে।

আব্লাহ হাফেজ।

বাংলাদেশ জিন্দাবাদ।

আব্দুল মান্নান ভূঁইয়া

(আব্দুল মান্নান ভূঁইয়া)



Minister
Ministry of LGRD & Cooperatives
Government of the People's Republic of Bangladesh
22 March 2002

Message

Bangladesh is blessed with generous water resources. The country experiences sufficient annual rainfall and enough water flows through rivers, khals, beels, haors etc. and aquifers underground. Still drinking water falls short, because we need safe water and in quantities as per our requirements round the year.

'Water for Development', the theme of the 'World Water Day 2002' suits well to our present context of national development. Our stunning success of supplying bacteriologically safe drinking water to 97% of the country's rural population and control over frequent outbreak of diarrhoea in epidemic form has been overcast with the presence of arsenic in groundwater. We are sincerely trying to ensure access to drinking water for all, which is safe not only from bacterial infestation, but also from harmful chemicals. In order to continue with the remarkable pace of development, which has been triggered by our government, we must reach an effective solution to this problem within shortest possible time.

On the occasion of the World Water Day 2002, I hope that our scientists, engineers, physicians, policy makers, implementers altogether will avail the advantage of sharing views with rest of the world and come up with effective solutions, which are meaningful, affordable and sustainable.

Allah Hafez, Bangladesh Zindabad.


(Abdul Mannan Bhuiyan)



মন্ত্রী

স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয়

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

ঢাকা

১৭ ই মার্চ ২০০২

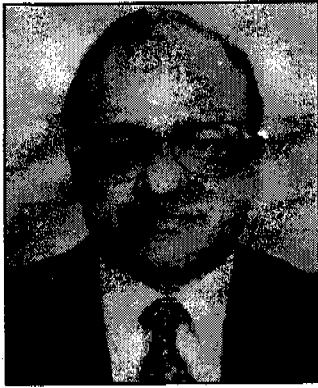
বাণী

“বিশ্ব পানি দিবস ২০০২” উপলক্ষে আমি সকলের সুস্বাস্থ্য ও উন্নতি কামনা করছি। গত বছর বিশ্ব স্বাস্থ্য সংস্থার উদ্যোগে অনুষ্ঠিত বিশ্ব পানি দিবসে পানি, পয়ঃনিষ্কাশন ও পরিচ্ছন্নতার উপর গুরুত্ব আরোপ করা হয়েছিল। এ বছর আমরা “উন্নয়নের জন্য পানি” এর উপর গুরুত্ব আরোপ করেছি।

স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয় জাতীয় উন্নয়নে পানি ও পয়ঃনিষ্কাশনের বিশেষ ভূমিকা সম্পর্কে অত্যন্ত সচেতন। বাংলাদেশের গ্রামঞ্চলে ও শহরে বসবাসকারী নিম্ন আয়ের জনসাধারণ যেসব ছোঁয়াচে রোগে আক্রান্ত হন তার ২০-৩০% রোগ দূষিত পানি ব্যবহার ও যথাযথ পয়ঃনিষ্কাশনের অভাবে হয়ে থাকে। অসুস্থতার কারণে অনেকে উপার্জন অক্ষম হয়ে পড়েন এবং তারা পরিবারের দেখাশোনা করতে পারেন না। নিরাপদ পানি ও কার্যকরী পয়ঃনিষ্কাশন ব্যবস্থার পাশাপাশি ব্যক্তিগত পর্যায়ে পরিষ্কার পরিচ্ছন্নতা পরিচর্যা অনেকাংশে এসব জনগোষ্ঠীর স্বাস্থ্য রক্ষা করতে পারে এবং এদেরকে টেকসই জাতীয় উন্নয়নের সুফল দিতে পারে।

স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয় ক্রমাগত জনসচেতনতার মাধ্যমে অভ্যাসগত পরিবর্তন সাধন ও রোগ প্রতিরোধ ব্যবস্থা জোরদার করার ক্ষেত্রে বিভিন্ন কার্যক্রম গ্রহণ করেছে এবং আর্সেনিক সমস্যা নিরসনে স্থানীয় সরকার, পল্লী উন্নয়ন ও সমবায় মন্ত্রণালয়ভূক্ত জনস্বাস্থ্য প্রকৌশল অধিদপ্তরের সাথে কাজ করে যাচ্ছে। আমরা এই পারস্পরিক সহযোগিতাকে আরো নিবিড় করার মাধ্যমে “উন্নয়নের জন্য পানি” - এর সুফল জনগণের কাছে পৌঁছে দিতে আগ্রহী।

(ডঃ খন্দকার মোশাররফ হোসেন)



Minister

Ministry of Health and Family Welfare
Government of the People's Republic of Bangladesh
Dhaka
17 March 2002

Message

I sincerely wish 'good health and progress' for everybody on the occasion of World Water Day 2002. Water, sanitation and hygiene were emphasized in last year's World Water Day through the efforts of the World Health Organization (WHO). This year we focus on "Water for Development".

Clearly, the Ministry of Health and Family Welfare is aware of the vital role that water and sanitation play in national development. Infectious diseases caused by poor water supply and lack of sanitation constitute some 20-30% of the disease burden in rural and low income urban areas of Bangladesh. These illnesses expose many of our citizens to poverty, as they cannot earn for their families during such periods. Safe water and sound sanitation, together with personal hygiene practices, will keep people healthy and give them the benefits of the nation's sustained development.

The Ministry of Health and Family Welfare promotes disease prevention through behavioral change communication and is working with the Department of Public Health Engineering (DPHE) and the Ministry of Local Government, Rural Development & Cooperatives to tackle the threat of arsenic. We hope to further intensify our collaboration so that our citizen can indeed enjoy the fruits of Water for Development.

(Dr. Khandaker Mosharraf Hossain)



মন্ত্রী
পানি সম্পদ মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
ঢাকা
১৮ ই মার্চ ২০০২

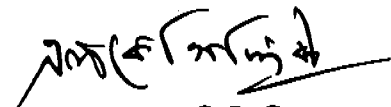
বাণী

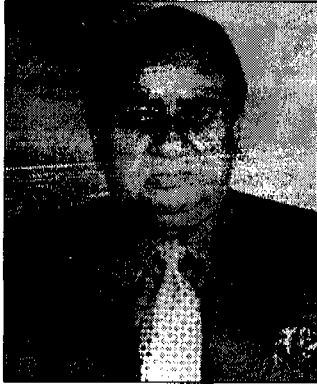
বাংলাদেশের উন্নয়নে পানি সম্পদের উপযুক্ত ব্যবহার ও এর অর্থনৈতিক অর্জন অনুধাবন করা অত্যন্ত গুরুত্বপূর্ণ। সম্প্রতি পানি সম্পদ মন্ত্রণালয় এই সম্পর্কিত বিভিন্ন বিষয়ের উপর একটি বিস্তারিত নীতিমালা প্রণয়ন সমাপ্ত করেছে যা' পানি সম্পদ ব্যবহার কৌশল নির্ধারণে সহায়ক হবে।

সরকারী, বেসরকারী ও সংশ্লিষ্ট গবেষণা প্রতিষ্ঠানের প্রতিনিধিবৃন্দের মধ্যে বিস্তারিত আলোচনার পর বর্তমানে আমরা পানি সম্পদ খাতের জন্য একটি উন্নয়ন অবকাঠামো তৈরী করেছি। এই অবকাঠামো পানি সম্পদ ব্যবহারকারী সকল সহযাত্রীর জন্য একটি দিক-নির্দেশনা হিসাবে কাজ করবে এবং একটি কার্যকরী পানি সম্পদ নিয়ন্ত্রণ কৌশল নির্ধারণ এবং পানির যথাযথ ব্যবহার নিশ্চিতকরণের ক্ষেত্রে বিশেষ ভূমিকা রাখবে।

আমি বিশ্ব পানি দিবস ২০০২ এর সর্বাঙ্গীন সাফল্য কামনা করছি।

আব্দুল হাফেজ। বাংলাদেশ জিন্দাবাদ।


(এল. কে. সিদ্দিকী)



Minister

Ministry of Water Resources

Government of the People's Republic of Bangladesh

Dhaka

18 March 2002

Message

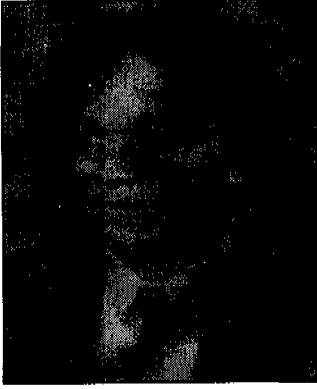
Pragmatic use of the available water resources and reaping economic benefits in national development are critical to the future of Bangladesh. The Ministry of Water Resources has in the last few years made an extensive inventory of the issues that will determine sustainable use of our water resources.

Through extensive consultations with representatives from the government, non-government, research and development institutions we have now arrived at a Development Framework for the Water Sector. This Framework will be an essential guiding tool for all stakeholders to develop regulatory mechanism, ensure efficient use and exploit opportunities for enhanced returns from water.

I wish the World Water Day 2002 all success.

Allah Hafez. Bangladesh Zindabad.

(L.K. Siddiqi)



প্রতিমন্ত্রী

স্থানীয় সরকার, পল্লী উন্নয়ন ও সমবায় মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
২২ শে মার্চ ২০০২


বাণী

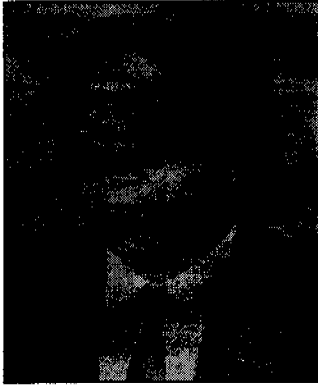
বাংলাদেশের অধিকাংশ জনসাধারণ খাবার পানির জন্য প্রাথমিকভাবে ভূগর্ভস্থ পানির উপর নির্ভরশীল। এ দেশের বর্তমান জনসংখ্যা প্রায় ১৩ কোটি। এর মধ্যে ৮০% জনসাধারণ পল্লী এলাকায় বসবাস করেন। বর্তমানে পল্লী এলাকার ৯৭% জনগণের খাবার পানির জন্য ভূগর্ভস্থ পানি ব্যবহার করার সুযোগ আছে। এর ফলে ডাইরিয়ার মত পানি বাহিত রোগের প্রকোপ বহুলাংশে নিয়ন্ত্রণ করা গেছে। ভূগর্ভস্থ পানিতে আর্সেনিকের উপস্থিতি এই উজ্জ্বল সাফল্যকে ম্লান করে দিয়েছে যা' বর্তমান জনস্বাস্থ্য ব্যবস্থাকে মারাত্মক সমস্যার সম্মুখীন করেছে।

আর্সেনিকের গতি-প্রকৃতি ও ভূগর্ভস্থ পানিতে এর বাড়তি মাত্রায় উপস্থিতির প্রেক্ষিতে “বিশ্ব পানি দিবস ২০০২” এর এই দিনে সবার জন্য নিরাপদ পানি ও কার্যকর পয়ঃনিষ্কাশন ব্যবস্থা নিশ্চিত করার লক্ষ্যে আসুন আমরা প্রতিজ্ঞাবদ্ধ হয়ে সমন্বিত প্রচেষ্টা গ্রহণ করি। নিরাপদ পানি ও পয়ঃনিষ্কাশন সুবিধা মৌলিক মানবিক প্রয়োজন। কেবলমাত্র অক্লান্ত প্রচেষ্টার মাধ্যমেই আমরা কাম্বিত সাফল্য অর্জন করতে পারি।

আল্লাহ হাফেজ।

বাংলাদেশ জিন্দাবাদ।


(জিয়াউল হক জিয়া)



State Minister
Local Government Division
Ministry of LGRD & Cooperatives
Government of the People's Republic of Bangladesh
22 March 2002

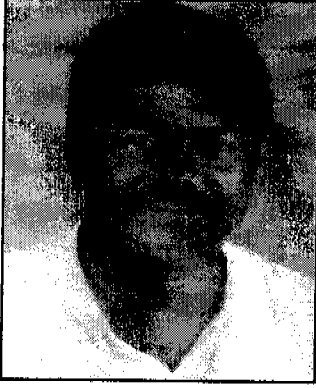
Message

Bangladesh's people rely primarily on groundwater for drinking purpose. Present population of the country is estimated at 130 million. About 80% of them live in rural areas and 97% of them have access to groundwater for drinking purpose. As a result, the prevalence of major waterborne diseases, particularly diarrhoea has been checked to a large extent. This remarkable success has been faded much by the presence of arsenic in the groundwater, which has posed serious problem to public health.

In view of the nature and extent of the arsenic problem, on the occasion of the 'World Water Day' let's vow to make concerted efforts to ensure access to safe drinking water and improved sanitation facilities. Access to safe water and sanitation facilities are basic human needs. Only untiring efforts can lead us to all success.

Allah Hafez.
Bangladesh Zindabad.

(Ziaul Haque Zia)



উপমন্ত্রী

স্থানীয় সরকার, পল্লী উন্নয়ন ও সমবায় মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

বাণী

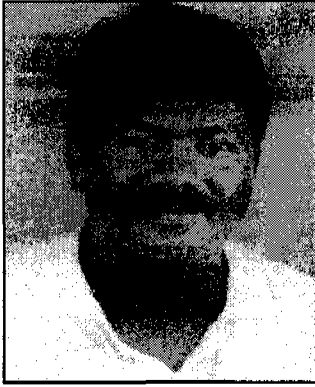
প্রতি বছর ২২শে মার্চ তারিখে বিশ্ব পানি দিবস পালন করা হয়। অন্যান্য সকল দেশের মত বাংলাদেশেও এ দিবসটি যথাযথ গুরুত্বের সাথে পালন করা হচ্ছে। এ বছরের প্রতিপাদ্য বিষয় হল “উন্নয়নের জন্য পানি”। আমার দৃষ্টিতে এই বিষয়টি আমাদের আর্থ-সামাজিক ও সাংস্কৃতিক আবহের সাথে অত্যন্ত সঙ্গতিপূর্ণ। আমরা পৃথিবীর সর্ববৃহৎ ব-দ্বীপ অঞ্চলের অধিবাসী। প্রতি বছর প্রাপ্ত পানির যথাযথ ব্যবহার নিশ্চিত করার উপর আমাদের আশা-আকাঙ্ক্ষা অনেকাংশে নির্ভরশীল। পানি আমাদের তৃষ্ণা নিবারণ করে, কৃষি জমিতে ফসলের সমারোহ আনে, শিল্প-কারখানায় প্রাথমিক কাঁচামাল সরবরাহ করে, সর্বোপরি জলবায়ু সংরক্ষণ ও পরিবেশকে রক্ষা করে। পানি ছাড়া আমরা আমাদের সভ্যতাকে টিকিয়ে রাখতে ও উন্নয়নের কথা বিবেচনা করতে পারি না।

বিশ্ব পানি দিবস উপলক্ষে আসুন আমরা সকলে একজোট হই, পানির উৎসগুলোকে দূষিত হওয়া থেকে রক্ষা করতে ও আর্সেনিকমুক্ত রাখতে কার্যকর পন্থা উদ্ভাবন করি এবং উন্নত জীবন ও টেকসই উন্নয়ন নিশ্চিত করতে ন্যায়সঙ্গতভাবে সকলের জন্য নিরাপদ পানির ব্যবস্থা করি।

আল্লাহ হাফেজ।

বাংলাদেশ জিন্দাবাদ

গ্যাডভোকেট রুহুল কুদ্দুস ডালুকদার (দল)



Deputy Minister
Local Government Division
Ministry of LGRD & Cooperatives
Government of the People's Republic of Bangladesh
22 March 2002

Message

The 22nd March every year marks the World Water Day. In Bangladesh, this day is celebrated with due importance as elsewhere in the world. This year's theme is 'Water for Development'. In my view, this theme suits our socio-economic and cultural context to a great extent. We are the inhabitants of the largest delta in the world. Fulfillment of our hopes and aspirations largely depend on the effective use of water received every year. Water quenches our thirst, provides life-blood to agricultuer, supplies basic input to industries, and above all, upholds climate and protects environment. We cannot think of continuity of our civilization and development without water.

On the occasion of the World Water Day, let's get united and innovate effective measures to protect water sources from arsenic and other harmful chemicals, and ensure equitable distribution of safe water for better livelihood and sustainable development.

Allah Hafez.
Bangladesh Zindabad.

Advocate Ruhul Qaddus Talukder (Dulu)



সচিব

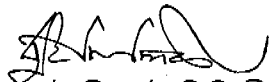
স্থানীয় সরকার বিভাগ
স্থানীয় সরকার, পল্লী উন্নয়ন ও সমবায় মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
২২ শে মার্চ ২০০২

বাণী

বাংলাদেশের শহর ও পল্লী এলাকায় ক্রমাগতভাবে জনবসতি বৃদ্ধির সাথে সাথে নিরাপদ পানি ও পয়ঃনিষ্কাশনের চাহিদাও দ্রুত গতিতে বৃদ্ধি পাচ্ছে। এ দেশের বর্তমান জনসংখ্যা প্রায় ১৩ কোটি এবং প্রতি বর্গ কিলোমিটারে জনঘনত্ব প্রায় ৮৬০ জন। জনসংখ্যা বৃদ্ধির গতি-প্রকৃতি থেকে প্রতীয়মান হয় যে, আগামী ২০২৫ সাল নাগাদ এদেশের জনসংখ্যা ১৭ কোটি ছাড়িয়ে যেতে পারে এবং এই জনসংখ্যার অর্ধেকের বেশী শহরে বসবাস করবে। এ ধরনের সম্ভাব্য অবস্থার প্রেক্ষিতে আমাদের এখন থেকেই যথাযথ পরিকল্পনা অনুসারে শহর ও পল্লী এলাকায় নিরাপদ পানি সরবরাহ ও পয়ঃনিষ্কাশনের ব্যবস্থা করতে হবে।

আমরা যতটুকু পানি ব্যবহার করি তার প্রায় সবটুকুই দূষিত অবস্থায় আবার প্রকৃতিতে ফিরে যায়। ক্রটিপূর্ণ পয়ঃনিষ্কাশন ব্যবস্থা, কৃষি ক্ষেত্রে বিভিন্ন রাসায়নিক সার ও কীটনাশকের ব্যবহার, শিল্প - কারখানা থেকে নির্গত ক্ষতিকর রাসায়নিক বর্জ্য এবং ভূতাত্ত্বিক কারণে নির্গত খনিজ পদার্থ বিশেষত আর্সেনিক, প্রতিনিয়ত পানিকে দূষিত করছে এবং এর ফলে আমাদের পরিবেশের অপূরণীয় ক্ষতি হচ্ছে।

আমাদের ভবিষ্যৎ উন্নয়ন নিরাপদ পানির চাহিদা পূরণের উপর বহুলাংশে নির্ভরশীল। তাই বিশ্ব পানি দিবস ২০০২ উপলক্ষে, পানি দূষণের সমস্যাটির প্রতি বিশেষভাবে নজর দেওয়া প্রয়োজন। আমরা আশা করব, সংশ্লিষ্ট সকলের সম্মিলিত এবং সমন্বিত প্রচেষ্টায় বাংলাদেশে নিরাপদ পানি সরবরাহ ও নিষ্কাশনের যথোপযুক্ত ব্যবস্থা গড়ে উঠবে।


(এ ওয়াই বি আই সিদ্দিকী)



Secretary

Local Government Division
Ministry of LGRD & Cooperatives
Government of the People's Republic of Bangladesh
22 March 2002

Message

Demand for safe water supply and sanitation facilities (WSS) for expanding human settlements in Bangladesh are rapidly increasing. Present population of the country is estimated at 128 million with 860 per sq. km. The population growth trend indicates that by the year 2025, the country's population may exceed 176 million and over a half of our total population will live in cities. This situation calls for proper planning and developing both urban and rural human settlements with safe water supply and adequate sanitation facilities.

Much of the water that we use for various purposes returns to the environment, but in a polluted condition. Lack of access to proper sanitation system, waste of various chemical fertilizers and pesticides, hazardous chemicals from industries and release of toxic materials available in hydro-geologic formation, particularly arsenic altogether contaminate water and ultimately cause great harm to our environment.

The challenge of our future development largely lies with meeting the demand for safe water. Therefore, on the occasion of the 'World Water Day 2002' we should look into the water pollution problem seriously and innovate possible ways and means so that Bangladesh, with the co-operation and co-ordination of all concerned may develop an effective arrangement to ensure safe water supply and sanitation.

(A Y B I Siddiqi)



Kofi A. Annan
Secretary- General United Nations

WORLD'S WATER PROBLEMS CAN BE 'CATALYST FOR COOPERATION'

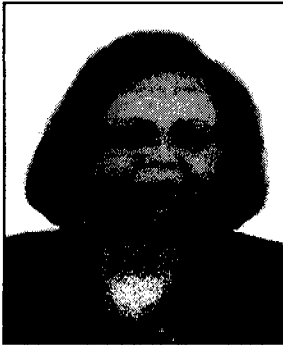
The theme of this year's observance of World Day for Water - "Water for Development" reflects the fundamental place of water in sustaining life and conserving the environment.

An estimated 1.1 billion people lack access to safe drinking water, 2.5 billion people have no access to proper sanitation, and more than 5 million people die each year from water-related diseases-10 times the number killed in wars, on average, each year. All too often, water is treated as an infinite free good. Yet even where supplies are sufficient or plentiful, they are increasingly at risk from pollution and rising demand. By 2025, two thirds of the world's population is likely to live in countries with moderate or severe water shortages. Fierce national competition over water resources has prompted fears that water issues contain the seeds of violent conflict.

But the water problems facing our world need not be only a cause of tension; they can also be a catalyst for cooperation. Two thirds of the world's major rivers are shared by several States. More than 300 rivers cross national boundaries. Increasingly, countries with expertise in the management of watersheds and flood-plains, or with experience in efficient irrigation, are sharing that knowledge and technology with others. Scientists from many nations and disciplines are pooling their efforts, to assess the threat and in the hopes of bringing about a much-needed "blue revolution" in agricultural productivity. The organizations of the United Nations system, for their part, in addition to a vast array of operational projects are also preparing the first edition of the World Water Development Report.

Later this year, heads of State and governmental organizations, private sector representatives and many others will gather in Johannesburg for the World Summit on Sustainable Development. The United Nations General Assembly has proclaimed next year the "International Year of Freshwater". Everyone has a stake in seizing these opportunities to chart a decisive course of action for meeting the Millennium Development Goals on access to freshwater.

If we work together, a secure and sustainable water future can be ours.



Dr. Suniti Acharya
WHO Representative in Bangladesh

For the last 30 years WHO has supported the development of the water and sanitation sector in Bangladesh mainly through the Department of Public Health Engineering. Our focus has been on capacity building for improved access to water supply and sanitation in rural and urban areas.

Safe water is essential to health. By providing bacteriologically safe water, the incidence of cholera and hepatitis in last few decades has come down substantially.

To really reduce the disease burden due to diarrhoeas, however, improvements in personal hygiene behaviour and access to adequate sanitation are even more important.

Bangladesh still lags behind in sanitation coverage, with only just over 40% of the rural population having access to sanitation and may be some 80% of the urban population.

For people to exercise good hygiene practices, a good supply of safe water and access to sanitary facilities are necessary. Only then health improvements will accrue and be sustained. WHO will give extra attention in the years to come, to close **the sanitation gap** and will urge all its partners to do the same.

Now that we have achieved good access to water for most people in the rural and urban areas, we discover that many of our water supplies are contaminated by arsenic.

Arsenic causes health effects ranging from skin lesions to cancers. There is no known cure. Thus, the only option is to ensure that people have access to alternative sources of arsenic free drinking water. Recently DGHS with the support of WHO has developed an agreed protocol on the diagnosis of arsenicosis. Presently work is on-going to validate the protocol and to undertake further research on a suitable management protocol for arsenicosis patients.

Surveillance of urban and rural water supplies for both bacteriological and chemical contamination is becoming more and more important. One cannot assume that water supplies that are safe when newly built will remain so during their useful life. DPHE and WHO have therefore embarked on community-based urban water supply surveillance project. In this project the service provider and the consumer together ensure a safe water quality through regular water quality testing and participatory sanitary surveys, complemented by repair and maintenance to reduce the risks of contamination.

It is further commendable to note that the concern for safe water very recently has led the Chief Engineer DPHE to constitute an advisory body on water quality, with wide ranging terms of reference to make DPHE more responsive and capable with respect to water quality issues.

Safe water for All is indeed a challenge in Bangladesh in these days. It is my wish that this goal will come nearer through the commitment of all stakeholders in planning, use, monitoring and conservation of our precious water resources.

Water, Sanitation and Hygiene A Matter of Survival for Billions of Poor People

**Sir Richard Jolly
WSSCC Geneva**

As we celebrate World Water Day on 22 March, we need to remind ourselves that water is our most precious resource, vital to our daily lives, our economies and to the health of our environment. But to billions of people, mostly the poor and marginalized segments of society, it is a matter of survival. Today, there are still some 1.1 billion inhabitants on Earth without access to a safe water supply and over 2.4 billion without adequate sanitation.

This scandalous situation exists despite the tremendous advances made during the International Drinking Water Supply and Sanitation Decade (1981-1990) to meet these basic needs.

Access to sanitation facilities is a basic human right that safeguards health and human dignity. Every individual deserves to be protected from disease and other health hazards posed by the poor disposal of excreta and human waste. Children, who are the first and the most vulnerable to fall prey to such hazards, deserve a better environment and the highest standard of living possible, according to the Convention on the Rights of the Child.

During International Conference on Freshwater in Bonn on 3 December 2001, the WSSCC launched the WASH campaign - a global advocacy effort by over 1200 members working in more than 140 countries - to mobilize political support and action to ensure an end to this scandal and the suffering of the poorest of the poor. Special emphasis is being placed on promoting a global sanitation target-halving the numbers without sanitation by the year 2015 - without which health for all cannot be achieved.

Revolutionary thinking and a new paradigm shift are required to change the attitudes and behaviours of those who are entrenched in top-down approaches and traditional water management policies. We know from experience that clean water alone leads only to minor health improvements. Sound hygiene behaviour must be recognized as a separate issue in its own right, with adequate sanitation and clean water as supporting components. While each of the three elements has some health benefit, it is their combined effect that has far greater impact. Water and sanitation should form part of an integrated resources management approach that leads to poverty alleviation and sustainable development.

As we commemorate World Water Day, we make a plea to every individual who is in a position to influence policy, provide adequate resources and generate political will, to do all that is possible to reverse one of this century's worst public health disasters, so that countries can strive towards economic progress, social stability and global security.

Water Supply and Sanitation Collaborative Council ; E-mail : wsscc@who.ch; Internet: www.wsscc.org/

THE ROLE OF THE DEPARTMENT OF PUBLIC HEALTH ENGINEERING IN SAFE WATER SUPPLY IN BANGLADESH

S.M.A. Muslim*

1. Introduction

Water is needed in all aspects of life. For a sustainable balanced terrestrial ecosystem water resources are essential and indispensable. Similarly development can not be thought of without water. Safe water is critical, directly or indirectly, to meeting basic human needs, such as food, shelter, clothing, health and education. To ensure the welfare of the people, the Government of Bangladesh is committed to provide safe water to its people. A national water supply and sanitation agency, the Department of Public Health Engineering (DPHE) under the Ministry of Local Government, Rural Development and Cooperatives has been created long back for the purpose.

With the creation of two public Water and Sewerage Authorities (WASA) in 1963 for Dhaka and Chittagong cities. DPHE presently is responsible for water supply and sanitation for the country except Dhaka, Chittagong and Narayanganj, cities.

During the 90's Bangladesh attained a coverage of 97% of the rural people having access to potable water sources within a distance of 150 meters from their respective households. This emergence of arsenic in groundwater has put a negative impact on the success. At present 27% of the tubewells have been affected with arsenic in excess of the Bangladesh Standard, of 0.05mg/l, of which most of the sampled tubewells are installed at shallow depths.

2. The Department of Public Health Engineering

The government of Bangladesh has mandated the DPHE with the following responsibilities:

- i. To provide advisory services to the government in framing policy and action plan for water supply and sanitation in the country;
- ii. To facilitate/provide safe water supply and environmental sanitation facilities to both urban and rural communities, and to improve their personal hygiene practices;
- iii. To provide operational training to Pourashavas/City Corporations, and technical support to local government institutions;

* Chief Engineer, Department of Public Health Engineering, Dhaka
Tel: 88-02-9343358.

- iv. To facilitate local government institutions (Pourashava, Union Parishads etc) in the operation and management of water supply and sanitation systems;
- v. To respond to natural disasters in order to ensure safe water supply and sanitation facilities; and
- vi. To ensure management of water supply and sanitation system surveillance.

To cater for the water supply and sanitation services, the DPHE has set up a multidisciplinary team of Sanitary/Environmental Engineers, Geologists, Chemists, hygiene educators and other support staff. The national agency has, for operation, offices at national, divisional, district, and upazila levels. Additional manpower support is usually provided as temporary set up during implementation of development projects.

3. Development in the Sector

Rural water Supply

The exploration of groundwater source after the liberation of Bangladesh in 1971 added a new horizon in the water supply sector. Bore hole tubewell turned into an appropriate water supply system in the country.

The service level of serving about 450 people with one tubewell in 1971 has been improved to about 100 people with one tubewell in the year 2000.

In addition to the above, the demonstration effect of public programmes helped develop demand for water supply and private sector catered the service to meet the demand.

Urban Water Supply

There are 252 municipal authorities in the country. Of them 101 have community water supplies. Another 60 towns will be having water supplies soon.

The coverage under water supply in urban areas has raised to 56% in 2000 from 20% in 1972.

Water Quality

With the improvement in quantity of water supply, safety of water was considered indispensable for deriving benefits out of water supplies. For the safe water supply, the GoB has set water quality standards for some polluting elements, and the DPHE, through its four regional laboratories, monitor the quality of water it delivers. The Bangladesh Standards for some of the potential hazardous elements are shown in the following table.

Water Quality Parameters	Unit	Bangladesh Standards	WHO Guideline values, 1993
Arsenic	mg/l	0.05	0.01
Barium	mg/l	0.01	0.7
Boron	mg/l	1.0	0.3
Cadmium	mg/l	0.005	0.003
Chloride	mg/l	150-600*	250
Chromium(Hexavalent)	mg/l	0.05	0.05
Chromium (Total)	mg/l	0.05	
Coliform (Total)	no./100ml	0	0
Coliform (Faecal)	no./100ml	0	0
Hardness	mg/l	200-500	
Fluride	mg/l	1	1.5
Iron	mg/l	0.3-1.0	0.3
Lead	mg/l	00.05	0.01
Manganese	mg/l	0.1	0.1
Nickel	mg/l	0.1	0.02
Nitrate	mg/l	10	50
pH	mg/l	6.5 - 8.5	
Sulphate	mg/l	400	250
Temperature	°C	20-30	
Turbidity	JTU	10	5

* For coastal belt areas

In addition to about 1.2 million hand pump tubewells installed by the DPHE in rural areas of the country, the private sector installed a huge number of hand pump tubewells, mostly shallow. Moreover, a large volume of groundwater is abstracted indiscriminately through tubewells for irrigation. In recent years contamination of groundwater with arsenic has been identified. An estimated 29 million people, exposed to arsenic contamination in excess of 0.05 mg/l through 27% contaminated shallow tubewells and few production wells in urban centers, will now require alternative safe water supply.

4. National Water Supply and Sanitation (WSS) Policy

For delivering services in a unified manner and for equity in services, the government has established a policy in the sector. Some important highlights of the policy are listed below:

- * Rural water supply and sanitation services shall be based on cost sharing.
- * Priority will be assigned to water supply in difficult and under served areas.
- * User communities shall be responsible for O&M of WSS facilities.
- * Strengthen capacity of local bodies, DPHE and other stakeholders.
- * Involve and encourage private sector.
- * Involve local government institutions, NGOs and CBOs.
- * Encourage and support women to actively participate in decision making.

5. Challenges

The water supply sector has been facing the following problems:

- * Lowering of groundwater Level;
- * Salinity in surface water and ground water aquifer in the Coastal Belt;
- * Iron, manganese and arsenic in excessive proportions in some places;
- * Non availability of water bearing aquifer in the hilly areas; and
- * Insufficient financial allocation in water supply and sanitation sector.

To solve the problems above, the following measures have been taken:

- * TARA hand pump has been developed to address the lowering of groundwater problem;
- * Shallow Shrouded Tubewell (SST), Rainwater Harvester and Pond Sand Filter (PSF), a version of Slow Sand Filter(SSF) have been developed for use in the coastal saline zone;
- * Treatment plants are installed to remove iron , manganese and arsenic in water; and
- * In stony areas, dug well with lining is used.

Arsenic contamination in drinking water is a big threat to the public health. The DPHE, with its development partners and actors, is facing the biggest challenge of the time in a coordinated manner. Alternative options for avoidance of arsenic in drinking water and for treatment of surface water are being tried. The removal of arsenic from water is problematic in real field situations; yet efforts are being undertaken.

In pursuant to the Prime Minister's 100 day programme, an international workshop on arsenic crisis in Bangladesh was organized. The expert group on alternative water supply observed the following:

- * Alternative technologies are area dependent and cannot be prioritized for the whole country;
- * The country is broadly divided in Shallow Water Table Area, Low water table Area, Coastal Saline Area, Stony Area and Chittagong Hill Tracts Area requiring technological variations;
- * No single option can serve the purpose of the people having different social and economic conditions;
- * Choice of the communities should be given priority in the selection of technological options;
- * There exists knowledge gap in some areas that impedes decision making regarding selection of alternative technologies for arsenic affected areas.

The group recommended the following emergency, short term and long-term options for mitigation of arsenic crisis:

Emergency Option

- * In acute arsenic problem areas an alternative safe water point appropriate in the area is to be provided in each village on an urgent basis following ongoing national screening programme.

Short- term Option

- * Deep tubewell (where suitable aquifer is available);
- * Dug/Ring well (where technically feasible);
- * Rain water harvester;
- * Treatment of surface water; and
- * Treatment of arsenic contaminated water.

Long-Term Option

- * Proven safe and sustainable technologies implemented under short-term options
- * Piped water supply

The options recommended above are site specific and depend on physical and hydrogeological conditions of the sites.

The workshop emphasized the role of central government, local government, NGOs, communities and private sector in mitigating arsenic problem.

