

# Arsenic Mitigation in Bangladesh

**MEDIA BRIEF**

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# C o n t e n t s

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## Arsenic Mitigation in Bangladesh

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UNICEF Media Brief

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## General Information

UNICEF Media Brief

### Description of Arsenic

Arsenic is a chemical element, a common constituent of many minerals and rocks. Arsenic occurs naturally in the ground, as part of the soil and rocks. Arsenic cannot be seen, tasted, or smelled when it is in water.

### Acceptable Level in Drinking Water

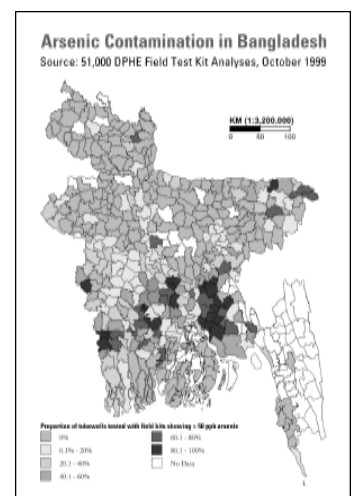
Some arsenic is always present in water. In Bangladesh, the Government's water quality standard for permissible level of arsenic in drinking water is 50 parts per billion (ppb), or .05 milligrams per litre (mg/L). This level is also accepted by many countries, including the USA and most countries in Europe. The World Health Organization (WHO) had issued a "Guideline Value" for arsenic in drinking water at 50 ppb. It revised this Guideline Value to 10 ppb in 1993. Guideline Values by WHO are not binding limits. They are intended for use as a basis for the development of national standards in the context of local or national environmental, social, economic and cultural conditions.

Water can be tested by trained personnel to determine if it contains more than the acceptable level of arsenic.

Testing initiatives have been undertaken by the Government of Bangladesh (GOB) with support from UNICEF and other donor agencies, and these are discussed in more detail later in this Media Brief. Measuring arsenic is a complex process that requires specialised equipment under controlled conditions. In other words, arsenic cannot be detected by looking at water, or even by placing water under a microscope.

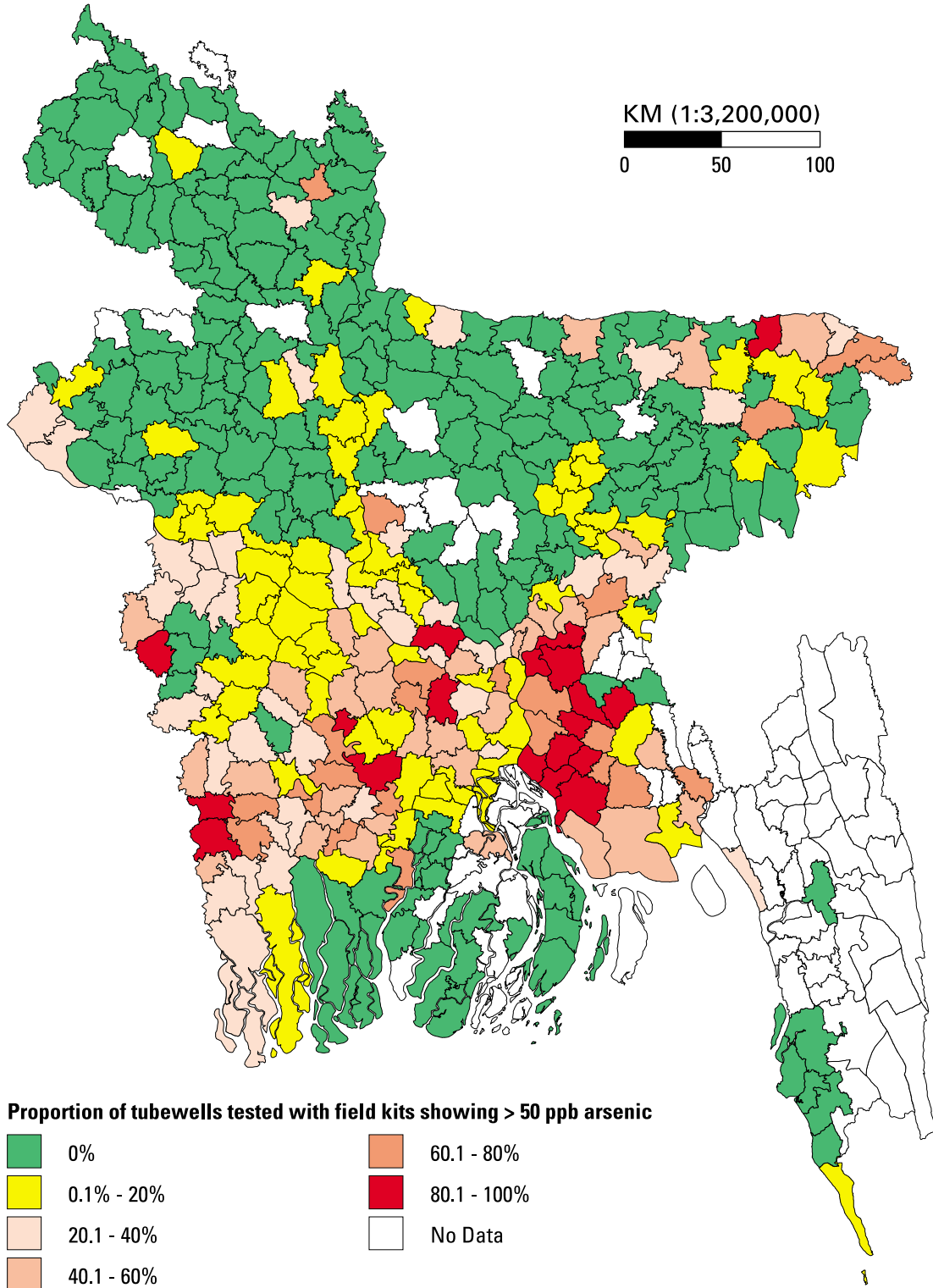
### Extent of Arsenic Contamination in Bangladesh

A UNICEF-funded Department of Public Health Engineering (DPHE) testing programme, which began in 1996 and (as of November 1999) has tested some 51,000 tubewells, has found arsenic contamination in the central part of the country, stretching from Chapai Nawabganj in the west to Brahmanbaria in the east. The greater Sylhet area is also affected. Isolated cases of arsenic



# Arsenic Contamination in Bangladesh

Source: 51,000 DPHE Field Test Kit Analyses, October 1999



contamination have been found in the northern and coastal areas of the country. (*Please see map 'Arsenic Contamination in Bangladesh'*.) A survey by the British Geological Survey (BGS/MML,1998)<sup>1</sup> confirms the general pattern of arsenic distribution found in the DPHE-UNICEF programme.

