Alternative Sources of Drinking Water

during an initial run.

However, they noted that

removal efficiency may deteri-

orate with use and recharging of

filter media will be necessary

after prolonged use. NIPSOM

adopting the concept of co-pre-

cipitation developed a packet

for household use with a mix-

ture of alum and charcoal. Fol-

lowing appropriate laboratory

testing of its effectiveness this

packet may be distributed

among the households with ap-

propriate demonstration and

training for use. In areas where

most of the tubewells have been

found to be contaminated with

arsenic, removal of arsenic by

chemical method need to be in-

troduced at family level as a

free Aquifer: As arsenic-free

ground water is still the best

option, efforts should be made

to find such aquifers at deeper

depths and install tubewells ac-

cordingly as an interim mea-

sure. Exploratory drilling pro-

gram should be started system-

atically followed by tubewell

fected areas. This intervention

is considered interim because.

in course of time these tube-

wells may become contami-

ter: Although surface water is

abundantly available during

and some post-monsoon

months, its volume depletes

fast afterwards and become

scarce in the dry season. Ponds

which are usually used by the

rural people for other domestic

water needs also dry up in many

parts of the country. Thus, wa-

ter supply based on ponds ap-

plying pond sand filter tech-

nology will not be feasible in

such condition unless the ponds

are made deeper with proper

stalled after fulfilling the nec-

essary conditions, pond sand

filters have the potential for

long term solution of the drink-

ing water problem. However,

the questions of community

participation, funding and sub-

sidy, roles of the government

surface water is to establish wa-

terworks at appropriate places

for impounding, treatment,

storage and distribution of wa-

ter to the community. Both the

government and the commu-

The other option to harness

and the NGOs still remain.

However, if properly in-

bank protection.

Rainwater Reservoir: Lean Days' Server

by Aminul Islam

THE PERSON SECTION AS

and the control of th

Azibur Rahman's Rain water Harvesting Plant

Exploitation of Surface Wa-

nated with arsenic.

installation program in the af-

Identification of Arsenic-

short term measure.

by Abu Shahjalal Azad and Dr A B M Badruzzaman

TN view of the fact that ground water is safe for drinking Land its harnessing is cheaper and sustainable, public as well as private water supplies are heavily dependent on this source. Unfortunately, when most of the people have developed the habit of drinking tube well water (ground water) being aware of its importance to avoid attack of diarrhoeal diseases, arsenic has been found in unacceptable concentrations in tubewell water in many parts of

Bangladesh. Hundreds of tubewells in rural Bangladesh have been identified with high arsenic concentration and many more are feared to have been contaminated with the same. Many people are suffering from arsenocos's and many more are at risk. To date, 1477 cases of Arsenicosis have been identified by NIPSOM (Khan, 1997). The only way to save their lives is to provide them with arsenic-free palatable water. Although many assumptions are being putforth the exact cause of high arsenic in ground water is not yet known. Extensive research has not yet been conducted in this regard to accentuate the

knowledge base. However, geological formation is presumed to be the primary reason for arsenic. The basis for such belief lies with the studies conducted in West Bengal, India having similar alluvial deposits (Nath and Majumder, 1997).

The Challenges

The main challenge is how to provide the millions of people at risk with arsenic-free, bacteriologically as well as chemically safe, and aesthetically acceptable alternative source of drinking water. The factors facing this chal-

lenge are: Identification of arsenicfree tubewells in the known af-

fected areas. Treatment of arsenic contaminated water where no other safe source exists.

 Identification of arsenicfree aquifers. Extent of the potential alternative sources, namely, surface water and rain water.

- Habit, culture and custom of the people. Economic condition of the people, and their willingness and ability to pay for the ser-

 Community motivation to face the challenge collectively. - Technologies.

— Cost. Monitoring.

- Research and Develop-Institutional support.