The DPHE, in line with the above recommendations, is implementing arsenic mitigation options through different projects. Past and present DPHE projects include (i) study in Arsenic Affected Areas in Bangladesh , (ii) Study of Groundwater for Arsenic Contamination in Bangladesh (BGS-DFID), (iii) Arsenic Mitigation Pilot Project (DANIDA), (iv) Action Research on Community Based Arsenic Mitigation in 5 Upazilas (UNICEF), (v) Study on

Groundwater Development of Deep Aquifers for Safe Drinking Water Supply to Arsenic Affected Areas in Western Bangladesh (JICA), (vi) Action Research on Community Based Arsenic Mitigation in 15 Upazilas (UNICEF with WHO), (vii) Action Research on Community Based Arsenic Mitigation in 25 Upazilas, (viii) Bangladesh Arsenic Mitigation Water Supply Project (World Bank), (ix) Water Supply Project from the Pond in saline-prone and Arsenic Affected Areas, and (x) Arsenic Mitigation Project (Danida)

Awareness raising campaigns have been conducted. A total of over 800,000 water samples have been tested and about 27% of the samples representative of different regions were found contaminated at levels more than Bangladesh Standard of 0.05 mg/l. In 61 districts, a total of 268 upazilas were affected with arsenic in varying degrees of contamination. About 10,000 patients have so far been identified and are under treatment. For supply of safe water, different technological options like household arsenic removal units, deep tubewells, Pond Sand Filters, dug ring wells and rain water harvesters have been tested and installed. Several NGOs like BRAC, CDIB, DCH, EPRC, Grameen Bank, GUP, ISDCM and NGO Forum for Drinking Water Supply and Sanitation and many local NGOs have been participating in arsenic mitigation.

The sources of water available in Bangladesh for development of alternative water supplies are groundwater, surface water and rainwater. In different projects, four groundwater based options, six surface water based options and few rainwater harvesting techniques have been experimentally adopted as alternative water supply options in Bangladesh. On the other hand, thirty community and household level arsenic removal technologies have been tried in to reduce arsenic contents of water of contaminated tubewells to acceptable levels. Deep tubewells, dug/ring wells, treatment of surface waters and few arsenic removal unit show good potentials for water supply in arsenic affected areas and are suitable for adoption in the national program. Most options are site specific and no single option can provide arsenic safe water in all areas or to people having wide variation in socio-economic conditions. Piped water supply, irrespective of source should be given priority where feasible considering convenience and better quality control. Rainwater harvesting has good potential at household level but a system completely based on rainwater appears to be costly and the method is yet to be popular in Bangladesh.

The estimated capital cost to provide arsenic safe water to 29 million people exposed to arsenic content exceeding Bangladesh Standard varies from Taka 2.6 to 36 billion at 2001 price level depending on the type of options. However, the cost will be significantly reduced if the people in the low contamination areas are mobilized to use the safe tubewells in the area. Alternative options for safe water supply will be provided at the hotspots.

A well designed active water quality monitoring program to test the safe tubewells at least once in a year is to be established. The estimated yearly cost of monitoring of safe tubewell once in each year by field test kit is Taka 176 million. An institutional arrangement with greater role of local government is needed for installation, operation and maintenance of alternative water supply options and monitoring of water quality at the local levels.

6. Conclusion

Inadequacy of safe water sources compels the users to go for other contaminated sources and thus made low use of safe water for all domestic purposes. The safe water sources should also be sufficiently close to the users. User friendly technological options in adequate numbers are needed.

Along with iron, salinity, manganese, hardness, arsenic other possibly toxic elements and contaminants also appear as threat. Necessary measures are being taken to redress the crisis.

Piped water supplies are the ultimate long-term options for safe water supply. The Government of Bangladesh as well as the development partners are committed to the improvement of the sector.

7. Recommendations

To achieve a sustainable water supply programme and global usage of safe water, the following are recommended:

- * Awareness raising campaign should further be strengthened;
- * Water quality should be monitored regularly through strengthening the DPHE laboratory network and community management;
- * Emphasis should be given on use of surface water sources along with groundwater source;
- * Research work to develop appropriate technology should be continued;
- * Private sector should be promoted for catering services; and
- * The DPHE should be strengthened further for development, enablement and regulation of community piped water supplies, big or small, in urban as well as rural areas of Bangladesh.

WSS POLICY IMPLEMENTATION *

The Unit for Policy Implementation (UPI) is supporting the Local Government Division in implementing the National Policy for Safe Water Supply and Sanitation (1998). UPI is currently undertaking two major activities to assist the rationalisation of the Water Supply and Sanitation (WSS) sector. These are the "Sector Development Framework" and an "Institutional Review". A short summary of each follows:

Sector Development Framework

Introduction

Water and sanitation sector development comprises disparate project activities without reference to a guiding framework or what others are doing. Duplication of activities and mutually contradictory strategies continue to frustrate sector development. Stakeholders including the government have time and again emphasised the importance of sector co-ordination but achieving it has not been easy.

The Government has adopted a National Policy for Safe Drinking Water Supply and Sanitation in 1998. The imperative of implementing the National Policy for Safe Drinking Water Supply and Sanitation has made sector co-ordination all the more important. At a minimum all sector activities should comply with the policy principles and complement each other in fulfilling the policy objectives.

The on-going GOB financed water supply and sanitation projects have yet to change to reflect the provisions of the National Policy. Most donor-supported initiatives are interpreting the policy principles and striving to incorporate them within their projects/programmes

A positive note is the government's formation of a Policy Implementation and Arsenic Section within LGD to oversee policy implementation and arsenic mitigation. The Danida funded Unit for Policy Implementation (UPI) works with this section. The LGD has also constituted a Forum for Co-ordination and Policy Implementation. The Forum has representation from relevant ministries, government agencies, donors, NGOs and the private sector. The Secretary, LGD, chairs the Forum.

Notwithstanding the noble intentions of the Forum, the absence of an effective framework for sector development is likely to thwart co-ordination. The National Policy is not an operational document. The national policy comprises

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principles that are general and abstract. Such principles are useful in achieving consensus and flexibility, but are difficult to operationalise.

Sector Development Framework

The Government has to take the policy a step further. It has to agree with key stakeholders on the interpretations of the policy principles in terms of specific actions, tally them against the on-going activities/projects in the sector and identify areas of interventions necessary to implement the policy. Such a document will in essence be the framework for sector development and co-ordination, and be a basis for a holistic development strategy.

The Government recognises the importance of a framework for sector development. The Forum in its meeting in October 2001 has approved the Concept of the Sector Development Framework.

For the SDF to be useful the involvement of the government and other stakeholders in the process of its formulation is essential. The stakeholders must own and commit themselves to the document.

The first step in the process of formulation of a Sector Development Framework is the interpretation of the policy principles in terms of specific actions. The other steps are a **Situation Analysis** and an **Institutional Review** the outputs of which will be important inputs into the Sector Development Framework. The on-going UPI study on **Regulatory Framework** in the sector and the feasibility study for **Private Sector Participation** in urban water supply will provide inputs into the situation analysis and the institutional review.

The UPI would work closely with key stakeholders in interpreting the policy principles, analysing the sector situation and matching ongoing projects with the policy interpretations. The output of the process will be matrix test the compliance or lack thereof of the current projects to the policy principles. More importantly the matrix would help identify the areas in need of interventions to implement the national policy.

The UPI has started the process of formulation of the SDF. This process will include a series of workshops at central and local levels to formulate the SDF. It is expected that the first central level workshop will be held in March or early April 2002 with the final workshop held around September 2002.

Institutional Review of the WSS Sector

Background of the study

There is a general recognition in the sector for the need for institutional reforms for improvement of WSS service delivery in support of sustainable outcome. The National Policy for Safe Water Supply and Sanitation recognises this need. The Policy also reflects the GOB commitment to decentralisation through greater responsibility to the local government institutions. Putting the policy into actions will require fundamental changes in the current institutional set-up.

Originally the Institutional Review of the Sector was an initiative of the World Bank under BAMWSP. It was considered that the institutional arrangement for the delivery of Water Supply and Sanitation (WSS) services needed reform and it was included as a legal covenant to the BAMWSP IDA loan agreement (December 1999).

As the Institutional Review was concerned more with "software" than "hardware" LGD requested DANIDA to consider funding this initiative under grant and the Unit for Policy Implementation (UPI) has now taken over responsibility for this initiative.

Salient features of the TOR

The broad objective is to establish processes that will lead to sustainable provision of WSS services in a transparent, timely and cost effective manner. There is a specific requirement to review and revise the role of DPHE in the institutional arrangements from implementor to facilitator and increase the involvement of local government institutions, in accordance with National Policy. The main features of the institutional review are as follows:

Phase 1- Review of current situation

- * Review current status of WSS
- * Assess critical success factors needed to ensure sustainable WSS
- * Review current institutional arrangements in WSS service delivery

Phase 2- Identification of options for service delivery, and preferred approach

- * Develop Options for Future Service Delivery
- * Assessment of Options against Critical Success Factors and Organisational Capacity
- * Presentation of, and Agreement to, the Preferred Option with sector stakeholders

Phase 3- Detailed transition planning

- * Overall Transition Plan developed in agreement with sector stakeholders
- * Detailed Transition Plan developed in agreement with concerned agencies
- * Establish Monitoring and Evaluation Programme

The review will be conducted in a participatory manner and there will be consultations with all sector stakeholders, particularly representatives of local government institutional and beneficiaries. Agreement with sector stakeholders on options for service delivery will be a requirement at critical stages of the review.

The result will not just be a paper report but an agreed option for service delivery by the sector stakeholders and an agreed plan of action to attain that option by the concerned agencies. Possible impact would be a more rational WSS service delivery in the sector leading to a more efficient, effective and sustainable provision of WSS services. It may provide a clear strategy for revising the role of DPHE and increasing the role of LGIs including detailed plans of the required capacity building support needed to fulfil these roles.

Participatory Process - The Improvement Team

The participatory process of the Institutional Review will result in a Transition Plan for institutional reforms in the sector. LGD will constitute an "Improvement Team" to oversee, guide and supervise the study at every stage. The Improvement Team will report to the Secretary LGD and will champion the operationalisation of the Transition Plan.

It is important that the Improvement team be small and meets the demand of innovation and efficiency. The improvement team may comprise the following: a representative from LGD not below the rank of Joint Secretary may chair the team; one representative each from DPHE and LGED not below the rank of Additional Chief Engineer, the Sector Advisor UPI which may work as the secretariat for the Team. There may also be representatives from Local Government Institutions, civil societies and donors. In addition the Improvement Team may co-opt members as necessary. It is important that the representatives are both dynamic and dedicated, and able to meet the demands required as a member of the Improvement Team. The Improvement Team will be officially formed by the LGD.

Current Status and Overall Timeframe

It is proposed to carry out the institutional reform in three phases, of which a review of the current situation is the first and will cover a review of the current status of water and sanitation and the institutions in the sector, assess the critical success factors needed to ensure sustainable service delivery and a review of the current delivery mechanisms. The second phase will focus on developing options for future service delivery, assess the options against critical success factors and organisational capacity and conclude with presentation and agreement of the preferred options with the stakeholders. The Institutional Reform will end with overall and detailed transition plans for sector institutions and implementation of these plans.

In the first phase, it is planned to carry out a number of detailed studies. The TORs for these studies have been prepared and the tendering process for selection of consultants is ongoing. The results from the detailed studies will eventually form part of a 'Current Situation - Institutional Review' report. The detailed studies are as follows:

1. Assessment of Public Sector Institutions, to get an overview of the public sector institutions in the water, sanitation and public health

- sector, the capacities, the institutional roles and responsibilities, current reform initiatives and the public sector delivery processes.
2. Assessment of NGOs, to get an overview of the NGOs active in the water, sanitation and public health sector, their roles, capacities and delivery processes.
 3. Assessment of Private Sector, to get an overview over the capacity in the Private Sector in Bangladesh in relation to the water, sanitation and public health sector, and the delivery processes used by the private sector.
 4. Assessment and validation of Coverage Statistics, with the objective of getting a better understanding of the water and sanitation coverage situation in rural and urban areas in Bangladesh and the health situation in relation to water borne diseases.
 5. User Level Survey, to get a better understanding of the user priorities in relation to water, sanitation and health and compare service delivery processes from the public sector, NGOs and private sector for water supply, sanitation and hygiene promotion as well as getting a better understanding of the role and impact of the private sector in water and sanitation service provision compared to that of the Government and the NGO sectors.

Local consultants will be contacted to conduct this study with international consultants as providing back stopping support and quality assurance. The studies will be carried out in close cooperation with the sector institutions, as much as possible as self-assessments under the guidance of the consultants compiling the results of the studies. This is an important aspect in order to build up consensus around the result of the studies in the participating institutions with the aim of facilitating participation in the later institutional reform processes.

In parallel with these studies, an update of the UPI Project Database will be carried out surveying the extent to which the ongoing and planned projects in the sector are complying with the principles in the National Policy. The policy statements are rather broad, and in order to get a better understanding of the practical implications of the policies, a number of workshops will be conducted at national and local level to develop more specific interpretations of the policy statements, which can be used as measuring indicators in the 'SDF Policy Compliance Matrix'. For the purpose of efficiency in the data collection, the subsequent exercise of guided self-evaluation by the implementation projects will be combined with a mapping of the present service delivery processes, both the 'official processes' as specified in project documents etc. and the 'actual processes' as experienced in the field where these might differ.

The ongoing review of the regulatory framework is expected to be completed

within the next few months. Another process of formulating a new Bangladesh Water Act is also ongoing in connection with the development of the National Water Resource Management Plan. These processes are providing important input into the institutional review.

The institutional review process will be managed by the UPI guided by the decisions and advice from the 'Improvement Team'. The execution of the detailed studies will be tendered by UPI amongst local consultants. Individual TORs have been prepared for the respective studies, so that the contracts can be awarded to separate consultants or alternatively a consulting company can be awarded some or all of the contracts, as may be the outcome of the tendering process. The management of the tendering process and the administration of the contracts will require considerable resources from UPI. The studies will eventually form part of the SDF, and in order to ensure coordination of all the aspects of the development of the SDF, it could be an advantage that the local consultant presently assisting UPI with the SDF process could be given a contract to manage the entire process including the tendering and management of the study contracts.

The aim is to complete the first phase of the Institutional Review including all the detailed studies and have the final (of the series) SDF workshop by September 2002 for presentation and discussion of the results of the review.

INSTITUTIONAL CHALLENGES FOR SCALING UP THE DELIVERY OF SAFE WATER AND SANITATION IN BANGLADESH*

K.M. Minnatullah**

Overview

Although Bangladesh had achieved a commendable coverage of about 97% in rural water supply, through the extraction of shallow groundwater by hand pumps, the detection of arsenic above the maximum permissible limit in a large number of wells has annulled this success and created a new challenge of toxic contamination, exposing nearly 20 million people and putting another 70 million at potential risk. Of about 10 million handpumps installed, nearly 70% are privately owned serving mostly affluent households, while the impoverished depend upon government installations with one handpump for a minimum of 105 people. Where no improved and safe source is available, these people are drinking water from traditional surface water sources which are highly polluted with fecal contamination. Access to adequate sanitation is also limited to the relatively affluent segment of the society, with nearly 40% of the people having some sort of latrines, while the rest carry out open and random defecation.

Infant morbidity and mortality are among the highest in the world. It is estimated that 3.6 million disability adjusted life years (DALYs) are lost each year in Bangladesh due to poor water quality and sanitation, mostly affecting the poor. Scaling up the access to safe water supply and adequate sanitation for the poorest segment of the community is therefore an urgent prerequisite for improving the quality of life of these people, to increase national productivity, and to reduce poverty.

Challenges

Water Supply

Over the years, Bangladesh has achieved a considerable success in providing safe water supply in the rural areas. About 97 percent rural people presently have access to handpumps within a distance of 150 meter with 1 handpump for 105 people. In the Fifth Five Year Plan (FFYP), 1997-2002,

* This paper was presented in the World Water Day Seminar of 21 March 2002. Full text of the paper is available in the proceedings of the seminar.

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the Government of Bangladesh (GOB) planned to increase the coverage of rural water supply, and decrease the number of persons per hand pump from 105 to 80. However, the recent disaster of arsenic contamination of groundwater has significantly reduced the access to safe water in 59 out of the 64 districts of Bangladesh.

In urban areas, although accurate data is not readily available, it is estimated that about 45 percent of the population has access to reasonably safe water, but the remaining 55 percent depend on contaminated surface and groundwater sources.

Groundwater constitutes the major source of drinking water in Bangladesh. Over 90 percent of the drinking water is derived from underground sources. Groundwater source became very popular and reliable, as it is safe from fecal contamination. It took more than 50 years to motivate rural people to use handpumps instead of untreated surface water, and at present people are quite habituated to drink handpump water. However, in recent years, arsenic problem has appeared in such proportion that it has now threatened the entire water supply program in Bangladesh.

Arsenic contamination is found in almost all regions, 59 districts out of 64 are affected, however, the severity of contamination varies greatly. The most highly contaminated wells are generally between 20 and 50 m deep. It is estimated that 20 million people are already currently exposed to arsenic poisoning, and it is further apprehended that about 70 million more people are potentially at risk.

The major constraints in addressing the arsenic problem in Bangladesh are (i) the problem is not uniform across the country, large variations in the levels of contamination occur by region and even within villages; (ii) no single and simple solution seems to be available to mitigate the problem; (iii) many users do not perceive it as a problem because of delayed symptomatic effects; and (iv) behavioral change for using different water sources for different purposes may be necessary.

Apart from the arsenic problem, high iron content, high salinity in the coastal areas, leachates from pit latrines as well as landfills are other potential sources of groundwater contamination. Dissolved iron in excess of 2 mg/l is found in groundwater in about 60% of Bangladesh. Some 170 thanas with a population of 15 million fall in the high iron concentration category. Groundwater is generally saline in the coastal areas and the regions north of Comilla. In such areas consumer tolerance to salinity is high and it is considered a problem only when chloride concentration exceeds 1000 mg/l. Surface water in the country is severely polluted by fecal matters. Up to 80 percent of all illness in Bangladesh are related to water-borne diseases. Water-related health impacts such as sickness and death are valued at 2 - 4 percent of GDP².

Sanitation

Poor sanitation degrades the water quality that causes widespread illness and death due to water-borne diseases. About 25,000 metric tons of fecal matters end up on public lands and waterways everyday. This practice brings with it illness and death. In statistical terms, 3.6 million DALYs (disability adjusted life year) are lost each year in Bangladesh due to poor water quality and sanitation

The existing sanitation facilities are very inadequate. Only 40% rural and 43% urban households have sanitary facilities across Bangladesh. Sustained and scalable sanitation strategy is a challenge as most sanitation interventions are undertaken with donor assistance through NGOs, bypassing the Local Government. As a result, continuous efforts with political support and people's ownership are lacking. Poor people are the most affected as their priority remains food security and survival, making sanitation a less important aspect of their daily life. The role of Local Government to address the public goods dimension of poor sanitation has been largely ignored at the policy level, resulting in a huge amount of resource allocation to urban and rural water supply as compared to on-site sanitation.

Hygiene Promotion as an Integral Component

Level of knowledge on health and hygiene of the people, a particularly in rural area is very low. It is now clear that mere technological options and physical progress in sanitation facilities are not enough in achieving the target of a sanitation program in terms of improved water quality, health and sound environment. Rather, a strategic approach combining both strategies and technologies should be considered for a successful sanitation program in Bangladesh. Technical, social and economic factors and direct involvement of the local Government should be incorporated to run an effective, scalable and sustainable sanitation programme.

ARSENIC: AN EYE OPENER

Dr. Abul Hasnat Milton*

Lots of development initiatives are being currently taken all over the world including the developing countries like Bangladesh to improve the quality of human life. But what happens to this development concept if there is no living human being!

Development by definition is an on going process to improve the quality of human life. No single input alone can improve the quality of life since development has multiple aspect. Water is one of the important components of human development. And we are lucky enough to live in a country like Bangladesh where we have plenty of water resources the underground as well as on the surface. Since it was not known or the technology to withdraw underground water was not available in a large scale, surface water was the main source of drinking water in this country before thirty years. During those days when people were drinking surface water, a host of water borne diseases specially diarrhoea and cholera were the major causes of death in this country. Epidemics of these diseases created havoc on mankind. Surface water has lots of germs that caused these diseases. Microbial contamination of surface water was our main concern and we were desperately looking for an alternate germ free safe drinking water. With the advent of tubewell, we started using underground water as the source of safe drinking water. With this practice the magnitude and severity of water borne diseases started declining. It was a great achievement. Virtually our drinking water-related problem was not only solved but also blessed with plenty of available safe water for all purposes. The diarrhoea situation improved dramatically.

The happy days soon disappeared following the detection of arsenic in groundwater. Arsenic has been discovered in underground water from different corners of the country a regular basis. Now arsenic related problem has been labeled as the menacing disaster. The whole water sector has been faced with threat due to the presence of arsenic.

Prior to detection arsenic, we including the foreign experts dealing with water in Bangladesh were concerned mostly with microbial contamination of water, and unfortunately ignored almost all other important parametres. We are now paying heavy toll the to our previous ignorance about the existence of other chemical parametres of drinking water. Had arsenic been detected ground water earlier we would have been able to control the problem at the initial stage and in a better manner. Whatever the current arsenic situation

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is, we must acknowledge the fact that it is arsenic which has opened our eyes regarding the safety of the drinking water. The groundwater should no more be taken as safe for granted.

At present we are discussing about different parameters of the drinking water and its adverse health consequences. Besides bacteria, salinity and iron, probable presence of uranium, boron, fluoride and other parameters are now getting attention indicating the potential contamination of groundwater by multiple factors. In a country like Bangladesh with abundance of surface water resources, a national guideline on the watershed management is the need of the hour.

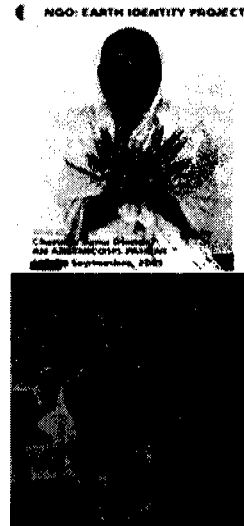
Since birth we have been oriented with the word: that 'water and life'. But, under the present context how far does the statement sound reasonable. Shall it be 'water' that means 'life' or 'safe water means life'? Water can save life as well can ruin life if not safe for drinking and household purposes.

ARSENIC—MASS POISONING ON AN UNPRECEDENTED SCALE *



It is a terrible public catastrophe, asserts Dr. Allan H. Smith, Professor of Epidemiology at the University of California, Berkeley, and a WHO consultant who has investigated arsenicosis in Bangladesh on several trips.

The number of people affected by this arsenic disaster is among the greatest of any disease facing the world today. "By virtue of its sheer size it is pushing the limits of our knowledge and capacity to respond to it", asserts Professor Hans van Ginkel, Rector of the United Nations University in Tokyo.



The crisis has, however, spurred intense research in water de-contamination techniques. How to ensure tens of millions of people arsenic-free drinking water when their water supply comes from wells, many of them rich in arsenic.

How many Bangladeshi are exposed to a high level of arsenic? Estimates vary from a low of 28-35 million to a high of 77 million, more than half the population of the country.

The Bangladeshi are being poisoned by drinking well water, usually without knowing it. Only three decades ago health and development experts, and small local contractors, dug between 7-11 million deep tube wells throughout Bangladesh. The experts encouraged the whole nation to drink well water because it was safe. It was free of the bacteria that caused water-borne diseases such as diarrhoea and other intestinal maladies that have long plagued tropical Bangladesh.

Ironically, the people of Bangladesh exchanged water-borne diseases for arsenicosis. In the 1970s public health specialists and government policy-makers did not think of arsenic. It was only in 1993 that the "clean" well water was discovered to contain dangerous quantities of the poison.

* WHO Press Release, March 2002 Geneva, The largest mass poisoning of a population in history is now underway in Bangladesh.
For further information visit www.who.int or [www.who.int/water sanitation health](http://www.who.int/water_sanitation_health)
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Arsenicosis can cause skin cancer as well as cancers of the bladder, kidney and lung, and diseases of the blood vessels of the legs and feet, and possibly diabetes, high blood pressure and reproductive disorders.

WHO's most recent guideline for a maximum amount of arsenic in drinking water recommends 10 parts per billion (ppb). That was in 1993 when it was lowered to that level from 50 ppb. A new guideline is anticipated in 2003. But most water that is drunk in arsenic affected areas in Bangladesh has substantially higher levels, frequently far above 50 ppb.

Arsenic-contaminated water is not restricted to developing countries. In the western states of the United States of America about 13 million people drink arsenic-tainted water, albeit less contaminated than the well water in Bangladesh. Australia, too, has arsenic-contaminated water. So do Argentina, Brazil, Chile, Hungary, Mexico, Taiwan (Province of China), Thailand, Viet Nam, and the eastern areas of India in Bengal.

"Unfortunately," says WHO sanitary engineer, Hiroki Hashizume, a Japanese expert on arsenic, "it is virtually impossible, with present measurement techniques, especially in the developing world, to measure quantities below 10 ppb. When drinking water guidelines or national standards are established, careful attention has to be paid to analytical capability, arsenic removal technology, etc., to ensure that the levels are really achieved. Since the principal health gain comes from targeting those most exposed to arsenic poisoning, using an intermediate target of 50 ppb, until a lower target can be achieved, would already improve people's health given Bangladesh's limitations.

"Another unfortunate and complicating fact about arsenic poisoning," Hiroki Hashizume adds, "is that it generally takes from seven to 10 years, sometimes longer, for the disease to be recognized. When it finally is, it may be too late to treat."

Professor Robert Goyer, who headed a nine-member commission of the US National Academies of Science, says its findings bolster a 1999 study by the Academy that found that men and women who drink every day water with 10 ppb of arsenic have an increased risk of more than 3 in 1000 of developing bladder or lung cancer during the lifetime. The risk rises to 7 in 1000 at 20 ppb.

Arsenicosis is recognizable from skin color changes, blotches all over the face and body, hyper pigmentation on the chest and upper arms, hard patches on palms and soles of the feet, inability to walk, debilitating pain, watery eyes.

Recently, a woman staggered into a village in Chandpur District where Nasrine R. Karim, the head of a Bangladeshi non-governmental organization, Earth Identity Project, was visiting arsenic-sick villagers.

"She was in a pitiful state," recalls Nasrine. She could barely walk or stand up. Her face and body were covered with dreadful splotches. Her hands and the bottoms of her feet were a solid mass of hard patches, her eyes watery. Her lips and tongue were blue. I had never seen a victim of arsenicosis in such a ghastly condition."

Nasrine, whose NGO deals with 5,000 villagers who have been drinking the arsenic-tainted water found in 98% of the area's wells, decided to transport Chandrabanu to Dhaka. There she was given vitamins and was well nourished for her severe malnutrition. Nasrine took the woman into her house for two months.

"During this period she followed the STAR water treatment", Nasrine says. "STAR stands for Stevens Technology for Arsenic Removal. Stevens is an institute in Hoboken, New Jersey, and one of their engineers, an environmental chemist named Xiaoguang Meng, has invented an effective and inexpensive method for filtering out the arsenic from drinking water for individual households.

"You pour well water into a 20-liter bucket and then empty into it a small packet of powder containing 3.8 grams of an iron sulphate mixture with a small quantity of calcium hypochlorite. You stir with a stick for less than a minute. Then pour the water into three or four inches of sand which serve as a filter. To make sure that no arsenic has slipped through the sand, we throw away this first water. The next batch of water flows into a hole in the bucket through a tube into a second bucket. It is perfectly clean and ready to be drunk.

"In about two months Chandrabanu felt and looked well enough to return to her village. Since then, the splotches on her face and body and the hard patches on her feet have disappeared. Today she is no longer in any pain, and she is walking and working.

She has improved tremendously, and yet we thought we couldn't possibly save her life.

For Chandrabanu it is a miraculous cure. For us at the Earth Identity Project it is a remarkable result, full of hope. I don't dare yet to call it a 'cure,' although it has all the signs of one".

Nasrine says that her 5,000 villagers are all using the same water treatment and "responding favorably. The results are, again, very encouraging".

Jamie Bartram, Coordinator of WHO's Water, Sanitation and Health Programme, says "we know that arsenic is rapidly excreted in urine. So, for early or mild cases of arsenicosis no specific treatment other than clean, safe water is required. Nasrine Karim's experience seems to suggest that ceasing to drink arsenic-tainted water, combined with the natural excretion of the arsenic in urine, can eliminate arsenicosis. Any technique that guarantees uncontaminated water, will do the trick. It remains to be seen,

however, whether all the possible long-term after-effects of arsenicosis will really have been eliminated. Basically, clean water is the cure.”

Considering what approach one should take for curing or preventing arsenic poisoning, Professor Smith of U. Cal. Berkeley, agrees that “the basic treatment is to supply the patient with drinking water that is free from arsenic. This is the first priority. Indeed, in the absence of good evidence for the effectiveness of other treatments, the second priority is to continue providing arsenic-free water, and the third priority is to monitor patients to ensure that they remain unexposed to arsenic”.

And is Nasrine Karim’s success on a small scale meaningful for the tens of millions of other Bangladeshi who are exposed to arsenic poisoning?

“I think so,” she says. “Instead of paying \$10 for the buckets and importing the chemical packets from the United States, we could easily manufacture them here in Bangladesh in huge quantities and sell them at a far lower price. To do this we need substantial funding. I’m often told that health funding is available if it’s for a good cause. Coping with the arsenic poisoning of millions of women, children and men—‘the largest mass poisoning of a population in history’— is a good cause, is it not”?

জলাবদ্ধতা ও লবণাক্ততার বিরূপ প্রভাব

আবুল কালাম*

বাংলাদেশের পরিবেশ ও অর্থনীতিতে কয়েক দশক যাবত নতুন আরেকটি সমস্যা তীব্রভাবে দেখা দিয়েছে; তা হচ্ছে - জলাবদ্ধতা ও লবণাক্ততা। দিনকে দিন এই সমস্যা বেড়েই চলেছে, লবণাক্ত এলাকার পরিধিও বৃদ্ধি পাচ্ছে। এ' কারণে বাংলাদেশের একটি বিশাল অঞ্চলের মানুষ বিশেষ করে দক্ষিণাঞ্চলের মানুষ হারাচ্ছে তাদের আবাস, কৃষিজমি। সব কিছু হারিয়ে তারা হয়ে পড়ছে উদ্বাস্তু ও নিঃস্ব। আর এ'সব উদ্বাস্তু ও নিঃস্ব মানুষেরা ভীড় করছে বড় বড় শহরগুলোতে যার ফলে সৃষ্টি হচ্ছে আরো নতুন নতুন সমস্যা।

কিন্তু কেন এই লবণাক্ততার আগ্রাসন? এই প্রশ্নটি খতিয়ে দেখলে আমরা দেখতে পাবো যে, এই সমস্যাটির উৎপত্তির পেছনে রয়েছে মানুষের অপরিণামদর্শী আচরণ ও অদূরদর্শী পরিকল্পনা। ষাটের দশকের প্রথমদিকেই জলোচ্ছ্বাস ও বন্যার কবল থেকে উপকূলীয় অঞ্চল রক্ষার জন্য শুরু হয় বাঁধ নির্মাণের কাজ। ১৯৬০ সাল থেকে ১৯৬৭ সাল পর্যন্ত বৃহত্তর খুলনা জেলায় ৩৭টি পোল্ডার, ১৫ শত ৬৬ কিলোমিটার বাঁধ এবং ২৮-২টি সুইসগেট নির্মাণ করা হয়। এর ফলে এ'সব অঞ্চলে সত্তর দশকের প্রথমদিকে কৃষি উৎপাদন বৃদ্ধি পেলেও কয়েক বছরের মধ্যে শুরু হয় বিরূপ প্রতিক্রিয়া। ক্রমে ক্রমে বিভিন্ন অঞ্চলে দেখা দেয় জলাবদ্ধতা। মাটিতে লবণাক্ততা বৃদ্ধির ফলে ফসল উৎপাদন হ্রাস পেতে থাকে।

একসময় সমগ্র দক্ষিণ-পশ্চিমাঞ্চলের নদীগুলো পরস্পরের সঙ্গে সংযুক্ত থাকার ফলে নদীগুলোতে প্রবল স্রোত থাকতো এবং সেইসঙ্গে গভীরতাও বজায় ছিলো। প্রতিটি নদীরই একটি নিষ্কাশন অঞ্চল ছিলো। সুতরাং কোথাও পানি আটকে থাকতো না। কিন্তু বাঁধ দে'য়ার ফলে পলি পড়ে নদী-নালাগুলো ভরাট হয়ে যায় এবং পানি নিষ্কাশনের পথও রুদ্ধ হয়ে পড়ে। এতে করে দক্ষিণ-পশ্চিম অঞ্চলের এক বিরাট এলাকা জলাবদ্ধতায় আক্রান্ত হয়। এই জলাবদ্ধতার কারণে খুলনা, বাগেরহাট, সাতক্ষীরা ও যশোর জেলার লক্ষাধিক হেক্টর কৃষি জমি পানির নীচে তলিয়ে যায়।

দক্ষিণাঞ্চলের সবচেয়ে ভয়াবহ জলাবদ্ধ অঞ্চল হচ্ছে বিল ডাকাতিয়া। এই বিলের জলাবদ্ধতা কয়েক লাখ মানুষের কৃষি জীবনকে সম্পূর্ণ ধ্বংস করে দিয়েছে। অপরিকল্পিত বাঁধ নির্মাণই এই অবস্থা সৃষ্টির কারণ।

দক্ষিণ-পশ্চিমাঞ্চলে লবণাক্ততা বৃদ্ধি ও জলাবদ্ধতার আরেকটি কারণ হচ্ছে চিংড়ি চাষ। চাষের জমি আবার কোথাও বিরাণ ভূমিতে লোনা পানি প্রবেশ করিয়ে ঘের দিয়ে তৈরি করা হচ্ছে চিংড়ি চাষ প্রকল্প। কোথাও বা সরাসরি ২০০-৩০০ একরের পুরো বিলটিকে লোনা পানির আওতায় এনে তৈরি করা হচ্ছে চিংড়ি ঘের। এতে করে ভূগর্ভস্থ পানির স্তর, মিঠা পানির পুকুর, কৃষা লবণাক্ততায় আক্রান্ত হচ্ছে। সেই সঙ্গে ঘেরের আশেপাশের জমিও আস্তে আস্তে লবণাক্ততায়

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আক্রান্ত হয়ে চাষের অনুপোযোগী হয়ে পড়ছে। এসব চিংড়ি ঘেরের স্থায়ী জলাবদ্ধতার কারণে লোনা ধরে মানুষের ঘরবাড়ি ভেঙ্গে পড়ছে যা' আর পুনর্নির্মাণ করা সম্ভব হচ্ছে না। এছাড়া বাঁধের কারণে পলি পড়ে ভরাট হয়ে যাওয়া নদ-নদীগুলোর পানি নিষ্কাশনের কোনো জায়গা না থাকায় জোয়ারের লোনা পানি নদী-খাল উপচে অনেক দূর পর্যন্ত ছড়িয়ে পড়ছে। এতে করে ক্রমান্বয়ে মাটির লবণাক্ততা বৃদ্ধি পাচ্ছে। সম্প্রতি একটি অনুসন্ধানে দেখা গেছে যে, এই লবণাক্ততার কারণে প্রকৃতি, পরিবেশ ও অর্থনৈতিক ক্ষেত্রে যে বিপর্যয় ঘটছে তা অকল্পনীয়। লবণাক্ততার কারণে ইতিমধ্যে অনেক প্রাণী ও উদ্ভিদের প্রজাতি বিলীন হয়ে গেছে অথবা হতে যাচ্ছে। জমির অন্যতম জীবনীশক্তি হলো ঘাস, লতাপাতা, আগাছা ইত্যাদি। কিন্তু লবণাক্ততার কারণে অনুজীবসহ এসব উদ্ভিদ কমই জন্মায়। তাই পুনঃজীবচক্র প্রক্রিয়া ক্রমান্বয়ে স্তিমিত হয়ে পড়ছে।

