The largest identified man-made environmental catastrophe

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http://arsenic.ws
http://phys4.harvard.edu/~wilson/arsenic_project_introduction.html
World Bank, UNICEF and British Geological Survey noted cholera epidemics from drinking contaminated surface waters.

They urged simple tubewells to tap groundwater. 10,000,000 were dug before arsenic was measured systematically. A Man made environmental catastrophe. Also Arsenic in tube wells in South East Asia,
30,000,000 exposed in Bangladesh

above (old) US EPA standard of 50 ppb

Before it is over, 300,000 to 1,000,000 will be seriously affected

A catastrophe that makes Chernobyl look small!

others in:

West Bengal
Nepal
Thailand
Vietnam
Pakistan

How does the world help?
Arsenic is a common element all over the world.

Why is it made available in the water? That varies. Why did one not look?

10,000,000 tube wells dug before anyone seriously looked for arsenic.
Who is to blame?

World Bank
UNICEF
British Geological Survey

The whole world toxicological community

Including me
Arsenic known to be acutely poisonous for 3 millenia
Not realized to be dangerous at chronic (low repeated) doses
Dr F owler of Edinurgh recommended it for stomach upsets 1788

BUT
Hutchinson 1888 overdoses of Fowler’s solution
1895 arsenic in vineyards
1903 manchester beer epidemic
1920 Air pollution from smelters
1920s angiosarcoma in farmers

IGNORED

Rats and mice did not get cancer!

1998 International conference by Dhaka Community Hospital and SOES Kolkata

10 million wells dug before systematic measurements
In 1998 we demanded three simultaneous actions.

1. Understanding the causes of the catastrophe;
   a. why was arsenic present;
   b. why was it in drinking water?
   and
   c. why did no one recognize what was happening in time to avert the catastrophe?

2. What is the effect on humans of drinking the water?

3. How can one rapidly bring pure water to the population?
   and crucially important.

4. How can the world avoid such catastrophes in the future from arsenic or some presently unknown cause?
2007 - NINE years later..
(if in OECD it would have been solved)
(1) In Bangladesh a reducing environment reduces iron oxide and liberates arsenic. No recipe yet for avoiding the problem.

(2) Studies, mostly outside Bangladesh, show many problems of arsenic and confirm there is no cure
1998 (2nd DCH conference) urged immediate action:

(1) Measure every well
   Green for OK
   Red for don’t use
   Encourage well switching

(2) Purify Water at House level
    with simple equipment

(3) Encourage deep wells
    (below clay layer)

(4) Encourage solutions that lead to the long term
Labeling wells was successful

Only 30% of people switched wells but ~10 million people helped!

67% switched when a massive education campaign (Columbia-U.Dhaka)

Some wells badly labeled
Perhaps status of wells changed

MY CONCLUSION
BETTER EDUCATION CAMPAIGN NEEDED on switching
MONEY is not the problem

MONEY in the right place is a problem

World Bank, Kuwait Fund give money ONLY through governments (WHEN ASKED) and Government of Bangladesh is hesitant
1998 The Bangladesh Arsenic Mitigation Water Supply Project (BAMWSP)
1998 World Bank $50 million (1%) loan
2001 BAMWSP had disbursed only US$2 million
2000 Kuwait fund Director told GoB (through me) to apply for similar loan from the KUWAIT
No application made
TUBE WELLS

Free from arsenic, but

GoB worried about contamination

Islam and Uddin 2002:

I Arsenic safe aquifers must be protected from future contamination at any cost.

II - Research should be undertaken before any decision is taken to withdraw large amount of water from the presently arsenic safe Late Pleistocene-early Holocene aquifer.

III Till definite data are available about the recharge of these aquifers they should not be allowed for exploitation.

In arsenic affected areas, no new tube wells be installed even in the presently arsenic safe aquifer to protect the presently safe water resources. Tube wells should be considered as the last option.

In case no other alternative water supply options .... in very limited areas deep tube wells may be considered.
Deep wells have worked in Dhaka for a long time!
Badly installed wells could bring water down from upper aquifer.

BUT 98% likely to work at least 20 years
Maybe for ever.
Department of Public Health Engineering (DPHE) installed deep tube wells.

2005: 80,000 deep tube wells for 1,500,000 people. One must applaud this success and regret that it is only happening slowly.

2006 DPHE produced an excellent report, (available on the arsenic.ws website) including maps and a data base. Professor Katim Ahmed will tell us about their work.

It goes a long way toward addressing concerns of the waverers and deserves wide circulation.
Tubewell culture was spurred by sanitation of surface waters. It is natural to assume that any return to surface water would be accompanied by an emphasis on sanitation. *That did not occur.*

The government report on surface waters by Faruque et al. in 2003 and the “National Policy” barely discussed it.

The International Center for Diarhoehal Disease Research (ICDDR’B) was located in Dhaka

Why did they not take a leadership role?

No strong guidance from the government

Some NGOs installed dugwells ignoring WHO guidelines for construction, and with no provision for subsequent supervision and maintenance
Dhaka Community Hospital dug wells according to WHO guidelines BUT were inconsistent about measurement and found high levels in the 2005 monsoon.

So Chlorinate!
Chakriborti (Kolkata) had always chlorinated

DCH began in July 2006
On chlorination Faecal Coliform (FC) drops to zero - but rises again after 21 days

EASY!
Drop a tablet in every night
Fae cal coli for m con n/100 ml

10 after 23 days and reached from 35 to 180+ in the water samples of all dugwells at the end of the month.
Uncritical use of Household Arsenic Removal Systems (ARS) May even be counterproductive.
• In West Bengal several hundred have been installed. 80% are not functional.

• (6th report: Jadavpur University) After some time there is a “Brak through”

• BUT they seem to work when there is “backup”

• $1 million Grainger Prize to:
  • Abul Hussam, George Mason University;
  • Abul Munir Kushtia
  • Abul Barkat U of Dhaka
  No break through after 5 years

• 60,000 units at $30 each household
At least three systems work!

Deep tube wells
Surface wells with chlorination
SONO filters

My recommendation to
the Government of Bangladesh

Find out which (NGO) is
doing a competent job

Get money direct to them

Even if not economically the “best”
doing nothing is expensive
especially in good will.
Information about successes and failures is crucial.

Arsenic Policy Support Unit (APSU) had a good website.

On Guy Howard’s departure it vanished.

I hope that all talks here will be on http://arsenic.ws
We need the GoB to
Have a laboratory in each region:
to measure (reliably)
(a) arsenic
(b) bacteria
(c) other pollutants
How to avoid the next catastrophe

LOOK at associations between two variables with **Caution**
Do not assume causality automatically.

**Remember:**

ALL MODELS ARE WRONG
SOME MODELS ARE USEFUL
Meanwhile please support the public foundation of your choice

Dugwell Foundation
http://www.dugwellfoundationusa.org
(Meera Smith)

Arsenic Foundation
http://arsenicfoundation.com
(Richard Wilson)