The DPHE-UNICEF testing programme is the largest national programme to date. As of November 1999, the programme has analysed tests from tubewells in 61 out of 64 districts across the country. It has found arsenic contamination above the permissible level of 50 ppb (parts per billion) in 211 of the country's 460 thanas. Arsenic contamination has been found in 29 % of all wells tested. In other words, 7 out of 10 wells tested have been found to be safe from arsenic contamination.

Due to arsenic contamination, safe water access is estimated to have dropped from 97% to 80% nationwide.

### Geological Origins of Arsenic in Bangladesh

Thousands of years ago, rocks rich in arsenic were eroded from the Himalayas and other high-lying source areas, and deposited along with sands, gravels, silts and clays in low-lying areas which now make up West Bengal, in India, and Bangladesh. These arsenic-bearing sediments became buried over thousands of years, forming part of the aquifers we are tapping today for our water resources.

A study (BGS/MML,1998) has found that the arsenic sediment has been released into the ground water in Bangladesh by a natural process called "oxyhydroxide reduction".

In this process, arsenic is released into the surrounding water when fine-grained iron or manganese oxyhydroxides dissolve due to natural conditions that lead to a decrease in oxygen levels.

Geologists cite several other processes by which arsenic can be released into groundwater. The process called "pyrite oxidation", for instance, involves iron sulfide compounds which contain arsenic. These compounds dissolve upon contact with oxygen, releasing iron, sulfide and arsenic into the surrounding water. Since there is little or no sulfide in groundwater in Bangladesh, this process is not regarded to be a widespread occurrence in this country.

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1. Ground Water Studies for Arsenic Contamination in Bangladesh, British Geological Survey, Mott-MacDonald Ltd. (UK), 1998

## Manifestations and Impact on Health

There is a need to know much more about the impact of arsenic poisoning. For instance, there is no clear understanding of why some members of a family or community are affected, while others in the same family or community, who are subject to the same contamination, are not. Arsenic tends not to accumulate in the body but is excreted naturally. If ingested faster than it can be excreted, arsenic does accumulate in hair and fingernails.

Early symptoms can range from the development of dark spots on the skin, to a hardening of the skin into nodules – often on the palms and soles. The World Health Organization (WHO) estimates that these symptoms can take 5 to 10 years of constant exposure to arsenic to develop. Over time, these symptoms can become more pronounced and in some cases, internal organs including the liver, kidneys and lungs can be affected. In the most severe cases, cancer can occur in the skin and internal organs, and limbs can be affected by gangrene. While evidence links arsenic with cancer, it is difficult to say how much exposure and for what period of time, will result in cancer.

The following aspects of medical management of arsenic poisoning are worth noting:

- ▶ Some reports show that stopping the ingestion of contaminated water may alleviate existing symptoms and drinking arsenic-safe water appears to lower the long-term risk of developing diseases.
- ▶ There is some evidence that providing patients with vitamins, especially Vitamin A, Vitamin C, Vitamin E and an enriched diet aids recovery. For this reason, patients are advised to eat plenty of vegetables, especially leafy greens.
- ▶ Symptoms such as skin hardening are also treatable with simple skin ointments.
- ▶ Screening a large number of possible patients for internal damage is an expensive procedure and unlikely to be a practical solution. For instance, testing for arsenic in hair or nail clippings costs as much as Taka 3,000 (about US \$60) for one test.

## Brief History of Tubewells in Bangladesh

Tubewells existed in this region during the British colonial era. When the partition of India took place, in 1947, there were an estimated 50,000 tubewells in East Pakistan, (the former name of Bangladesh). By 1972, the Government had constructed approximately 135,000 tubewells. At this time, there was about one tubewell for every 400 people in Bangladesh.



Tubewell water was an important source of pathogen-free drinking water, especially because surface water in Bangladesh was, and continues to be, contaminated with faecal bacteria. Drinking untreated or inadequately treated water can cause cholera, dysentery and other water-borne diseases that can be fatal.

Where tubewells were not within easy reach, people relied on surface water sources such as ponds. These were usually fenced off and reserved for drinking purposes. In some households the pond water was treated either by adding alum (*phitkiri*), or by filtering the water by passing it through layers of gravel, sand and charcoal in a pot. The more affluent households could afford to have their own dugwells for drinking water.

UNICEF's first major assistance to the water supply in Bangladesh was in response to a devastating cyclone that hit the region in November 1970; some 10,000 damaged tubewells were repaired.

UNICEF continued to assist Bangladesh, initially providing assistance on an emergency footing after the end of the War of Liberation, in 1973, and thereafter supporting long-term initiatives by the Government to provide safe water to drink.

By the mid 1970s, UNICEF was providing support to the Department of Public Health Engineering (DPHE) to install shallow (No. 6) and deep tubewells as well as other safe water sources in different parts of the country. These included the pond sand filtration systems which were installed mainly in the coastal belt of Bangladesh where saline water in the aquifer was a problem. After a UNICEF-supported DPHE pilot project in 1984, a larger programme was undertaken in the coastal region. UNICEF also assisted in the promotion of rain water harvesting techniques by DPHE in some 14 districts in Bangladesh. UNICEF support for shallow (No. 6) tubewells was discontinued from the late 1980's when the private sector became successful in installing inexpensive No. 6 handpumps. Today, a national average of 3 out of 4 tubewells are privately owned. In some parts of the country, however, as many as 9 out of 10 tubewells are privately owned.