এসব এলাকায় আম, কাঁঠাল, চালতা, বাতাবী লেবু, বিভিন্ন ফলের গাছ চেষ্টা করেও জন্মানো সম্ভব হচ্ছে না। জন্মালেও তা ৪-৫ বছরের মধ্যেই মরে যাচ্ছে। শাক-সব্জীও জন্মানো সম্ভব হচ্ছে না। এখানে বীজ পুঁতলে চারা জন্মাচ্ছে না, চারা জন্মালেও তা' বৃদ্ধি পাচ্ছে না অথবা মরে যাচ্ছে। অথচ আমাদের সমগ্র চাষযোগ্য জমির ৩০% উপকূলীয় অঞ্চলে অবস্থিত। জমিতে লবণাক্ততা বৃদ্ধির কারণে ঐ এলাকার এসব জমিতে ফসল উৎপাদন সম্ভব হচ্ছে না। এতে করে দেশের সামগ্রিক উৎপাদন ব্যবস্থার উপর একটি নেতিবাচক প্রভাব পড়ছে। আশংকার কথা এই যে, চাষের জমিতে এই লবণাক্ততা ক্রমে বৃদ্ধি পেয়েই যাচ্ছে এবং নতুন নতুন এলাকা লবণাক্ততায় আক্রান্ত হচ্ছে। এই লবণাক্ততার কারণে এই অঞ্চলে মিঠা পানির মাছ প্রায় বিলুপ্তির পথে। আগে শিবসা, রূপসা ও পশুর নদীর পানি সামান্য লোনা হওয়ায় তা ইলিশের ডিম ছাড়ার পক্ষে উপযুক্ত ছিলো। ফলে বঙ্গোপসাগর থেকে ঝাঁকে ঝাঁকে ইলিশ ডিম ছাড়ার জন্য এসব নদীতে চলে আসতো। কিন্তু সম্প্রতি এসব নদীর পানিতে লবণাক্ততা বৃদ্ধির কারণে ইলিশ মাছের বাঁক দিক পরিবর্তন করে অন্যত্র চলে যাচ্ছে। স্থায়ী জলাবদ্ধতা ও লবণাক্ততার কারণে মাটির অনুজীবসহ স্বাদু পানির মাছ ও জলজ উদ্ভিদ ও প্রাণী প্রায় বিলুপ্তির পথে। এমনকি পুকুরের পানিতে লবণাক্ততা বৃদ্ধি পাওয়ায় স্বাদু পানির মাছ চাষ করাও সম্ভব হচ্ছে না। ইতিমধ্যে স্বাদু পানির বেশ কিছু প্রজাতির মাছ সম্পূর্ণ বিলুপ্ত হয়ে গেছে। অথচ একসময় এ' অঞ্চল মৎস্য সম্পদে পরিপূর্ণ ছিলো যা' আজ সুদূরের স্বপ্ন মাত্র।

লবণাক্ততার আত্মাসনে পৃথিবীর সবচেয়ে বড় ম্যানগ্রোভ সুন্দরবন আজ হুমকির সম্মুখীন। বাংলাদেশ ও ভারত জুড়ে সুন্দরবনের মোট আয়তন হচ্ছে ১০ হাজার বর্গ কিলোমিটার। এর মধ্যে বাংলাদেশের ভাগে পড়েছে ৫ হাজার ৮শ বর্গ কিলোমিটার। সুন্দরবনের শতকরা ৩০ ভাগ দখল করে আছে নদী-নালা-খাল। কিন্তু এসব ভরাট হয়ে যাওয়ায় এবং মিঠা পানির প্রবাহ হ্রাস ও জোয়ারের পানির স্থায়ীত্ব বৃদ্ধির কারণে মাটিতে লবণাক্ততা বৃদ্ধি পাওয়ায় সমগ্র সুন্দরবন প্রায় ধ্বংসের পর্যায় চলে গেছে। কারণ সুন্দরবন সৃষ্টিই হয়েছে মিষ্টি ও লবণাক্ত পানির ভারসাম্যমূলক অবস্থানের উপর। একটি সমীক্ষায় দেখা গেছে যে, সুন্দরবনের ১৭% গাছ-গাছড়া লবণাক্ততার কারণে মরে যাচ্ছে। আগা মরা রোগে সুন্দরবনের সুন্দরী গাছই আজ হুমকির মুখে। স্বাদু পানির উৎস কমে যাওয়া ও লবণাক্ততা বৃদ্ধির কারণে পরিবেশগত বিপর্যয়ে সুন্দরবনে বাঘ, হরিণ, বনবিড়াল, শূকরসহ বিভিন্ন ধরণের জীবজন্তু দ্রুত হ্রাস পাচ্ছে। সাম্প্রতিক কালে সুন্দরবনের বিস্তার সম্পূর্ণভাবে রুদ্ধ হয়ে গেছে। সুন্দরী, হল্লা, কেওড়া, বাইন প্রভৃতি গাছের বীজ পানিতে ভেসে

নতুন চরাঞ্চলে সরলরেখায় প্রোথিত হয়ে বনের বিস্তার ঘটাতো। কিন্তু আজ পানি প্রবাহ হ্রাস আর লবণাক্ততা বৃদ্ধির কারণে বনের এই বিস্তার আর সম্ভব হচ্ছে না। স্থায়ী জলাবদ্ধতা ও লবণাক্ততা বৃদ্ধি কেবল পরিবেশ ও প্রকৃতির উপরেই নয় দক্ষিণ-পশ্চিমাঞ্চলের সমগ্র জনস্বাস্থ্যের উপরেই বিরূপ প্রতিক্রিয়া সৃষ্টি করেছে। স্থায়ী জলাবদ্ধতার কারণে ভূগর্ভস্থ পানিতে লবণাক্ততা বৃদ্ধি পাওয়ায় পানীয়জলের ক্ষেত্রে এক জটিল পরিস্থিতি সৃষ্টি হয়েছে। সব পানির উৎসই লবণাক্ততায় আক্রান্ত হয়েছে। নিরাপদ পানির অভাবে ডায়রিয়া ও পেটের অসুখ বর্তমানে এ' অঞ্চলের বেশিরভাগ মানুষের নিত্য সঙ্গী।

সব দিক বিবেচনা করে বলা যায় যে, সমগ্র দক্ষিণ-পশ্চিমাঞ্চলে স্থায়ী জলাবদ্ধতা ও লবণাক্ততা বৃদ্ধি আজ এক স্থায়ী সমস্যা হিসাবে দেখা দিয়েছে। পরিবর্তিত হয়ে গেছে এ' অঞ্চলের প্রাকৃতিক পরিবেশ। এ' অবস্থায় সরকার, দাতা সংস্থা, বেসরকারী সংস্থা, পরিবেশবিদ, পানি বিশেষজ্ঞ এদের সকলের সম্মিলিত প্রচেষ্টা ও কার্যকর সিদ্ধান্ত গ্রহণের মধ্য দিয়েই এর একটা সমাধানের পথ খুঁজে পাওয়া যেতে পারে। আর তা' করতে হবে এখনই। কারণ ইতিমধ্যে অনেক দেবী হয়ে গেছে। তা' না হ'লে অদূর ভবিষ্যতে এই সমস্যা বাংলাদেশের সামগ্রিক পরিবেশ ও অর্থনীতির ক্ষেত্রে এক মারাত্মক বিপর্যয় হিসাবে দেখা দিবে।

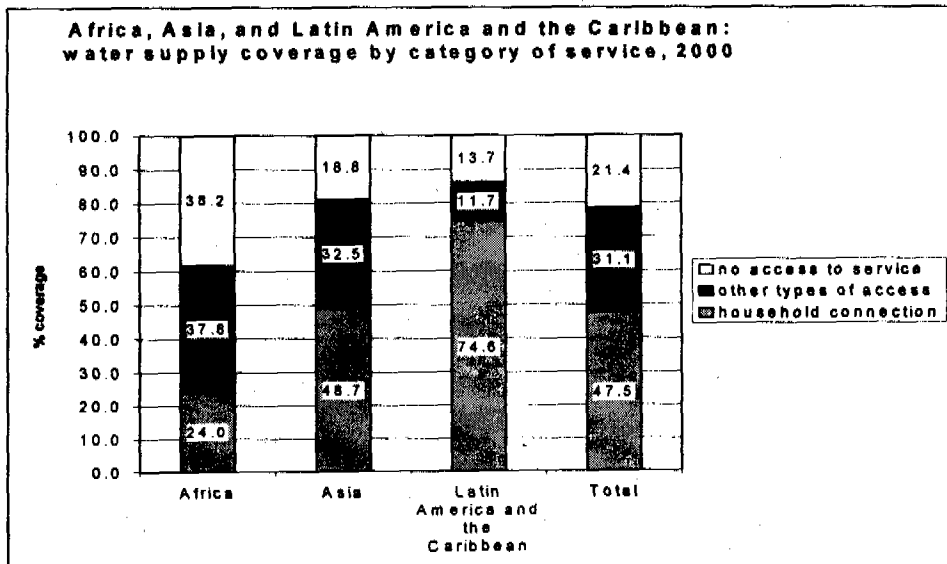
TOWARDS WATER QUALITY GUIDANCE FOR COLLECTED RAINWATER

Han A. Heijnen*

Introduction

Traditionally surface water and (shallow) ground water have been used as sources for drinking water. In harsher environments societies have developed ways of securing sufficient good quality water by developing techniques for digging deeper and collecting water in underground drains (qanats) or by constructing run-off water collection systems to fill surface reservoirs (ponds, tank, wewa, hafir etc.).

In recent years exploitation of water resources has focused on providing water for food production, and water supply for domestic and industrial purposes. Population growth, intensification of agriculture and growing urbanization have led to water stresses in locations that used to be self sufficient in water. Quantity and quality of water for all human purposes are becoming compromised and many countries are now developing strategies to conserve and protect water.



WHO/UNICEF 2000 Global Water Supply and Sanitation Assessment
2000 Report, (Summary, Figure 8)

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Hazard: a biological, chemical, physical or vector borne agent in, or associated with,
water with the potential to cause an adverse health effect.

Households and communities all over the world have from time immemorial collected rainwater for their daily needs. *Dying Wisdom*, published by CSE in New Delhi in 1995 as a result of an extensive journey across the Indian Sub-continent, beautifully describes the intricate ways in which people secured their livelihood through harvesting and protection of rainwater. On the other hand, public health concerns and technological developments of the last 150 years have combined to provide many people with safe and convenient water supply facilities near their home. This will have pushed rainwater harvesting to the background as a water supply option.

Unfortunately, the Global Assessment of the Water Supply and Sanitation Sector, 2000, has to report that in 2000 only 82% (4.9 billion) of the world's population is served with some form of improved water supply. The diagram above shows that of the combined population of Africa, Asia, Latin America and the Caribbean some 21% is not served.

Chances are that many of those not served, and even a good number of those served by an improved supply, will practice some form of rainwater harvesting to secure or augment domestic supplies.

In view of the stress on available water sources and because many people will have no alternative, the use of rainwater for a variety of domestic purposes is likely to grow rapidly. Not all collected rainwater will be used for drinking and cooking. But for the part that is, it would be useful to develop guidelines with respect to safeguarding its quality. WHO intends to include guidance on the quality and storage of collected rainwater as a source of drinking water, in its next update of the Drinking Water Quality Guidelines scheduled for 2003.

WHO Guidelines for Drinking Water Quality

The current, second, edition of the WHO Guidelines for Drinking-water Quality was published in three volumes: Vol. 1 - Recommendations; Vol. 2 - Health Criteria and other Supporting Information; and Vol. 3 - Surveillance and Control of Community Supplies, in 1993, 1996 and 1997, respectively. Addenda were published in 1998, addressing selected chemicals only. Current information about the Guidelines and specific Guideline Values is available from www.who.int/water_sanitation_health/water_quality/drinkwat.htm and the documents mentioned above.

The primary aim of the Guidelines for Drinking-Water Quality (GDWQ) is the protection of public health. The GDWQ provide an assessment of the health risk presented by microorganisms, chemicals and radionuclides present in drinking-water. The guideline values recommended for individual constituents of water are not mandatory limits - they are intended to be used in the development of risk management strategies, including national or regional standards developed in the context of local or national environmental, social, economic and cultural conditions. Such strategies, if properly implemented,

will ensure the safety of drinking-water supplies through the elimination, or reduction to a minimum concentration, of constituents of water that are known to be hazardous to health.

Throughout the development of guidelines it has been recognised that the primary requirement is a sufficient supply of water. The second requirement is that the water is microbiologically safe since waterborne pathogens give rise to acute episodes of disease and these episodes of disease can have a serious debilitating effect on those affected even if they are not directly fatal. The third requirement is that the water is chemically safe, although there are different levels of risk associated with different chemical parameters and this too means that there will be different priorities associated with different chemical parameters.

It is also important that the water is acceptable to the consumer in terms of its colour, turbidity and taste. There is a danger that even if water is safe to drink but is unpalatable due to discolouration or taste, that consumers will turn to other sources of water which have a better appearance and taste but which are unsafe.

Specific Guidelines for Collected and Stored Rainwater?

People collect rainwater in many different ways and for a variety of reasons. Water may be collected primarily for agriculture and through bank filtration used for drinking as well (wells near many tanks in South East Asia; it may be collected only for community use in large protected, cemented areas (central Jamaica), or as a community supply for drinking water only using large (school) roofs and extracted with a handpump (Cambodia). In all these instances one is dealing with small community water supply systems which in principle should meet the national standards or in their absence the current WHO guidelines for drinking water. One may argue the applicability of the guidelines in all such instances, but here again the evaluation of risk to the public through limited compliance or through reverting to alternative, even less safe sources, should determine the appropriate course of action.

This paper focuses on the quality of rainwater as it is collected from domestic roof catchments. Some of the considerations mentioned here will however also be important for the design and management of community systems.

Quality of any water is determined by the quality of the source water, the exposure to contaminants during the production process (collection, treatment, storage) and when it reaches the consumer. Rainwater is generally bacteriologically safe, has low mineralization, but may be acidic, contain lead, traces of pesticides, etc. depending on locality and prevailing winds. Contamination occurs when rain falls on to the roof, collects dirt, dissolves some zinc or lead in case of metal surfaces and then flows into storage. In storage it may increase in alkalinity in ferro cement tanks or dissolve chemicals from paints used. A good description of the water quality concerns in rainwater is provided in *Rainwater Catchment Systems for Domestic Supply* (Gould and Nissen-Petersen, 1999).

Bacteriological quality of rainwater will depend on the collection and storage methods. In a well-designed system, pathogenic bacteria counts are low in collected rainwater, and the conditions (lack of light or food source) do not promote their growth. Under these conditions pathogen levels will actually decrease with storage, rather than increase.

- * Typical fecal and total coliform counts in water collected from rooftops average 5-15 and 25-75 per 100 ml, respectively (e.g. Pinfold et al., 1993; Appan, 1997; Simmons et al., 1999a). Mansur (1999) reported 0 fecal coliform in rural Sri Lanka, with total coliforms typically from 0-50 and fecal streptococci from 0-20 per 100 ml. By examining the ratio of fecal coliforms to fecal streptococci, Appan found approximately 80% of the fecal contamination to be of non-human origin, presumably from animal droppings on the rooftop (Appan, 1997). Simmons and others found similar coliform counts in rural New Zealand, though occasionally cases counts were significantly higher (maximum total and fecal coliforms were 19,000 and 840 per 100 ml). Two samples showed *Cryptosporidium*, but none showed *Giardia*, *Campylobacter*, or *Legionella pneumophila* (Simmons et al., 1999a). Recent rainfall, silt build up in the reservoir and the size of the reservoir are reported to influence microbiological quality.
- * Yaziz and others found moderate levels of coliform bacteria in rainwater collected from rooftops, and showed that the highest counts were in the first samples collected during a rainfall. When samples were collected after a 'first flush' equivalent to 35 liters per 100 square meters of roof catchment area, no fecal coliforms could be detected, and total coliforms were reduced by over 50% (Yaziz et al., 1989).

The **chemical composition** of collected rainwater is very different from that of surface or groundwater. Rainwater is very low in dissolved minerals, and as such is relatively corrosive.

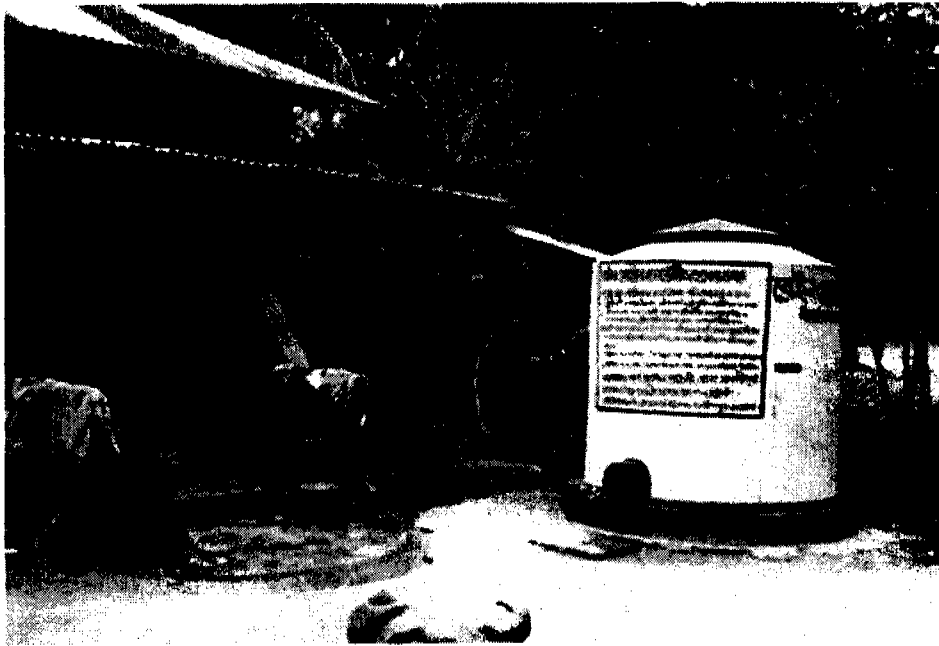
Due to atmospheric carbon dioxide, rainwater is naturally slightly acidic. Industrial activity, especially production of sulfurous aerosols, can result in acid rain, which can extend well beyond zones of industrial activity.

- * Acid rain has been documented in rainwater collection systems: drinking water collected from rooftops in Singapore was found to have pH as low as 4.2 (Appan, 1997). On the other hand Mansur and others report levels between 7 and 8.5 in rural areas.
- * In urban settings, rainwater may have elevated concentrations of human-caused pollutants such as hydrocarbons and heavy metals. Several water quality studies have documented elevated lead levels in rainwater collected from rooftops (e.g. Yaziz et al., 1989; Chang and Crowley, 1993; Thomas and Greene, 1993; Appan, 1997), often at several times the WHO Guideline value of 10 µg/L. In some cases this is most likely due to atmospheric contamination, rather than leaching from roof materials, since similar levels have been found in rainwater collected directly, and in waters collected from metal and concrete roofs (Yaziz et al., 1989). However, others report elevated lead levels in rural New Zealand, where atmospheric lead should be low. Lead levels were higher in houses using lead or galvanised iron flashing (Simmons et al., 1999b).

- * Especially when rainwater is acidic, contaminants can be leached from roof catchment or tank materials. Terra cotta and concrete materials can result in highly alkaline waters (Chang and Crowley, 1993). When rainwater is collected from corrugated sheet metal roofs, elevated zinc levels are commonly reported, typically ranging from 2-6 mg/L (Yaziz et al., 1989; Appan, 1997), sometimes exceeding the WHO guideline value of 3.0 mg/L. Note that this an acceptance based guideline and not a health based guideline value.

Typical Values of Some Parameters Associated with Rainwater Quality

Interest in the use of rainwater is growing around the world, and this has led to an increase in studies on aspects related to the collection and storage of rainwater. Some national authorities issue guidance already, but in most countries no regulatory provisions exist with respect to rainwater. The EU funded research project on rain water harvesting coordinated by Warwick University, with partners in Germany, Uganda, Sri Lanka and India has boosted information exchange and knowledge gathering among rainwater practitioners including those in more developed countries. The 10th Conference of the International Rainwater Catchment Systems Association offers a further opportunity to consider the need for guidelines specific to the quality of rainwater. If so what could be done?



Source: NGO Forum for Drinking Water Supply and Sanitation, Dhaka.

Hazard Assessment and Critical Control Point (HACCP) System

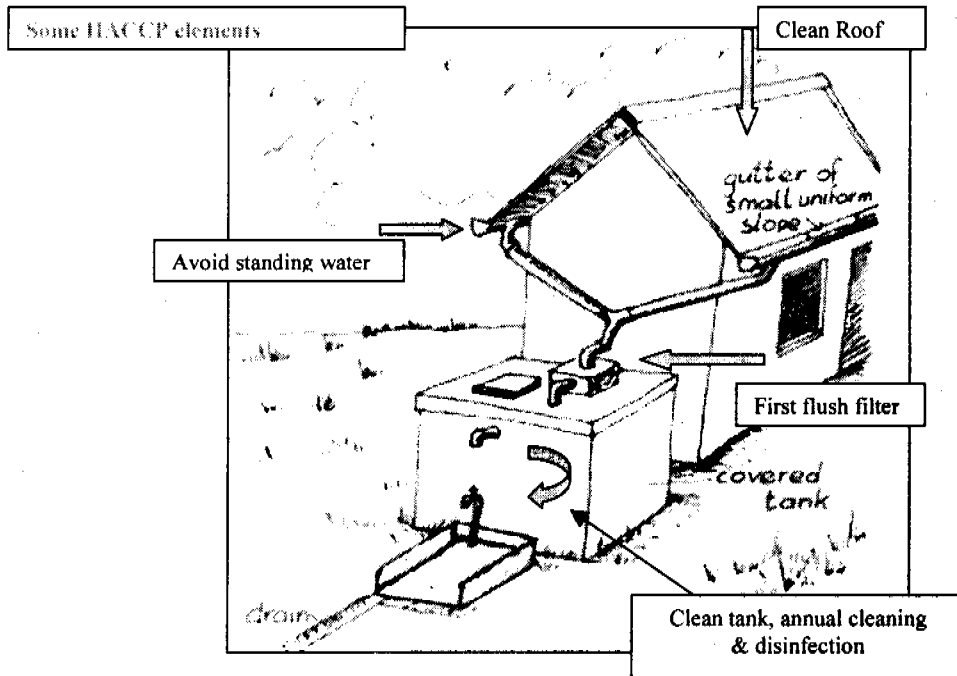
In recent consultations on the WHO drinking water quality guidelines, it was recommended that guidelines should not (just) consist of a set of compliance values, but rather emphasize the requirement to go through a process of evaluation of the system from the water resources to the point of use. The guidelines would require that, based upon this risk analysis, critical control points and appropriate verifications be identified. Finally, the guidelines would require periodic auditing of procedures and assessment of verifications at appropriate levels.

For the last thirty years, the Hazard Assessment and Critical Control Point (HACCP) system has been associated with the management of food safety. It has become an effective tool to assess hazards and establish control systems that focus on prevention rather than relying mainly on end-product testing. Its implementation should be guided by scientific evidence of risks to human health.

HACCP can very well be applied to water production processes in general and appears even more suited for the design, construction, management and operation of domestic rainwater systems, where user commitment to diversion of the "first flush" and regular maintenance is critical to the quality of the water produced. HACCP also allows an assessment of risks related to the use of different roof surfaces and fittings (bacteriological, chemical) and a continuous check on vector borne diseases. An example of the approach that is envisaged for guidance on rainwater in the update of the WHO DWQG is given below. Cross referencing with the Guideline Values will be given. Suggestions will further be made for incremental improvements in design and operation that can be used by public health authorities to develop local guidance materials for promoters and users of rainwater harvesting in their command area.

Example of some elements of a HACCP system derived checklist

DESIGN ISSUE	Justification/explanation (includes cross-referencing to support texts) draft for illustration of approach only
Tank is watertight	Tank should not allow any water to enter the tank other than through the inlet from the gutters. The joint between the inlet pipe and tank should be properly sealed and not allow contamination to enter.
Tank has drain valves to allow proper cleaning and drainage of wash water	It should be possible to completely drain down the tank and for dirty water to be removed during cleaning. Drained water should be removed from the tank and flow to a soak-away or drain.
First flush diversion systems in place	Foul-flush systems allow the first rains to be drained to waste. The design should be simple and easy to use. In cases where there is very limited rainfall, care should be taken to ensure that foul-flush diversion does not seriously compromise the amount of water to be collected.
Roof is hard impermeable surface	Hard impermeable surfaces increase the potential for cleaning and reduce the potential for microbial ecosystems to develop.
Trees do not overhang roofs used for collection	Avoiding direct overhang of roofs used for collecting rainwater by trees helps reduce the likelihood of bird or rodent feces building up on the roof
Cover all vents etc with mesh	Putting mosquito and other fine mesh material on the inside of all air vents and overflow pipes reduces vector borne disease risks.



Verification issues

Critical control point	Verification
Tank is disinfected periodically	Chlorine residual, presence of thermotolerant coliforms
Roof and gutters are clean	Sanitary inspection, thermotolerant coliforms
Inside of tank is clean	Sanitary inspection, thermotolerant coliforms
Tank walls and roof remain in good condition	Sanitary inspection
First-flush system used and in good working order	Sanitary inspection
Mesh in place on all vents/ overflow	Sanitary inspection

Microbiological Quality

Already in 1993 Krishna proposed a three tier classification for stored water quality collected from roofs:

Class I	0	fecal coliform/100 ml
Class II	1-10	fecal coliform/100 ml
Class III	> 10	fecal coliform/100 ml

Class I represents the desired waterquality that also meets WHO guidelines, while Class II would represent water of acceptable quality. WHO (1997a) lists this category as "low risk" for small community water supplies.

As most systems will serve a household or a family cluster of households (5 - 15 members), monitoring can at best be done on a sampling basis only. The appropriate analytical methods, cost of transport and the test itself will determine the feasibility of monitoring.

Simmons (1999a) reports testing for various protozoal enteric pathogens in heavily contaminated systems and found *Aeromonas hydrophila* in 16% of the samples investigated with a significant association with reported gastrointestinal symptoms among householders in the months prior to sampling. Many people using (rain)water may not link these symptoms or discomforts to consumption of contaminated water and so underreporting is likely in a normal situation. Clearly, however, some more study needs to be done to assess the health implications of roof water consumption.

Various studies hint at the importance of good design and maintenance and it is those aspects that the HACCP above explains to address as a most important barrier to microbiological health risks. Disinfection or filtration will play a role as well depending on economic considerations and logistics.

Chemical Quality

Roof and tank surfaces may leach certain chemicals, while air pollution may cause increased concentrations in lead or pesticides. HACCP should determine the extent of the risk and what should be done to eliminate or minimize the risk.

The recent detection of widespread arsenic contamination in Bangladesh offers an illustration of risk assessment. Use of bacteriologically safe shallow tube well water was successfully promoted with over 90% of the population preferring tubewell water. Toxic arsenic now makes many of the tubewells unsafe for drinking. Even though all-year rainwater consumption for drinking and cooking can not be ensured economically in view of the rainfall pattern, rainwater harvesting has been accepted as a suitable water supply as it will remove the exposure of consumers to the deadly arsenic. In return they will have water that is bacteriologically low-risk or safe with possibly some elution of zinc in

case of metal roofs. Zinc is however not known to be a health risk in drinking water, and is actually supplied as nutritional supplement in rural Bangladesh.

Information on current materials used in rainwater harvesting (roof materials, paints, fittings), especially in developing countries, will need to be collected to ascertain appropriateness for use, and if not, suggestions should be made for (local) alternatives.

Vector Control

Malaria, dengue and filariasis may be associated with imperfect water storage systems in tropical countries. In regular storage systems linked to piped supplies, mosquito problems are a lesser risk as there will be important variation in water levels in the tank thus causing an unfavourable breeding situation. In rainwater systems mosquitoes may breed in case mosquito meshes or sealing of passage points is inadequate. Regular checking is necessary to ensure that mosquitoes do not breed and other vermin (rats, cockroaches) does not enter the tank.

Biological control through *Bacillus Thuringiensis israelensis* (BTi) or larvivorous fish may help limit mosquito breeding (Sri Lanka, Bangladesh). Drops of kerosine, herbal oils (neem?) and insecticides such as Temephos have been used. The overall effectiveness and health effects of these methods needs further study.

Vector control is an important issue when introducing rainwater harvesting. The evaluation of the 2000 dengue epidemic in Bangladesh showed that of 5400 patients and 91 deaths overall recorded by the Ministry of Health, most patients were from the urban areas. Half of the patients reporting to one of the reference hospitals in Khulna, or around 200 patients, however, came from Dakop upazilla where rainwater harvesting was introduced some 10 years ago, as other water sources where too saline. Of 336 containers searched for aedes, 68% were positive. The highest density of aedes larvae were found in motka (earthen pots) used for storing rainwater (Directorate General of Health Services, Ministry of Health, Bangladesh ; August 2001)

Conclusion

Rainwater will prove increasingly an essential source of drinking water for households living in isolated and underserved locations or where chemical contamination of traditional sources is prevalent. Health risk assessment guidance for the use of collected rainwater will be needed in various climatic settings and settlement situations. The current WHO water quality guidelines provide a starting point for a HACCP approach applied to design and maintenance of rainwater systems, and including vector control.

WHO will include guidance on the quality and storage of collected rainwater

as a source of drinking water in its next update of the Drinking Water Quality Guidelines scheduled for 2003.

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UNITED THEY STAND

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Introduction

Community-managed programme implementation is a new concept in the development arena of Bangladesh. Traditionally, since the independence of Bangladesh in 1971, the development programmes have been operating by the Government and Non-Government Organizations (NGOs) mainly as target group approach. However, unlike other development agencies, NGO Forum for Drinking Water Supply & Sanitation follows the community-focused and community-managed approach instead of target group approach. NGO Forum realizes that the spontaneous participation of the target community at every step is a pre-requisite for successful implementation of any development programme. In the community-managed WatSan Programme approach of NGO Forum a Village Development Committee (VDC), formed with the participation of the villagers, works as the focal point for ensuring successful implementation and sustainability of WatSan services.

In the community-managed WatSan village, the WatSan programme is implemented with direct supervision of the VDC at community level with assistance from NGO Forum, and under the guidance of the Forum's partner organization. NGO Forum believes that if the overall responsibility of developing a village is handed over to and performed by the VDC with necessary awareness and capacity building, the development process of the village would be effective and sustain the programme achievement. As one of the objective, NGO Forum provides support to capacity building of the partner organizations, VDC members as well as other community groups who will finally play the pioneering role for effective implementation of the WatSan programme.

South Datinakhali

South Datinakhali, a village under Burigoalini union under Shamnagar Thana of Satkhira district was selected under the community-managed WatSan Programme in January 2000. The *Nowabenki Gonomukhi Samabay Samiti*, a partner organization of NGO Forum has been assisting the villagers to implement the WatSan programme through formation of the VDC. The

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village was selected as the most un-served one as regard to safe WatSan coverage.

The South Datinakhali village is located on the saline tidal floodplain of Satkhira district. The coastal tide on the floodplain and salinity are the main factors that affect the WatSan programme.

The saline tidal floodplain is physically in shallow depth, and water from this aquifer cannot be used for drinking, cooking and bathing, because it yields brackish water. Tubewells have rarely been successful in the coastal area. The tidal flow is strong and its impact is noticeable. Some in the interior are deeply flooded in the monsoons, which make drinking water scarce in the water-surrounded area. The groundwater is also contaminated with excessive iron and arsenic.

Most of the people in the South Datinakhali use surface water for drinking and cooking after some treatment. People of this village also collect rainwater for drinking, cooking and bathing in the rainy season. But in most cases indigenous methods of harvesting and storing of rainwater are not found safe. Because of severe scarcity of sweet and safe water, people also wash and take bath in river and canal water, which is not only saline, but also has high concentration of silts and other pollutants. However, finding no other way the poor people are forced to use river and canal-water, which have severe health threats.

To ensure safe water for drinking and all other household uses, solution in appropriate water technology feasible for the coastal belt. Pond-sand Filter and Rain-water Harvesting System are suggested. NGO Forum has also been implementing Pond-Sand Filter and Rain-Water Harvesting System in this area. Both the technologies are appropriate for the coastal area in avoiding the salinity as well as arsenic problem. NGO Forum has also been facilitating the Iron Removal Plant in this region to combat the excessive iron concentration in Tubewell water. As a part of this NGO Forum has provided a Pond Sand Filter in the South Datinakhali village.

The poor latrine coverage in this belt is caused by geophysical condition. In coastal area tidal surge, cyclone and many other natural calamities hit each year, which wash away the infrastructure and also damages the latrine super structure. There is also a lack material of sanitary latrine, because of the communication problem and remoteness of the locality.

Institutional Development

The villagers, with the guidance of *Nowabenki Gonomakhi Samobay Samiti*, formed the Village Development Committee in January 2000 for ensuring the progress of village development activities with particular focus on WatSan.

The Village Development Committee was the outcome of a course of activities that continued through a process. The whole community of the village sat together in cooperation with the NGO Forum's partner *Nowabenki*

Gonomakbi Samobay Samiti, and discussed on the existing problems of the village and the possible role, which the Village Development Committee could play in solving those.

The Village Development Committee of South Datinakhali was formed consisting of 15 members including one chairperson, two vice-chairmen, one member secretary, one treasurer and 9 general members. The VDC was formed with participation of different section of people of the village including 4 women members who are involved in different occupation. The representative of the partner organization who has been working in the Datinakhali village has been involved in the VDC as the member secretary.

The VDC concentrated operating activities under the Community-managed WatSan Programme for promoting the overall development of the village including WatSan. After formation of the VDC, the members started massive social interaction with different section of the village people.

They conducted participatory rural appraisal in the village to understand WatSan situation, problem identification and prioritization. Among identified problems drinking water, sanitation, and communication were identified as the most striking ones in the village. After identification and ranking of those problems, the VDC members in association with the villagers prepared village profiles and conducted the need assessment through participatory exercises. They also prepared a village development plan with special emphasis on the water and sanitation coverage.

The VDC in association with the villagers identified that they very urgently needed safe water source in the village. During the orientation programme in the village the villagers learnt that NGO Forum supports the construction of Pond Sand Filter (PSF), with cost sharing from the community. After village development planning, VDC members started motivational activities among villagers to participate in the programme and to share the cost for the safe water sources installation in the village. Side by side, they also motivated the people to buy sanitary latrine at cost price. Both male and female members of the village took active part in those activities. Different types of promotional activities were also conducted to make the villagers aware about the water and sanitation programme and its benefit.