Strategic Responses

Identification of arsenicfree tubewells: It has been observed that tubewells, public and private, exist in several numbers in any cluster or community. It has also been found that generally not all

tubewells in an area are affected

by arsenic. Therefore, the im-

TATER is the most com-

per cent of the planet's surface.

Ancient people, who clearly

sensed the importance of water.

made it a central feature of

great many mythologies and

cosmogonies including that of

olutionary development of sci-

ence and technology, water is

given the highest importance.

Water is the source of life and

no living being in the universe

can do even a moment without

ter in the world is fixed and has

a volume of some 326,000,000

cubic metres, or

1,100,000,000,000 acre feet. Of

the total amount, it is estimated

that 97.2 per cent occurs in

oceans and inland seas, 2.2 per

cent in ice caps and glaciers and

0.6 per cent is liquid groundwa-

ter. Most of the liquid fresh wa-

ter occurs as groundwater, as

Distribution of Liquid Fresh

2,000,000

Water sources may be classi-

fied as either surface water or

ground water. Both groundwa-

ter and surface water sources

are used for community water

supplies. There is a strong ten-

dency in large municipalities

for surface water sources but

groundwater provides itself

more readily in smaller com-

munity water-supply develop-

there are places where the sup-

ply of groundwater is not ade-

quate, or somehow the ground

water available is contami-

nated. In the coastal areas of

Bangladesh people cannot take

ground or surface water due to

high rate of salinity. Iron con-

tent is another enemy against

which coastal people are to

of the coastal districts of the country life Khulna, Satkhira

were looking for alternative ar-

rangement to meet their de-

mands of pure drinking water.

Though in a small-scale, the

people of these areas could, at

last devise some technology in a

bid to improve the existing wa-

ter-supply system. Of course,

they could not do it alone. NGO

Forum for Drinking Water Sup-

ply and Sanitation, in associa-

tion with some other local

small NGOs extended their

helping hands to these enter-

and financial assistance.

People of the remote villages

fight constantly.

But then the problem is,

30,000

16,000

Cubic metre Percentage

97.74

1.47

shown in the table:

River and stream water 300

But the total amount of wa-

Even today, in the age of rev-

genesis.

water.

Water

Location

Groundwater

Surface water

Lake water

mon substance on earth,

V covering more than 70

The main challenge is how to provide the millions of people at risk with arsenic-free, bacteriologically as well as chemically safe, and aesthetically acceptable alternative source of drinking water.

mediate challenge is to find out the unaffected ones in the affected areas and commence routine monitoring in order to stop using the currently affected

tubewells as soon as arsenic is

A number of different organizations are conducting testing of tubewell water for arsenic. BUET, DPHE, NIPSOM, etc., are routinely conducting such tests to identify arsenic polluted tubewells at a large scale. DPHE analyzed water samples from 2,385 hand tubewells spread over Bangladesh of which 22 per cent were found to have exceeded the acceptable limit of 0.05 mg/L set in the EQS (Quadiruzzaman, 1997), NIPSOM also conducted similar tests of 2,434 using field kits and found 545 tubewells exceeding the 0.05 mg/L limit (Khan, 1997). However, these studies are primarily concentrated in the areas of the alluvial deposits around the south and south-western parts of

A comprehensive arsenic testing campaign was conducted by BUET in cooperation with the Ministry of Agriculture under the North-East Minor Irrigation Project (NEMIP) where 1,210 water samples from the six districts in the north-eastern zone of Bangladesh were tested. These districts include Sylhet, Netrokona, Kishoregonj, Hobigonj, Sunamgonj, and Moulavibazar. Contrary to the common belief, it was found in that study that about 33 per cent of the wells in those six districts contain arsenic well over the acceptable Bangladesh standard of 0.05 mg/L (Badruzzaman et al. 1997).

Bangladesh.