## UNICEF-supported Arsenic Mitigation Programme

UNICEF Media Brief

### National Programme

UNICEF was one of Bangladesh's first development partners to respond to the arsenic crisis. It supports Arsenic Mitigation activities at two levels. At the national level, support comprises of:

- ▶ Testing of existing wells to identify safe sources of water
- ▶ Provision of alternative safe water sources
- ▶ Health care and management of arsenic related conditions
- ▶ Mass and interpersonal communications campaigns

### Sub-National Programme

#### Community-Based Action Research Project

To move the national arsenic mitigation agenda forward in an integrated, effective and accelerated manner, UNICEF has supported a comprehensive community-based arsenic mitigation programme in four thanas (788 villages) which is being coordinated and managed by DPHE and implemented by the country's three leading NGOs. These are Bangladesh Rural Advancement Council (BRAC), Dhaka Community Hospital (DCH) and Grameen Bank. This action-oriented research project integrates testing, provision of alternative safe water supply options, communication, health care and management and research & development components in a complementary manner.

### Testing for Arsenic

The first step in addressing the arsenic problem is to identify which tubewells are affected. Testing for arsenic in water identifies which tubewells are unsafe for drinking and cooking, and at the same time, also identifies which tubewells are safe.

UNICEF is supporting DPHE to promote a consistent way to label wells as safe or unsafe, by painting them green and red, respectively, after testing.





UNICEF support has enabled the testing of approximately 144,000 tubewells throughout Bangladesh

### **National Arsenic Testing Programme**

UNICEF was among the first to provide support to the Government for widescale testing of existing tubewells. Starting in 1996, the Government of Bangladesh has been testing tubewells across the country. The programme has tested tubewells in 61 out of the nation's 64 districts. The DPHE-UNICEF National Arsenic Testing Programme is an ongoing process with the continuing goal of testing tubewells from every union in the country. Tubewells are tested with a field kit.

So far, the DPHE-UNICEF National Arsenic Testing Programme has analysed the results of some 51,000 tests nationwide. Results from this random sample survey have shown arsenic contamination above the permissible level in 29 % of all wells tested, located in 211 of the country's 460 thanas. In other words, 7 in 10 tubewells have been found to be safe. (*Please see map 'Arsenic Contamination in Bangladesh'*.)

In addition, UNICEF has supported approximately 67,000 tests at sub-national levels, some 13,000 post installation tests and nearly 12,000 tests in the vicinity of sites selected for installation of new deep tubewells. This brings the total number of arsenic tests supported by UNICEF to approximately 144,000 (as of November 1999).

UNICEF is also cooperating with a World Bank-funded Bangladesh Arsenic Mitigation-Water Supply Project (BAMWSP) that is expected to screen tubewells in all 460 thanas of the country.

### **Field Kits**

Field testing can be done by anyone who has been given basic training. The field testing kits at present are qualitative in nature. This means that they give a 'yes' or 'no' answer to indicate whether the tubewell water contains arsenic above or below the permissible level. The speed of coverage and on-the-spot results make the field testing kit the essential equipment for identifying the arsenic affected areas.

With UNICEF support, DPHE tubewell mechanics and community workers are now undertaking routine arsenic measurements in the countryside. Results from field test kits are validated by laboratory measurements of random samples, which are more sensitive and precise.

Following the recommendation of the Government of Bangladesh, UNICEF has procured an interim field test kit known as the MERCK kit, manufactured in Germany. So far, close to 2,000 kits have been distributed among the NGO partners for immediate deployment in the field: 660 kits to BRAC, 410 to Grameen Bank, 240 to Dhaka Community Hospital and 300 to the Rotary. UNICEF presently has some

170 MERCK kits in reserve for selected testing. Results from the field show that the MERCK kit has been performing reliably.

Results from the field show that the MERCK kit is relatively reliable in indicating whether the water sample has arsenic below 20 ppb or above 100 ppb. To be on the safe side, tubewells that contain arsenic between 20-50 ppb are also being marked as red or as unsafe.

A reliable field test kit that can accurately detect arsenic at 50 ppb is not yet available commercially. Together with other development partners, governmental and non-governmental agencies and academic bodies, UNICEF has helped to develop specifications and standards for an improved kit to be produced in Bangladesh. The quest for a locally manufactured kit is continuing and research in this field is ongoing. UNICEF is committed to ensuring strict quality control procedures once local manufacture recommences.

### **Strengthening Laboratory Capacity**

The most reliable methods for arsenic testing are in the laboratory with sophisticated equipment and trained personnel. Laboratory testing is time consuming, expensive and resource intensive. For instance, a private laboratory is charging about US \$10 for a single arsenic analysis.

UNICEF continues to be active in providing support to the DPHE zonal laboratories, increasing their capacity for arsenic analysis.

Each of the laboratories has been provided with equipment and high-quality chemical reagents necessary for accurate arsenic analysis. UNICEF has also supplied the laboratories with power generators and computers so that Government chemists can work more efficiently.

UNICEF is supporting the development of new technologies for arsenic analysis. One example is the work of Dr. Walter Kosmus, an Austrian chemist who has developed a new instrument for accurately measuring arsenic in water (*See UNICEF Press Release, 'Advances in arsenic detection' Dhaka, December 20, 1998*). UNICEF has supported this research, purchasing ten of the devices for evaluation in Bangladesh. These arsenators were evaluated by BUET, BCSIR, the Atomic Energy Commission, ICDDR,B, Dhaka University, and several private laboratories. These will be used to support DPHE laboratory analyses and other UNICEF arsenic mitigation projects.

If even one tubewell is found to have arsenic concentrations above the permitted limit, no new shallow tubewells are installed and alternative options are explored. For all new deep tubewells installed, the water is retested periodically.

## Arsenic Testing Protocol

Arsenic testing is now part of the standard testing protocol for all installations.