Increased WatSan Coverage

With the direct supervision of the VDC, a Pond-Sand Filter has been installed in the village. Before installation of the Pond Sand Filter (PSF) all households took unsafe pond water for all purposes. However, after installation of the Pond Sand Filter 93 percent of the household are now getting safe water for drinking purpose. Liakot Ali, a shopkeeper in the village said, "the villagers had to visit doctors frequently. Now that has reduced after the use of PSF water and sanitary latrine". Abdus Salam, a VDC member mentioned, "During their work wood cutter and honey collector would drink unsafe pond water

from nearby, but now they carry water with them from the PSF". The facilitation of the Community-managed WatSan Programme created a positive attitude towards the safe WatSan promotion among the villagers of *South Datinakhali*. Because of effective and active performance of VDC, the villagers became motivated and realized the necessity of hygienic latrine. This has helped to raise the coverage of sanitary latrine in the village. In January 2000, out of 300 households only 91 i.e. 30% of them had a sanitary latrine. Now (234 household) 95% have achieved that in December 2001. Hazrat Ali another VDC, member said that before the start of the Community Managed WatSan Programme only about 5 percent people were habituated to hygiene practices like hand washing with soap or ash after defecation, but at least 30 percent do so. All these indicate that attitudinal changes have occurred among the villagers in relation to safe WatSan and personal and domestic hygiene practices.

Sustainability of the Services

Though most of the people of the South Datinakhali village are very poor, the VDC has mobilized them and introduced a system of token cost-sharing to bear the cost of maintenance of the PSF. They have fixed-up one Taka a/ month/ for each household. The villagers have also installed hygienic latrines in their households collecting those with full cost. The VDC members expressed that the objective of this initiative is not merely the cost bearing but also for introducing a system of cost-sharing and establishing ownership over the services. The VDC members viewed that this will ensure sustainability of the system as well as services.

The institution building process has shaken the community and the partner organization staff largely. It has been found that VDC members organize the schedule meetings, review the activities of previous months, set action plan and set agenda for the next meeting by their own initiatives. The villagers consider that the VDC is a village-based institution and they abide by the decisions of it. This has been possible due to the participation of community people in the development process. From the self-realization and understanding about the existing situation of the village, members of VDC are committed to continue their role as an institution, which will put forward the issue of sustainability of their development initiatives and achievements.

THE SAFER SLUM PROJECT *

The SAFER Project (Sanitation and Family Education Resource), has been providing hygiene behaviour change services to a population of 139,950 in Chittagong and Cox's Bazar districts of Bangladesh from July 1996 through June 2001 with funding from the U.K. Department for International Development (DFID), the European Union, and CARE/U.K. SAFER's rural program is conducted by a group of seven nongovernmental organizations. CARE Bangladesh is the initiator, trainer, and provider of technical assistance to six partner organizations (PNGOs). CARE conducts some program activities itself, but the majority of the work is done by PNGO staff members. The partner organizations receive no funding from CARE-SAFER. They are:

- * BGS (Bangla-German Sampreeti);
- * CODEC (Community Development Centre);
- * Concern Universal;
- * ISDE (Integrated Social Development Effort);
- * PROTTYASHI; and
- * YPSA (Young Power in Social Action).

SAFER's program goal is "improved health and hygiene status of beneficiaries of programs supported by NGOs in Bangladesh." Immediate project objectives are:

1. To improve the capacity of six NGOs to implement better hygiene behaviour change programming;
2. To increase by 50 percent the number of households in the catchments areas of the six partner NGOs where improved behaviours are observed; and
3. To develop the awareness of 160 NGOs regarding the basic principles and concept of hygiene behaviour change programming.

In August 1998 SAFER expanded its activities to an urban area for the first time. Two slums were selected for program intervention: Maliar Bill and Masjid Colony, both in Chittagong City. A year later, when staff were needed elsewhere, the slum program cut back to working only in Maliar Bill. Monitoring continued in Masjid Colony.

Two full-time SAFER Field Trainers work in Maliar Bill, which has a population of 2800. A male Field Trainer conducts SAFER activities in a fisher-folk

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neighbourhood (Jhelepara) having approximately 250-300 households. A female Field Trainer conducts these activities in another section of the slum, which has approximately 400 households. These staff is supervised by a Project Officer who makes regular site visits and handles most negotiations with non-resident local landlords.

There are 21 landlords. They have formed a committee, which makes most decisions about local improvements. A few area residents have joined the committee since SAFER began its work there. The SAFER effort receives strong support in from the ward Commissioner, who lives nearby and visits the area often. He participates some of the slum committee meetings and once presided over a community data-sharing meeting as acting Mayor of Chittagong. Thanks in part to the encouragement of SAFER, the NGO Niskriti has opened up a weekly health clinic in Maliar Bill.

Maliar Bill is extremely crowded. The houses, which rent for Tk.400--700 per month, are one- or two-room structures built of local materials (kacca). Lanes in the larger section are narrow and unpaved. In the crowded lane, in front of a house here and there, one sees a stove of the type normally found in village courtyards. The whole settlement is enclosed by a high brick wall, inside of which runs a drainage canal, whose water runs out to the Karnaphuli River. This canal, which is filled with garbage, has some hang latrines draining into it.

Program Description

SAFER's working techniques are similar to those used in rural areas: hygiene education sessions with flash cards, selection of Key Community Persons (KCPs), child-to-child, and adolescent orientations, and consultations with community leaders. But new flash cards were designed for use in the slums, and there is more emphasis on solid waste than in most rural sites. This is one of two sites in which SAFER has provided some "hardware" assistance, in the form of materials for a four-stall community latrine, which area residents installed with their own labour.

The slum project has several accomplishments to its credit besides having the community latrine constructed. According to field staff, open defecation by children is reduced, in fact almost eliminated. SAFER staffs are promoting use of fixed places, polyethylene bags, or pots for very young children's defecation. Field workers also claim that covering food is a more regular practice than it used to be.

SAFER staff have found some interesting differences between rural and urban work, which affect their hygiene education and sanitation promotion activities. One is the use of time. Urban people, both men and women, are busier year-round than those living in villages. Conscious of their time being worth money, they are less interested in attending long meetings than rural people are. Children also work, collecting scraps for sale or household use and taking lunch to garment factories. Very few children are in school.

Another difference is space. Few rural settlements are as crowded as Bangladesh slums. Space problems, among others, limit the possibilities of installing hygienic latrines in most homes. Being dependent on local leaders and/or landlords, slum dwellers also have less control over decisions affecting the quality of life in their communities. A final difference is that men living in slums, being from different parts of the country, and working and living under pressure, are prone to fighting with each other. Their fights have at times interrupted the SAFER team's work.

A number of hang latrines, mostly draining into the canal, have been replaced by water-seal latrines. There are approximately 40 distributed around the slum, wherever landlords were willing to pay for them. Some landlords have no interest in doing so.

Groups of women gather for discussions about hygiene and sanitation, as per the normal SAFER-routine. There are four very active KCPs and about eight who are active only when SAFER staffs are present to appreciate them. The active ones are: an activist housewife, a traditional birth attendant, a fisherman who is also a musician, and a woman employed as a maid. At some point the 12 KCPs decided that they would walk together through the village every month. The birth attendant conducts occasional tea stall sessions on her own.

A remarkable achievement of the SAFER program is to have organized a group of 18 adolescent boys to do garbage collection in the fisherman neighbourhood. These boys go out for two hours on Friday mornings and collect garbage from all the houses. By depositing Tk. 1.00 to a fund weekly, they themselves purchased baskets where area residents can toss their garbage. The Ward Commissioner donated a trolley (wheelbarrow) for their use. They deposit the garbage in a public dustbin just outside the slum boundary. In the other section of the slum there also is a garbage collection arrangement of some sort. One of the slum committee members is promoting garbage recycling and composting as a solution to the solid waste problem that also will provide some income for people living in the slum.

Monitoring Findings

A baseline study was done in both slums in October-November 1998. Since October-November 1999 there have been six-monthly monitoring surveys on some impact indicators. As in rural monitoring surveys, these include only households having at least one child less than five years of age. The Table below presents findings on a few points.

The use of unhygienic latrines has continued to decline in Maliar Bill but not in Masjid Colony. Use of fixed place defecation by children under age five is difficult to assess with these data, but it has not become very frequent in either place. Covering of food and use of ash or soap for hand washing improved in both places. But covering of drinking water containers improved only in Maliar Bill.

These monitoring data, like those from rural model sites, show different rates of improvement for different behaviours. Soap or ash use and covering of food improved during the first year of the project's work in both slums. Latrine use, however, only started to improve after one and a half years, and reached the 50% mark in Maliar Bill only two years after the SAFER work started there. Diarrhoea prevalence among children under age five declined in Maliar Bill but not in Masjid Colony.

The following table SAFER Slum Project Monitoring Findings: October-November 1998 to December 2000

Monitoring Indicator	Maliar Bill				Masjid Colony		
	Base line	Mon.-2	Mon.-2	Mon.-3	Base line	Mon.-1	Mon.-2
	(n=139)	(n=159)	(n=161)	(n=161)	(n=154)	(n=140)	(n=141)
Sanitary or hygienic water-seal latrine use	6%	0%	21%	50%	19%	11%	16%
Use of unhygienic water seal latrines, or hang latrines	90%	100%	79%	50%	75%	80%	84%
Fixed defecation place used by children under age -5	40%	19%	23%	17%	45%	34%	17%
Food covered	81%	93%	99%	94%	86%	96%	96%
Drinking water covered	67%	81%	87%	84%	66%	69%	67%
Ash or soap available	65%	99%	90%	94%	59%	96%	89%
Diarrhea of child under age 5 within past 2 weeks	34%	34%	25%	8%	29%	33%	36%

Evaluation Comments

The differences between Masjid Colony and Maliar Bill are interesting to consider. The work in Masjid Colony went on for one year, or two communications and monitoring cycles while Maliar Bill has been covered by SAFER for three years. The differences in monitoring results say something about how long it takes to get good results in slums. But the two slums are different socially, so there are surely several reasons for their differences other than program intervention. One difference is that Masjid Colony has a much higher rate of population mobility than Maliar Bill-has.

Maliar Bill, is a slum in which SAFER activities have a chance of success. It is physically difficult because of the garbage and the canal (which overflows in the rainy season). But social factors are relatively favourable. For one, it has a relatively stable population. Even more important, is the relative security of land tenure. Unlike many slums elsewhere in Bangladesh, those in control of this area (the landlords) have legal leases from the Jute Corporation, which owns the land. Also unlike many other slums, these landlords and the Ward Commissioner are mostly interested in improving living conditions of the slum residents. The SAFER Project is indirectly benefiting the landlords, of course, by improving the value of their rental properties. So it is in their

interest to cooperate with the project. The environment thus improves, making the quality of life better for area residents. From the point of view of program planners, it is important to understand that the working conditions seem far less contentious than in slums elsewhere - especially ones that are dominated by violent 'strong men' (mastans/gundas). Together the Ward Commissioner and SAFER have stimulated the City Corporation to help out with garbage collection in this location. Such locally favourable conditions are as important to the effectiveness of the program as are staff skills.

An important feature of this SAFER component is the activity level of the adolescent boys. As one staff member said, 'If we can make them understand, they act directly'. Their interest in promoting local improvement, and the degree of initiative they have taken to clean up their neighbourhood is noteworthy. It shows that this largely unemployed social group may have untapped potential rarely recognized by any development program. The use of female adolescent monitors and some boys too in the rural SAFER program underscores the same point.

As to the future of the community latrines installed at SAFER's expense, they are better maintained than most such facilities elsewhere. The slum committee has appointed one man to clean them, and also to keep clean a hand tubewell platform installed next to them. This arrangement ensures that they will continue to serve as a useful local amenity.

Concerning sanitation, there is a local assumption that, as the water in the drainage canal carries away faces to the Karnaphuli River, there is no special problem. The presence of a truly putrid water body within the residential area here, as in many slums throughout Bangladesh cities and towns, apparently is accepted as a fact of life by people who have to live in low-rent areas called "slums." Persuading people that this is an unhealthy condition, and then persuading landlords to invest in construction of hygienic latrines is surely an uphill battle. The achievement of 50 percent hygienic latrine use in Maliar Bill is remarkable under the circumstances.





WATER, SANITATION AND HYGIENE FOR ALL – THE WASH CAMPAIGN*

Why a campaign now?

At the dawn of the 21st century, some 1.1 billion people on Earth are still without access to a safe water supply and over 2.4 billion are without adequate sanitation. Rapid population growth during the 1990s, particularly in the world's megacities has meant that, by 2000, an estimated 620 million more people gained access to water supply and some 435 million more people had access to sanitation facilities. Despite laudable achievements by the sector during the International Decade for Water Supply and Sanitation (1981-1990) to meet these basic needs, there remains a tremendous backlog in terms of the billions of unserved people, mostly the poor and marginalized citizens living in squalid, unhealthy environments in the developing world.

Access to sanitation facilities is a basic human right that safeguards health and human dignity. Every individual deserves to be protected from disease and other health hazards posed by the poor disposal of excreta and human waste. Children, who are the first and the most vulnerable to fall prey to such hazards, deserve a better environment and the highest standard of living possible, according to the Convention on the Rights of the Child, a treaty which has been ratified by nearly every country in the world.

The WASH campaign is an effort by the Water Supply and Sanitation Collaborative Council to mobilize political support and action around the world to ensure an end to this suffering. Particular emphasis will be placed on setting a global sanitation target, without which health for all cannot be achieved.

The poverty, sickness and death toll on these populations are shameful and scandalous in these times of relative prosperity. Many of those affected are impoverished women and children living in squalor in Asia, Africa, Latin America and the Caribbean. Some countries in Eastern and Central Europe as well as the Middle East are also suffering in misery from lack of these

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basic facilities. Improper disposal of human wastes is one of the developing world's most serious public health problems. The statistics are staggering: nearly two million children die each year from diarrhoea – dehydration caused by this disease has killed more children in the last ten years than all the people lost to armed conflict since World War II.

The health and social consequences of this deplorable state of affairs are especially harsh for women and girls: they pay a high price in terms of loss of dignity where there are no latrines, compelling them to wait until dark to defecate and exposing them to harrassment and sexual assaults; lack of education due to the absence of school sanitation facilities, increases to their already heavy workloads and infectious diseases associated with the lack of water and sanitation.

Why then do politicians and decision-makers turn a blind eye? Why are the world's citizens not more involved in pressuring their leaders for more action in solving this crisis? The reasons are many and complex. Politicians and decision-makers consider *Sanitation* a dirty word. They do not realize that by giving people access to latrines and enabling them to practice basic hygiene, that the death toll on the half of humanity that do not enjoy these fundamental rights can be halved. Incentives to tackle sanitation are often lacking. There is no prestige or political capital to focus on sanitation because those who are most in need have the least political power.

Economic Benefits From Sanitation and Hygiene Promotion

- * Reduces the health burden of individuals from water-borne and water-washed diseases.
- * Lessens the time taken off work or school by people who are ill or suffering.
- * Improves nutrition due to reduced loss of nutrients through diarrhoea.
- * Alleviates the burden, especially of women and children, who have to fetch water from distant sources
- * Makes time for other activities such as children attending school and adults earning livelihoods and generating income

Because water has always taken a key role in people's cultures and priorities, it is only natural that they should demand water as the first priority, not sanitation or hygiene promotion. Whereas investments in water quality and quantity can reduce deaths caused by diarrhoea by 17 percent, sanitation can reduce it by 36 percent and hygiene by 33 percent. Another reason why these figures are frequently overlooked is that water sector agencies are typically led by highly qualified water engineers, but they are either untrained or uninterested in sanitation or hygiene issues.

The Role of the Water Supply and Sanitation Collaborative Council

Mandated by a United Nations resolution in 1990 to maintain the momentum of the International Drinking Water and Sanitation Decade, the mission of the WSSCC is *"to accelerate the achievement of sustainable water, sanitation and waste management services to all people, with special attention to the unserved poor, by enhancing collaboration among developing countries and external support agencies and through concerted action programmes."*

At its fifth Global Forum in November 2000, the Council's blueprint for action, the *Iguacu Action Programme* was unanimously collectively agreed upon by more than all two hundred members. The IAP provides an agenda upon which all agencies and individuals can base their activities. Its messages are relevant for everyone who is involved in water, sanitation and hygiene, from individual householders to politicians and decision-makers

Water, Sanitation and Hygiene for All – the WASH Campaign

Introduced by the WSSCC at the International Conference on Freshwater in Bonn, Germany in December 2001, the WASH campaign is a concerted global advocacy effort by members and partners of the Collaborative Council to place sanitation, hygiene and water firmly on the political agenda. The Council is working with governments, parliamentarians, non-governmental organizations, community groups and other stakeholders to promote a sanitation target, a goal that was overlooked by the Millennium Declaration that was signed by over 150 Heads of States and Governments at the United Nations General Assembly session in 2000. Concerned individuals and organizations that wish to make a difference in alleviating the suffering and improving the health and productivity of the world's poor have formed a global alliance for making safe, water, sanitation and hygiene a reality for all. WASH aims to raise the commitment of political and social leaders to achieving these goals and effecting the necessary behavioural changes through various information and communication channels, using traditional and mass media, hygiene promotion in schools, training and building local capacity in advocacy communications and improving networking and research.

With the help of its Regional and National Co-ordinators, partner organizations and allies working in concerted action in different parts of the world and complemented by advocacy strategies and guidance from the Secretariat, the Collaborative Council will test and adapt a "communication for development" methodology for the WASH campaign that has been successfully used by UN organizations and donor agencies such as UNICEF, WHO and USAID among others, in implementing health, water and environmental sanitation programmes in the developing world.

This social mobilization and advocacy strategy calls for a range of partnerships to be developed among all the stakeholders involved, from policy-makers and practitioners to community, religious and business

leaders, schools and sector professionals, all the way down to the households and individual families. The media community features significantly in this strategy and is the thread that binds all segments of society in the quest for needed changes in policy, behaviour and practice.

Major Milestones

The WSSCC is taking advantage of major events and important milestones taking place in many countries and regions of the world to galvanize public opinion and to focus its advocacy activities. These milestones are: the International Conference on Freshwater in Bonn, Germany in December 2001, the World Summit for Sustainable Development in Johannesburg in 2002, the Third World Water Forum in Kyoto, Japan in 2003, the WSSCC Sixth Global Forum in Dakar, Senegal and the UN-sponsored International Year of Freshwater in 2003. The Collaborative Council hopes that, with adequate resources and political will, nations can reverse one of this century's worst public health disasters and get their economies back on track towards sustainable development.

Changing Behaviours, Policies and Practices

A new paradigm shift and revolutionary thinking are needed to change the attitudes and behaviour of those who are entrenched in traditional water and sanitation practices and knowledge. Experience has shown that clean water alone leads only to minor health improvements. Sound hygiene behaviour must be recognized-recognized as a separate issue in its own right, with adequate sanitation and clean water as supporting components. While each of the three elements has some health benefit, it is their combined effect that has far greater impact. Thus, hygiene behaviour is virtually impossible without a source of water and a safe means of disposal of human and other wastes. The WASH campaign will promote a genuine transformation of attitudes, policies and practices and persuade the international and donor communities to allocate high priority to those countries with good water supply yet poor sanitation facilities. Proper monitoring and evaluation through the development of indicators will be developed to track the campaign's progress and help ensure its effectiveness

These are the key themes on which campaign messages are being developed and targeted those who can and areis willing to effect much needed changes in behaviour, policy and practice:

1. Water, Sanitation and Hygiene can Save Lives.

Billions of people die each year due to unhygienic environments, their food and drinking water contaminated by faeces riddled with bacteria, viruses and parasites that cause diseases such as diarrhea, the deadliest killer of children under five in developing countries. Solving the sanitation problem and helping people to practice better hygiene can save many lives and reduce incidence of disease.

2. Water, Hygiene and Sanitation for People: Women and Children Come First.

Lack of access to environmental sanitation and hygiene affects women and children most. This has also led to many incidences of violence against women and girls and endangered their reproductive health. Addressing gender issues benefits girls' status and education, improves privacy and restores human dignity – a first step to improving the quality of life.

3. Reforms are Critical to Improving Water and Sanitation Services for the Poor.

Governments, private water utilities and international agencies must give priority and resources to institutional reform and recognize that doing so will contribute to better practices, good governance, safeguard basic rights and responsibilities of every citizen.

4. Water, Hygiene and Sanitation are Entry Points for Poverty Alleviation.

The problem exacts the highest toll on the poorest segments of society in both rural and urban areas. Giving high priority to these basic services at local, regional and global levels should be at the top of the political agenda and recognized as essential for eradicating poverty and contributing to sustainable development

UNDERSTANDING PEOPLE'S PERCEPTION OF CHANGES IN HYGIENE AND SANITATION *

The Unit for Policy Implementation (UPI) recognises the importance of improving personal hygiene and sanitation situation to complement achievements made in improving access to safe drinking water. UPI has played a facilitating role by supporting sector coordination in hygiene and sanitation. In so doing it has been involved in organising a regional training workshop on "Improved Participatory Techniques for Hygiene Promotion" and plans to conduct further action research participatory techniques.

Action Research - Background

Over the past decades Bangladesh has achieved great success in improving access to safe drinking water. Notwithstanding the arsenic contribution in ground water, today more than 97% of the rural people have access to a tube-well within 150 metres of their homes compared to only 40% in 1981. Over the same period latrine coverage has increased significantly but to a much less extent than water with about 42% of the rural population having access to household sanitary latrines compared to less than one percent in 1981.

Although deaths from diarrhoeal diseases in under-five children have reduced from 300,000 in 1980 to 110,000, morbidity still remains high at 3-5 annual episodes per under-five children. Experts seem to opine that improved management of diarrhoea (through ORT) and immunisation has more to do with the reduction in diarrhoea mortality than improved water supply. There is also a general consensus that improved sanitation and behavioural change if accompanied with safe water supply are likely to reduce rate of morbidity.

The past decades have seen a gradual shift towards hygiene in all water and sanitation programmes. Current WSS programmes include activities to bring about behavioural changes in people. The approaches, however, are more didactic than promotional. Sharing of experiences and lessons or co-ordination of strategies are still marginal activities of secondary importance.

The Department of Information, Education and Communications of the Ministry of Health bears the mandate for hygiene promotion and the DPHE under the MLGRD&C is responsible for water and sanitation. There is

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seldom, if ever, co-ordination of the activities between the two agencies. Even within the WSS sector different stakeholders pursue a variety of hygiene promotion strategies that do not always complement each other.

Stakeholders in the sector recognise the importance of participatory approach in hygiene and sanitation promotion. They all use participatory techniques in extracting information to select messages and prepare materials for hygiene promotion but fall short of involving the people in information analyses and selection of the messages. More often than not "experts" select the messages and prepare the materials based on their perception of what people ought to do. The effect is a mismatch between the messages and the behaviour people recognise as bad and wish to change. This transforms hygiene promotion into "sermons" from the "wise one, the hygiene promoter", to the "ignorant, the people" — more of "a hygiene education" than "hygiene promotion".

There is mounting global evidence that a true participatory approach with the people selecting the behaviour they wish to change, is more cost effective than a didactic approach to hygiene/sanitation. Promoting innovative methods/approaches without clear evidence of success in Bangladesh always meets with resistance especially where an alternate approach is deeply entrenched. Action research to test and finetune the use of participatory methods in sanitation hygiene promotion may provide important lessons and arguments for change.

UPI, NGO Forum for DWSS and WaterAid have taken the initiative to establish an informal network to encourage participatory sanitation and hygiene promotion. NGO Forum has agreed to be the focal point for this informal network. As part of the same initiative UPI and WaterAid organised and conducted a workshop for trainers on "Improved Participatory Techniques for Hygiene Promotion".

UPI further proposes to test the participatory approach in hygiene and sanitation promotion in Bangladesh through an Action Research with the NGO Forum. The UPI has already developed an action research project with NGO Forum on credit schemes for the poor who are unable to access micro-credit for water and sanitation facilities. It would be opportune to undertake the proposed action research on improved participatory approach in sanitation and hygiene promotion with the same partner NGOs.

Trainers Workshop

In the water supply and sanitation sector hygiene and sanitation are often neglected in deference to the relentless pursuit of improving access to drinking water. Yet there is overwhelming evidence that improvements to hygiene behaviour and sanitation have a far greater effect in reducing diarrhoeal disease transmission (and other faecal-oral diseases) than improvements to drinking water quality alone.

The reason for this neglect is to some extent understandable. Most would agree that this field, particularly hygiene behaviour, is more complex than water supply. It is also more difficult to measure whether efforts to improve hygiene and sanitation have been effective.

The purpose of this workshop has been to try and address this issue to make promotion of hygiene and sanitation more effective. To simplify matters we have divided hygiene/sanitation promotion into 3 steps:

1. Introduction phase, rapport building & mobilisation;
2. Community self analysis & community selection of hygiene practice /sanitation facilities; and
3. Promotion/Education

Most projects that are involved in hygiene and sanitation usually pay attention to steps 1 and 3 but ignore step 2, partly because there is little experience on how it can be done effectively. We believe that a true participatory approach to hygiene/sanitation promotion must involve step 2. This workshop introduces participatory techniques that are specifically designed to allow community self-analysis and selection of hygiene practice/sanitation facilities i.e. step 2.

The workshop also emphasised how the more traditional participatory techniques (PRA) can be used in hygiene and sanitation promotion. In step 1 participatory technique such as social mapping can, when done properly, not only complement a participatory approach but simplify the process. For example baseline surveys often use tools (such as questionnaires) that produce inaccurate and spurious information most of which is never used in the project while social mapping can quickly provide accurate and salient information, as well as helping the community monitor progress.



Participatory mapping of the water and sanitation situation in the village

Although most participants were familiar with the traditional participatory techniques used in step 1 they were not well versed in practicing these methods in the field as part of a hygiene/sanitation promotion strategy. The participatory techniques introduced for step 2 were more or less new to the participants. Almost all participants were keen to introduce these techniques to their organisation and discuss how they might do this resulted in an action plan. It was suggested to establish network of like minded people and arrange a further workshop/meeting to explain approach to policy/decision makers of respective organisations. It was recommended that future workshops be planned for those organisations interested in adopting this approach (and facilitation support coming from the network) and other workshops for sector coordination on hygiene promotion. Step 3, promotion and education phase, could not be addressed except to conclude that "social marketing" would complement the participatory approach. There is actually a wealth of experience of different methods used in step 3 and it would be useful to arrange a workshop to assess the most effective methods.

This workshop was jointly organised by UPI, NGO Forum and WaterAid. The Centre for Community Development Assistance (CCDA) arranged for the village visits. The workshop could not have succeeded without this assistance.

Conclusion

The widely prevalent didactic approach to sanitation and hygiene inspired this workshop. The workshop approach and methodology were participatory with group-work, field exercise and discussions. The participants were familiar with the "participatory techniques" per se, but no participant has used the techniques for sanitation or hygiene promotion.

Participants identified that most hygiene/sanitation projects do not generally include a step where communities analyse and select hygiene practice and sanitation options. The participatory tools introduced by the workshop help fill that step. In developing a common strategy it was also found that general participatory techniques can effectively and quickly provide important ingredients to the strategy, such as mobilisation and baseline, in one simple step. It was not the intent to completely replace existing methods. On the contrary, the tools complement many existing methods in modifying hygiene promotion but rationalising the strategy makes for a more efficient and effective use of resources.

Despite limitations of time and logistics, the participants practised the techniques with much exuberance and jest: often working late into the evening. They were convinced of the usefulness and advantage of the tools in assessment and promotion of sanitation and hygiene and progress monitoring.

Participants have learnt a few lessons:

- * It is very difficult to keep quiet and listen and that "listening" needs special effort. The participants could not contain their enthusiasm. They talked and directed where they should have been listening to what the villagers had to say.
- * Participatory approach is about equal opportunity, choice and voice for even the "smallest" person in a community. Anything that inhibits this spirit is contrary to participatory approach. Participation is about listening, recognising and building on the knowledge of the community and learning.
- * Giving influential persons more than their share of opportunity to speak disparages participation and promotes elitism. It is for the facilitator to create this environment for equal opportunity.

HYGIENE EDUCATION, ENVIRONMENTAL SANITATION AND SAFE WATER HELP POVERTY ALLEVIATION

J. K. Baral*

Bangladesh has made great stride in the last decade towards a general improvement in the lives of its people particularly children and women. Significant progress has been made, especially in the fields of health, education and population. At the same time, Bangladesh has achieved a certain degree of economic stability. However, Bangladesh still remains one of the poorest countries in the world with a per capita income of approximately US \$ 400, and more than 50 million people living below the poverty line.

When arsenic was first discovered in the groundwater in the early 90's, the problem was assumed to be localized. With reliable evidence coming to light in later years, it became apparent that the problem was in fact widespread and constitutes a major and serious threat to life. It is now estimated that access to safe water supply has dropped to about 74% and that over 50 million people are potentially at risk of contracting arsenicosis.

Although death from diarrhoea decreased considerably, post diarrhoea morbidity is still high with 3-5 episodes in under-five children annually. Awareness of the risks of disease from unsanitary conditions and unhygienic behavior is limited, just as the knowledge of the potential effect of living in a polluted environment, leading to further health risks. The use of hanging latrines by over 30% of the rural population and seventy percent of urban slum dwellers is another serious concern.

It is observed that use of safe water supply, use of sanitary latrine and hygiene practices is not getting the priority at Government level and as well as at the family level. An integrated programme combining these three aspects will require at the same time a definite shift in emphasis from service delivery to providing services through behavioral change. Also we can change the program's name from water, environmental sanitation and hygiene education to hygiene education, environmental sanitation and safe water emphasizing health education.

This shifting of paradigm should be popularized all over the country by our government, NGOs and different stakeholders.

Now we can ask, how this integrated approach will contribute to poverty alleviation.

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In a country like Bangladesh, post diarrhoea morbidity is still high, and direct and indirect cost for its treatment runs to billions. An integrated approach - one combining hygiene promotion, sanitation and safe water supply - as the primary health care components, if properly implemented, will directly contribute to poverty alleviation.

It is a question of priority. If the Government, NGOs, civil society and others make this their No. 1 priority among the other social development programmes for at least a few years and create a comprehensive communication programme, good results will surely be gained within a few years.

A lot of money has already been for conducting different research and studies in development sectors. Now the time has come to make studies and research on cost analysis of diarrhoea and other waterborne diseases by economists.

Article 24 of the convention on the rights of the child (ratified by the Government of Bangladesh) recognises that access to safe water supply and pollution free environment are important aspects of a child's right to survive. The convention also states that all community members have a right to be informed and to be given education in basic hygiene and sanitation practices. The government of Bangladesh has further supported and articulated these rights to achieve universal access to water supply and sanitation at affordable cost in national water supply and sanitation sector policy.

This article 24 of course will achieve its goal within its time frame, only when we change our slogan to hygiene education, environmental sanitation and safe water to contribute to poverty alleviation as well as reduce the incidence of diarrhoea, infant mortality and other waterborne diseases.

REVIEW OF HYGIENE BEHAVIOUR FOR BETTER USE OF WATER AND SANITATION *

Background

A study was undertaken in 1999 as part of the DPHE R&D programme to identify some of the reasons behind the slow progress of changing hygiene behaviour of rural people, necessary for better utilization and coverage with safe water and sanitation.

Socio-Economic Profile and Hygiene Behaviour

Major Findings

Survey findings of 200 households show that majority (44.2%) of the households are dependent on cultivation, followed by 21% that depend on business, 20.7% wage labour, 7.2% service and 7.7% on others. The largest group of the households (45.5%) has a monthly income of Taka 1001-2000, followed by more than 24.5%, with monthly income of Taka 5000. Education influences health awareness and modifies human behaviour. Almost half (49%) of the respondents have no education at all.

About 96 percent of the respondents use ground water for drinking purposes and of them majority (73%) use shallow tube well. Some 4% of the respondents use water from other source that are not safe. Although 96% of the people use tubewell water for drinking purposes, large percentages of the respondents do not use this water for other purposes like dishwashing, gargling, hand washing before taking food, washing fruits, laundry, bathing and ablution.

When resources are available in the rural households meeting the consumption needs of the households become their first priority. Housing comes second after which various forms of income generation through buying a cow, taking lease of land etc. Installation of a tube well or a sanitary latrines occupies the 6th and 7th places among the list of 7 priorities. Only 2.5% respondents have mentioned that water and sanitation is their first priority. The level of awareness makes enough justification for intervention in enhancing the level of awareness of the respondents with respect to what the safe drinking water means.

* A Review of the Study on Hygiene Behaviour Leading to Enhancement of Use of Tubewell Water and Sanitation, Final Report, (Prepared by NACOB Consultancy Services for DPHE-WHO Project BAN CWS 001, Dhaka, March 2000) by A. F. M. Khalid Hassan, Project Officer, Environmental Health Unit, World Health Organisation, Dhaka.

Findings show that tubewells they use, are owned by the consumers themselves (37.5%) and the neighbor's tubewell (20.5%). Tubewells belonged to community is 17%, tube wells owned in partnership 15% and other (mosque, school, market and etc.,) 10%. 30 percent of the respondents obtained tubewell from the government sources while the remaining 61 of the respondents purchased tubewell from private sources including NGOs. This indicates that private sector is emerging as the cheaper and convenient sources of tubewell supply in the rural areas.

Some 76 percent of the tubewells are located within 20 meter of their dwelling units. But 19 percent of the tubewells are located far away beyond a distance of 40 meter. Proximity facilitates quick collection of water, enhances human willingness to collect water and ensures easy use.

50% of the respondents mentioned that they use tube well water as it prevents stomach disorder, 20 percent use tube well water for drinking purposes, as it safe, 13.5% use tubewell its it prevents diarrhoea/cholera. 11.5% users of the tubewell water do not know why they use tube well water and 3% use this water as this is the only source available to them.

The proportion of non-functioning of the tube wells is more prominent in the Participatory Rural Appraisal (PRA) areas to the national situation where only 9.1% (1998. BSS) rural tube wells remains non-functional compared to 14% in the sample (355 tubewells). Findings also show that 16% tubewells are choked up and 70% tubewells are in operation.

50% of the total of 320 tubewells (of which 225 private and 95 Public) surveyed have no platform at all. Almost all the public tubewells have been found with platform. The worst platform conditions lie with the private tubewells many of which either damaged or do not exist. Most of the tubewells do not have good drainage system.

In a country like Bangladesh where there is a constant threat from diarrhoeal diseases and other parasitic infections the importance of the subject is well understood. Control of these water borne diseases depends on:

- * Access to safe water and its use for all domestic purposes
- * Sanitary disposal excreta through sanitary latrines for each household and
- * Improved personal hygiene practice

Several types of latrines developed and produced in Bangladesh, also found in the sample area. Among them FC slab, water seal latrine, chute type, Ventilated improved pit latrines can be mentioned. Findings show that out of 200 households, 180(90%) having latrines whatever may be its type. Of all, only 40% are having sanitary latrines, 10% households have no latrine at all. Findings show that inability to afford is still the most important cause of not having latrine in households. Other causes are lack of space, reluctance of

the family members to use latrine and inability of the household heads to repair their latrines after the damage of the structure.