Although a number of identification studies are currently being conducted at various parts of Bangladesh by different organizations, these are only short-term measures which can be accomplished quickly at relatively low cost. But the questions regarding identifying responsible institutions/organisations, resources, community involvement re-

Treatment of Arsenic Contaminated Water: The conventional coagulation and filtration methods seem to be more appropriate in this regard. Nath and Majumder (1997) were successful in achieving about 90 per cent removal of arsenic by co-precipitation with Ferric Chloride and 97 per cent removal with alum. However, pH control was necessary in the later case and was achieved by using lime. Effectiveness of removal of Arsenic was found to be dependent on the amount of arsenic remaining in water. Ali and Hossain (1997) at BUET nity will have to play vital roles in planning, implementation, studied the approach of co-preoperation and maintenance. cipitation of arsenic with Iron

with similar result. Hossain Initial investment cost may seem exorbitant but may prove and Badruzzaman (1997) studfeasible in the long run. Since ied the effectiveness of the no experience for such intermethodology of adsorption on granulated media laden with vention in rural Bangladesh exists some pilot projects may be iron precipitates in arsenic removal. About 95 per cent recarried out to gather essential moval of arsenic was achieved experience.

Rain Water Harvesting: Rain water harvesting at family level would be very economical if it rained round the year. For example, the total water use of Bermuda is being met by harvesting rainwater every year. With a small jar the family could manage its drinking water through out the year by filling the jar as frequently as needed. But as the dry spell during dry season is long, a family will need a relatively large jar/tank to store water for that period. At least a 2000-liter jar will be needed by each family. which will cost about Tk 4000. This is beyond the capacity of majority of the families. But with subsidy or long term credit people may be encouraged to establish their rain water based water supply as a long term so-

Other factors associated with this intervention include limited practical knowledge except for those living in the coastal areas thus, requiring extensive promotional work; intensive educational program; training on collection and monitoring methods, storage and use. A comprehensive training programme needs to be undertaken to create the work force comprising masons and technicians.

Technologies: Technologies such as treatment, storage and distribution for exploitation of surface water, pond sand filter for harnessing pond water, tube wells for abstraction of ground water, and ferrocement jar/tank for rain water harvesting are already in use in Bangladesh. Refinement of some technologies and training of more artisans in private sectors is needed to build local ca-

Field kits to test arsenic in water have been developed in many countries. Some kits including the one improvised by NIPSOM, are in use here. It should be noted that, policy decisions made based on data acquired through field kits may not be appropriate. Because, the type and quality of the reagents (e.g., Zinc) govern the results of a large extent. The arsenic test results may vary depending on the physical form of Zinc, such as powder, granulated, foil, etc. Also the grade of Zinc used may affect the test result. Usually,

Reagent Grade (Analar Grade) chemicals are recommended for critical analysis. Thus, field kits may be used to get an idea on the range of arsenic present rather than the exact concen-

tration in the water. Cost: Cost is one of the most important factors in adopting alternative water sources. Main heads of cost are manpower. software, hardware, equipment, logistics, monitoring, and research and development. Critical choices of intervention have to be made to derive most urgently needed solution based on resources available.

Monitoring: Designing, implementation and monitoring of well to ensure sustainable and quality services is needed for each intervention. Monitoring roles should be shared among the community and the institutions based on comparative strength and strategic advantages. Support in terms of training, equipment and logistics, as necessary will be needed.

Research and Development: Many assumptions with some supportive arguments are being made about the cause of arsenic in ground water, but no research has been carried out yet to confirm them. Unless the causes have been correctly diagnosed permanent solution will remain a far cry.

Institutional Support: Many organizations are endeavouring to intervene with their respective strengths but with limited capacity and resources. Useful knowledge and experience have been gained through these activities. Effective coordination and strengthening of all these agencies for sharing the responsibilities according to their respective comparative strengths have become a neces-

The authors are Project Officer (Rtd), UNICEF, Bangladesh; and Associate Professor, Environmental Engineering Division, Dept. of Civil Engineering, BUET, Dhaka, respectively.