UNICEF has played a key role in supporting the development of this new arsenic testing protocol for new tubewell installation. Under this protocol, the groundwater from existing tubewells surrounding the proposed site of a new tubewell is tested. Samples are required to be taken from up to 10 wells within a radius of 250 metres. If even one tubewell is found to have arsenic concentrations above the permitted limit, no new shallow tubewells are installed and alternative options are explored. For all new deep tubewells installed, the water is retested periodically.



## Alternative Options for Safe Drinking Water

UNICEF's cooperation with the Government of Bangladesh in providing safe water, especially in the rural areas, started in 1972. Until the discovery of arsenic, 97% of the country's population had access to safe water. This figure is now estimated at 80%, subject to verification and further testing.

Drinking water can come from many different sources, such as groundwater, surface water, and rainwater. Surface water is heavily contaminated with faecal bacteria and residues from fertilizers and pesticides. Not much rainwater is yet collected in Bangladesh for drinking purpose. As a result, groundwater is preferred, as long as it is arsenic-safe.

UNICEF has supported the construction and installation of some 800 alternative safe water systems in arsenic affected areas, as of November 1999. These range from community deep tubewells, to locally made household filters.

### Safe Existing Tubewells

In the event that a family finds that their tubewell has arsenic, the safest, fastest, and easiest way to get safe drinking water is to find a nearby tubewell that has been tested for arsenic and found safe. This is one reason it is so important to test as many tubewells as possible, and to clearly label them after testing.

Experience shows that in many affected villages, only some of the wells are contaminated, and safe wells may be very near. Owners of safe tubewells are therefore encouraged to share their safe water with their neighbours in need of safe tubewell water. In this way, people can have access to safe drinking water without any new construction or costs. However, in some areas, many of the tubewells are contaminated, and alternative sources must be found.

### Deep Tubewells

There are two main aquifers (water-bearing layers) in Bangladesh, one shallow and one deep. Usually there is a thick layer of silt and clay in between the two aquifers. Water cannot easily move through the layer. From the tests conducted so far, we can tell that the deep aquifer is much less contaminated than the shallow one. A

UNICEF is helping DPHE to mitigate the effects of arsenic contamination and develop alternative safe water supply options given the significant role that safe water plays in disease reduction and in improving quality of life for rural families in Bangladesh.

Dug wells are a traditional source of water and are being introduced in the Community-Based Action Research Project.

hydrogeological study conducted by the British Geological Survey (BGS/MML, 1998) tested 280 tubewells deeper than 200 metres, and only found unsafe levels of arsenic in two of them - less than 1%. DPHE has also tested many deep tubewells, and found only limited arsenic contamination. Any new deep tubewell sunk with UNICEF assistance is now tested for arsenic before use and monitored on a regular basis.

However, deep tubewells cannot be drilled in all areas. In some parts of the country, rocky layers make drilling impossible. In order to find out where deep, arsenic-safe tubewells can be safely drilled, DPHE has been making hydrogeological investigations, with UNICEF support. Nearly 200 deep exploratory boreholes have been drilled, and many areas where deep tubewells are a safe, possible option have been identified. These hydrogeological investigations will continue.

Dug wells are a traditional source of water and are being introduced in the Community-Based Action Research Project. Some 39 dug wells and 7 ring wells have been installed and 100 more will be installed by April 2000. The quality of water from such wells is being tested to ensure that it does not contain harmful chemicals and/or bacteria.

### **Pond Sand Filters**

In areas where deep tubewells are not feasible, it is possible to treat surface water from ponds that are exclusively reserved for drinking purposes and to make it safe for drinking and cooking. DPHE, supported by UNICEF, has designed a community-based slow sand filtration system, called a pond sand filter, which can remove bacteria from surface water by filtering it through a large tank filled with sand and gravel. UNICEF began to support research and development of the pond sand filter in 1984 primarily as a safe water source in coastal areas where there was high salinity in the water source. It is now being used successfully in arsenic-affected areas. Pond sand filters must be periodically cleaned by community members, by washing the top layer of sand.

Since the 1980s, DPHE has installed some 1,900 pond sand filters mainly in the coastal belt. UNICEF is transferring this technology to the Community-Based Action Research Project in the four new thanas, Bera, Kachua, Sonargoan and Jhikargacha. Here, in collaboration with BRAC and Grameen Bank, ten new pond sand filters have been installed already and 46 more will be installed by April 2000.

Experience shows that it takes special efforts to motivate community members to reserve a pond exclusively for drinking and not use it for fish culture and other household purposes.

## Rainwater Harvesting

Like pond sand filters, rainwater harvesting systems have been used in the coastal districts for years, and are being introduced in arsenic-affected areas.

UNICEF has been supporting research and development of rainwater harvesting in the coastal areas since 1994 and has assisted DPHE in the promotion of this technology in some 14 thanas across the country already. With the scaled up Community-Based Action Research Project underway, 67 rainwater harvesters have been installed with UNICEF support and 430 more will be installed by April 2000. UNICEF has supported training of DPHE sub-assistant engineers, tubewell mechanics and private masons to improve their understanding of the technology and encourage the promotion of the rainwater harvesting. UNICEF support has included the provision of moulds for the construction of rainwater collection jars.



Rainwater harvesting systems use a tin rooftop, or sometimes a sheet of plastic, to collect rainwater, and store it in large cement tanks. Users let the first few minutes of rain fall without collecting the water, to clean the roof and gutters. Once in the tank, the rainwater can be safely stored indefinitely without becoming contaminated by bacteria. With a large enough tank, a family can store enough water to use for drinking and cooking through the dry season.

Studies in Thailand, India, and Sri Lanka, show that properly stored rainwater is safe from bacteria, and can be stored for many months. Also, research in Bangladesh by the International Centre for Diarrhoeal Disease Research, Bangladesh, (ICDDR,B) confirms that rainwater can be a safe drinking water source. *(See photo showing rainwater harvesting)*

## Arsenic Removal

There are several well-known methods for removing arsenic from water that have been successfully used by other countries with arsenic contamination problems. Most commonly, arsenic is removed in large, urban water quality plants, and distributed through a piped system. Until recently, there had been very little work on low-cost arsenic removal in rural settings like Bangladesh, but now with the UNICEF-supported integrated Action Research Project, alternatives for arsenic removal are being field tested with considerable success.