Findings show that possession of sanitary latrines in a household has a relation with income. Some 92% households with income of less than Taka 1500 per month, has no proper latrine. But as income level changes the percentage of sanitary latrine as proportion of total latrine goes up. Analysis of the findings indicates that 54.5% households spent less than Tk. 400 for the latrine units. Only 28% spent Tk. 800 or more for their latrine unit. For superstructure 71.6% households spent less than Tk. 100 and 18.2% spent more than Tk. 400. For installation, 52.3 % households spent less than Tk. 100, while 27.3% spent more than Tk. 400.

About 61% of the respondents have made their judgment in favor of water seal latrine as the best type of latrine, while 9.5% respondents suggested that home made latrine is best as it is economic. Majority (65.5%) opined that the most significant benefit of latrine is that it does not smell. The second important benefit as reported by the respondent is that it does not pollute environment.

The knowledge about diseases caused by the use of unsanitary latrine is an indicator of level of awareness of the people about the sanitation. Majority (87.5%) of the respondents said that unsanitary latrine causes cholera and diarrhoea. Similarly 85% mentioned that drinking or use of impure water cause diarrhoea.

Concluding Remark

Although safe drinking water achieved a significant success- especially if compared to the past, the sanitary practice is still very awful in many areas. Only 40% households have sanitary latrines, 10% have none. Most important cause of having no latrine is inability to afford one, but other causes include adherence to old practices, cultural norms and lack of health awareness. An analysis of the situation shows that the poorest people - the landless and the asset less do not have latrine. It may used to be considered to provide one ring- one slab latrine free of cost to the poorest. The poor be given scope to buy latrine on credit. The credit may come through NGOs, Grameen Bank, BRAC and CARITAS are already giving loans for the purpose.

Awareness building among the people to adopt the concept of sanitation should be reinforced.

Private producers of sanitary latrines may be provided with mould and other equipments by DPHE to facilitate them in producing sanitary latrine units.

An Upazila water and Sanitation Committee should preferably be formed with the representatives of NGOs, Local Government representatives, Upazila officials, teachers and social leaders to monitor implementation of sanitation activities.

PROMOTION OF WATER SUPPLY AND SANITATION THROUGH THE CHILDREN OF BANGLADESH

M. Mofazzal Hoque *

1. Introduction

Many households in Bangladesh are subjected to the vicious cycle of illiteracy and poverty. About 50% of the people are illiterate and fall below the poverty line. As the benefits of development will only accrue with awareness and understanding, communication is a vital ingredient of all development work. Raising of awareness on different issues is however not an easy task in illiterate and underprivileged communities. Different groups need to be targeted through different complementary approaches including social mobilization to achieve the intended aims.

About 25% of the population are enrolled in the educational institutions. School performance needs hard work and good memory, which in turn depends directly on the state of the student's health. Therefore, improvement and protection of health status is imperative for the students. In Bangladesh, major concerns are still associated with the water and excreta related diseases. So, hygiene promotion for behavioral change is an essential element in controlling the poor sanitation-caused diseases.

2. Hygiene Awareness

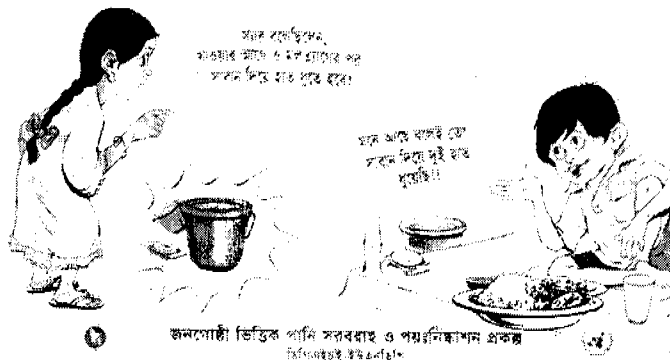
A recent study revealed that the level of hygiene awareness and hygiene practice are still very low in the country. Even the people with formal education lack knowledge and practices in this regard.

To encourage adoption and use of the hygiene practices, school children may be targeted to help promote water supply and sanitation. School children, being in a favoured position in the society, can convince their parents and neighbors to adopt sanitary latrines and use safe water. Contributions of the students in influencing behavioural improvement in household environment have been well recognized.

3. Information, Education and Communication (IEC) Materials

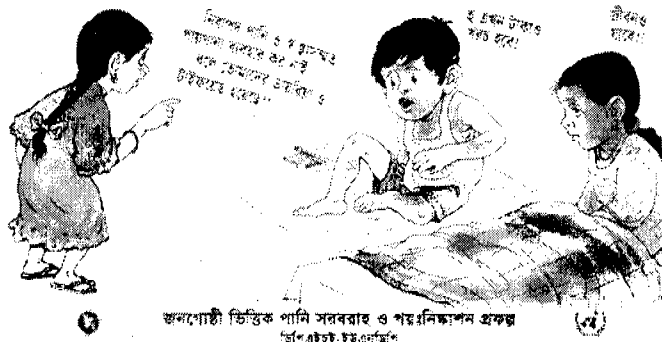
Children like cartoons and attractive pictures. Through cartoons hygiene messages can be disseminated to the children. They enjoy the cartoons and the texts used for the messages, and will discuss themselves these

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Girl: The teacher told us to wash hands with soap before eating and after using the toilet !

Boy: So I did, and I washed my two hands with soap !



Girl: Why did you not use safe water and a sanitary latrine? Now you are suffering from diarrhoea and typhoid !

Boy: ...and money will be spent on medicines !

Sick Girl: ...and life is becoming miserable and uncertain also....

among for understanding. Once they are imbued with the theme they by nature adopt the best practices and take pride of that towards their contemporaries.

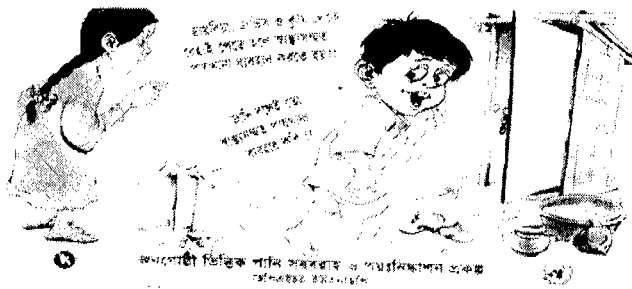
The social, economic and health benefits of WSS through the use of safe water and sanitary latrine, and hand washing after defecation and before handling foods etc. have been targeted for messages at this time. The Community Based Water Supply and Sanitation Project (CWSSP), along with other approaches, attracts the children with cartoons for raising their awareness level and practicing the same. Some stickers with cartoons with hygiene messages are presented here.

4. Monitoring and Re-focusing

The IEC materials are now in use in the CWSSP. The approaches for dissemination and adoption of hygiene practices are being monitored and reviewed and issues hindering the changes for improvement of the water and sanitation situation analyzed. Message delivery approaches and methods, and additional awareness raising tools will be developed and re-focused as required to address successfully the changing circumstances.

5. Conclusion

Hygiene promotion for better use of water supply and sanitation can be a powerful tool for change. Audience research and need assessment are the prerequisites to enhance acceptance and consolidation of change. CWSSP has initiated communication through school children for their own health and hygiene, as well as, to influence the water and sanitation situation in their homes. A systematic approach for delivering appropriate promotional and educational messages at appropriate time in the life cycle of the children has been adopted. The effectiveness of the approach are being monitored and evaluated for subsequent improvement and finetuning.



Girl: You better use a sanitary latrine to avoid diarrhoea, hepatitis or worms!

Boy: I know, so I use a sanitary latrine!



Girl: That happens when you take uncovered food!

Boy: I will never take uncovered food, and not suffer from diarrhoea!

A NEW APPROACH TO SCHOOL SANITATION AND HYGIENE*

Introduction

Children are the most vulnerable to environmental health hazards and are subsequently also the worst affected. Schools will partly determine children's health and well-being by providing a healthy or unhealthy environment and by developing useful life skills on health and hygiene. The quality of sanitation and hygiene promotion in schools can be quite poor in developing countries. Although water and sanitation facilities are being recognised as fundamental for hygiene behaviour and children's well-being, in practice, many schools are confronted with extremely bad sanitary conditions. Conditions vary from inappropriate and inadequate sanitary facilities to the outright lack of latrines and safe water for drinking and hygiene. This may even contribute to absenteeism and the drop-out rates of girls.

Schools can be a key factor for initiating change. Children are often eager to learn and willing to absorb new ideas. New hygiene behaviour learned at school can lead to life-long positive habits. Teachers can function as role models, not only for the children but also within the community. School children can influence the behaviour of family members - both adults and younger siblings - and thereby positively influence the community as a whole.

Schools are a stimulating learning environment for children. A safe learning environment is a pre-condition for joyful learning which facilitates the development of the child's potential. The School Sanitation and Hygiene Education (SSHE) started as a pilot project in late 1992 in collaboration with DPHE & Department of Primary Education (DPE) and supported by UNICEF for hygienic behaviour development for both the children and the community at large and to ensure a safe learning environment. From 1992 to 2000, approximately 4,500 primary schools in 44 districts have been reached by this pilot project.

The SSHE Strategy

The SSHE strategy went through two major revisions in 1995 and 2000 based on the lessons learned during the pilot project. Previously software activities followed the provision of hardware support to the schools, which meant that primary schools in a district or Upazila were not covered with sanitation and hygiene education activities if they did not require WatSan facilities. During the last SSHE revision DPE suggested that all primary schools in a District or Upazila should be covered particularly with software

* Compiled from DPHE-UNICEF: Environmental Sanitation, Hygiene and Water Supply in Rural Areas *Project Inception Report* and various UNICEF information sources by Han A. Heijnen, Environmental Health Advisor, WHO, Dhaka.

activities. Therefore, under the revised SSHE, all primary schools (GoB and registered non-government) of a District or Upazila will be covered with software activities while an estimated 30% of all primary schools also require WatSan facilities.

DPHE, DPE & UNICEF have agreed that SSHE & the IDEAL (Intensive District Approach to Education for All) education project will be linked for mutual support. In this way non-IDEAL districts, which are covered by the project, will use a reduced IDEAL package including local level planning, fund generation and participatory monitoring. Meanwhile, the IDEAL districts where the project will not operate, will use the SSHE package for sanitation & hygiene education. Out of 7 districts planned for the developmental phase of the project, 3 districts are covered with IDEAL and another district is planned for 2001. SSHE and IDEAL will be highly complementary.

Good schools can offer an environment where children learn, are stimulated and where changes and new behaviour is introduced. It is also generally recognised that childhood is the best time for learning hygienic behaviour. Improved hygiene practices are essential if transmission routes of water and sanitation related diseases are to be cut. Children are the most vulnerable victims of these diseases. In Bangladesh now there is a primary school in almost every village which has a central place in the community. If water and sanitation facilities are available in schools they can be treated as models, as well as teachers and students who can act as role models for their families and other community members through school and outreach activities.

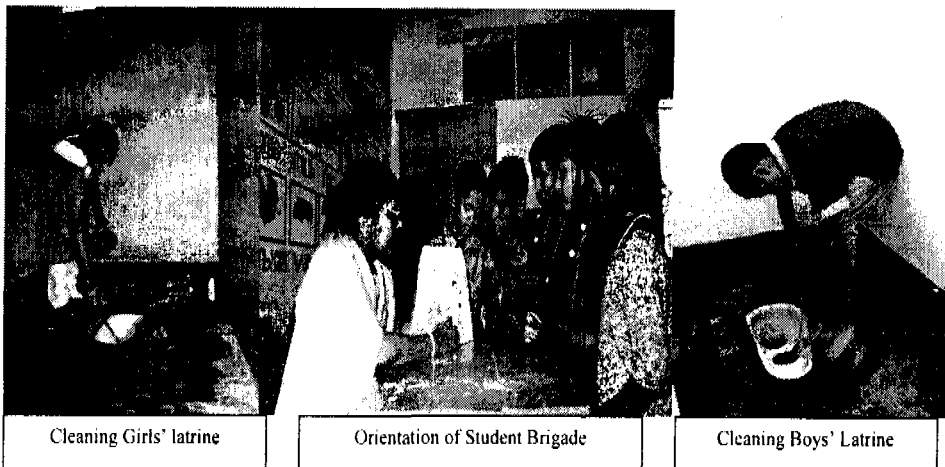
Objectives

The SSHE has the objective to change hygiene and sanitation behaviour of children, adolescents and adult community members.

It has been observed that sanitation coverage in the school catchment area is more than 70% while the District sanitation coverage is around 30% (source: field report from Noakhali; .98). Diarrhoeal diseases dropped remarkably (almost to nil) with overall improvement of the village environment in Doshchira (Shivalaya Upazila of Manikganj District) with Student Brigades activities of the local primary school guided by teachers & SMC (source: report on Doshchira). The specific objectives of the SSHE component are:

1. To fulfil the right of the children to have access to safe water and sanitation facilities in primary and secondary schools and to ensure a safe environment for learning;
2. To ensure health and nutrition benefits to children through the provision of behavioural development and life skills regarding sanitation, hygiene and safe water use as well as management of safe environment in primary schools;

3. Strengthen the capacity of primary schools to operate as resource centres for developing hygienic behaviour among children and promoting such behaviour among teachers and community people in the surrounding villages.



Lessons Learned and Problem Analysis

A national evaluation of SSHE by DPHE-DPE-UNICEF in 1994, a Comparative Study Between School Management Committee (SMC) & Contractor Constructed Facilities under School Sanitation Programme in Noakhali District in 1998 and field observations showed that:

- * Provision of WatSan facilities, separately for boys and girls, increased girls attendance by 11%;
- * Involvement of SMC in construction of facilities has created ownership and expedited the construction process;
- * More than 80% students interacted with their family members to discuss practices concerning sanitation and hygiene acquired at school which resulted in higher sanitation coverage (than District coverage) in the school catchment area;
- * The overall condition of the school environment were found clean for 55% cases, hence 45% cases still remained unsatisfactory;
- * In more than 70% programme schools both latrines (1 for girls + 1 for boys) are used regularly but 30% cases are still a problem;
- * In 30-40% cases water system remained non-functional.

Major Problems Found Related To

- * Lack of ownership on the part of school community including students, teachers & SMC

- * Lack of involvement of local communities as PTA, Union Parishad etc. for development of the schools and the learning environment
- * Lack of monitoring and evaluation of school performances.

Revision of the SSHE Strategy

Based on lessons learned from its activities the SSHE strategy went through revision processes. One major revision was in 1995 when it was decided that School Management Committee (SMC) should be involved in the construction of WatSan facilities in primary schools to create ownership. Earlier it was the DPHE contractors which installed WatSan facilities in schools.

In 1997 local level discussions for the revision of teachers and SMC training manuals took place.

In 1998 a two-day retreat of UNICEF WES & Education sections was organised to develop a concept paper to build linkages between the IDEAL and SSHE project. The IDEAL project is focused on improving the quality of education in primary schools using Multiple Ways of Teaching & Learning (MWTL) techniques and the Safe Learning Environment (SLE) package. In 1998 three local level workshops in Dinajpur, Mymensingh & Manikganj Districts were organised with DPHE & DPE including teachers, SMC members, UP Chairpersons and female members, UEO/AUEO and SAE. The objectives of the workshops were to revise the SSHE strategy and to formulate appropriate strategy in order to be demand responsive, more focused to children & school activities and to create scope for more community participation.

Also a study was carried out to evaluate the package of WatSan facilities for schools in terms of child-friendliness, arsenic contamination of ground water, perception of school communities including students, teachers and SMCs etc.

In 1999 based on the study findings and three District Workshop recommendations one workshop was organised in Dhaka on appropriate technology for WatSan options in schools. The participants were SAE, EE and UPC from different Districts. After the workshop a Task Force was formed of DPHE & UNICEF to revise the WatSan options, designs, cost estimates etc. The Task Force produced Construction Guidelines including technology options, designs, cost estimates and revised technology options which then were piloted in 11 schools in Bandarban & Chandpur Districts. Based on the piloting experiences changes were made in the guidelines and the current WatSan options are as follows:

1. 2 or 4 latrines (separate latrines for girls & boys)
2. One water tank to ensure running water inside latrines
3. One safe water source from the list below:

- Deep tubewell with no.6 handpump
- Tara or Tara-2 with Dev-head (lever action)
- Deep Tara or deep Tara-2 with Dev-head
- Ringwell with Tara Dev-head
- Pond-sand-filter
- Rain water harvesting

In the revised technology options ventilation has been increased to allow more light and air inside latrines; stairs to latrines are broadened; foot-rests have been changed so that (length is increased along the pan) both younger & older ones can use the latrines; and the water tank is at a particular height from the ground to ensure running water inside latrines. The man-hole of the tank is increased in diameter for proper cleaning.

Rain Water Harvesting (RWH) option is mainly meant for drinking purpose in case any other safe water option is impossible (as in some cases of CHT Districts) and where other water sources are available for cleaning and washing.

A Central Co-ordination Committee (CCC) of DPHE-DPE-UNICEF was formed which helped to accelerate the process of the SSHE strategy revision. In January 2000 one national workshop was organised in Dhaka to finalise the SSHE revised strategy which was finally approved in an inter-ministerial meeting of MOLGRD, PMED, DPHE, DPE & UNICEF in September 2000.

WatSan facilities are now provided with the new school buildings under the PEDP project of DPE. Allocations are also made to a number of schools each year for repair works under this project. Therefore, not all schools will need WatSan facilities in the project area. DPE suggested that all primary schools in a project District or Upazila should be covered with software activities which will include planning, sanitation & hygiene education, participatory monitoring and motivation by Student Brigades (SB).

SB activities were piloted in a few primary schools in 5 Districts during 1998-2000 during the SSHE strategy revision process.

Part of the revised SSHE strategy is the criteria for repairing support to primary schools:

- * Petty repair should be done by SMC (replacing spare parts, small fittings, and routine maintenance)
- * Major repair, if necessary, should be supported by the project and only once at the beginning (pump rod replace, re-sinking, rising main replace, Y junction, soakwell, door & commode)

- * SMC must be interested and committed to share costs of minimum 25% of the repairing costs and future maintenance with their own fund
- * WatSan facilities (provided by LGED & Facility dept.) with STW, will be replaced by TARA & other water sources in the context of sustainability and arsenic contamination.
- * Facilities damaged by natural calamities
- * School must have a minimum of 100 students

Local (Upazila & District) DPHE will make estimate for the cost of repair/rehabilitation which will be approved by Upazila & District Committees. Accordingly fund will be requested from the project by DPHE.

Under the Primary Education Development Project (PEDP) of DPE yearly allocations are made for repairing of primary schools which is carried out by LGED. Therefore co-ordination and collaboration of DPHE, DPE & LGED at different levels will be done regularly so that available resources are used effectively for repair and rehabilitation of facilities and no duplication takes place.

School Brigades



Brigade activities Mymensingh

All students of class IV & V will be divided into groups of 5/6 neighbouring children which are termed as Student Brigades. The catchment area of primary schools are marked by DPE. The total households of school catchment area will be divided into number of clusters so that the number of clusters are equal to the number of Student

Brigades (one Brigade in each cluster). The Brigade members will receive training on participatory monitoring and motivational activities by teachers. Brigade members will monitor and motivate sanitation & hygiene behaviour in households of the respective cluster. Since they are children of that same cluster they can plan their activities as convenient to them and the community. It will also help them to own the results and achievements together with their family members. This is a "Learning by Doing" activity for the children. Each teacher will guide & supervise a number of Brigades based

on the local situation. SMC members will also be related to School Brigades for the overall guidance, supervision & monitoring. The Brigade's activity will start with a (baseline) survey of the catchment area households and with motivational activities. The Brigades will fill in monitoring formats twice in a year. Formats will be compiled at school, which will show the status and progress in terms of hygiene behaviour of the community. This information is shared with community members in a community gathering twice a year. The school will also submit an annual report of the progress of the Brigade activities to the respective AUEO and to Union WatSan Committee, which will be compiled, in turn, at the Union & Upazila levels with the help of Field Agency.

School Brigade's activities were introduced in 5 Districts in 1998 in a limited number of primary and secondary schools for about one year. The activities were not continued due to lack of project/required funds. Adequate supervision was absent at the times but it was observed that students, teachers & SMCs were very enthusiastic about their activities and a recent evaluation showed that the school brigades still exist in many schools in Noakhali, Mymensing, Jhenaidah, Potuakhali & Bandarban Districts.



স্কুল পর্যায়ে স্বাস্থ্য উন্নয়ন

এ এফ এম খালিদ হাসান*

শিক্ষার ক্ষেত্রে স্কুলই হ'লো প্রথম পাদপীঠ। উন্নয়নশীল দেশে যদিও সব শিশু স্কুলে যেতে পারে না এবং স্কুল থেকে ঝরে যাওয়া ছাত্র সংখ্যার হার যথেষ্ট বেশী, তা' সত্ত্বেও আমাদের দেশে স্কুল হ'লো মানুষের আশা আকাঙ্ক্ষা ও শিক্ষার প্রদীপ। অনেকে মনে করেন স্কুল থেকে শিক্ষা লাভ করতে পারলে ভবিষ্যতে কর্মসংস্থানের সুযোগ সৃষ্টি হবে। বর্তমানে এ' ধারণাও দিন দিন পরিবর্তিত হচ্ছে।

স্কুল হ'লো এমন ধরনের স্থাপনা যেখানে ছেলে মেয়েরা শিক্ষা লাভ করে, চরিত্র গঠিত হয়। মূল্যবোধ তৈরীর ক্ষেত্রে স্কুলের কোন বিকল্প নেই।

স্বাস্থ্যগত সমস্যা উন্নয়নশীল দেশের শিশু-কিশোরদের জন্য আজ বিরাট চ্যালেঞ্জ হয়ে দাঁড়িয়েছে। এ' সমস্যা যুব সমাজের সমূহ ক্ষতি করছে। স্থানান্তরের মাধ্যমে সৃষ্ট রোগ, অপুষ্টিজনিত ও পানিবাহিত রোগ, ধূমপানজনিত রোগ, অস্বাস্থ্যকর খাবারের কারণে সৃষ্ট রোগ, যৌন রোগ ও মানসিক রোগ জাতির জন্য সমস্যা হয়ে দাঁড়িয়েছে। অমানবিক আচরণ যুবসমাজের মধ্যে নৈতিক মূল্যবোধ তৈরী করতে ব্যর্থ হচ্ছে। উপযুক্ত কর্মসংস্থান, নিয়মিত উপার্জন, বসবাসযোগ্য আবাসন ইত্যাদি সমস্যার কারণে দেশের যুব সমাজের উপর একটা প্রচলন মনস্তাত্ত্বিক ও সামাজিক চাপ বিদ্যমান। দুঃখজনক হলেও সত্য যে, উন্নত বিশ্বের বিদ্যমানের সাথে সঙ্গতি রেখে উন্নয়নশীল দেশের যুব সমাজ তাদের প্রতিভা, দক্ষতা ও যোগ্যতার বিকাশ ঘটাতে ব্যর্থ হচ্ছে। এ' সমস্যার মোকাবেলায় স্কুল পর্যায়ে স্বাস্থ্য উন্নয়ন একটি খুবই গুরুত্বপূর্ণ বিষয়।

স্কুল স্বাস্থ্য উন্নয়ন কার্যক্রম একটি গতিশীল স্থাপনা হ'তে পারে; স্বাস্থ্যবান জাতি তৈরীর জন্য হ'তে পারে একটি উপযুক্ত ক্ষেত্র। স্বাস্থ্য এবং শিক্ষা একে অপরের পরিপূরক। শিক্ষা অর্জনের ক্ষেত্রে সুস্বাস্থ্য একান্ত আবশ্যিক। উন্নততর শিক্ষা শিশু-কিশোরদের স্বাস্থ্য সচেতনতা সৃষ্টিতে সাহায্য করে; জনগোষ্ঠী ও পরিবারে স্বাস্থ্য সচেতনতা সৃষ্টিতে ও স্বাস্থ্য পরিচর্যার ক্ষেত্রে সহায়ক ভূমিকা পালন করে। এ'সব বিবেচনা করে স্কুল পর্যায়ে শিক্ষা ও স্বাস্থ্য বিষয়ক কর্মসূচী জোরদার করা একান্ত প্রয়োজন।

স্কুল পর্যায়ে স্বাস্থ্য শিক্ষা প্রচলনের মাধ্যমে নিম্নবর্ণিত লক্ষ্য ও উদ্দেশ্য অর্জিত হতে পারেঃ

- * স্বাস্থ্য শিক্ষা ও স্বাস্থ্য পরিচর্যা বিষয়ে সচেতনতা সৃষ্টি;
- * নিরাপদ ও স্বাস্থ্যকর পরিবেশ তৈরীতে সহায়তা;
- * পরিবার ও জনগোষ্ঠীর মধ্যে স্বাস্থ্য সচেতনতা বৃদ্ধি;
- * দক্ষতাভিত্তিক স্বাস্থ্য শিক্ষার উন্নয়নে সাহায্য; ও
- * স্বাস্থ্য শিক্ষা সম্পর্কিত কৌশল বাস্তবায়নে সহযোগিতা।

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হেলদি স্কুলের কার্যক্রম

স্কুল পর্যায়ে স্বাস্থ্য শিক্ষার উন্নয়নে উল্লেখযোগ্য উপাদানগুলো নিম্নরূপ :

- * স্কুল পর্যায়ে স্বাস্থ্য শিক্ষা;
- * স্বাস্থ্য সচেতন স্কুল;
- * স্কুল স্বাস্থ্য সেবা;
- * পুষ্টি কর্মসূচী;
- * পরিবার ও জনগোষ্ঠির সম্পৃক্ততা;
- * শারীরিক ব্যায়াম ও খেলাধুলা;
- * পরামর্শ ও সামাজিক সহযোগিতা; ও
- * স্কুলের স্টাফদের স্বাস্থ্যের উন্নয়ন।

হেলথ প্রোমোটিং স্কুল প্রতিষ্ঠার লক্ষ্যে নিম্নোক্ত নীতিমালার আলোকে কৌশল নির্ধারণ করা যেতে পারে :

- * স্কুল পর্যায়ে স্বাস্থ্য উন্নয়নকল্পে পরামর্শ বৃদ্ধি;
- * জাতীয় পরিকল্পনা গ্রহণ;
- * নেটওয়ার্ক তৈরী;
- * স্কুল ব্যবস্থাপনা কর্তৃপক্ষকে এ' উদ্দেশ্যে শক্তিশালী করা;
- * স্কুল পর্যায়ে স্বাস্থ্য উন্নয়নের জন্য গবেষণা পরিচালনা;
- * সামগ্রিক কার্যক্রম মূল্যায়ন;

* উন্নয়ন সহযোগী তৈরী; ও

* স্থানীয় ও আন্তর্জাতিক সহযোগিতা বৃদ্ধি।

একটি স্বাস্থ্যবান জাতি গড়ে তোলার ক্ষেত্রে স্কুল পর্যায়ে স্বাস্থ্য শিক্ষা প্রবর্তনের কোন বিকল্প নেই। এ' জাতীয় উদ্যোগ আমাদের শিশু কিশোরদের স্বাস্থ্য সচেতন করবে এবং তাদের স্বাস্থ্য সচেতনতা বোধ নিজ নিজ পরিবার ও জনগোষ্ঠীর দৃষ্টিভঙ্গি ও আচরণের পরিবর্তন ঘটাতে সাহায্য করবে।

FIELD EXPERIENCES ON URBAN SANITATION

A.F.M. Khalid Hassan*

Introduction

In recent decades, Bangladesh has experienced a rapid growth in urban population. Expansion of public services has not kept pace. Urban dwellers are the first to suffer from unemployment, inadequate housing, sanitation problems and lack of clean water. When such a situation is compounded with insufficient access to health care, high incidence of illness and malnutrition results.

In the urban slums and fringes, access to sanitary latrines is estimated at 23 percent. The health risks indicated by this low coverage figure can only be imagined. The home area often get polluted due to indiscriminate disposal of rubbish and inadequate drainage systems causes domestic waste water to stagnate. Beyond this, poor sanitation and hygiene practice have also been a major factor to high diarrhoeal episodes per year, leading to 110,00 death associated with malnutrition : a third of all child deaths, and many more types of illness.

The general policies regarding water supply and sanitation in the urban areas only indirectly affects the urban poor. Projects like 9 District Towns Project (9 DTP) and 18 District towns Project (18 DTP) aimed to provide services in some selected pockets within the urban core of the pourashavas. The Project interventions aim to reduce the incidence of diarrhoeal diseases and prevent infections in children by providing safe water facilities integrated with improved sanitation and promotion of personal hygiene, through imparting basic health education installation of hand pumps, construction of water seal latrines and sullage pits.

The Projects

1. The 18 District Towns Project (18 DTP)

The 18 DTP ran from March 1995 to December 1999. This project was executed by the Department of Public Health Engineering (DPHE). The main objectives of the programme were to create awareness on health and facilitate the adoption and retention of hygiene behaviour to reduce water and sanitation related diseases and to ensure proper usage and maintenance of the hardware implemented by 18 DTP. The software activities were carried out by NGOs under supervision of pourashaves, The NGOs promoted use of sanitary latrines and undertook hygiene educations activities.

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2. The 9 District Towns Project (9 DTP) (1994-2001)

The household environmental sanitation (HES) programme of the 9 DTP aimed at enabling households to improve the living conditions through the use of : (i) hand tubewells (ii) sanitary latrines (iii) soakage pits. The project had provisions for the installation of 14,600 hand tubewell units, 24,000 sanitary latrines and 17,000 soakage pits in 9 pourashavas. It provided the funds required from the establishment of the revolving fund from which the householder receives a loan if so required. The loan was to be repaid over two years. Maximum loan amount had been Tk. 2000. The implementation programme was being carried out through contracting with NGOs in the project towns.

The responsibilities of the NGOs included awareness campaign, community mobilization, participatory planning, resource mobilization, installation and maintaining. The pourashavas played an active role in the HES programme implementation.

Review

The goals of the both projects were to improve the environmental health of the communities especially women and children by facilitating environmental sanitation interventions.

18DTP

- * Hygiene education was conducted with groups of women using different techniques such as courtyard meetings, group discussions, household visits, demonstration, IEC material as communication tools.
- * The project provided low cost sanitary latrines with which were free of cost to the urban poor.
- * The 18 DTP developed a special curriculum for hygiene education in primary schools
- * Only women were trained as caretakers of hand tubewells.

Achievements/Findings

The low cost sanitary latrines and the hand tubewells provided under the community based facilities 18 DTP project. Increased hand washing before eating and after defecation, increased knowledge on the cause, prevention and cure of diarrhoea are the achievement of the programme. The hygiene promoters under the project succeeded in creating hygiene awareness. The future sustainability of the programme is uncertain, since an institutional framework for continuation of the hygiene education activities was not a objective of the project.

9 DTP

- * Provided safe water to pourashavas communities
- * Created community awareness for controlled disposal of human waste

and enable community to install necessary facilities, and

- * Generated community awareness for controlled disposal of household solid and liquid wastes.

Achievements/Findings

During implementation of the HES programme, hygiene education gets less priority than loan sanction, main thrust of the NGO staff was to sanction and recover the loan. Loan recovery was satisfactory. The loan ceiling for each handpump, latrine and sullage pit are Tk 2000, Tk 1,350 and 1,100 respectively. It is recovered inclusive of 14% interest over hundred weeks. Beneficiaries showed negative attitude to take the loan for the installation sullage pit as it would be extra burden to refund the loan with 14% interest.

Conclusion

Both projects showed interesting elements. However, for sustained hygiene behaviour and to encourage people to construct proper latrines, some form of institutional embedding is required.

Clear policies should also be developed which spell out roles and responsibilities for all stakeholders. And then the policy should be applied and monitored.

A strategy for the improvement of sanitation in high-risk communities will need to encompass the following elements.

- * Creation of political commitment;
- * Institutional mobilization;
- * Validation of Technology options;
- * Awareness raising;
- * Community involvement;
- * Hygiene promotion;
- * Human resource development; and
- * Monitoring and evaluation.