Water: Going with the Flow

Someshwar Singh writes from Gland, Switzerland

As Sweden prepares to present its eighth Stockholm Water Prize, the new interest of big business in global water supply offers an opportunity for investment in the earth's most precious resource. But conservation and management must be top of the agenda.

LREADY famous for its Nobel Prizes, Sweden has A had the vision to institute yet another award — this one for conservation. The Stockholm Water Prize, which honours a significant contribution to the conservation of the world's water resources, goes this year to Professor Gedeon Dagan of Israel, a

groundwater specialist. "Protecting groundwater resources and avoiding further pollution is very important for Israel and the Middle East region," says Professor Dagan. "Because of the desert climate and scarcity of water, we must develop new techniques rather than use our resources to the maximum."

Well known for excellence in water-conservation techniques, Israel also treats 70 per cent of its sewage water for re-use. But on a wider scale, groundwater is the most important freshwater resource on earth, equalling more than double the total volumes of rivers and lakes. Because of its purity, natural groundwater is considered to be the best water for human consumption. The percentage of groundwater used for drinking water supply is 65 per cent in France, 72 per cent in Germany, 84 per cent in Switzerland, and more than 90 per cent in Aus-

This importance is recognized by the award, presented by its patron, King Carl Gustaf of Sweden, during the eighth Stockholm Water Symposium from 10 to 30 August. The theme of this year's event - which attracts about 700 participants each year — was 'Water: the Key to Socioeconomic Development

and Quality of Life." Central to the theme are issues such as water scarcity. groundwater management and

water harvesting. "Sweden is certainly playing a pioneering role in spreading awareness of the need for change and promoting respect for water," says Dr Biksham Guija. Head of the Freshwater Programme at WWF International. "We need to adopt a holistic, catchment approach to water management, to encourage research into traditional smallscale water-use techniques, and to stop leakages and waste in water distribution while promoting re-use of waste water."

Such an approach could stop "water wars" between nations, when even in the hotbed of Middle East politics, Jordan and Israel have set a good example of cooperation in water sharing. With intervention by the International Court of Justice. Hungary and Slovakia are finalising an amicable settlement over the Gabcikovo dam on the Danube river and only last year. Bangladesh and India concluded an agreement on sharing the flow of the Ganges.

Indeed, conservation efforts are a more potent weapon than guns in settling international water disputes. Experts estimate that many countries can reduce water use by about 50 per cent through implementing well-known water conservation and affordable production methods. One example is irrigation, the principal user and loser of water, where consumption can be reduced by almost half if modern methods, equipment, and management systems are applied.

The Stockholm Symposium

took place this year against the background of a significant new development in the water business. American multinational Enron was adding to its gas and electricity interests by buying Britain's Wessex Water company as a first step towards building a global water business. This was expected to lead to further consolidation among utility companies, with Enron valuing water as a \$300 billiona-year market, forecast to reach \$400 billion by early in the next

"This could become as large as our natural-gas or electricity business in just a few years. Enron chairman and chief executive Kenneth Lay said at a recent conference. Enron executives said they want to pursue water infrastructure projects in Europe and Latin America, and to a lesser extent in Asia. They will also look at the North American water market, which is more fragmented. WWF — World Wide Fund For

Nature — believes the entry of big business into the water sector should be guided by the broader ecological and environmental concerns that ensure a sustainable supply of freshwater. Improving the quality of life through the provision of clean and safe drinking water is one aspect, but there must also be respect for the water needs of natural ecosystems, such as wetlands, which actually sustain precious water flows. Bit business has the means

to invest in technical innovations that promote water conservation. What it must demonstrate is the will to do so.

- WWF Feature

Employers Count the Cost of Equal Pay Victory

A landmark ruling in Canada has decided in favour of equal pay for women workers in government. The cost of backdating the award will be huge, reports Gemini News Service, and other employers are now reassessing their policies. Sharon Gerein

writes from Regina, Canada

T was a hard-fought victory - 14 years of legal proceedings, including a sixyear struggle at Canada's Human Rights Commission.