For instance, there are house-based filters which are currently undergoing tests with UNICEF support. These filters can remove some of the bacteria in the water – but not all. Such water should still be disinfected with chlorine or boiled before drinking. UNICEF is extending support to several such indigenous initiatives to develop alternate options for safe drinking water in Bangladesh.

UNICEF has been supporting the NGOs, Village Education Resource Centre (VERC), and WaterAid to test a house-based filter called the Safi filter in Sitakunda thana, Chittagong. Some 265 Safi filters have been distributed in the four-thana Action Research Project. In addition, more than 200 indigenous household filters have been installed in Bera thana as well. By April 2000 an additional 770 filters will be distributed/installed for field validation.

UNICEF and DPHE are supporting a research project by the Bangladesh University of Engineering and Technology to evaluate activated alumina for arsenic removal. Activated alumina is a sand-like material that strongly binds arsenic. By passing contaminated water through an activated alumina filter, the arsenic is removed. Eventually (after months or years) the filter becomes exhausted, and has to be regenerated in a laboratory, and the resulting arsenic waste disposed of safely. However, even when full of arsenic, activated alumina is not harmful to handle.

There are other methods of arsenic removal, such as adding iron or aluminum salts to water, or passing the water through various kinds of filters, that researchers are currently evaluating in field studies in Bangladesh.

## Health Care Options

### Drinking Safe Water

There is no medicine yet known that can cure arsenic poisoning – the best treatment is to drink arsenic-safe water. Some research shows that a better diet, especially with Vitamin A, Vitamin C, Vitamin E and proteins, can help the body to fight arsenic.

### Treating the Symptoms

Some of the symptoms of arsenic poisoning can be treated. Advanced skin lesions on the hands and feet can be very painful, even making walking impossible. This kind of symptom can be treated with medicated lotions, which soften the skin. UNICEF has procured 21,900 tubes of locally made medicated lotions for health workers to distribute to arsenic-affected patients.

This does not mean that the patient should continue to drink arsenic-contaminated water, even if the skin symptoms get better. All people with suspected arsenic poisoning should visit a health professional to confirm the symptoms and to get advice on how to become healthy again.

### Training

Since the arsenic problem is relatively new to Bangladesh, many health professionals have not been trained to recognize the symptoms. UNICEF is working with the Directorate of Health Services, Government of Bangladesh, and Dhaka Community Hospital to provide training courses to doctors and health professionals to help them identify patients, and provide counselling on how to get better. A National Orientation Programme has been launched and the Directorate of Health Services has already started training workshops for arsenicosis management.

UNICEF is supporting the training of 1,600 medical officers and 5,000 field health workers in 36 districts to identify arsenicosis cases, as well as to counsel and advise families.





## **Arsenicosis Prevalence Survey**

There are many questions about how arsenic affects health. For instance, in some families using the same tubewell, some people might become sick while others appear healthy. This might be due to differences in diet, health, or general resistance. UNICEF is providing support to initiatives that will provide us with answers.

In order to find out more about the prevalence of arsenicosis, a module on skin manifestations of the disease has been added to a UNICEF-supported survey on Iodine Deficiency Disorders. The survey has covered a population of 25,000 and has included water sample testing. Preliminary results will be available in February 2000.

UNICEF is collaborating with Dhaka Community Hospital in the Community-Based Action Research Project sites to develop arsenicosis patient profiles and protocols for patient management and rehabilitation.

## Information and Communication

### National Communication Strategy

The Government of Bangladesh launched in December 1999 a Nationwide Communication Strategy for Arsenic. This is a comprehensive, scientifically researched National Arsenic Mitigation Communication Strategy which is now being implemented.

The overall goals of the National Communication Strategy are to redefine the concept of safe water so that people are able to understand that consuming arsenic contaminated water has serious health and economic implications, and to make people aware about the desirability of switching to safe water supply options.

The multi-media, multi-channel programme strategy was developed with UNICEF support for the Department of Public Health Engineering by a full-service social marketing company. Until recently, awareness of arsenic was very low. A 1998 National Media Survey found that only 14%-of households knew of it.

The Communication Strategy constitutes an integral part of arsenic mitigation activities, and will seek the achievement of specific awareness and behavioural change objectives. With the materials designed for this programme, behavioural change in communities will be promoted by key communicators and their efforts will be reinforced by spots and messages shared through mass and outdoor media.

The UNICEF-supported process started in early 1999 with agreement by a group of agencies including the DPHE, Ministry of Health and Family Welfare, ICDDR,B World Bank/UNDP and WHO, on a set of technical parameters formulated from available scientific knowledge on arsenic, the negative health impact it can have if consumed over a long period of time and in high concentrations, as well as available alternative safe water options. The organizations have also agreed to periodically renew and update these parameters.

Extensive research was conducted in different regions of the country in order to assess people's awareness and their attitudes towards the problem and its solutions. Following that, mass media materials were designed and thoroughly pre-tested. The materials included television and radio spots and interpersonal communication packages for community based communicators including health workers, doctors, DPHE engineers, agricultural extension workers, imams, and high school students