পানি ও স্বাস্থ্য : সুস্থ জীবনের নিশ্চয়তায় একে-অন্যের পরিপূরক

ফারাহ নাজ*

নিরাপদ পানি সুস্বাস্থ্যের জন্য অপরিহার্য ও জনস্বাস্থ্য উন্নয়নের প্রধান উপযোগ। নিরাপদ পানি যেমন প্রত্যক্ষভাবে জনস্বাস্থ্যের সাথে সম্পর্কযুক্ত তেমনি পরোক্ষভাবে স্বাস্থ্যসম্মত পরিবেশ নিশ্চিতকরণেও এর ভূমিকা অনস্বীকার্য। পানি ও স্বাস্থ্য এ দু'টি অমূল্য সম্পদই পারে সমাজের কাঙ্ক্ষিত উন্নয়ন অর্জন করতে। দূষিত পানি স্বল্পমেয়াদী ও দীর্ঘমেয়াদী উভয় স্বাস্থ্য-ঝুঁকির অন্যতম কারণ। একদিকে ব্যাকটেরিয়া, ভাইরাস এবং জীবাণুর মাধ্যমে দূষিত পানি মানবদেহে রোগ ছড়াচ্ছে অন্যদিকে কৃষিকাজে ব্যবহৃত রাসায়নিক সার বৃষ্টির পানিতে ধুয়ে বিভিন্ন পুকুর, খাল-বিলের পানিকে দূষিত করছে এবং মানুষ খাবার পানি হিসাবে এসব পুকুর, খাল-বিলের পানি ব্যবহার করার ফলে বিভিন্ন রোগে আক্রান্ত হচ্ছে।

বিভিন্ন পানিবাহিত রোগ

ডায়রিয়া

দূষিত পানি, অস্বাস্থ্যকর স্যানিটেশন ব্যবস্থা এবং অপরিচ্ছন্ন খাদ্যাভ্যাসই হচ্ছে ডায়রিয়া রোগের প্রধান কারণ। বিশ্ব স্বাস্থ্য সংস্থার মতে উন্নয়নশীল দেশসমূহে শুধুমাত্র ডায়রিয়াজনিত রোগে অধিকাংশ লোকের মৃত্যু ঘটে। উন্নয়নশীল দেশসমূহে প্রতি বছর প্রায় ২০ লক্ষ লোক ডায়রিয়ায় মৃত্যুবরণ করে যার ৯০% হচ্ছে শিশু। বার বার পাতলা পায়খানার কারণে শিশুর দেহ পানিশূন্য হয়ে পড়ে এবং পুষ্টিহীনতার কারণে শিশুর মৃত্যু ঘটে। উন্নত স্বাস্থ্য পরিচর্যা নিরাপদ পানি এবং স্বাস্থ্যসম্মত স্যানিটেশন চর্চার মাধ্যমে সহজেই ডায়রিয়া রোগ নিয়ন্ত্রণ করা সম্ভব। পায়খানার পর সাবান ও পানি দিয়ে হাত ধোয়ার অভ্যাস গড়ে তোলার মাধ্যমেই শুধুমাত্র ৩৫% ডায়রিয়াজনিত রোগ নির্মূল করা সম্ভব। এখন পর্যন্ত বিশ্বের ৬০০ কোটি জনসংখ্যার ৪০ শতাংশ স্বাস্থ্যসম্মত স্যানিটেশন সুবিধা থেকে বঞ্চিত রয়েছে এবং ১০০ কোটির অধিক জনগোষ্ঠী দূষিত পানির উৎস থেকে পানি সংগ্রহ ও ব্যবহার করে ডায়রিয়ায় আক্রান্ত হচ্ছে।

কলেরা

কয়েক বছর আগে ও দক্ষিণ-পূর্ব এশিয়ার দেশগুলোতে কলেরা মহামারী আকার ধারণ করত। দূষিত পানির মাধ্যমে কলেরার জীবাণু মানব দেহে প্রবেশ করে। ১৯৯২ সালের অক্টোবর মাসে বাংলাদেশ ও ভারতে V. Cholera এর আর্বিভাব উপমহাদেশব্যাপী এক আতঙ্কের জন্ম দেয়। ভাবা হয় V. Cholera উপমহাদেশে মহামারী আকার ধারণ করবে। পরবর্তীতে এশিয়ার মধ্যেই এ' রোগের ব্যাপ্তি সীমাবদ্ধ ছিল। যদিও গত কয়েক বছর ধরে দক্ষিণ-পূর্ব এশিয়ার দেশসমূহে মহামারী আকারে কলেরা সংঘটিত হওয়ার কোনো তথ্য পাওয়া যায়নি তথাপি এর অবস্থান যথাযথভাবে অবলোকন না করা হলে আবারও কলেরা মহামারী আকার ধারণ করতে পারে বলে বিশেষজ্ঞরা মত প্রকাশ করেছেন।

* সহযোগী তথ্য কর্মকর্তা, এনজিও ফোরাম ফর ড্রিংকিং ওয়াটার সাপ্লাই এ্যান্ড স্যানিটেশন, ঢাকা।

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ডেঙ্গু

ডেঙ্গু হেমোরাজিক ফিভার সাম্প্রতিককালে বাংলাদেশসহ পৃথিবীর বিভিন্ন দেশে একটি ভয়াবহ রোগ হিসাবে আবির্ভূত হয়েছে। এ' রোগের জীবাণু বহনকারী এডিস মশার জনস্থান হচ্ছে বাড়ীর পরিত্যক্ত বিভিন্ন কৌটা, ফুলদানি, ফুলের টবে এবং গাড়ির পরিত্যক্ত টায়ারের ভেতরে জমে থাকা পানি। ১৯৯৭ সাল থেকে দক্ষিণ-পূর্ব এশিয়ার দেশগুলোতে বিশেষ করে ভারত, ইন্দোনেশিয়া, মায়ানমার, শ্রীলংকা ও থাইল্যান্ডে ডেঙ্গু রোগের ব্যাপক প্রাদুর্ভাব লক্ষ্য করা গেছে। বর্তমানে বাংলাদেশ, ভারত, মালদ্বীপ, মায়ানমার, ইন্দোনেশিয়া ও শ্রীলংকা এই ৭টি দেশের প্রায় ১.৩ বিলিয়ন জনসাধারণ ডেঙ্গু সংক্রমণ ঝুঁকির মধ্যে বসবাস করছে। ১৯৯৮ সালে দক্ষিণ-পূর্ব এশিয়ায় প্রায় ৪ লক্ষ লোক ডেঙ্গু রোগে আক্রান্ত হয়েছে এবং প্রায় ৮,০০০ মানুষ ডেঙ্গু রোগে মৃত্যুবরণ করেছে। গত ১০-১৫ বছরের মধ্যে ডায়রিয়ার পর ডেঙ্গু রোগে সবচেয়ে বেশী সংখ্যক মানুষ চিকিৎসার জন্য হাসপাতালে ভর্তি হয়েছে এবং বেশী সংখ্যক শিশু ডেঙ্গু রোগের কারণে মৃত্যু বরণ করেছে। ডেঙ্গু মৌসুমে জনগোষ্ঠীর সম্মিলিত অংশগ্রহণের মাধ্যমে এডিস মশার লার্ভার জনস্থানগুলিকে যথাযথভাবে নির্মূল করার মাধ্যমেই এ' রোগের বিস্তারকে নিয়ন্ত্রণ করা সম্ভব।

হেপাটাইটিস

১৯৯৯ সালের রিজিওনাল হেল্থ রিপোর্টের তথ্য অনুযায়ী দক্ষিণ-পূর্ব এশিয়ায় প্রায় ২৮,০০০ মানুষ হেপাটাইটিস রোগের কারণে মৃত্যুবরণ করেছে। দক্ষিণ-পূর্ব এশিয়ার অনুল্লত স্বাস্থ্যবিধি এবং নিরাপদ পানি ও স্যানিটেশন ব্যবস্থার অপ্রতুলতা হেপাটাইটিস 'এ' রোগের অন্যতম কারণ। স্বাস্থ্যবিধির উন্নয়ন, স্বাস্থ্যসম্মত স্যানিটেশন এবং নিরাপদ পানি সরবরাহ ব্যবস্থার সন্তোষজনক পরিবর্তনের মাধ্যমে ৭ থেকে ১২ বছরের শিশুদের মধ্যে হেপাটাইটিস রোগের সংক্রমণের হার সম্প্রতি অনেকাংশে লাঘব করা সম্ভব হয়েছে। ১৯৭৮ সালে যেখানে হেপাটাইটিস রোগের সংক্রমণের হার ছিল ৮৫-৯০%, ১৯৯৫ সালে তা' ৩০-৩৫% এ নেমে গেছে।

ইনটেস্টাইনাল প্যারাসাইটিক ডিজিজ

বিশ্বের অনুল্লত দেশসমূহের যেখানে স্যানিটেশনের ক্ষেত্রে অব্যবস্থা বিরাজ করছে সে সমস্ত দেশসমূহে আন্ত্রিক ইনটেস্টাইনাল রোগের উপস্থিতি বেশী মাত্রায় পরিলক্ষিত হয়। কিছু কিছু পরজীবি জীবাণু যেমন আন্ত্রিক কৃমি সংক্রমণ মাটির মাধ্যমে দেহে সংক্রমিত হয়। দরিদ্র দেশসমূহে যেখানে অনুল্লত স্যানিটেশন পানি সংকট এবং ব্যক্তিস্বাস্থ্য পরিচর্যার মান খুবই নীচে সে সমস্ত অঞ্চলের জনগোষ্ঠীর মধ্যে এ' রোগের উপস্থিতি বেশী মাত্রায় বিদ্যমান।

ম্যালেরিয়া

ম্যালেরিয়া একটি অন্যতম প্রধান পানিবাহিত রোগ যার জীবাণু এনোফিলিস মশা বহন করে। দক্ষিণ-পূর্ব এশিয়ার মোট ১৪০ কোটি জনগোষ্ঠীর মধ্যে ১২০ কোটি ম্যালেরিয়ার আশংকায়ুক্ত এলাকায় বসবাস করছে এবং এদের মধ্যে প্রায় ৪০ কোটি জনগোষ্ঠীর ঔষধের মাধ্যমে ম্যালেরিয়া প্রতিরোধের সম্ভাবনা আছে। সাধারণত অস্বাস্থ্যকর পরিবেশে বসবাসরত জনগোষ্ঠীর মধ্যে ম্যালেরিয়ার প্রাদুর্ভাব লক্ষ্য করা যায়। আবদ্ধ পানিতে এনোফিলিস মশা বংশ বিস্তার করে। পুকুর, জলাশয়, গর্ত, নর্দমা ইত্যাদি জায়গাগুলোতে এই মশা ডিম পাড়ে। পৃথিবীর প্রায় ৩০ কোটি জনসাধারণ ম্যালেরিয়া রোগে ভুগছে এবং শুধুমাত্র আফ্রিকার সাহারা অঞ্চলে প্রতি বছর ম্যালেরিয়ার কারণে ১০ লক্ষ লোক

মৃত্যুবরণ করে যার মধ্যে বেশীর ভাগ রয়েছে পাঁচ বছরের কম বয়সের শিশু। পরবর্তী পর্যায়ে আছে দক্ষিণ ও দক্ষিণ-পূর্ব এশিয়ার অন্তর্ভুক্ত দেশগুলো এবং দক্ষিণ আমেরিকার কিছু অংশ যেখানে ম্যালেরিয়ার প্রাদুর্ভাব খুব বেশী। মশারী ব্যবহার, বিভিন্ন ইনসেক্ট কিলার স্প্রে করে এবং বিভিন্ন জলাশয়, নর্দমা, ছোট ছোট নালা যেখানে এনোফিলিস মশা বংশ বিস্তার করে সেখানে জলাবদ্ধতা দূরীকরণের মাধ্যমে ম্যালেরিয়া প্রতিরোধ করা সম্ভব।

ট্রাকোমা

ট্রাকোমার কারণে শিশুরা অন্ধত্ব বরণ করে। উন্নত স্যানিটেশন ব্যবস্থা ও মাছির বংশ বিস্তার রোধের মাধ্যমে এবং শিশুদের পরিষ্কার পানি দিয়ে মুখ ধোয়ার অভ্যাস সংক্রান্ত সচেতনতা সৃষ্টির মাধ্যমে ট্রাকোমা রোগ প্রতিরোধ করা সম্ভব। বর্তমান বিশ্বে প্রায় ৬০ লক্ষ লোক প্রতিরোধযোগ্য দৃষ্টিহীনতায় এবং প্রায় ১৪ কোটি ৬০ লক্ষ মানুষ সংকটজনক দৃষ্টিহীনতায় ভুগছে।

ফ্লুরোসিস

শুধুমাত্র খাবার পানির ফ্লুরাইড সমস্যাই নয় বিভিন্ন কল-কারখানা থেকে নির্গত ফ্লুরাইড বাতাসের মাধ্যমে মানব দেহে প্রবেশ করে জনস্বাস্থ্যের মারাত্মক ক্ষতি করছে। ভূগর্ভস্থ এবং ভূগর্ভস্থ পানিতে ফ্লুরাইড এবং পরিমাণ একটি নির্দিষ্ট মাত্রা পর্যন্ত ক্ষতিকর নয়। যখন পানিতে ফ্লুরাইড এর পরিমাণ অতিরিক্ত বৃদ্ধি পায় তখনই তা' মানবদেহের জন্য ক্ষতিকর হয়ে যায়। খাবার পানিতে অতিরিক্ত পরিমাণ ফ্লুরাইডের কারণে ডেন্টাল ফ্লুরোসিস এবং স্কেলিটাল ফ্লুরোসিস হয়ে থাকে। সাম্প্রতিক এক তথ্যে জানা যায় যে, বাংলাদেশসহ সারা বিশ্বের প্রায় ২৫টি দেশে ফ্লুরোসিস রোগের ব্যাপকতা বিদ্যমান। এ' রোগে আক্রান্ত রোগীর সঠিক সংখ্যা জানা না গেলেও প্রায় ১০ মিলিয়ন লোক ফ্লুরোসিস রোগে আক্রান্ত বলে অনুমান করা হয়। ১৯৯৩ সালে ভারতের ৩২টি রাজ্যের মধ্যে ১৫টিতেই ফ্লুরোসিসের প্রাদুর্ভাব লক্ষ্য করা যায়। মেক্সিকোর প্রায় ৫০ লক্ষ লোক অর্থাৎ মোট জনগোষ্ঠীর প্রায় ৬% ভূগর্ভস্থ পানির ফ্লুরাইড সমস্যায় ভুগছে। দু'ধরণের ফ্লুরোসিস এর কোন চিকিৎসা এখন পর্যন্ত আবিষ্কৃত হয়নি। প্রয়োজনীয় পরিমাণ ফ্লুরাইড গ্রহণ করাই হচ্ছে এ' রোগ প্রতিরোধের একমাত্র উপায়। ডেন্টাল ফ্লুরোসিস হলে দাঁত কালো হয়ে যায়, দাঁতের উপর বিভিন্ন ছাপ পড়ে এবং দাঁত চকের মত সাদা বর্ণ ধারণ করে।

আর্সেনিকজনিত রোগ

ডায়রিয়া রোগে মৃত্যু এবং রুগ্নতা প্রতিরোধকল্পে ভূগর্ভস্থ পানি নিরাপদ খাবার পানির একমাত্র নির্ভরযোগ্য উৎস হিসাবে যখন সাফল্য লাভ করল ঠিক তখনই ভূগর্ভস্থ পানিতে আর্সেনিকের ভয়াবহ উপস্থিতি আমাদের নিরাপদ পানির উৎস হিসাবে ভূগর্ভস্থ পানির নির্ভরযোগ্যতাকে অনিশ্চয়তার মুখে ঠেলে দিল। ১৯৮০ সাল পর্যন্ত বাংলাদেশে সরকারী ও বেসরকারী উভয় পর্যায়ে থেকেই ভূগর্ভস্থ পানিতে অতিরিক্ত পরিমাণে আর্সেনিকের উপস্থিতি ধরা পড়েনি। বর্মমানে বাংলাদেশে ভূগর্ভস্থ পানিতে আর্সেনিকের কারণে প্রায় ৩ কোটি ২০ লক্ষ মানুষ অর্থাৎ মোট জনসংখ্যার প্রায় ২৬% মানুষ ঝুঁকিপূর্ণ জীবন যাপন করছে। বাংলাদেশের ৬১টি জেলার মধ্যে ৫৩টির ভূগর্ভস্থ পানিতে সহনীয় মাত্রার অধিক আর্সেনিক পাওয়া গেছে। সাধারণত একজন মানুষ আর্সেনিক যুক্ত পানি পান করতে আরম্ভ করার পর ৮-১৪ বছরের মধ্যে তার শরীরের তুকে রোগের লক্ষণগুলি দেখা দিতে পারে। এই দূষণের কারণ যদি পানীয়জল হয়, তাহলে আর্সেনিকের পরিমাণ, ব্যক্তির শারীরিক পুষ্টির মান, অভ্যস্তরীণ রোগ প্রতিরোধ ক্ষমতা এবং কত সময় ধরে আর্সেনিক দূষিত

পানি পান করছে ইত্যাদির উপর রোগলক্ষণ প্রকাশের বিষয়টি নির্ভর করবে। সাধারণত 'মেলানোসিস' ও 'কেরাটোসিস' এই দুই প্রকার রোগ লক্ষণযুক্ত ব্যাধির মধ্য দিয়ে আর্সেনিক দূষণ অথবা 'আর্সেনিকোসিস' মানুষের শরীরে প্রকাশ পায় ও চিহ্নিত হয়।

১. মেলানোসিস : এতে আক্রান্ত ব্যক্তির শরীর ও ত্বকের স্বাভাবিক রং বদলে ক্রমশ কালচে হয়ে যায়। প্রথমতঃ হাত ও পায়ে এই পরিবর্তন দেখা দেয় এবং পরে সমগ্র শরীরে দৃশ্যমান হয়। এই লক্ষণকে 'ডিফিউজড মেলানোসিস' বলা হয়। যদি ত্বকে ছোট ছোট সাদাকালো দাগ পড়ে, তাহলে তাকে 'স্পটেড মেলানোসিস' বলা হয়।

২. কেরাটোসিস : এতে হাত ও পায়ের তালু ক্রমশ রুক্ষ হয়ে যায়। সম্পূর্ণ হাতের ও পায়ের তালু রুক্ষ হয়ে যাওয়াকে 'ডিফিউজড কেরাটোসিস' বলে। এই কেরাটোসিসের ওপরে আঁচিলের মতো শক্ত গোটা পরিলক্ষিত হয়। ডিফিউজড কেরাটোসিস ছাড়াও এ' ধরনের গোটা দেখা দিলে তাকে 'স্পটেড কেরাটোসিস' বলা হয়। ব্যথা বা চুলকানি অনুভূত না হলেও ক্রমশ তালুতে ঘা হয়। এই অবস্থাকে **Pre-cancerous** বলা হয়। ত্বকের ক্যান্সার, যেমন **Squamous cell carcinoma** ও **basal cell carcinoma** এর অন্তর্গত।

৩. আর্সেনিক বিষক্রিয়ার ফলে মানব শরীরে ক্ষুদ্র রক্তনালীর ক্ষত সৃষ্টি হয়। এই ক্ষতের কারণে হাতপায়ে ঘা অথবা পচন দেখা দিতে পারে যা প্রয়োজনে কেটে বাদ দিতে হতে পারে।

৪. এছাড়াও শারীরিক দুর্বলতা, অরুচি, চোখ মুখ জ্বালা-পোড়া করা (বিশেষতঃ রোদে), বেশি গরম অনুভব করা, দীর্ঘমেয়াদি কাশি ইত্যাদি লক্ষণ দৃশ্যমান হয়।

উপসংহার

বাংলাদেশ জনস্বাস্থ্য উন্নয়ন ও মানুষের জীবন যাত্রার মান উন্নয়নের লক্ষ্যে নিরলস প্রচেষ্টা চালিয়ে যাচ্ছে। বর্তমানে সংকটজনক পরিস্থিতি মোকাবেলার জন্য সবচেয়ে জরুরী হচ্ছে সরকারী বেসরকারী সংস্থা, ব্যক্তি উদ্যোক্তা এবং সুশীল সমাজের ঐক্যবদ্ধ ও সম্মিলিত উদ্যোগ গ্রহণ যা নিশ্চিত করবে দীর্ঘস্থায়ী ও টেকসই উন্নয়ন। বিভিন্ন সুলভ, সহজলভ্য ও নিরাপদ পানি সরবরাহ প্রযুক্তির উদ্ভাবন ও তার প্রচলন নিশ্চিত করতে হবে। ব্যক্তিস্বাস্থ্য পরিচর্যা নিশ্চিতকরণে উদ্বুদ্ধকরণ কার্যক্রম জোরদার করা একান্ত জরুরী। কেবলমাত্র সাবান ও পানি দিয়ে হাত ধোয়ার মাধ্যমেই একজন মানুষ বিভিন্ন পানিবাহিত রোগ থেকে অনেকখানি মুক্ত থাকতে পারে। সর্বোপরি জাতীয় নিরাপদ খাবার পানি সরবরাহ ও স্যানিটেশন নীতিমালার কার্যকর বাস্তবায়নের উপরই নির্ভর করছে জাতীয় সুস্থতা ও সুস্থ ভবিষ্যৎ।

বাংলাদেশের পানিসম্পদ ও দূষণ সমস্যা

Water Resources of Bangladesh and Pollution Problem*

মোঃ তৌফিকুল আরিফ**

ভূমিকা

পৃথিবীর কম-বেশী ৭৫% জল ও মাত্র ২৫% স্থল এলাকা। এই বিশাল জলাধারে যে পানি আছে তার ৯৭.৫% লবনাক্ত ও মাত্র ২.৫% স্বাদু পানি। এই স্বাদু পানির প্রায় ৬৯% বরফ ও হিমবাহ, ৩০% ভূগর্ভস্থ পানি, ০.৭৫% মাটির জলকণা ও বাকি ০.২৫% নদী-নালা, খাল-বিল, হাওড়-বাঁওড়, পুকুর-দিঘির পানি। মোট পানির তুলনায় এর পরিমাণ যথাক্রমে মাত্র ১.৭৪%, ০.৭৩%, ০.০২% ও ০.০১%। জলীয় বাষ্পের আকারে বাতাসে যে পানি আছে তার পরিমাণ মোট স্বাদু পানির তুলনায় অতি সামান্য।

ভূপৃষ্ঠস্থ পানি সূর্যতাপে বাষ্পীভূত হয়ে এবং ভূগর্ভস্থ পানি গাছপালার শ্বস্বেনের মাধ্যমে বাতাসে জলীয় বাষ্প সৃষ্টি করে। সব সময় পৃথিবীর কোন না কোন স্থানে বৃষ্টিপাত ও তুষারপাত হচ্ছে। এভাবে প্রতিবছর ভূপৃষ্ঠের ওপর কম-বেশী ১ লক্ষ ঘন কিঃ মিঃ স্বাদু পানি পতিত হয়। ভূপৃষ্ঠ থেকে ৮০০ মিটার ভূগর্ভ পর্যন্ত মাটির স্তরে প্রায় ৪২ লক্ষ ঘন কিঃ মিঃ ভূগর্ভস্থ পানি আছে। সমগ্র পৃথিবীতে এত বিশাল পরিমাণ পানি থাকা সত্ত্বেও প্রায় সর্বত্র পানির স্বল্পতা পরিলক্ষিত হয়। কারণ, জীবজন্তু, গাছপালা সবার জীবন ধারণের জন্য কেবলমাত্র স্বাদু পানি প্রয়োজন। কিন্তু, সকলের চাহিদা অনুসারে পানি সর্বত্র পরিমিত পরিমাণে পাওয়া যায়না।

এখানে উল্লেখ্য যে, সুস্থ্য জীবনের জন্য কেবলমাত্র স্বাদু পানি প্রয়োজন এবং তা' নিরাপদ অর্থাৎ রোগ-জীবাণু ও মাত্রাতিরিক্ত খনিজ তথা ক্ষতিকর রাসায়নিক পদার্থ মুক্ত হতে হবে। নিরাপদ পানি সুস্থ্য ও উন্নত জীবনের পূর্বশর্ত। আপাতঃদৃষ্টিতে বাংলাদেশ পানি সম্পদে সমৃদ্ধ। বিভিন্ন সমস্যা ও সীমাবদ্ধতা সত্ত্বেও আমাদের যে পরিমাণ নিরাপদ পানি প্রয়োজন তা' জাতীয় পর্যায়ে একটি সুষ্ঠু নীতিমালা ও তার আলোকে স্থান-কাল ভেদে কার্যকরী পরিকল্পনা প্রণয়ন ও বাস্তবায়নের মাধ্যমে নিশ্চিত করা যেতে পারে।

সমগ্র বাংলাদেশে পানির প্রাপ্যতা

বাংলাদেশে ছোট-বড় ৭০০টি নদ-নদী ও শাখানদী আছে। এই নদীগুলোর মোট দৈর্ঘ্য ২২,১৫৫ কিঃ মিঃ। এ'ছাড়া ছোট-বড় ১৮.৫ লক্ষেরও বেশী পুকুর-দিঘি আছে। এ'গুলোর ১৮.৪% মজা পুকুর। বাংলাদেশের চাষাবাদযোগ্য জমির পরিমাণ কম-বেশী ৯১ লক্ষ হেক্টর যা' মোট জমির ৭৪%।

এছাড়া নদ-নদী ও হাওড়-বাঁওড়ের অধীনে যথাক্রমে ৮.৪ ও ৪.১ লক্ষ হেক্টর জমি আছে, যেখানে

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শুকনো মৌসুমেও পানি থাকে এবং তা' নৌ পরিবহন ও মৎস্য সম্পদ রক্ষা করা ছাড়াও সেচকার্যে ব্যবহার করা যায়। পুকুর-দিঘির অধীনে জমির পরিমাণ আরও বেশী অর্থাৎ ৯.২ লক্ষ হেক্টর। ভৌগোলিক সমুদ্রসীমা বঙ্গোপসাগরের উপকূল থেকে দক্ষিণে ১২ নটিক্যাল মাইল আর অর্থনৈতিক বহিঃসমুদ্রসীমা ২০০ নটিক্যাল মাইল পর্যন্ত বিস্তৃত।

ভূপৃষ্ঠস্থ পানির প্রাপ্যতা

প্রতিবছর বাংলাদেশে গড়ে ২,১৮১ মিঃ মিঃ বৃষ্টিপাত হয়। এর পরিমাণ গড়ে সর্বনিম্ন ১,৪৯১ মিঃ মিঃ থেকে সর্বোচ্চ ৩,৮৭৭ মিঃ মিঃ। সবচেয়ে কম বৃষ্টিপাত হয় যশোরের পশ্চিম অংশে (সর্বনিম্ন গড়েরও কম) আর সবচেয়ে বেশী বৃষ্টিপাত হয় সিলেটের উত্তর অংশে (সর্বোচ্চ গড়েরও বেশী)। গড় বৃষ্টিপাতের তারতম্য স্থানভেদে নিম্নে ৬৯% আর উর্ধ্বে ১৭৮% পর্যন্ত।

উল্লেখিত বৃষ্টিপাতের পাশাপাশি বাংলাদেশের ভূপৃষ্ঠস্থ পানির প্রাচুর্যতা মূলত উত্তর-পশ্চিমে করতোয়া, তিস্তা, ধরলা, ব্রহ্মপুত্র; পূর্বে সুরমা ও কুশিয়ারা পশ্চিমে পদ্মা এবং দক্ষিণ-পূর্বে কর্ণফুলী, সাজু ও মাতামুহুরী নদীর প্রবাহের ওপর নির্ভরশীল। কেবলমাত্র দক্ষিণ ও দক্ষিণ-পূর্বের ৩টি নদী ছাড়া উত্তর, উত্তর-পূর্ব ও উত্তর-পশ্চিমের ৫৪টি নদ-নদী ভারত হয়ে বাংলাদেশে প্রবেশ করেছে।

ভূগর্ভস্থ পানির প্রাপ্যতা

বাংলাদেশের অধিকাংশ এলাকা মূলত পলি মাটি (কণার ব্যাস ০.০০২-০.০৪০ মিঃ মিঃ) দিয়ে গঠিত। এখানে স্থানভেদে ভূপৃষ্ঠ থেকে ৭৬ মিটারের মধ্যে খুব মিহি (০.০৪১-০.১০০ মিঃ মিঃ) মিহি (০.১০১-০.১১৫ মিঃ মিঃ), মাঝারি (০.১১৬-০.১৪০ মিঃ মিঃ) মোটা (০.১৪১-১.০০০ মিঃ মিঃ) ও খুব মোটা (১.০০০-২.০০০ মিঃ মিঃ) বালুকণার স্তর ও নুড়ি পাথর (১,১০০-১০.০০০ মিঃ মিঃ) মেশানো স্তর আছে। ভূগর্ভস্থ পানিসমৃদ্ধ মাটির এই স্তরগুলো (aquifer) অধিকাংশ ক্ষেত্রে বেশ নরম ও অনাবদ্ধ (unconfined) অথবা আংশিক আবদ্ধ (semi-confined) বলে এখানে প্রচুর পানি জমা হয় ও চলাচল করে।

১৯৮১ সালের ভূগর্ভস্থ পানির প্রাপ্যতা এবং সম্ভাবনা জরিপ প্রতিবেদন অনুসারে বাংলাদেশের বিভিন্ন এলাকাকে উত্তম, খুব ভাল, ভাল, খারাপ ও খুব খারাপ; এই পাঁচ রকম এলাকায় ভাগ করা হয়েছে। এই জরিপ অনুসারে বাংলাদেশের উত্তর-পশ্চিম এলাকার অধিকাংশ স্থানেই ভূগর্ভস্থ পানির উপস্থিতি ও প্রাপ্যতা বেশ ভাল। শুধুমাত্র দিনাজপুর ও বগুড়ার অল্প কয়েকটি এবং রাজশাহীর বেশ কয়েকটি এলাকায় পানির প্রাপ্যতা কিছুটা সমস্যাপূর্ণ। চট্টগ্রাম, নোয়াখালী, বরিশাল, খুলনার সমুদ্র উপকূলবর্তী এলাকায় ভূগর্ভস্থ স্বাদু পানির প্রাপ্যতা এবং ফরিদপুর, যশোর, কুষ্টিয়া, জামালপুর, ময়মনসিংহ, ঢাকা ও কুমিল্লা এলাকায় ভূগর্ভস্থ পানির প্রাপ্যতা সম্পর্কে এখনও বিস্তারিত জরিপ করা সম্ভব হয়নি। এতদসত্ত্বেও বিভিন্ন জরিপ ও প্রাপ্ত তথ্য বিশ্লেষণ করে বাংলাদেশের জন্য শুকনো মৌসুমে (ডিসেম্বর-মার্চ) ভূগর্ভস্থ পানির প্রাপ্যতাসহ বিভিন্নভাবে পাওয়া পানির প্রাপ্যতা সম্পর্কে একটি বৈজ্ঞানিক পরিসংখ্যান তৈরী করা হয়েছে। এই পরিসংখ্যান অনুসারে বাংলাদেশে শুকনো মৌসুমে ভূগর্ভস্থ পানির স্তর থেকে প্রায় ৫.৪ লক্ষ ঘনমিটার পানি পাওয়া সম্ভব।

ব্রহ্মপুত্র ও পদ্মা বা গঙ্গা, এ দুটি নদ-নদীর আববাহিকায় (The Brahmaputra-Ganges Flood Basin) এশীয়ার সর্ববৃহৎ ব-দ্বীপ অঞ্চল অবস্থিত। এই অববাহিকা প্রায় ১৭.৫০ লক্ষ বর্গ কিঃ মিঃ

এলাকা জুড়ে ৫টি দেশঃ চীন, নেপাল, ভূটান, ভারত ও বাংলাদেশ পর্যন্ত বিস্তৃত। এর মাত্র ১.৩০ লক্ষ বর্গ কিঃ মিঃ অর্থাৎ মাত্র ৭% বাংলাদেশে অবস্থিত। কিন্তু বাংলাদেশ এই ব-দ্বীপ এলাকার সর্ব দক্ষিণে ঢালের শেষ প্রান্তে অবস্থিত বলে এই আবাহিকার সম্পূর্ণ পানি প্রতি বছর বাংলাদেশ হয়ে বঙ্গোপসাগরে পড়ে।

উল্লেখিত পানি প্রবাহের প্রধান উৎস মূলত দু'টি। প্রথমতঃ এপ্রিল-জুন মাস পর্যন্ত হিমালয় পর্বতমালা থেকে আসা বরফগলা পানি; দ্বিতীয়তঃ জুলাই-অক্টোবর মাস পর্যন্ত সমগ্র আববাহিকার মৌসুমী বৃষ্টিপাতের পানি। বর্ষাকালে কেবলমাত্র ব্রহ্মপুত্র নদ দিয়ে প্রতি সেকেন্ডে ১৪,০০০ ঘনমিটার পানি প্রবাহিত হয়। কিন্তু শীতকালে এই প্রবাহ কমে প্রতি সেকেন্ডে মাত্র ৪,৫৩১ ঘনমিটার অর্থাৎ এক-তৃতীয়াংশেরও নীচে নেমে যায়। নভেম্বর থেকে মে মাস পর্যন্ত শুকনো মৌসুমের গড় প্রবাহ একটু বেশী হলেও প্রতি সেকেন্ডে ৬,৫৩১ ঘনমিটার মাত্র।

এই উপমহাদেশের প্রায় ৬০ কোটি মানুষ ব্রহ্মপুত্র-পদ্মা বা গঙ্গা নদ-নদী বিধৌত অববাহিকায় বসবাস করে। এর মধ্যে ২১% বাংলাদেশী। এদের সকল অর্থনৈতিক কার্যক্রম বিশেষভাবে ব্রহ্মপুত্র-গঙ্গার পানির প্রাপ্যতা ও নিয়ন্ত্রণের উপর নির্ভরশীল। বাংলাদেশের অভ্যন্তরে পদ্মা, ব্রহ্মপুত্র ও মেঘনা নদীর সম্মিলিত প্রবাহ ফেব্রুয়ারী-মার্চ পর্যন্ত প্রতিমাসে গড়ে মাত্র ৭,০৮০ ঘনমিটার যা' জুলাই-আগষ্ট নাগাদ বেড়ে প্রতিমাসে গড়ে ১.৫ লক্ষ ঘনমিটার হয়। অর্থাৎ বর্ষা মৌসুমে পানির প্রবাহ খরা মৌসুমের পানির প্রবাহের তুলনায় ২১ গুণ বৃদ্ধি পায়। প্রতিবছরকে একটি পানি চক্র ধরে বাংলাদেশের প্রধান নদীগুলোতে প্রতি মাসের পানির প্রবাহ প্রত্যক্ষ করে দেখা যায় যে, বর্ষা ও খরায় পানি প্রবাহের তারতম্য এত ব্যপক যে, বর্ষাকালে ব্যাপক বন্যা ও শীতকালে ব্যাপক খরা এ'দেশের মানুষের একটি চিরকালের সমস্যা।

উপরন্তু, ভারত ব্রহ্মপুত্র ও গঙ্গা নদ-নদীর উচ্চ অববাহিকায় অবস্থিত হওয়ায় এ'দু'টি নদ-নদী সহ এর বেশ কয়েকটি শাখানদীর ওপর বিভিন্ন প্রকার পানি নিয়ন্ত্রণ অবকাঠামো তৈরী করে শুকনো মৌসুমে প্রচুর পরিমান পানি তুলে নেয়। ফলে, এ'সময় বাংলাদেশের নদ-নদীতে পানির স্বল্পতা দেখা দিচ্ছে, খরা পরিস্থিতি দীর্ঘস্থায়ী হচ্ছে, দক্ষিণাঞ্চলের নদীর পানিতে লবণাক্ততা বৃদ্ধি পাচ্ছে এবং ভূগর্ভস্থ পানি বাড়তি আর্সেনিক দূষণের শিকার হচ্ছে যা' ইতিমধ্যে এ'দেশের প্রায় ১৩ কোটি মানুষের জীবন-জীবিকা ও উন্নয়নের ক্ষেত্রে এক বিরাট অন্তরায় সৃষ্টি করেছে।

ভূপৃষ্ঠস্থ পানির দূষণ সমস্যা

প্রাকৃতিক ও উন্নয়নমূলক কার্যক্রম উভয় কারণেই এ'দেশের ভূপৃষ্ঠস্থ পানি দূষিত হচ্ছে। প্রাকৃতিক কারণগুলোর মধ্যে পানি বাহিত বিভিন্ন রোগ-জীবাণুর উপস্থিতি, ক্রমাগত জনসংখ্যা বৃদ্ধি এবং প্রতি বছর বন্যার পর নদ-নদীর তলদেশে প্রায় ২০০ কোটি টন বালি জমা হওয়ার বিষয়গুলো অন্যতম। এর ফলে একদিকে পানির চাহিদা বৃদ্ধি পাচ্ছে। অপরদিকে, নদী-নদীর পানি ধারণ ক্ষমতা ও গতি-প্রবাহ কমে যাচ্ছে। গ্রীষ্মকালে দক্ষিণাঞ্চলের নদীর পানির লবণাক্ততা বৃদ্ধি পাচ্ছে। উপকূলীয় এলাকার নদীর লবণাক্ত পানি সুপেয় এলাকায় প্রবেশ করছে। ফলে নদীর স্বাদু পানির প্রাপ্যতা হ্রাস পাচ্ছে। ইতিমধ্যে এ'দেশের চাষযোগ্য ৩২% জমি ও ১ কোটি মানুষ লবণাক্ততা সমস্যার শিকার হয়েছে।

উন্নয়নমূলক কার্যক্রমের আওতায় কৃষিক্ষেত্রে বিভিন্ন প্রকার রাসায়নিক সার, কীটনাশক ইত্যাদি আধুনিক উপকরণ ব্যবহার, শিল্প-কারখানার বর্জ্য নিষ্কাশন ও নগরায়ণের গতি-প্রকৃতি অন্যতম।