But battle over pay equity has finally been won by about 200,000 Canadian civil servants, most of whom are female.

The campaign was waged by the Public Service Alliance of Canada, which complained that women workers in six job categories, ranging from librarians to clerks, were grossly underpaid compared with male counterparts doing similar work.

In late, July, after six years consideration of the case, the human rights tribunal decided that the complaint was legiti-

It determined that the federal government has to give back-pay and interest to nearly 200,000 people. The landmark ruling has

left the federal government reeling because the cost of arrears is estimated at between Cn\$1.5 billion and Cn\$8 bil-

The government has until the end of August to decide whether or not to appeal.

But for civil servants such as Christine Collins, the battle is

Until four years ago, Collins worked in what the tribunal called the job ghetto. She spent about 13 of her 17 years working in junior clerical positions as a word-processing operator. a secretary and a clerk until she became a supervisor for Trans-

port Canada in Ottawa. Collins estimates she is owed about Cn\$15,000, plus up to Cn\$5,000 in interest.

For Collins, a single parent, the money is welcomed but is not what the fight was about. "It's about respect," she says.

"The ruling has been a huge moral booster. Pay-equity in the work place finally gives us some respect. Finally, someone is saying that what we do is valuable.

Collins says that it has not been an easy time. She recalls how, in opposition, Prime Minister Jean Chretien's Liberal Party fought for pay equity, but once elected, carried on the previous government's light against. "Even how we were treated

during the tribunal smacked of disrespect. The federal Treasury Board appealed everything they could during the hearing They've spent millions fighting this at every step. "Now that the ruling has

come down in our favour, the politicians are talking about how much this is going to cost the taxpayer," she adds. "But how much has the 14

years of legal proceedings cost the taxpayer? And if the federal government had implemented pay equity 14 years ago, they would not have to pay out billions of dollars today.

Collins believes the government will not appeal: "This was their tribunal. The government chose the judges, they hired the lawyers. They chose the staff to work throughout the hearings," she says. "How will it look now if the government appeals? They have set this tribunal in motion, and as government it is their duty to oversee that other employers abide by human rights legislation, including

pay equity legislation." If there is no appeal, the ruling could help to speed up pay equity across Canada. Three provinces

Saskatchewan, Alberta and New Brunswick — do not have equal pay laws. The private sector is not covered by pay equity laws in most provinces, but there is a move afoot to speed up implementation in federallyregulated industries. That means companies such as telecommunications giant Bell Canada, Air Canada and the Canadian Broadcasting Corpo-

SEA SLAVE HAS

ISDIC - WHAT YOU

'SONAR

AMERICANS CALL

A woman's place WORLD CANADA 13% Administrators 42% 14% and managers Professional and 39% 56% technical workers Share of earned 30% income 99% 70% Adult Interacy Educational 57% 100% enrolment 65.4 years Life expectancy 81.7 years

ration, which have until now resisted pay equity complaints by employees, could be forced to pay up or face penalties.

Legislators across Canada are waiting for the federal government's response. After the new ruling, there is growing awareness that, in the long run, stalling may cost governments a lot more.

The writer is a journalist with the Canadian Broadcasting Corporation.

China Tightens Adoption Standards

safety and protect the interests is readying to slacken restrictions on domestic adoptions. since a larger number of Chi-Minister Doje Ceding stated

HINA is contemplating Zhu Rongji has already affixed more rigorous standards his seal of approval to the

to ensure the "maximum revisions." of adoptees." Simultaneously it sions, foreigners wanting to nese families now have the to the Chinese government a means to support more chil- clean health record and a life dren. The Chinese Civil Affairs free of crime. The purpose of this on the floor of the Parlia- adoptions is to provide a ment while explaining the re- greater number of orphans acvisions made to the 1992 cess to the warmth of a family. Adoption Law recently. Premier

According to the draft revi-

adopt Chinese children will have to get the approval of their own government before proving relaxing curbs on domestic WFS/News Network

By Hanna-Barbera

TOM & JERRY

James Bond

BY IAN FLEMING

STILL

PINGING.