Flash Cards for Health and Welfare workers

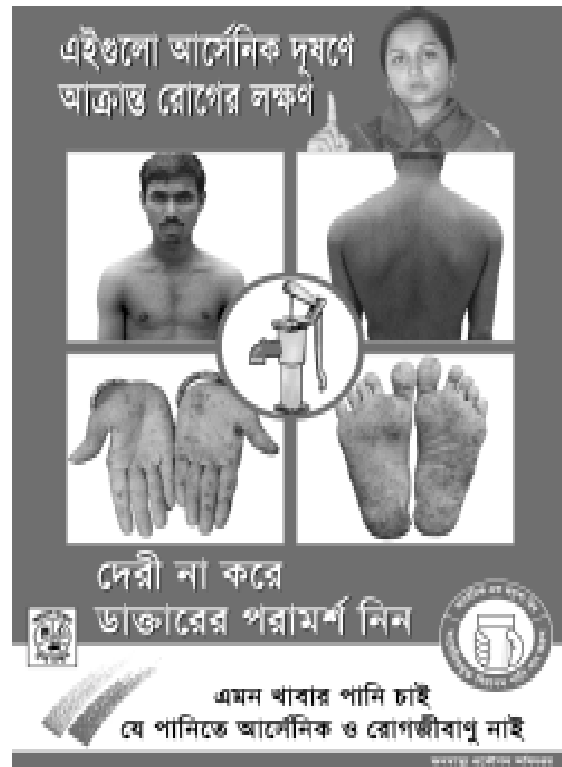
Asiatic Marketing Communications Limited, the social marketing company, has worked on similar campaigns on oral rehydration, sanitation and children's rights, using social marketing techniques well-established in Bangladesh.

The specific communication objectives of the Communication Strategy are to focus on:

- ▶ Awareness Raising
- ▶ Health Care and Management
- ▶ Testing & Alternatives
- ▶ Gender and Social Considerations

The Communication Strategy is being directed at national and sub-national levels.

Working within parameters indicated by the above objectives, four different packages have been developed on the following major areas of communication:



Posters for outdoor display

**1. General Awareness.** This consists of TV and radio commercials, an instructional film for dissemination via a mobile film unit, audio-messages for outdoor mass media such as miking, interpersonal communication literature such as posters for schools, Union Parishad members, pictorial leaflets for front line workers, and displays for hoardings or billboards.

**2. Health Care & Management:** This includes materials focused on specific health care issues that provide information about arsenic contamination, arsenicosis (that it is not contagious; symptoms; medical advice is essential if suspected) and are primarily directed for the sub-national programme domain. The materials in this package include TV and radio commercials, and a range of



*Class 9 routine card for students*



*Billboard for outdoor display*



*Folder for tubewell mechanics and NGO-workers*

literature and training aids such as flash cards, calendars and posters for health workers, assistants and registered medical practitioners.

**3. Testing and Alternative Water Supply Options.** This provides information on the need for testing, alternatives for drinking water, the need to switch to safe sources and the significance of red and green painted tubewells on the average person's water needs. The materials for this package consist of TV and radio spots, posters, hoardings or billboards, and interpersonal communication literature.

**4. Gender and Social Issues.** This is aimed at promoting community sharing of safe water, as well as encouraging men to participate in water collection and management activities with women. The materials in this package consist of TV and radio spots, posters and useful tools such as a prayer timings clock.



#### Facts for Life Messages on Arsenic

UNICEF has developed a new set of specially targeted arsenic-related messages to add to its ongoing and well-accepted Facts for Life or FFL programme. It is continuing to advocate dissemination of the messages through print and electronic media in the country. (See *UNICEF 'Arsenic in Bangladesh, Mass Media Messages'*)

UNICEF's arsenic related FFL messages include basic information about arsenic, explaining what it is, how it affects the human body, the possibility of water being contaminated by arsenic, why testing water supply sources is important, and what families can do if their tubewell water is contaminated with arsenic. The messages also promote awareness about the need for sensitivity to emerging social issues, such as children and women being ostracized when they show signs of being affected by arsenic.

These messages are included in the 1998 edition of Facts for Life, an important handbook for teachers, health and NGO workers. Some 477,500 copies for teachers, health workers, NGO workers and other communicators who work at the grassroots level have been printed and distributed across Bangladesh, with orientation in communication techniques.

## Community-Based Action Research Project

The UNICEF supported Community-Based Action Research Project is the first sub-national arsenic mitigation project of its kind in the country.

UNICEF launched the initiative in mid-March 1999, through the Department of Public Health Engineering (DPHE), in conjunction with three leading non-governmental organizations (NGOs): the Bangladesh Rural Advancement Council (BRAC), Dhaka Community Hospital (DCH) and Grameen Bank.

UNICEF took this initiative because there was an urgent need to scale up national arsenic mitigation activities in a meaningful manner. There was a need for a comprehensive, integrated, community-based plan of action that would mitigate and provide solutions at the sub-national level and also, eventually, serve as a base model for a comprehensive and strategic response to the arsenic challenge in Bangladesh.

### Project Components

Consequently, the project integrates the major components of UNICEF's National Arsenic Mitigation Programme in a complementary manner. These components are:

- ▶ Blanket Testing of all Tubewells in the Project Area
- ▶ Demonstration of Alternative Safe Water Supply Options
- ▶ Information & Communication
- ▶ Health Management Research & Development

### Project Sites

The target area of this project includes some 788 villages in four thanas: Jhikargacha in Jessore District, Sonargoan in Narayanganj District, Kachua in Chandpur District and Bera in Pabna District.

In each thana, UNICEF is working through DPHE and an implementing NGO partner:

- ▶ BRAC in Jhikargacha and Sonargoan
- ▶ Grameen Bank in Kachua
- ▶ Dhaka Community Hospital in Bera



The project sites have been chosen based upon preliminary surveys on the extent of possible tubewell contamination and the probability of arsenicosis prevalence. Consideration was also given to geographical conditions, such that major hydrogeological zones of Bangladesh are represented.

Preliminary results from COMMUNITY-BASED ACTION RESEARCH PROJECT				
Thana	District	Implementing NGO	Population	Arsenic contamination in tubewells: range
Bera	Pabna	Dhaka Community Hospital	237,000	41-60%
Jhikargacha	Jessore	BRAC	267,000	41-60%
Kachua	Chandpur	Grameen Bank	333,000	94-100%
Sonargaon	Narayganj	BRAC	301,000	61-80%

## Objectives & Action

The overall project goal is the development of arsenic mitigation strategies that may be scaled up to cover all the affected regions of Bangladesh. A simultaneous goal is to build the capacity of the three leading national NGOs in arsenic mitigation to help strengthen community management.