সাম্প্রতিক হিসাব অনুসারে বাংলাদেশে প্রতিবছর কৃষিক্ষেত্রে ১১,০০০ টন কীটনাশক ও শিল্পক্ষেত্রে ৭০ লক্ষ টন রাসায়নিক পদার্থ ব্যবহৃত হয়। এর মধ্যে অনেকগুলো পপস্ (POPs or Persistent Organic Pollutants) এর আওতায় পড়ে যা' মানুষের স্বাস্থ্য ও পরিবেশের বিরাট ক্ষতি করছে। পপস্ এর বৈশিষ্ট্য হ'ল এ'গুলো অত্যন্ত বিষাক্ত (toxic), দীর্ঘসময় ক্রিয়াশীল থাকে (persistent), জীবের দেহে জমতে থাকে (bioaccumulative) প্রকৃতিতে ছড়াতে থাকে (mobile in the environment) ও ক্রমাগত ব্যবহারের ফলে পরিমাণে বাড়তে থাকে (continued release leads to increasing level)। এই পপস্ এর আওতায় ১২ প্রকারের রাসায়নিক পদার্থ চিহ্নিত করা হয়েছে যার মধ্যে রয়েছে ৯ প্রকারের কীটনাশক (Pesticides) : এ্যালড্রিন (aldrin), ক্লোরডেন (chlorodane), ডাইএলড্রিন (Dieldrin), ডিডিটি (DDT or dichlorodiphenyltrichloroethene), এনড্রিন (endrin), হেপ্টাক্লর (heptachlor), হেক্সাক্লোরোবেনজিন (hexachlorobenzene), মিরেক্স (mirex) ও টক্সাফেন (toxaphene); শিল্প-কারখানায় ব্যবহৃত বিভিন্ন রাসায়নিক পদার্থ (Industrial Chemicals) বা পিসিবিস (PCBs or Poly Chloro Benzene) এবং ২ প্রকারের উপজাত পদার্থ (Byproducts) : ডক্সিনস্ (dioxins) ও ফুরানস্ (furans)।

শিল্প-কারখানা থেকে নির্গত রাসায়নিক বর্জ্য প্রতিনিয়ত নিকটবর্তী নদী ও অন্যান্য জলাশয়ে এসে পড়ছে। উদাহরণ হিসাবে উল্লেখ্য যে, ঢাকা নগরীর হাজারীবাগ এলাকার কেবলমাত্র ১৯৮টি ট্যানারী থেকে গড়ে প্রতিদিন ৬,০০০ ঘনমিটার বিষাক্ত বর্জ্য পার্শ্ববর্তী বুড়িগঙ্গা নদীতে এসে পড়ে। এ'ভাবে প্রতিদিন হাজারীবাগ ও তেজগাঁও শিল্প এলাকার কারখানা থেকে গড়ে দৈনিক যথাক্রমে ১৬,০০০ ও ৩,৫০০ মেট্রিক টন বর্জ্য নিকটবর্তী বুড়িগঙ্গা, শীতলক্ষা, বালু ও তুরাগ নদীতে এসে পড়ছে।

১৯৮১ থেকে ১৯৯৭ সাল পর্যন্ত পরিবেশ অধিদপ্তর ও ঢাকা পানি সরবরাহ কর্তৃপক্ষ পরিচালিত বুড়িগঙ্গা, শীতলক্ষা, বালু ও তুরাগ নদীর পানি পরীক্ষার ফলাফল অনুসারে বর্তমানে বুড়িগঙ্গা নদীর পানিতে যেসব ভারী ধাতু (heavy metal) পাওয়া গেছে তার মধ্যে এ্যালুমিনিয়াম (Al), ক্যাডমিয়াম (Cd), লেড বা সিসা (pb), সেলেনিয়াম (Se), জিনক বা দস্তা (Zn), মার্কারী বা পারদ (Hg) ও ক্রোমিয়াম (Cr) অন্যতম। এর মধ্যে এ্যালুমিনিয়াম (Al), লেড বা সিসা (pb), মার্কারী বা পারদ (Hg) ও ক্রোমিয়াম (Cr) ধাতুর পরিমাণ ইতিমধ্যে নিরাপদ খাবার পানির জন্য নির্ধারিত বিভিন্ন গ্রহণযোগ্য মাত্রা ছাড়িয়ে গেছে। বর্তমানে বুড়িগঙ্গা নদীতে ক্রোমিয়াম (Cr) এর পরিমাণ গ্রহণযোগ্য মাত্রার চেয়ে ৫ গুণ; আর বুড়িগঙ্গা ও তুরাগ উভয় নদীতে লেড বা সিসা (pb) ও মার্কারী বা পারদ (Hg) এর পরিমাণ গ্রহণযোগ্য মাত্রার চেয়ে যথাক্রমে ৫ গুণ ও ২.৫ গুণ বেড়ে গেছে।

এছাড়া, বস্তিবাসী ও বৃহত্তর দরিদ্র জনগোষ্ঠীর মধ্যে পয়ঃনিষ্কাশন (sanitation) ও ব্যক্তিগত স্বাস্থ্য পরিচর্যা (personal hygiene practices) সম্পর্কিত অব্যবস্থার কারণেও প্রতিনিয়ত ভূপৃষ্ঠস্থ পানি দূষিত হচ্ছে। বর্তমানে ঢাকা নগরীতে ছোট-বড় ১,২৩৭টি বস্তি আছে। এসব বস্তিতে বসবাসকারী ৭০% এরও বেশী দরিদ্র মানুষ অস্বাস্থ্যকর বুলন্ত পায়খানা ব্যবহার করে। অন্যান্য শহরের বস্তির পয়ঃনিষ্কাশনের চিত্র নিশ্চয় এর চেয়ে ভাল নয়। ইউনিসেফ (UNICEF) কর্তৃক ২০০০ সালে স্বাস্থ্য পরিচর্যা (hygiene practices), পয়ঃনিষ্কাশন (sanitation) ও নিরাপদ পানির ব্যবহার (safe water use) এর উপর গ্রামীণ জনগণের ধারণা (knowledge), দৃষ্টিভঙ্গি (Attitude) ও

পরিচর্চা (Practices) বা ক্যাপ (KAP) বিষয়ক একটি নমুনা জরিপ পরিচালনা করে। উক্ত জরিপ অনুসারে গ্রামাঞ্চলে ৩৫% দরিদ্র মানুষ অস্বাস্থ্যকর কুলন্ত পায়খানা ব্যবহার করে। উপরন্তু, গ্রাম এলাকায় এখনও বিভিন্ন বয়সের ১৮% মানুষ খোলা জায়গায় পায়খানা করে। ব্যক্তিগত স্বাস্থ্য পরিচর্চা সম্পর্কে এদের কারো ধারণা স্পষ্ট নয়। ফলে, প্রতিদিন কোটি কোটি মানুষের মলমূত্র নানা ভাবে নীচের দিকে গড়িয়ে শেষ পর্যন্ত নদী-নালা, খাল-বিল, হাওড়-বাঁওড়ের পানিতে মিশে যাচ্ছে। শহরে প্রতিদিন যে আবর্জনা জমে তা' প্রায়ই যত্রতত্র পড়ে থাকে। প্রায়ক্ষেত্রে শহরের অদূরবর্তী নদী ও মজা পুকুর পয়ঃনিষ্কাশন ও বর্জ্যের ভাগাড় হিসাবে ব্যবহৃত হচ্ছে।

ভূগর্ভস্থ পানির দূষণ সমস্যা

ভূগর্ভস্থ পানিও প্রাকৃতিক ও উন্নয়নমূলক কার্যক্রম উভয় কারণে দূষিত হতে পারে। প্রকৃতিতে ভূগর্ভস্থ পানি সম্পূর্ণ অনাবদ্ধ (unconfined), আংশিক আবদ্ধ (semiconfined) ও আবদ্ধ (confined) স্তরের মধ্য দিয়ে প্রবাহিত হয়। এই পানি সাধারণতঃ রোগ-জীবাণু মুক্ত অবস্থায় থাকে। এ'ছাড়া, ভূগর্ভস্থ পানিতে বিভিন্ন প্রকার খনিজ পদার্থ দ্রবীভূত অবস্থায় থাকে। এ'সব পদার্থের পরিমাণ বিশ্ব স্বাস্থ্য সংস্থা (WHO) কর্তৃক নির্ধারিত মাত্রার মধ্যে থাকলে তা' মানুষের স্বাস্থ্যের জন্য ক্ষতিকর নয় বলে ধরে নেয়া যায়। কিন্তু, প্রাকৃতিক কারণে কোন একটি পদার্থের পরিমাণ বেশী হয়ে গেলে তা' ক্ষতিকর হতে পারে।

উপরোক্ত দৃষ্টিকোণ থেকে বাংলাদেশে ভূগর্ভস্থ পানিতে স্থান-কাল ভেদে মাত্রাতিরিক্ত আর্সেনিকের উপস্থিতি একটি বিশেষ প্রাকৃতিক সমস্যা হিসাবে চিহ্নিত করা হয়েছে। তবে বিভিন্ন উন্নয়নমূলক কার্যক্রম, বিশেষ করে অগভীর (STW or shallow tubewell) ও গভীর নলকূপ (DTW or deep tubewell) এর সাহায্যে পরিচালিত উন্নত সেচ ব্যবস্থার মাধ্যমে বিগত ৩ দশকের বেশী সময় ধরে অত্যধিক পরিমাণে ভূগর্ভস্থ পানি উঠানোর ফলে এ'সমস্যার সৃষ্টি হয়েছে কিনা তা' এখনই নির্দিষ্ট করে বলা যাচ্ছেনা। বিশ্ব স্বাস্থ্য সংস্থার মতে খাবার পানিতে আর্সেনিকের মাত্রা ০.০১ মিঃগ্রাঃ/লিটার এর মধ্যে থাকা বাঞ্ছনীয়। অপরপক্ষে, বাংলাদেশ সরকার কর্তৃক নির্ধারিত এই মাত্রা হ'ল ০.০৫ মিঃগ্রাঃ/লিটার; অর্থাৎ বিশ্ব স্বাস্থ্য সংস্থা কর্তৃক প্রদানকৃত মতামতের চেয়ে ৫ গুণ বেশী।

২০০১ সালে বাংলাদেশ ভূতাত্ত্বিক জরিপ এবং জনস্বাস্থ্য প্রকৌশল অধিদপ্তর ৩৫০০টি নমুনা নলকূপের পানি পরীক্ষা করে এই মর্মে মতামত প্রদান করে যে, এ'দেশের ৬৪টি জেলার মধ্যে ৫৯টি জেলার কোথাও না কোথাও ভূগর্ভস্থ পানিতে ০.০৫ মিঃগ্রাঃ/লিটার মাত্রার বেশী আর্সেনিক রয়েছে যা' উর্ধে ১.৫০ মিঃগ্রাঃ/লিটার পর্যন্ত। চাঁদপুরের কাছাকাছি দক্ষিণ, দক্ষিণ-পূর্ব এলাকার ভূগর্ভস্থ অগভীর পলিবাহিত পানির স্তরেই এর আধিক্য সবচেয়ে বেশী। ফলে বর্তমানে বিশ্ব স্বাস্থ্য সংস্থা কর্তৃক নির্ধারিত মাত্রার নীরিখে এ'দেশের কম-বেশী ৫ কোটি ৭০ লক্ষ এবং সরকারী মাত্রার নীরিখে ৩ কোটি ৫০ লক্ষ মানুষ আর্সেনিকযুক্ত বিষাক্ত পানি পান করছে বলে আশংকা করা হচ্ছে।

উপরোক্ত আর্সেনিকের পাশাপাশি কোন কোন জায়গায় ভূগর্ভস্থ পানিতে আরও যেসব পদার্থ পাওয়া যাচ্ছে তার মধ্যে আয়রন বা লোহা (Fe), ম্যাঙ্গানিজ (Mn) ও বোরন (B) রয়েছে এবং সেই সাথে কোথাও কোথাও যৎসামান্য ইউরেনিয়াম (U), ফ্লুরাইড (Fl), আয়োডাইড (Iodide), নাইট্রেট (Nitrate) ও অ্যামোনিয়াম (Amonium) রয়েছে। ভারী ধাতুর মধ্যে রয়েছে নিকেল

(Ni), ক্রোমিয়াম (Cr), লেড বা সিসা (pb), বেরিয়াম (ba) ও সেলেনিয়াম (Se)। কিন্তু ভূগর্ভস্থ পানিতে আয়রন বা লোহা (Fe), ম্যাঙ্গানিজ (Mn) ছাড়া বাকিগুলো সহনীয় মাত্রায় থাকায় অথবা এ'সবের বিস্তৃতি নিতান্ত কম হওয়ায় এখনও জনস্বাস্থ্যের জন্য বড় সমস্যা নয় বলে ধরে নেয়া হয়েছে। ভূগর্ভস্থ কোন কোন অগভীর ও অনাবদ্ধ পানির স্তরে আয়রন (Fe) ও ম্যাঙ্গানিজ (Mn) এর আধিক্য এবং ফ্লুরাইড (Fl) ও আয়োডাইড (Iodide) এর স্বল্পতা এলাকা ভিত্তিক সমস্যার কারণ হলেও সামগ্রিক দৃষ্টিকোণ থেকে ভূগর্ভস্থ পানির আর্সেনিক দূষণই এখনকার সবচেয়ে বড় সমস্যা।

বর্তমান সরকার ও শহরের শিক্ষিত জনগোষ্ঠী আর্সেনিক দূষণ সমস্যার সমাধানে অত্যন্ত সচেতন। তা' সত্ত্বেও এখনও কেউ তেমন ফলপ্রসূ কোন সমাধান খুঁজে বের করতে সক্ষম হননি। অপরদিকে গ্রামাঞ্চলের বৃহত্তর জনগোষ্ঠীকে এ'সম্পর্কে অবহিত করা হলেও তাঁরা এখনও কোন কার্যকরী ব্যবস্থা গ্রহণ করতে পেরেছেন বলে মনে হয়না কারণ জীবাণুমুক্ত নলকূলের পানি পান করার বিষয়ে সচেতন হওয়ার স্বল্পকালের মধ্যে আবার আর্সেনিকের আধিক্যেতে হঠাৎ করে সেই নলকূলের পানি পান করতে নিষেধ করায় তাদের পক্ষে গোলক ধাঁধায় পড়ে যাওয়াই স্বাভাবিক।

এ'দেশের অধিকাংশ মানুষ পানি খাওয়ার আগে দু'টো বিষয় সম্পর্কে খোঁজ নে'য়া। তা' হ'ল ঐ পানি নলকূলের কিনা ও দেখতে পরিষ্কার কিনা। এখন নলকূলের পানি সবসময়ই পরিষ্কার দেখা যায়। কিন্তু ঐ পরিষ্কার পানি আর্সেনিক দূষণযুক্ত কিনা তা' তো আর খালি চোখে দেখা যায়না। খানিকটা পান করেও আলাদা কোন স্বাদ পাওয়া যায়না। এমনকি, দু-চার-ছয় মাস পান করেও অনেকেই আর্সেনিকোসিস (Arsenicosis) অথাৎ কেরাটোসিস (Keratosi) বা মেলানোসিস (Melanosis) রোগে আক্রান্ত হন না। ফলে, যদি কেউ এ' বিষয়টি যথাযথ গুরুত্ব সহকারে গ্রহণ না করে আর্সেনিক দূষণযুক্ত নলকূলের পানি পানি করতে থাকেন তাহলে তার অসুস্থতার জন্য কেবলমাত্র তাকে দায়ী করা ঠিক হবেনা। তাই অবিলম্বে রোগ-জীবাণু ও আর্সেনিকমুক্ত নিরাপদ পানি সম্পর্কে জনগণকে আরো স্বচ্ছ ধারণা (Knowledge) দে'য়ার ব্যবস্থা গ্রহণ করতে হবে। আর্সেনিকযুক্ত নলকূলের পানি ব্যবহার করা থেকে তাদেরকে সম্পূর্ণ বিরত করার জন্য নতুন করে দৃষ্টিভঙ্গীর (attitude) পরিবর্তন ঘটাতে হবে। ব্যক্তিগত স্বাস্থ্য পরিচরার (personal hygiene practices) সুফল সম্পর্কে ব্যাপক গণসচেতনতা সৃষ্টি করতে হবে। এ'জন্য সরকার (GOB or Government of Bangladesh) এবং ছোট-বড় সকল বেসরকারী সংস্থাগুলোকে (NGO or Non- Government Organization) অবিলম্বে আরো অনেক বেশী সচেতন হ'তে হ'বে এবং পারস্পরিক অবিশ্বাস ও বিদ্বেষের মনোভাব পরিহার করে একাত্ম হয়ে প্রচেষ্টা চালাতে হবে। কেবলমাত্র আর্সেনিক দূষণযুক্ত নলকূপগুলো চিহ্নিত করে সেগুলোর পানি পান করা থেকে বিরত থাকতে বললে খুব বেশী কাজ হবেনা। একই সাথে তারা যাতে খাবার ও রান্না করার জন্য আর্সেনিকমুক্ত নিরাপদ পানি পায় তাও একই সাথে নিশ্চিত করতে হবে। নিরাপদ খাবার পানি সকলের অধিকার। এর সাথে ৩.৫০ কোটিরও বেশী মানুষের সুস্থতার প্রশ্ন জড়িত। এ'টি একটি জরুরী মানবিক সমস্যা। একে ছোট করে দেখার বা ব্যবস্থা গ্রহণে দেরী করার কোন অবকাশ নেই।

নলকূলের পানিতে আর্সেনিকের উপস্থিতি, এর কারণ ও গতি-প্রকৃতি সম্পর্কে এখনও পর্যন্ত নিশ্চিত করে বলা সম্ভব হয়নি। তা' হলেও এ'বিষয়ে কারো অমত নেই যে মাটির নীচে পানি ধারণ ও পরিবহন ক্ষমতা সম্পন্ন স্তরের (aquifer) বালু কণার মধ্যে আর্সেনিক ছিল ও আছে।

একটি নীরব রাসায়নিক প্রক্রিয়ার মাধ্যমে এখন সেই আর্সেনিক অধিক মাত্রায় ছাড়া পেয়ে ভূগর্ভস্থ পানির সাথে চলে আসার কারণে কোথাও কোথাও ভূগর্ভস্থ পানিতে আর্সেনিকের মাত্রা বেড়ে গেছে।

আশার বিষয় এই যে, সম্প্রতি প্রাপ্ত উপাত্ত বিশ্লেষণের মাধ্যমে দেখা গেছে যে, কিছু কিছু এলাকার ভূগর্ভস্থ পানির অগভীর স্তরে আর্সেনিকের আধিক্য দেখা গেলেও সেখানে ২০০ মিটার বা আরও বেশী গভীর স্তরের পানিতে আর্সেনিকের আধিক্য নেই। যদি তাই হয় তবে যতশীঘ্র সেসব এলাকা খুঁজে বের করে সেখানে ২০০ মিটার বা তার অধিক নীচের ডুপিটীলা (Dupi Tila) বা বেলে পাথরযুক্ত পানির স্তর (productive sand stone aquifer) থেকে গভীর নলকূপের সাহায্যে পানি উঠিয়ে পাইপ লাইনের সাহায্যে সরবরাহ করার ব্যবস্থা করতে হবে। সেই সাথে এ'সব পানির স্তরগুলো যাতে উপরের অনাবদ্ধ স্তরের আর্সেনিক দূষণযুক্ত পানির দ্বারা কোনক্রমেই দূষিত হতে না পারে সে'জন্য সম্ভাব্য সকল প্রকার সতর্কতামূলক ব্যবস্থা গ্রহণ করতে হবে।

যেখানে উল্লেখিত গভীর নলকূপ স্থাপন করা সম্ভব নয় সেখানে পানির জন্য সংরক্ষিত পুকুরের ব্যবস্থা করতে হবে ও সেই পানি যাতে রোগ-জীবাণুমুক্ত হয় তার জন্য স্লো স্যান্ড ফিল্টার (SSF or Slow Sand Filter) অথবা ক্লোরিনেশনের ব্যবস্থা করতে হবে।

যেখানে সম্ভব পরিবার পর্যায়ে বৃষ্টির পানি ধরে রেখে ব্যবহার (RWH or Rain Water Harvesting) করার ব্যবস্থা করতে হবে। এ' বিষয়টি প্রবর্তন ও প্রচলন করার জন্য সরকার ও এনজিওদের নিবিড়ভাবে প্রচেষ্টা চালাতে হবে। সর্বোপরি যে' ব্যবস্থাই নে'য়া হোক না কেন যথাসময়ে তার যথাযথ বাস্তবায়ন নিশ্চিত করতে হবে। তা' না হ'লে এ'সমস্যার আর্বতে জনগণের একটি বিরাট অংশ যাদের প্রাতিষ্ঠানিক শিক্ষা নেই, উপরোক্ত বিষয়ে তেমন সচেতনও নয়; তারা সাধারণ শ্রমজীবী মানুষ, কিন্তু জাতীয় উৎপাদন ব্যবস্থার অতি গুরুত্বপূর্ণ অঙ্গ; তারা অসুস্থ হয়ে পড়বে এবং দেশজুড়ে এক মারাত্মক পরিস্থিতির উদ্ভব হবে যা' কারো কাম্য নয়।

Abstract

Water Resources of Bangladesh and Pollution Problem

Bangladesh, the biggest delta in the world, is naturally rich in both surface and ground water resources. The country is located at the tail end of the great Brahmaputra-Ganges River System, which flows through 5 countries having influence over 1.75 million sq. km of floodplain and 600 million people of the Indian subcontinent. Out of that, the country owns only 7% of the floodplain, and 21% of the people. The land is netted by 700 rivers and their tributaries of 22,155 km length having an area of 1.25 million hectare. Average annual rainfall is 2,181 mm with lowest of 1,491 mm in Jessore and highest of 3,877 mm in Sylhet. During the Monsoon, Bangladesh receives more than two-third of the total rainfall within six months from mid April to mid October every year. In rainy season, all the major rivers together encounter very high flow of 150,000 cubic meter per month, which becomes less than 5% in winter creating drought from November to March every year. This situation of very low flow in rivers is worsen further due to persistent withdrawal of river water at the upstream by India for irrigation, navigation and various other purposes.

The hydro-geology of the country is dominated by young alluvial sediments (Holocene) deposited within 6,000 to 10,000 years. The deposits in the north mainly include coarse-grained alluvial fan deposits (Tista Fan), which become more and more fine-grained towards the south. While the north-central part comprises the deep brown older (Pleistocene) sediment deposits well known as Barind and Modhupur Tracts. These two tracts at depth of 150-200 meter or more are underlain by productive sandstone aquifers (Dupi Tila Formation). Based on the groundwater survey conducted in 1981, it is possible to withdraw 0.54 million cubic meter of ground water from aquifers during the driest part of the winter season (December-March).

Beginning early 1970s, the country achieved stunning success in terms of establishing control over frequent outbreak of diarrhoea in epidemic form by ensuring bacteria-free safe groundwater for drinking purpose to over 97% of the rural people through tubewells. But, the presence of arsenic (As) in excess of the WHO guideline value of 0.01 mg/l and even the GOB approved value of 0.05 mg/l in tubewell water has made 35 to 57 million people vulnerable to diseases like arsenicosis, more specifically called keratosis or melanosis. By now, the number of arsenic victims have exceeded 10,000 persons. Aside from that, it is presumed that continuing population growth, agricultural modernization, industrialization and rapid urbanization have also caused much harm to surface water and environment.

Until recently, river water has been persistently contaminated with pesticides and industrial wastes. For example: an average of 11,000 tons of pesticides and 7 million tons of industrial chemicals are used every year. Of them, many fall under the most toxic POPs. These include 9 different types of pesticides, the PCBs and 2 types of byproducts. It is estimated that only 198 tanneries of Hazaribag area discharge an average of 6,000 cubic meter of toxic waste in adjacent Buriganga river everyday. Further tests regarding the presence of heavy metals indicate the presence of a number of heavy metals like aluminium (Al), cadmium (Cd), lead (pb), selenium (Se), zinc (Zn), mercury (Hg) and chromium (Cr) in the river water. Of them, the presence of Cr and pb were 5 times in excess of the WHO guideline value set for drinking purpose.

There are 1,237 slums in Dhaka city. It is estimated that about 3 million people live in these slums. Of them, two-third use hanging latrines. In rural areas, about 35% people also use similar latrines, and another 18% do not use any latrine even. Their knowledge, attitude and practices (KAP) in respect of safe water, sanitation and personal hygiene were poor, which resulted in continuing environmental pollution and recurrent outbreak of water borne diseases in these worse-off societies.

Presently, the GOB, NGOs, CBOs, the UN and donor agencies and the World Bank have progressed much in creating awareness among the people about safe water supply, sanitation and personal hygiene practices, and

protecting the environment from pollution. Majority of the arsenic affected tubewells have been identified. But, very little have been achieved in terms of providing the people with effective alternative means to getting arsenic-safe drinking water at rural community level. Recently, GOB in collaboration with all stakeholders convened an International Workshop on Arsenic Mitigation and shared views with international personalities . It is expected that some of the productive sandstone aquifers below 200 meter or more have arsenic-safe drinking water. Whatever be the situation, there is no denial of the fact that, despite the abundance of both surface and ground water everywhere, the country is faced with the problem of continuing pollution of both surface and ground water, which must be resolved within shortest possible time.

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প্রতিপাদ্য বিষয় : উন্নয়নের জন্য পানি ।

মোঃ সোহরাব উদ্দিন খান*

স্বাস্থ্যের জন্য পানি, পরিবেশের জন্য পানি, উন্নয়নের জন্য পানি এ' প্রতিপাদ্য বিষয়গুলো বিশ্লেষণ করলে দেখা যাবে স্বাস্থ্য, পরিবেশ ও উন্নয়ন সব কিছুর সাথেই সম্পৃক্ততা রয়েছে পানির । পবিত্র কোরআন শরীফের সূরা ফুরকানের ৫৪ আয়াতে বর্ণিত আছে “এবং তিনি মানুষকে সৃষ্টি করিয়াছেন পানি হইতে; অতঃপর তিনি তাহার বংশগত বৈবাহিক সম্বন্ধ স্থাপন করিয়াছেন” ।

মানব দেহের প্রধান উপাদান হচ্ছে রক্ত । আর রক্তের ৭৫% হচ্ছে পানি । তাই পানির গুরুত্ব সবচেয়ে প্রধান বলে বিবেচিত হওয়াই স্বাভাবিক । দেখা যায় যে, বিশ্বের সকল বন্দর, নগর ও শিল্প নগরী সহ অধিকাংশ নগরায়ণ হয়েছে নদী বা সাগরের তীরবর্তী এলাকায় । এখানেই উন্নয়নের সাথে পানির রয়েছে সংশ্লিষ্টতা । কৃষি, শিল্প ও প্রযুক্তি উন্নয়নের প্রতিটি ক্ষেত্রেই পানির অপরিহার্যতা রয়েছে অপরিসীম । আর এ' অপরিহার্যতা ও গুরুত্ব অনুধাবন করেই পানিকে নিরাপদ রাখার মানসে বিগত ১০ বছর যাবৎ পালিত হচ্ছে, “বিশ্ব পানি দিবস” ।

বিগত বছরগুলোতে পানিকে কিভাবে নিরাপদ অর্থাৎ দূষণমুক্ত রাখা যায় সে' দিকটার উপর গুরুত্ব আরোপ করেই পালিত হয়েছে বিশ্ব পানি দিবস । পৃথিবীর মোট পানি সম্পদের মধ্যে ৯৭.৫% মানুষের ব্যবহারের অযোগ্য । বাকি ২.৫% এর মধ্যে মাত্র ১% ব্যবহারের আওতার মধ্যে আছে । এ' ১% পানির উপরই বেঁচে আছে মানুষের জীবন । আবার এই ১ ভাগের ৯৫ অংশই রয়েছে ভূগর্ভে । আর বাকী ৫ অংশ ভূপৃষ্ঠে । বিষয়টি খুবই বিস্ময়কর । ভূগর্ভ বা পাতালের পানি আহরণের ব্যবস্থা উদ্ভাবনের পূর্ব মানব জাতি ভূপৃষ্ঠের পানি ব্যবহারেই অভ্যস্ত ছিল । কিন্তু জনসংখ্যা বৃদ্ধির সাথে সাথে ভূপৃষ্ঠের পানি নানা প্রকার বর্জ্য পদার্থ ও মলমূত্র দ্বারা দূষিত হয়ে পড়ে । এ' অবস্থায় বিজ্ঞান ও প্রযুক্তি বিকাশের ফলে ভূগর্ভের পানি নিরাপদ পানি হিসাবে আমাদের পানীয় জলের চাহিদা মেটাতে সক্ষম হয় । কিন্তু বিগত এক দশক যাবৎ ভূগর্ভের পানিতে বিষাক্ত আর্সেনিকের উপস্থিতি আমাদের জীবন ধারণের জন্য হুমকি হয়ে দাঁড়িয়েছে ।

তুরস্কের ইস্তাম্বুল নগরীতে পানি তথা পরিবেশ নিয়ে বিশ্ব সম্মেলনে পানিকে অর্থনৈতিক মানের মর্যাদা প্রদান, পানির অপচয় রোধ, সরকারী-বেসরকারী পর্যায়ে পানি প্রকল্পে বিনিয়োগ বৃদ্ধি, পানি দূষণ রোধে আরো বেশী সমন্বিত উদ্যোগ এবং পানি ব্যবহারে আরো দক্ষতা অর্জনের বিষয়ে আলোচনা করা হয় । কৃষি, শিল্প ও দৈনন্দিন প্রয়োজনে সারা পৃথিবীব্যাপি ভূগর্ভস্থ পানির উত্তোলন দিনকে দিন বৃদ্ধি পাচ্ছে । ফলে ভূগর্ভস্থ পানির স্তর নেমে যাচ্ছে দ্রুত হারে, দেখা দিচ্ছে প্রাকৃতিক বিপর্যয় ও খরা । ভূগর্ভস্থ পানি যত নীচে নেমে যাচ্ছে পানিতে ততোই বৃদ্ধি পাচ্ছে খনিজ পদার্থের পরিমাণ । অধুনা বাংলাদেশের ভূগর্ভস্থ পানিতে আর্সেনিকের উপস্থিতি সম্পর্কে বিশেষজ্ঞরা ভূগর্ভস্থ পানির স্তর নীচে নেমে যাওয়াকে একটি উল্লেখযোগ্য কারণ হিসেবে অবহিত করেছেন ।

* নির্বাহী প্রকৌশলী, জনস্বাস্থ্য প্রকৌশল অধিদপ্তর, কুমিল্লা বিভাগ, কুমিল্লা ।

পানি সম্পদের আরো একটি উল্লেখযোগ্য দিক হচ্ছে এর ব্যবহার। সুপেয় পানির ২১% ব্যবহার হচ্ছে শিল্প কারখানায়, ৭৩% ব্যবহৃত হচ্ছে সেচ কাজে এবং মাত্র ৬% ব্যবহৃত হচ্ছে পান এবং গৃহস্থালীর কাজে। এ'ক্ষেত্রে গুরুত্বপূর্ণ তথ্য হচ্ছে, সেচ কাজে ব্যবহৃত ৬৭% পানিই শস্যের কাছে পৌঁছায় না অর্থাৎ অপচয় হচ্ছে। কোথাও কোথাও এত বেশী পানি সরবরাহ করা হচ্ছে যে, জলাবদ্ধতাসহ জমি লবণাক্ততার শিকার হচ্ছে। এ'ভাবে পানি ব্যবহারের ফলে উন্নয়নশীল বিশ্বে সুপেয় পানির অভাব দেখা দিয়েছে এবং ক্রমান্বয়ে পরিবেশ দূষিত হচ্ছে। পৃথিবী জুড়ে সৃষ্টি হচ্ছে মরুভূমির প্রক্রিয়া।

বাংলাদেশের চাঁপাই নওয়াবগঞ্জ জেলায় ১৯৯৩ সালে সর্বপ্রথম নলকূপের পানিতে আর্সেনিকের উপস্থিতি ধরা পড়ে। ১লা মে, ১৯৯৭ সালে "আর্সেনিক দূষণ সমস্যা বাংলাদেশ ও পশ্চিম বাংলার জন্য একটি মারাত্মক সমস্যা এবং এর মোকাবেলায় জরুরী ভিত্তিতে কার্যক্রম গ্রহণ প্রয়োজন" এ' ঘোষণা দে'য়া হয় দিল্লী থেকে। পরবর্তীতে বাংলাদেশে স্বাস্থ্য মন্ত্রণালয় ঘোষণা করে জরুরী আর্সেনিক নিরসন প্রকল্প যা' পরবর্তী কালে RAP (Rapid Action Programme) নামে পরিচিতি লাভ করে। এ' সম্মেলনেই ঘোষণা করা হয় যে, বাংলাদেশ ও পশ্চিম বাংলার জন্য আর্সেনিকের সর্বোচ্চ গ্রহণ মাত্রা হবে ০.০৫ মিঃ গ্রাঃ/ লিঃ।

এ' সময়ের মধ্যে ঢাকা কমিউনিটি হাসপাতাল সারা বাংলাদেশের ৬৪ জেলার ১২ হাজার নলকূপের পানি সংগ্রহ ও Flow Injection Hydride Generation Atomic Absorption Spectrophotometry পদ্ধতিতে পরীক্ষা করে ঘোষণা করে যে, দেশের শুধু দক্ষিণ-পশ্চিমে নয় ৬৪ জেলার ৫২ জেলাতেই আর্সেনিক দূষণ ধরা পড়েছে। সমীক্ষায় ৭০% নলকূপে ০.০৫ মিঃ গ্রাঃ / লিঃ এর বেশী আর্সেনিক ধরা পড়ে। এ' ৫২ জেলার লোকসংখ্যা প্রায় ৮.০০ কোটি। দেশের এ' বৃহত্তর জনগোষ্ঠী আজ আর্সেনিকযুক্ত পানি পানের হুমকির সম্মুখিন।

পরবর্তীতে জনস্বাস্থ্য প্রকৌশল অধিদপ্তর, বিশ্ব ব্যাংকের সহায়তায় আর্সেনিক মিটিগেশন প্রকল্প গ্রহণ করে। বর্তমানে উক্ত প্রকল্পের কাজ কুমিল্লা জেলার লাকসাম ও দাউদকান্দি উপজেলায় সমাপ্ত হয়েছে। আগামী ১ মাসের মধ্যে আরো ৮টি উপজেলায় উক্ত কার্যক্রম শুরু হবে। বাকী ৩টি উপজেলা অর্থাৎ বরুড়া, হোমনা ও মুরাদনগর উপজেলায় ইউনিসেফের সহযোগিতায় একটি প্রকল্প হাতে নে'য়া হয়েছে।

উন্নয়নের অর্থ হচ্ছে উন্নততর স্বাস্থ্য ব্যবস্থা, উন্নততর জীবনমান; সাধারণভাবে সামাজিক উন্নয়ন। আর এ'সব ক্ষেত্রে নিরাপদ পানির ভূমিকা অপরিণীম। অর্থাৎ নিরাপদ পানির পর্যাপ্ত সূচু যোগান, পরিবেশের সঙ্গে সঙ্গতি রেখে পানি ব্যবহার করা ইত্যাদি। সামগ্রিক ভাবে পরিবেশের ভারসাম্য রক্ষা করা তথা উন্নততর জীবন ব্যবস্থাকে নিশ্চিত করার জন্য বিশ্ব পানি দিবসকে ঘিরে পানি সম্পদ বিষয়ক কার্যক্রমকে আরো গতিশীল ও কার্যকরী করতে হবে। বিশ্ব পানি দিবসে এটাই হোক আমাদের অঙ্গীকার।

NO WATER NO FUTURE: A WATER FOCUS FOR JOHANNESBURG *

1. World Water Crisis

Water is crucial to development. As the world population tripled in the 20th century, the use of renewable water resources has grown sixfold. The substantial investments in the development of water resources in OECD countries and Asia have made major contributions to food security, to electricity production and economic growth in general. These investments have also succeeded in satisfying the basic needs of much of the world's population. However, this water development has not always been sustainable and many are convinced that there is a world water crisis.

