

The largest identified man-made environmental catastrophe

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Richard Wilson

**Mallinckrodt Research Professor of Physics
Harvard University**

<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
ground water.**

**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
1,000,00 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
Edinburgh
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 Interantional conference
by Dhaka Community Hospital
and SOES
Kolkata**

**10 million wells dug before systematic
measuremnts**

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.

DEEP TUBE WELLS (ctd)

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 Diarrhoeal 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

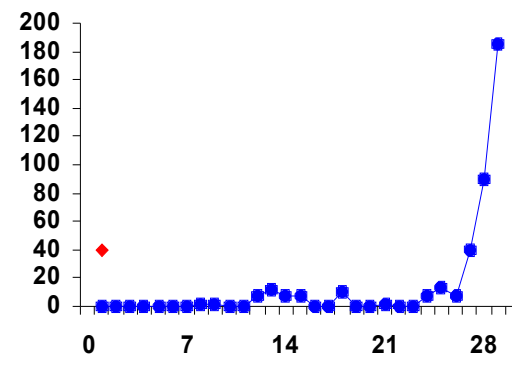
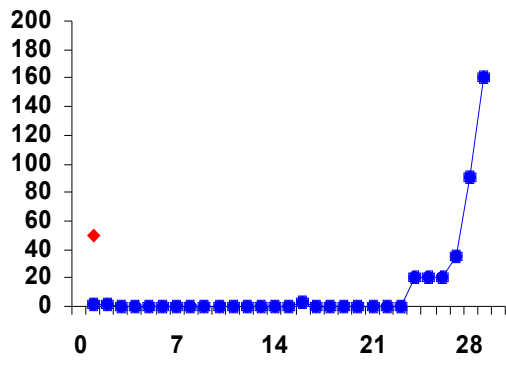
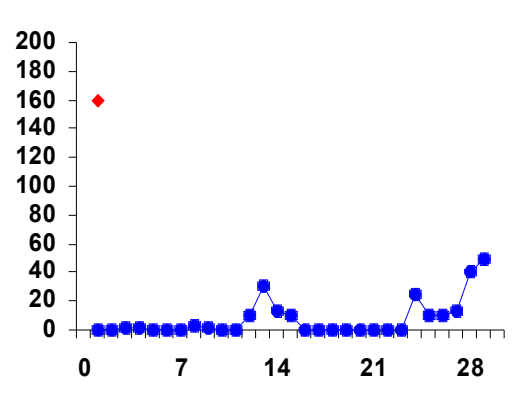
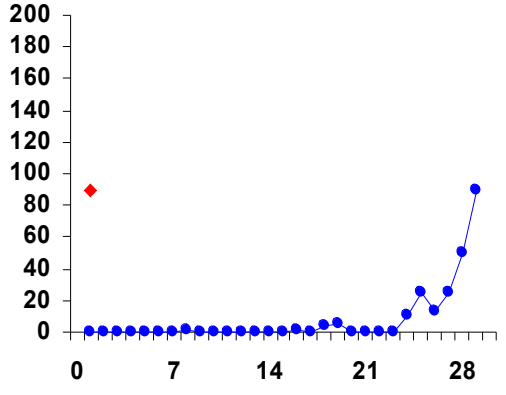
**Dhaka Community Hospital
dug wells
according to WHO guidelines
BUT were inconsistent about
measurement and found
high levels in the 2005 monsoon.**