The specific project objectives include:

- ▶ Training community members to test the tubewells using field kits, and marking all the tested tubewells (**red** if arsenic detected above 50 ppb, otherwise **green** if safe for drinking).
- ▶ Identifying arsenic-affected patients in the project area. Village health workers/community volunteers are doing the initial screening of the arsenic-affected patients and trained physicians are doing the final diagnosis. The physicians are also providing symptomatic treatment and medical counseling.
- ▶ Raising awareness in the community. Among other things, village health workers are informing the community about the harmful effects of arsenic, the relationship between arsenic contaminated water and manifestation of

diseases and how arsenic contaminated water may be used for washing but not for drinking or cooking purposes. They are also providing patients who have symptoms of arsenic poisoning with nutritional advice including recommendations to have a protein-rich diet augmented with leafy vegetables containing vitamin A and C.

- ▶ Identifying arsenic contamination hotspots based on the extent of contamination and prevalence of patients.
- ▶ Strengthening the capacity of communities to select and install demonstration units of different safe water options in the project area and manage the repair and maintenance schedule.
- ▶ Monitoring operation, maintenance and water quality parameters of the alternative drinking water systems and continued promotion of safe water use in the community.



The alternate safe water sources which are being promoted are :

1. Pond Sand Filters: Reserve ponds with slow sand filtration
2. Rain Water Harvesters: Harvesting and safe storage of rain water from roofs
3. Home and community-based arsenic treatment systems to produce arsenic-safe water from arsenic-contaminated well water.
4. Treatment units for treatment of surface water to be fit for human consumption.

## Achievements

(as of November 1999)

### Testing:

Nearly 68,000 tubewells have been tested using the MERCK field test kits.

### Alternative Safe Drinking Water Options:

The following alternative safe water options have been built, installed and introduced:

- ▶ 67 rainwater harvesters
- ▶ 10 pond sand filters
- ▶ 39 dug wells; 7 ring wells
- ▶ 265 Safi filters
- ▶ 226 indigenous household filters



### Health Management:

- ▶ Training of 92 health workers has been completed
- ▶ Nearly 400 persons have been identified and referred to appropriate medical facilities for treatment
- ▶ Successful collaboration with Dhaka Community Hospital to develop arsenicosis patient profiles and protocols for patient management and rehabilitation.

### Programme Communication:

- ▶ Materials developed for health workers, doctors, agricultural extension workers, tubewell mechanics and high school students, as well as Union Parishad members and imams
- ▶ Development, pretesting, review of TV and radio spots for national broadcasting, as well as outdoor media materials such as posters, billboards, leaflets, audiocassettes
- ▶ Checked by government committees, piloted in the sub-national domain for final approval
- ◀ National Communication Strategy launched in December 1999

## Lessons Learned

A significant aim of the Community-Based Action Research Project is to provide a base model for arsenic mitigation strategies and action in the country and so far, several valuable insights have been gained. These include:

**1. Community Capacity:** Village women, if trained properly, are capable of testing tubewell water for arsenic with field kits; the same applies to health workers and community volunteers. A validation exercise by BRAC on training provided to village workers in BRAC, DCH and Grameen Bank villages, has substantiated this claim, thus opening the way for more community-based mitigation activities in the future. The involvement of village women in particular enhances community participation and creates a sense of community ownership. Mass testing of tubewells in a campaign mode creates enormous local energy and awareness of the arsenic problem.

**2. Awareness Levels:** It is clear that awareness levels vary from village to village and hence the changes in behaviour of switching from red tubewells to other sources by people also varies. Villages with arsenicosis have the highest consciousness.

**3. Blanket Testing:** In order to understand the extent of contamination, all wells will have to be tested. This is because there seems to be no pattern in the

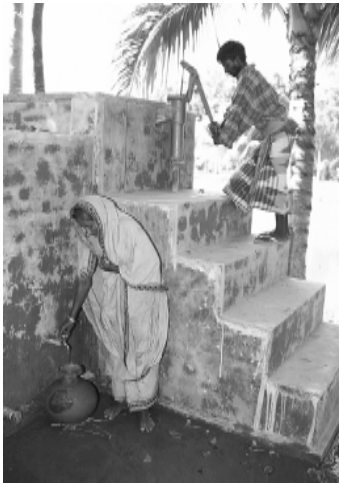
occurrence of arsenic in the ground water. Even in an area as small as a village, no pattern has emerged. Variations are often very high. For instance, the average percentage of contaminated wells in Jhikargacha thana varies from 37% in Jhikargacha union to 87% in Bankra union. And even within Jhikargacha union, Srirampur village shows a 17% level of contamination, as opposed to Sagarpur village where the level is 99%.

**4. No Pattern:-**Not all villages are affected equally and hence there is the need for prioritisation in intervention. There appears to be no correlation between patients with arsenicosis and per cent of tubewells contaminated with arsenic above 50 ppb, as the table below illustrates:

Thana	Contaminated tubewells	Number of identified Patients	Surveyed Population ('000)	Patients per 10,000 people
Bera	55%	86	197	4.3
Jhikargacha	59%	96	267	3.6
Kachua	97%	01	83	0.1
Sonargaon	62%	213	301	7.1
Total	61%	396	848	4.7

As indicated above, the number of arsenicosis patients does not occur in areas where the tubewell contamination is most widespread. For example, the largest number of patients in Jhikargacha, 86 out of a total of 96 patients in the thana, are concentrated in three villages in Gadkhali union where 63% tubewells are contaminated. The most contaminated union, Bankra, with 84% tubewells contaminated, has only three patients, all in the same family. Shankarpur union, with 84% tubewells contaminated, does not have any patient. Jhikargacha union with 37% contaminated tubewells has four patients in two villages. Srirampur village with 17% contaminated tubewells has two patients in two families, and Gulbaghpur village with 19% contaminated tubewells has one patient. From these findings, it seems likely that factors other than per cent of contaminated groundwater must be contributing to the occurrence of arsenicosis. Dhaka Community Hospital is compiling a detailed medical profile of patients to find out more about the factors that cause arsenicosis.