Today's world water crisis is defined by insufficient access to safe drinking water for over a billion people, and inadequate sanitation for half the world's population. Population growth, the increase in GNP in most countries and progressing industrialisation combine to create a demand for water in the urban areas of developing countries will continue to increase substantially in the coming decades. At the same time, lakes/rivers, wetlands and marine waters provide the vast majority of environmental goods and services, including fish. Many of these services depend on the integrity of aquatic ecosystems. This integrity has been affected by (1) the decline in surface area of these ecosystems; (2) widely deteriorating water quality; and (3) reduced quantities of water that are needed to sustain these ecosystems. Large-scale development of river and groundwater resources is less acceptable today, for environmental reasons. It is also less cost effective than it was in the 1960-1990 period, when the large majority of the world's 45,000 large dams were built. Set against this is the fact that the lack of access to water is expected to be one of the key constraints to achieving food security for all in coming decades. We will see continued pressure to develop the world's remaining water resources-a challenge which will have to be met innovatively and sustainably.

* Initial contribution of HRH the Prince of Orange (1) to the Panel of the UN Secretary General, in preion for the Johannesburg Summit. Version 14 February 2002. For comments on this paper please visit www.nowaternofuture.org until May 2002.

The UN Secretary General has appointed twelve persons to serve on a Panel to help him prepare the World Summit on Sustainable Development in Johannesburg. The Prince of Orange is a member of this Panel, with a special focus on water resources development and management. This document is submitted as an initial contribution on behalf of the Prince of Orange to the second meeting of the UN Secretary General's Panel in February 2002. Comments will also be invited from stakeholders, through the network of the Global Water Partnership, and through other networks and groups. The document will be finalized after a meeting of African water stakeholders in Accra, Ghana (14-16 April 2002) where the reactions to the document will be discussed with the Prince of Orange. The purpose of this document is to increase the awareness of water-related issues in the preparation for the Johannesburg Summit and to indicate directions that can contribute to overcoming the world water crisis.

Compounding the problem, water infrastructure built in recent decades is becoming obsolete e.g, reservoirs are silting up; irrigation networks falling into disrepair. Groundwater levels are falling in important aquifers that have contributed substantially to food security in recent years by providing water-on-demand to millions of farmers that tapped them using tubewells to grow their crops. All these developments result in an increasing scarcity of water resources. A scarcity that hits the poor and vulnerable-first and hardest. Women and children are among those that suffer the most.

The global analysis presented above hides the enormous differences that exist among regions and nations-both in terms of water resources and water infrastructure per capita. Water storage infrastructure per capita in Ethiopia is less than 1% of that of North America and Australia. Hydropower development in Africa is less than 5% of its potential, versus more than 70% in OECD countries. Development of water resources remains a major development opportunity in Africa.

Box 1: The seven challenges of the The Hague Ministerial Declaration, March 2000

1. **Meeting Basic Needs** to recognise that access to safe and sufficient water and sanitation are basic human needs and are essential to health and well-being, and to empower people, especially women, through a participatory approach of water management.
2. **Securing the Food Supply** to enhance food security, particularly of the poor and vulnerable, through the more efficient mobilisation and use, and the more equitable allocation of water for food production.
3. **Protecting Ecosystems** to ensure the integrity of ecosystems through sustainable water resources management.
4. **Sharing Water Resources** to promote peaceful cooperation and develop synergies between different uses of water at all levels, whenever possible, within and, in the case of boundary and trans-boundary water resources, between states concerned, through sustainable river basin management or other appropriate approaches.
5. **Managing Risks** to provide security from floods, droughts, pollution and water-related hazards.
6. **Valuing Water** to manage water in way that reflects its economic, social, environmental and cultural values for all its uses, and to move towards pricing water services to reflect the cost of their provision. This approach should take account of the need for equity and the basic needs of the poor and the vulnerable.
7. **Governing Water Wisely** to ensure good governance, so that the involvement of the public and the interests of all stakeholders are included in the management of water resources.

Some forecasts show that by 2025 more than 3 billion people will face water scarcity. But this is not because the world lacks water. The world water crisis is a crisis of governance-not one of scarcity. At the global scale, there is enough water to provide 'water security' for all, but only if we change the way we manage and develop it. As we focus on the smaller scale level, looking at regions or watersheds, approaches to water scarcity will require clear policy choices. The scarcity of water is a very relative concept that can only be seriously be addressed by taking a cross-sectoral perspective, looking at a basket of factors, including socio-economic, technical and institutional aspects of water use. This is the emerging concept of integrated water resources management.

2. From the Hague to Johannesburg, via Bonn

Water was not at the top of the agenda in Rio. For the water sector, one of the preparatory conferences for Rio, held in Dublin in January 1992, probably had a greater impact than the Rio Conference itself. The so-called Dublin Principles have become widely accepted but have been implemented only to a very limited extent. The challenge is bridging the gap between principles and practice.

Box 2: The Dublin Principles, January 1992

1. **Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment;**
2. **water development and management should be participatory, involving users, planners and policymakers at all levels;**
3. **women are central to providing, managing and safeguarding water; and**
4. **water has an economic value in all its competing uses and should be recognized as an economic good**

The 2nd World Water Forum, held in The Hague in March 2000, put the world water crisis squarely on the international agenda. Over 5000 water stakeholders, including more than 100 ministers and 600 journalists, came together to call the world's attention to the many urgent water issues. The conference introduced and adopted the idea of "water security", a goal to be achieved alongside food security and environmental security. A key message of the Forum was that "**Water is Everybody's Business**". Water for poverty alleviation means giving poor people access to, and control over, water. Access to water means sharing control. Sharing control implies a seat at the table. This is the underlying obligation of making water everybody's business. Dealing with this issue is fundamentally about good governance. It is about creating a situation where the most important 'water-decision' taken at global level is possibly the International Development Target set by the UN Millennium Assembly in October 2000. The target is

"...to halve, by 2015, the proportion of people living in extreme poverty and to halve the proportion of people who suffer from hunger and are unable to reach or to afford safe drinking water resources".

The recent International Freshwater Conference organized in Bonn by the German government in December 2001 was appropriately titled *Water, Key to Sustainable Development*, as many believe that there can be no sustainable development without access to water for drinking and access to water for productive purposes-for all people.

More than 50% of food insecure people live in areas where food production is based on rainfed agriculture. In these areas, improved soil and crop productivity-rather than water management-are the real development constraints. In these cases increased soil and crop productivity through technical and management measures that are taken at the level of farms and 'ecological regions' will result in the improved productivity of water.

Box 3: The Bonn International Conference on Freshwater December 2001

1. The first key is to meet the **water security needs of the poor.**
2. **Decentralization** is key. The local level is where national policy meets community needs.
3. The key to better water outreach is **new partnerships.**
4. The key to long-term harmony with nature and neighbour is **cooperative arrangements at the water basin level**, including across water that touch many shores.

The essential key is stronger, better performing governance arrangements.

3. Positioning water in Johannesburg

This section lays out key positions and principles concerning water, following the structure chosen by the Secretary General's Panel, i.e.: (1) shared values; (2) public / private sector nexus; (3) global governance; and (4) science and technology.

3.1 Shared Values

Many cultures and peoples have traditionally shared values of water as a source of life. Water also has a unique spiritual value in many religions. The growing specialization of branches of government, however, has divided the responsibility for various water related tasks to a wide variety of agencies and institutions. This has led to diverging values for water among sectors and stakeholders, particularly at national levels. The sharp conflicts over the largest investments in the water sector-large dams-are a case in point. Much more pervasive, however, is the separate planning and management of water for different uses. Water for municipal and industrial use appears to have a

separate value from that for agriculture, while water for sustaining valuable ecosystems, or fisheries is often not valued at all. The move towards integrated water resources management can be interpreted as a call to re-develop shared water values.

Two major international exercises have attempted to develop a set of more widely shared values. The World Water Vision process involved over 15,000 people worldwide, who contributed to the development of 'water visions'-at the global, regional and sectoral levels, on the development and use of water in 2025. Those visions were presented at the 2nd World Water Forum in March 2000. The process started by the World Commission on Dams attempted to bring together those who were for and against dams, into a rational dialogue. While these two innovative processes were not completely successful in bringing together all stakeholders around a set of shared values, they did increase the awareness of the central issues and the willingness of formerly entrenched interests to participate in open dialogues. In 2001 several dialogue exercises have started that aim to foster cross-sectoral dialogues on shared water values at national and river basin level, including the *Dialogue on Water, Food and Environment*.

Box 4: Dialogue of Food Water and Environment

Ten key stakeholders in the water, agriculture and environment areas have joined hands to form a strategic alliance-known as the Dialogue on Water, Food and the Environment-to help bridge the chasm between agriculture and environmental communities over the way water should be managed and developed. These organizations range from UN agencies (FAO, UNEP, WHO) to associations of farmers (IFAP), irrigation engineers (ICID), environmental organizations (IUCN, WWF), water umbrella organizations (GWP, VWC) and water research (IWMI, representing the CGIAR). The Dialogue is organized around three main (groups of) activities:

1. cross-sectoral dialogues at national and basin levels, aimed at developing shared values related to water for food and environmental security;
2. a "knowledge-base" of credible and authoritative information-acceptable to both agricultural and environmental communities; and
3. local-action activities that aim to provide an information exchange and best-practice identification, platform, linking thousands of local, NGO and bilateral projects and activities into the formal knowledge base(s).

The goal of the Dialogue is provide a multi-stakeholder learning framework that will generate a body of knowledge to help answer the question, at river basin level, how to manage and develop water resources to achieve food security as well as environmental security (www.iwmi.org/dialogue).

A position that is strongly held by many, particularly in the NGO community, is that access to water is a human right and should be enshrined as a value and shared globally by all governments. Many in government circles argue that current declarations on human rights include basic water needs

sufficiently and additional declarations are unnecessary and too complicated politically. Most calls for basic water rights focus only on water for domestic use, and speak only of amounts of the order of 30-50 litres per person per day. The debate on basic needs often focuses on domestic water use only. But for many poor people, access to water for productive purposes is a crucial basic need as well. This is because water is a key factor of production in agriculture and for most other forms of economic activity that are vital to the livelihoods and opportunities of the poor.

Recommended Targets

Halve the proportion of people who are unable to reach or to afford safe drinking water resources by 2015.

Halve the proportion of people who are unable to reach or to afford sanitation by 2015.

Increase water productivity in agriculture (rainfed and irrigated) to enable food security for all people without increasing water diverted for irrigated agriculture over that used in 2000.

Recommended Action

Mandate the World Water Assessment Programme of the United Nations to establish a baseline and monitor progress towards these targets and report to the Ministerial Conferences associated with the World Water Forum series.

In situations of rapidly increasing demands on water resources and current use levels that are approaching the carrying capacity of the amount of water available, it is important to have institutional mechanisms to (re-)allocate water to specific, higher-value uses and more equitable use by all stakeholders. To allocate or re-allocate water effectively, efficiently and equitably, the value of water in alternative uses must be known and this information shared among all stakeholders. One striking example of lack of knowledge is the value of water necessary to sustain ecosystem services, which in most cases is inadequate. This is an area that urgently requires investments in terms of data collection, research-and in stakeholder processes that foster a consensus on these values, and makes valuation information available to the water stakeholders. Whether water is allocated through government institutions or the market, allocation decisions will be improved when the actors have access to information on the value of that water for alternative uses. Strong differences over the value of water for alternative uses among stakeholder groups are a primary source of water conflicts.

3.2 Public/Private Sector Nexus

In this past decade since Rio, international and national organisations have emphasised private sector provision of municipal water services as a potential

solution to the major problems in the sector. This recommendation is based on an overall analysis of the disappointing performance of many governments in this particular area, characterized by low coverage rates, high loss rates, low levels of cost recovery and the poor quality of water provided. Consequently, governments in many developing countries have signed long-term contracts for the private provision of these services in major metropolitan areas, often the capital cities. Given the massive scale of the investments and services required, most contracts have been awarded to major consortia with European multinational companies as partners. Even though 95% of municipal water services are still provided by the public sector, in many countries the possible privatisation of municipal water services has led to sharp debates among stakeholders.

Privatisation of water *service provision* does not imply privatisation of water *resources*, even though those against private sector service provision often imply this. Water is a public good, which should be treated as an economic good where it is used for economic purposes. On the other hand, fair access to affordable water for all does not imply that it has to be free. The cost of providing water services should be recovered from all that can afford it, which, again, does not exclude preferential treatment for the poor.

Large private companies can add value by bringing specialized management experience and large-scale financing to situations where these are lacking. Conversely, other models—from public companies to public service provision—can be just as efficient and effective as private sector service provision. Irrespective of the approach chosen, governments maintain a major responsibility for providing an effective and efficient regulatory framework within which the service providers operate. Also, quite separately from water service provision, it is the government's responsibility to provide a framework of water use rights—respecting the customary rights of traditional water users and indigenous peoples.

The public-private sector debate within the water sector generally focuses on the role of multinational companies and ignores the role and significance of the small-scale private sector in developing countries. In at least two water-related areas the debate overlooks the crucial role that the domestic private sector plays.

Firstly, where piped municipal water supply is unavailable or of inadequate quality, the provision of bottled drinking water is a very significant economic activity that has seen astronomic growth rates in countries ranging from Mexico to India to Thailand. In fact, the success of this domestic private sector has in recent years motivated multinational companies to develop near-global brands of drinking water that compete with local brands. For consumers in developed countries 'bottled water' refers to high-priced mineral water. For consumers in developing countries bottled water often refers to reliable, filtered water in 20-litre reusable containers, used for drinking, cooking

or other uses that really require drinking water quality. Provision of affordable drinking-quality water in bottles or containers also relieves the piped-water system of the need to produce drinking water quality that is largely used for lower-grade purposes such as toilet flushing. Innovative public-private partnerships that devise alternative ways of providing water supply and sanitation services at various scales deserve more attention.

Secondly, in agriculture, private farmers have been largely responsible for the major investments in groundwater development in recent decades. This groundwater use has contributed significantly to food production and the creation of wealth in rural areas. But governments have largely failed to elaborate rules and mechanisms that ensure that groundwater is used in a way that minimises the risks of over-use and protects groundwater quality.

Recommended Target

Have at least 20% of all water infrastructure investments funded by alternative forms of financing by 2015.

Recommended Action

Build capacity in local government to assess alternative forms of financing for infrastructure, including capacity to identify, develop and negotiate sound projects that are financially feasible and environmentally sustainable as alternative solutions to large-scale investments.

3.3 Global Governance

The most important area of global governance with a substantial potential impact on the water sector is the system of international trade. Globally, agriculture uses as much as 70% of all renewable water resources that are diverted for human use. The figure is as high as 80-90% in developing countries. Worldwide trade in agricultural products-also referred to as trade in virtual water-has the potential to counteract water scarcity locally. It is evident that the food self-sufficiency targets maintained by many countries are closely linked with the demand for water for agriculture use. A fair and reliable system of international trade in agricultural products that would enable countries to relax national food self-sufficiency targets would have a major impact on the demand for water. In addition, the \$1 billion a day agriculture subsidies in OECD countries have a major impact on the export of agricultural products from developing countries-and thereby on their demand for water. Changes in the agriculture trade regimes and subsidies in both the developed and the developing world are therefore going to have a very important impact on the demand for water.

The effort to develop a much-needed institutional framework for international water governance has met with resistance and been relatively unsuccessful. The UN Convention on the non-Navigational Use of International Waters took several decades to draft and then attracted insufficient ratifications to enter

into force. There are, on the other hand, a large number of bilateral and international agreements concerning the use and development of water resources in international basins. These agreements have successfully allowed countries to share water benefits, even in situations where bilateral relations less than optimal. There is likely to be intense competition and conflict for water among uses and users within countries at the local level. But in the international arena, water has shown to be a good catalyst for cooperation between nations.

Recommended Target

Assess virtual water imports and exports through agricultural products for each country by 2015.

Recommended Action

Have the World Trade Organisation develop and consider virtual water balances, using a resource accounting framework, when assessing and negotiating agriculture subsidies and trade in agricultural products.

At a more conceptual level, integrated water resources management (IWRM) has gradually become a generally accepted framework for 'good water governance'. It is also encouraging that in many places around the world the river basin and groundwater aquifer are more and more accepted as the appropriate scale to assess and manage water resources. While not an end in itself, and not a guarantee for a more desirable outcome, these developments do point in the right direction. That said, there are many failures and few successes in developing or developed countries in actually making river basin management work.

Box 5: The Nile Basin Initiative

The Nile is the world's longest river. It flows 6,600 kilometres, and drains an area of about 3.1 million square kilometres, one-tenth of the African continent. The extraordinary physical and ecological features of the Nile River have supported dramatic evolution and expansion of human activity. The overwhelming majority of people in the basin lives in rural areas and depends directly on land and water resources for shelter, income and energy. Despite the extraordinary natural endowments and rich cultural history, its people face considerable challenges. Six of the ten Nile countries are among the world's poorest. The Nile holds great potential to foster regional co-operation. However, the control and use of Nile waters has long been a source of contention and potential conflict among and between riparian countries.

In 1999, the riparians took a historic step by launching the Nile Basin initiative (NBI). The initiative is a transitional mechanism that includes all the Nile countries in a regional partnership to promote economic development and fight poverty. The NBI is guided by a 'shared vision' that is based on consensus among

riparians and reinforced by international agreement that the Nile's environmental and development issues are of global concern. To translate the vision into action, a Strategic Action Plan has been initiated. Co-operative management of the Nile River is one of the greatest challenges of the global international waters agenda. The Nile Basin Initiative represents a significant step towards overcoming those challenges.

Source: NBI Transboundary Environmental Analysis.

Speaking of sustainable development, it is clear that better water management should be a means to reduce poverty. The DAC Poverty Guidelines identify five dimensions of poverty: economic, human, political, socio-cultural and protective capabilities. Strategies to address water-poverty relationships need to improve the different capabilities of the poor in their battle against poverty. These strategies will also have to address the pervasive gender issues in water. Those affected by water problems are too often women, while those deciding on solutions tend to be men. Building gender-equitable capabilities of the poor to manage their water resources should also be at the heart of capacity building in the water sector.

3.4 Science and Technology

It is often assumed that increasing the efficiency in irrigated agriculture will result in large water savings. But the results of research done at the river basin scale show that these conclusions based on irrigation efficiency measured in the farmers' fields are often quite misleading. Basing scale savings can often not be extrapolated from savings at the farm level-one person's water 'loss' is another person's recharge. The attention should be focused, instead, on the productivity of water in different uses. The UN Secretary General, for instance, concluded: *"We need a Blue Revolution in agriculture that focuses on increasing productivity per unit of water-"more crop per drop" (Report to the Millennium Conference, October, 2000).*

Indeed, at the farm level, the focus on water productivity in physical terms, crop output per unit of water, is a necessary and useful framework. Likewise, appropriate soil fertility and plant nutrition management is in many places the best way to achieve more crop per unit of water. At the level of watersheds, basins, or country water use, water productivity needs to be understood from a multi-stakeholder perspective, in the broadest possible sense. That is, water productivity at the basin level must be defined to include crop, livestock and fishery yields, wider ecosystem services and social impacts such as health, together with the systems of resource governance that ensure equitable distribution of these benefits.

A focus on the productivity and value of water in all its uses should also help to change the thinking, still widely held in agricultural circles, that we should not 'waste any water by letting it flow to the sea'. Only rarely is fresh water

that flows to the sea 'lost' or 'wasted'. The coastal zone is one of the most productive ecosystems on earth, and depends vitally on the inflow of fresh water in estuaries, deltas, lagoons, mangrove forests etc. Maintaining fresh-salt water gradients is a key ecosystem service that produces high biodiversity as well as highly productive fisheries.

Box 6: Breeding for drought tolerance

A recent review of the status of breeding for tolerance of abiotic stresses by John Bennet (International Rice Research Institute), concluded that the advances in genomics, and the development of advanced analytical tools at the molecular level, provide a basis for understanding the mechanisms of stress tolerance. Investments in the new tools for gene discovery will produce breakthroughs in understanding abiotic stress tolerance. Drought is the most important but also the most intractable of abiotic stresses but irrigated and rainfed crop plants can be developed that are high-yielding even when grown under recurrent mild water deficit.

Scientists and engineers have made significant progress in many areas related to assessing water resources, water flows, and water quality. Particularly, advances in remote sensing, remote data collection and geographic information systems provide powerful tools to complement hydrological and hydrographic data collection systems. Unfortunately, the national systems for collecting water data are declining in many developing countries due to a lack of financial resources to maintain or expand them. This trend needs to be reversed. It is also of major concern that the knowledge of water quality remains fragmented and practical knowledge of water-related ecosystem services minimal.

There are other areas where daily practice is ahead of scientific progress and interest. While scientists and engineers still debate the wisdom of re-using municipal and industrial wastewater and sludge for agricultural purposes, farmers in the peri-urban areas of Africa and Asia have widely adopted this practice out of sheer necessity. Research on the impact on human health, wealth, and nutrition (as well as soil-fertility) of using wastewater for agricultural production is needed to generate practical advice for farmers and information for consumers, to limit risks and maximise benefits. Certainly, the recycling of wastewater is a high priority area, with important implications for water scarcity, public health and nutrient flows. Even better than recycling wastewater would be the large-scale introduction-technically feasible but socio-culturally difficult-of ecological sanitation.

Recommended Target

Develop, by 2010, an agreed strategy for the use of molecular biology to increase drought tolerance and water productivity of crops to achieve water, food and environmental security.

Recommended Action

Have the CGIAR assess the potential for increased drought tolerance and increased water productivity in agriculture, including the potential of the use of functional genomics and other tools of modern molecular biology.

Some scientists and a few practitioners have long questioned the wisdom of providing water of drinking quality at great expense, only to have a large share flushed down toilets, to carry waste, where after it is cleaned again for the few that can afford this costly practice. Opinions differ: some water experts advocate ecological sanitation, others dry toilets, some people argue that only bottled water should be of drinking quality and piped water quality should be limited to fit all other use made of it. All these alternative approaches deserve more attention. Of potentially major importance to the water sector are the advances in molecular biology, i.e. functional genomics and modern biotechnology. Some of the new techniques simply increase the efficiency of 'traditional' plant breeding, while others would lead to genetically modified plants. Plant breeders have already had a major impact on the world's water demand through the development of the modern high-yielding crop varieties. On the one hand, they require irrigation, but, on the other, drastically increased the water productivity of the plant. Recent advances in corn (maize) crop yields, for example, have come in the form of increased drought tolerance of new varieties. Rice breeders are working on improved dry' (or aerobic) rice. These developments may have a major impact on the water demand of agriculture. Similar advances in breeding for pest control will, indirectly, have the same broad impact on the demand for water in agriculture. Developing countries should be free to make their own choices on the social acceptability of these technologies. This is not a plea for high-tech agri-business in isolation from the environment, however. If we have learned anything from the Green Revolution, it is that the next wave of successful modernisation in agriculture will be through eco-technology-where farming works with, not against, the environment.

Finally, variability is a core characteristic of water. As a consequence of climate change, rainfall variability is likely to increase, particularly in places where people already have a low ability to deal with current weather variability. Enhancing the protective capabilities of the poor to cope with the impacts of floods, droughts, storms and other water-related disasters is crucial for to improve the livelihoods of poor people in many parts of the world. This is an area that requires considerable added investments in research and capacity building.

4. Conclusion

Overcoming the world water crisis-achieving water, food and environmental security simultaneously-is one of the most formidable challenges to achieve sustainable development. More and more people, organizations and governments are aware of this challenge. The World Summit on Sustainable Development should reconfirm the priority of this issue and adopt targets and actions that jointly will address this challenge.

Improving Water, Sanitation and Hygiene Reduces Water-related Disease

Faecal-oral disease cycle



Infectious hepatitis
Dysentery
Diarrhoea
Cholera
Typhoid

- 2.2 million people die each year of diarrhoeal disease from inadequate water supply, sanitation and hygiene. Most are children in developing countries.
- 900,000 people were struck by cholera in the 1991 Latin American outbreak, which was strongly associated with drinking-water, sanitation and food hygiene.
- 1.5 million people are infected by hepatitis A each year.

All faecal-oral diseases can be reduced by providing adequate safe water, and improving sanitation and hygiene.

Removal of excessive fluoride from drinking-water reduces crippling fluorosis.

- An estimated 30 million people suffer from chronic fluorosis in China alone.
- 35-77 million drink arsenic-rich water in Bangladesh.



Arsenicosis
Fluorosis
"Blue baby" syndrome
Lead poisoning

Chemicals in drinking-water

Vector-borne diseases

River blindness (Onchocerciasis)
Elephantiasis hydrocoele (Filariasis)
Japanese encephalitis
Dengue
Malaria



- 1 million people die each year from malaria.
- at least 20% of the people infected by Japanese encephalitis die and a further 20% are permanently brain damaged.

Improved management of water resources reduces transmission of disease.

Trachoma can be prevented by improving sanitary conditions and hygiene practices

- 6 million people are irreversibly blinded by trachoma.
- 200 million people have schistosomiasis.



Trachoma
Guinea worm
Schistosomiasis
Scabies
Helminthiasis
Leptospirosis

Sanitation and hygiene

World Health Organization
http://www.who.int/water_sanitation_health/



Water resources planning: many opportunities to enhance health, many opportunities missed.

Water resources development

... creates many opportunities for health improvement.
Uncoordinated planning, development and management
of water resources greatly increases health risks.

- 300 million people suffer from malaria. Intensified irrigation, dams and other water projects contribute to this.
- schistosomiasis affects 200 million worldwide, and is virtually synonymous with irrigation development in Africa.



Health impact assessment

... acts upstream in water resource planning
and management.

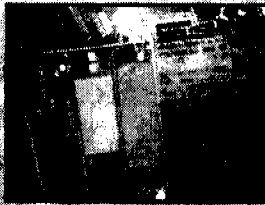
- stops transfer of hidden costs to the health sector;
- promotes intersectoral action and synergy; and
- provides an evidence base for health risk management.



Integrated river basin management

... incorporates health protection and promotes addressing
environmental and social risk factors.

- schistosomiasis prevalence jumped from 0 to 80%
in Richard Toll, Senegal, following dam construction.



Human health equals human health

... requires many synergies between safeguards to
human health and safeguards to protect
the environment and biodiversity.

Health assessment is an integral part of environmental assessment.



Water supply and sanitation: basic human rights, fundamental in poverty alleviation.

"Effective water supply and sanitation underpin long-established health gains in industrialized countries and are proven interventions with large scale health benefits when deployed in the developing world."

Gen. Håkan Brandt
Director General,
World Health Organization

All people have the right to safe water and sanitation.



- 2.4 billion people lack access to basic sanitation.
- 1.1 billion lack access even to basic improved water sources.
- These numbers remained unchanged from 1990 to 2000.

Improving water supply and sanitation is fundamental in breaking the vicious cycle of poverty, improving health and promoting economic and social development.



- 3.4 million people, mostly children, die annually from water-related diseases.
- Diarrhoeal diseases, including cholera, account for 2.2 million deaths annually.

Water and sanitation interventions can benefit particularly the poor.



- Provision of safe water and adequate sanitation, combined with hygiene education, reduces the mortality caused by diarrhoeal diseases by 65% and the morbidity by 26%.





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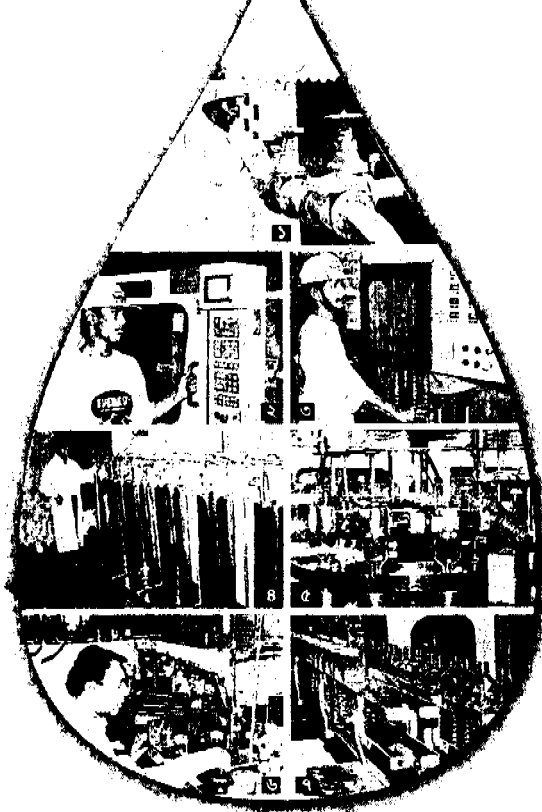
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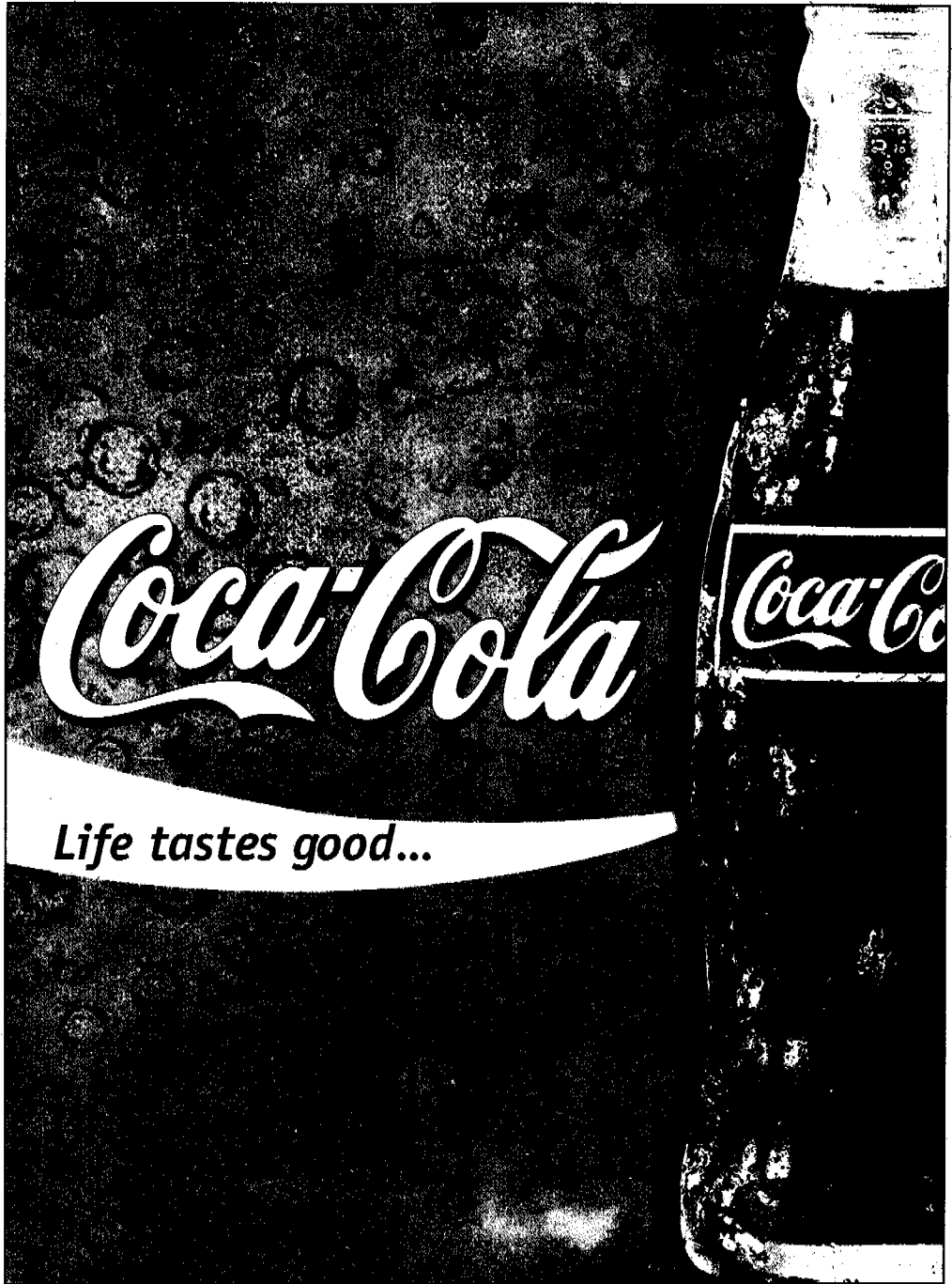
এভারেস্ট ড্রিংকস এন্ড ডেইরী প্রোডাক্টস লিঃ
বাংলাদেশে সর্বপ্রথম সরকারী অনুমোদন প্রাপ্ত প্রাকৃতিক খনিজ পানি
উৎপাদনকারী ও দায়িত্বশীল প্রতিষ্ঠান হিসেবে এর নিজস্ব উৎপাদন
প্রক্রিয়া সম্পর্কে ভোক্তা এবং ক্রেতা ও বিক্রেতাগণকে
অবহিত করা নৈতিক দায়িত্ব বলে মনে করে।

❑ এভারেস্ট-এর নিজস্ব গভীর নলকূপ (৬০০ ফুট গভীর) হ'তে প্রাকৃতিক খনিজ
পানি আহরণ ও জীবাণুমুক্তকরণ, ❑ ৩ ❑ সর্বজন স্বীকৃত সফটসফট ও PET
বোতল নিজস্ব কারখানায় উৎপাদন, ❑ ৪ ❑ স্বরঞ্চিত মেশিনে পানি পরিশোধন,
জীবাণুমুক্তকরণ ও উৎপাদন, ❑ ৫ ❑ সম্পূর্ণ স্বরঞ্চিত মেশিনে বোতল বিশোধন
কিলিং ও সিলিং করণ, ❑ ৬ ❑ সঠিক মাননিয়ন্ত্রণের জন্য নিজস্ব ও স্বীকৃত পরীক্ষাগারে
নমুনা পরীক্ষা করণ, ❑ ৭ ❑ স্বরঞ্চিত মেশিনে খালি ও উৎপাদিত বোতল অবলোকন।



এভারেস্ট ড্রিংকস এন্ড ডেইরী প্রোডাক্টস লিঃ

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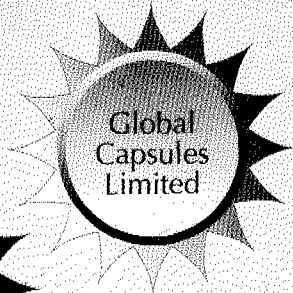


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