**So Chlorinate!
Chakriborti (Kolkata)
had always chlorinated**

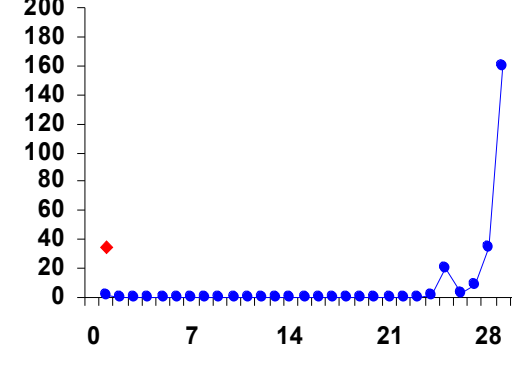
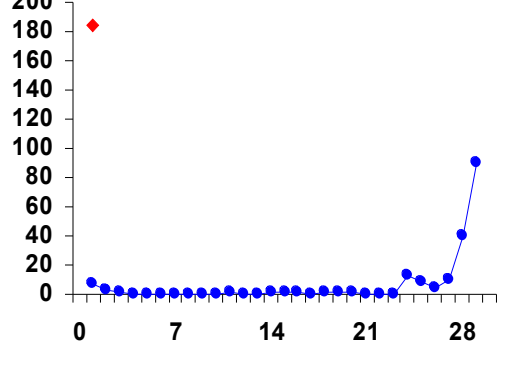
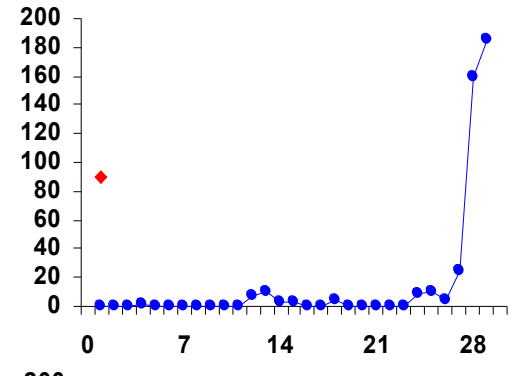
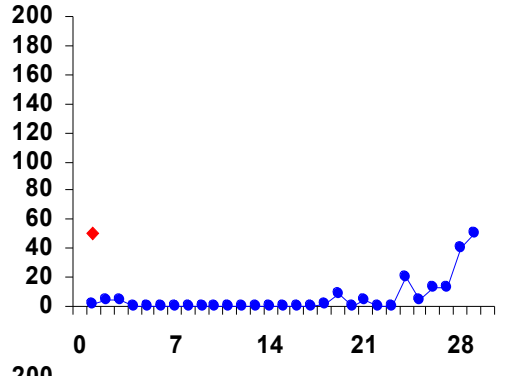
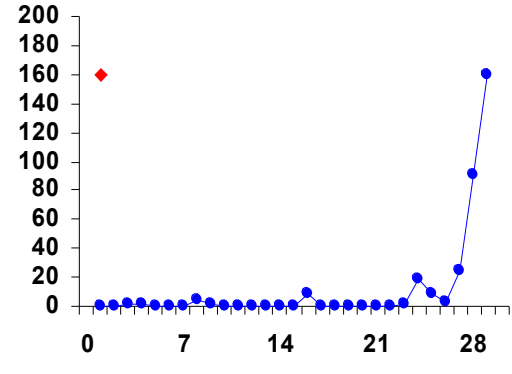
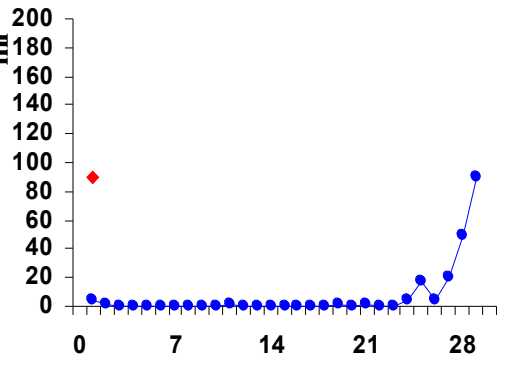
**DCH began in July 2006
On chlorination Faecal Coliform (FC)
drops to zero - but rises again after 21
days**

EASY!

Drop a tablet in every night



Faecal coliform count (n/100 ml)







WILSON DUGWELL

WATER TAP



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 “Break 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)