**5. Local Situation:** Both ground and surface water may need to be used as 'safe water' depending on the local situation. For example, not every village has a pond available for a pond sand filter. Where surface water is available, it may be a preferred source, but people's trust on using this has to be built.



**6. Alternative Options:** It is too early to conclude on the effectiveness of alternative options. Each method has its own advantages and disadvantages. The methods that need to be promoted are those that provide water that is free of pathogens, arsenic and other chemical pollutants on a sustained basis and which are environment friendly, and are acceptable and affordable to the people.

**7. Attitude Change:** An important insight gained by the Community-Based Action Research Project is that for alternative water supply options to be adopted and sustained, people's attitudes must undergo a fairly significant change. All three implementing NGOs are actively involved in community interaction to discuss ways and means for alternative water supply options to be installed. They have found that the perception that tubewells are a safe source of drinking water is deep-seated. Even when tubewells are shown to contain unacceptable levels of arsenic, people continue to drink from them. This is partly because tubewells are usually located close to the villagers dwellings and there is a reluctance to fetch water from a 'distant' source, but it is also because the urgency to switch to a safe source is not readily felt.

**8. Behavioural Change & Communication:** An overwhelming conclusion has been that it is essential to raise awareness levels, to help develop an appropriate attitude for people to be able to take appropriate steps to seek out and maintain safe water supply sources. The recently launched (December, 1999) National Arsenic Mitigation Communication Strategy is vital to achieve these changes.

**9. Community Participation:** In order to be successful in arsenic mitigation activities, especially the development of alternative water supply sources, communities must work together. The NGOs report that there is an overall reluctance to reserve ponds exclusively for drinking. The practice of using ponds for fish culture, bathing or washing is not going to be changed easily. In the case of rainwater harvesting, people are not easily convinced that they can store water safely and use it exclusively for drinking. In these and other mitigation activities, it is vital to involve all quarters of society and ensure that all initiatives are mutually reinforced by them.

**10. Epidemiology:** We need to know much more about the epidemiology of arsenicosis and the effects of different safe water options and the treatment regimes on incidence and severity of the disease. Patients who have been continuously drinking arsenic-free water over several months have reported an improvement in their overall condition.

## Scaling up

The project has already been scaled up once, from 500 to the present 788 villages and is going to be further scaled up in the year 2000. UNICEF is committed to expanding its support from four to 50 thanas, from 788 villages to 10,000 villages. The scaled-up activities under community-based arsenic mitigation will contain the major elements, namely, blanket testing of tubewells, identification of arsenicosis patients and their immediate relief measures, communication and information campaigns, and community capacity building for decision making and management of safe water options.

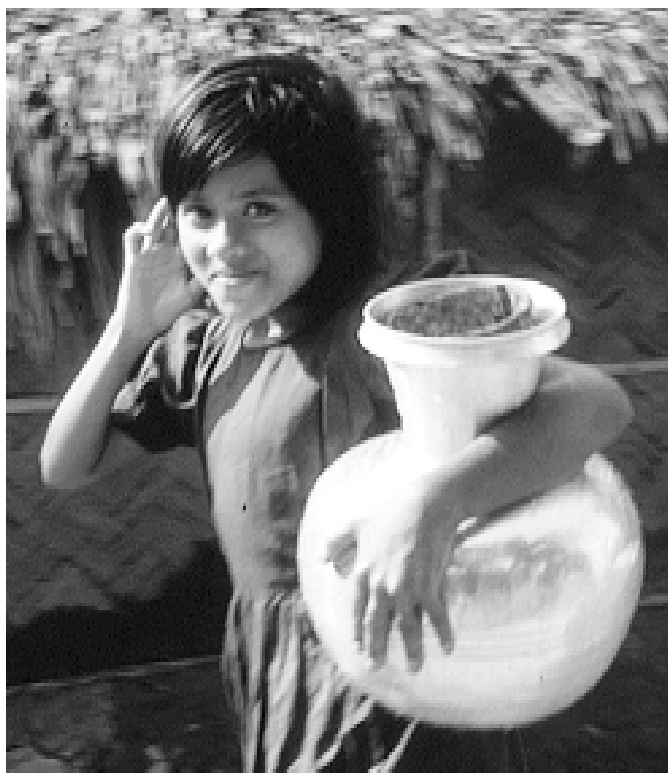
This project also complements a programme, launched in October 1999, under the Bangladesh Arsenic Mitigation – Water Supply Project (BAMWSP) supported by the World Bank and the Swiss Agency for Development and Cooperation, that is expected to screen tubewells in all 460 thanas of the country.

# G l o s s a r y

## Glossary of Terms and References

BGS/MML/1998	Ground Water Studies for Arsenic Contamination in Bangladesh, British Geological Survey, Mott-MacDonald Ltd. (UK), 1998
BUET	Bangladesh University of Engineering and Technology, Dhaka, Bangladesh
district	largest sub-national administrative unit; Bangladesh is divided into 64 districts
DPHE	Department of Public Health Engineering, Government of Bangladesh
East Pakistan	former name of Bangladesh
FFL	Facts For Life, a communication resource providing knowledge and skills to improve the health and well-being of children and women
GOB	Government of Bangladesh
ICDDR,B	International Centre for Diarrhoeal Disease Research, Bangladesh
kua	dugwell
phitkiri	alum
thana	administrative unit of some 250,000 people
union	lowest tier of administration, with some 25,000 people
Union Parishad	local government body for union
imam	religious leader in Muslim communities

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**For further information, please contact:**

June Kunugi  
Communication Officer  
UNICEF Bangladesh  
BSL Complex, 1 Minto Road  
Dhaka  
Bangladesh

Tel: (880-2) 933-6701 to 17  
Fax: (880-2) 933-5641  
e-mail: [dhaka@unicef.org](mailto:dhaka@unicef.org)

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