THE PORT

BOW!

DRAWING BY HORAK











eas to ensure round-the-year pure drinking water supply facilities. But applying this system, people can easily store rain water for using as pure drinking water. The system has proved feasible both economically and technically in the

The NGOF started the project in early 1997 in remote villages of Satkhira and Khulna districts and so far it has installed some 34 Rainwater Harvesting Plants there. Most of the plants were installed at two thanas of Satkhira district. "It's so easy a technique, but the system was unknown to us until 1997," said one Azibur Rahman.

Azibur Rahman, a mason by profession, installed a plant in the yard of his house in 1997. Srikalaskhathi, the name of his village, is an underdeveloped area in any sense. One of the main problems of the day to day life of the poverty-stricken people is acute shortage of pure drinking water, Azibur described.

prising struggling people and provided them with technical Diarrhoea was a common phenomenon in the village. But Rainwater Harvesting Systhe situation began to change tem is one of the devices NGOF gradually from 1997, Azibur had developed in the coastal arsaid with confidence. It took

some Tk 7000 for the completion of the total plant which he shares with another family. As Azibur himself is a mason, he did not have to pay for the construction of the plant. Sushilon, a local NGO, provided money for the installation of the plant.

We are about 15 people in two families." Azibur said, adding, "the tank serves us the whole rainy season, and the water that we store in the rainy season can serve us the whole dry season (five months) — by supplying pure drinking water."

"The water stored in the tank is pure sweet water. A superstitious believe has developed in the locality that the water of my tank cures stomach ache. Any person who feels stomach ache just rushes to my home and takes some water from the tank," Azibur said. "It works like parapani (blessed water). Though it is sometime problematic, I fell happy when people come to my house for taking water from my tank which they believe cures their ailment," he

As the days pass on, the system is gaining popularity in the coastal areas of Khulna and

construct and operate a plant. Using rain water as the sources of pure drinking water supply is not new at all. It had

Satkhira. People with mini-

mum technical know-how can

been there in Egypt where rain water was first stored for using as drinking water. The technology of using rainwater as the source of pure drinking water was later transferred to the whole of African continent. As evidence supports, the use of rain water at individual and community level began some 2000 years ago. In Asia, the technology has been in operation in Thailand and some other parts for long. In Thailand, 60 per cent of the total rural water supply is operated by this technology. The largest water tank with a capacity of 80,000 litre is located at Istanbul, Turkey. It was installed during the regime of Caesar Jus-

tinia (AD 527-556) eas of Bangladesh also began using rainwater long ago. But the way they store water is not hygienic at all. Very often the rural people area seen rearing fish in the catchment, the arti-

the full dry season (five months), a 2000 litre tank can serve 6-7 persons for the same period

Pond Sand Filter (PSF) is

People of the areas feel that

more Rain Water Harvesting Plants and PSFs should be installed in their localities to ensure year round supply of pure

The people in the coastal ar-

ficial reservoir, making themselves vulnerable to be attacked by various water-borne dis-It has been estimated that a tank of 3200 litre capacity can serve a 12-member family for

another alternative measure to get pure drinking water in coastal districts of the country. People of the coastal areas, who live in acute shortage of pure drinking water, apparently got astounded seeing this simple but totally new technology.

In this system pond water is made usable for drinking by getting it filtered through a simple and easy technology. It is not a technology in the pure sense of the term, said the director of Nakshikantha, a local NGO which works in association with NGOF at Shamnagar in Satkhira. Nakshikantha launched a

PSF project in remote village of the thana in 1996. The system created much enthusiasm in the area. The people of this area used to drink pond water without getting it filtered. Diarrhoea was a common phenomenon. But with the installation of some PSF, the scenario began to change, says a beneficiary of the project. People from farflung areas now come to collect water from the plant.

drinking water.