Innovations in Small-Scale, Local, Women & Children-centered Solutions Bringing Safe Drinking Water to 1 Billion People

Susan Murcott – Senior Lecturer
Civil and Environmental Engineering Dept, MIT
Stratton Lecture on Critical Issues
"Running out of Water: What's the Problem? What's the Solution?"
November 4, 2009

Innovative Wastewater Treatment using CEPT in Mega-cities of the Developing World

Hong Kong Stonecutters Island WW Plant

Donald Harleman

(1922 – 2005)

Largest CEPT wastewater treatment plant in the world, serving > 6 million people

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Safe Water For 1 Billion People

GLOBAL WATER & SANITATION PROJECTS

MIT M.ENG. H_2O-1B	DOCUMENTS	MIT	GLOBAL

TECHNOLOGIES

- Household Treatment
- Water Supply
- Water Treatment
- Sanitation
- Hygiene

IN THE NEWS

MEDIA

STUDENT BLOGS

WATSAN FACEBOOK

COURSES

- MIT OpenCourseWare (Murcott)
- MIT Water Courses
- Global Water Courses

WEBLINKS

GLOBAL WATER MAPPING

- Drinking Water Supply & Treatment Mapping
- Sanitation Mapping

INTERNATIONAL HWTS NETWORK

- HWTS Network Tools
- HWTS Monitoring & Evaluation
- Network Conference Proceedings

METHODS

- Water Quality Standards & Guidelines
- Low Cost Field Testing
- Microbiological
- Physical
- Chemical
- Radiological
- Surveys
- Units of Measurement

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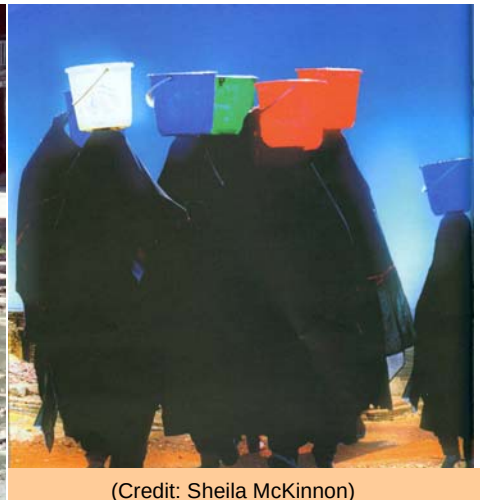
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

http://web.mit.edu/watsan

“Safe Water for 1 Billion People” has two goals:

- To educate MIT and other students as leading engineers and global citizens
- To contribute to the work of safe water for all, focusing on the 1+ B people lacking access to safe drinking water and 2.6+ B lacking adequate sanitation



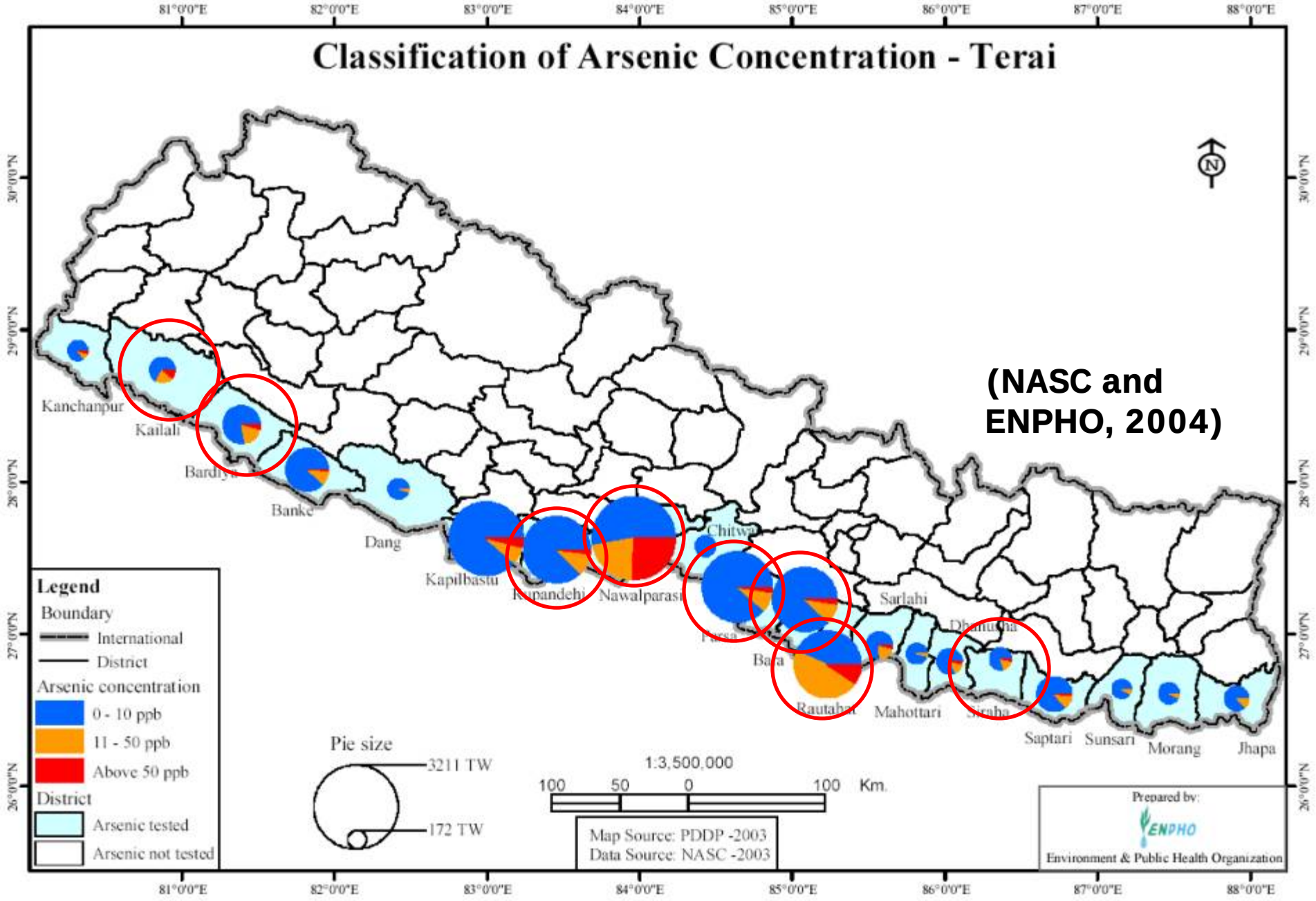

(Credit: Sheila McKinnon)


Solutions 1.

Kanchan™ Arsenic Filter (KAF)

MIT invention in collaboration with Nepali NGO-ENPHO and Canadian NGO - CAWST

Arsenic in Drinking Water in Nepal



The Kanchan Filter has been recognized by various awards …

- ***MIT IDEAS Competitions – (2002, 2003, 2005)***

- ***World Bank Development Marketplace Competition (2003)***

**** Wall Street Journal Technology Innovation Award – Environment Category (2005)***

**** St. Andrews Prize for the Environment – 2nd Prize (2006)***

**** Kyoto Water Prize - Top Ten Finalists (2006)***

Michael Doret

KAF Expansion in S.E. Asia

Nepal

About 12,000 filters disseminated in Nepal reaching over 100,000 people

Cambodia

- Successful 1-year laboratory and pilot study, funded by the Asian Dev Bank, to verify the KAF in Cambodian waters.
- We are currently carrying out a 2nd year of pilot tests.

Solution 2.

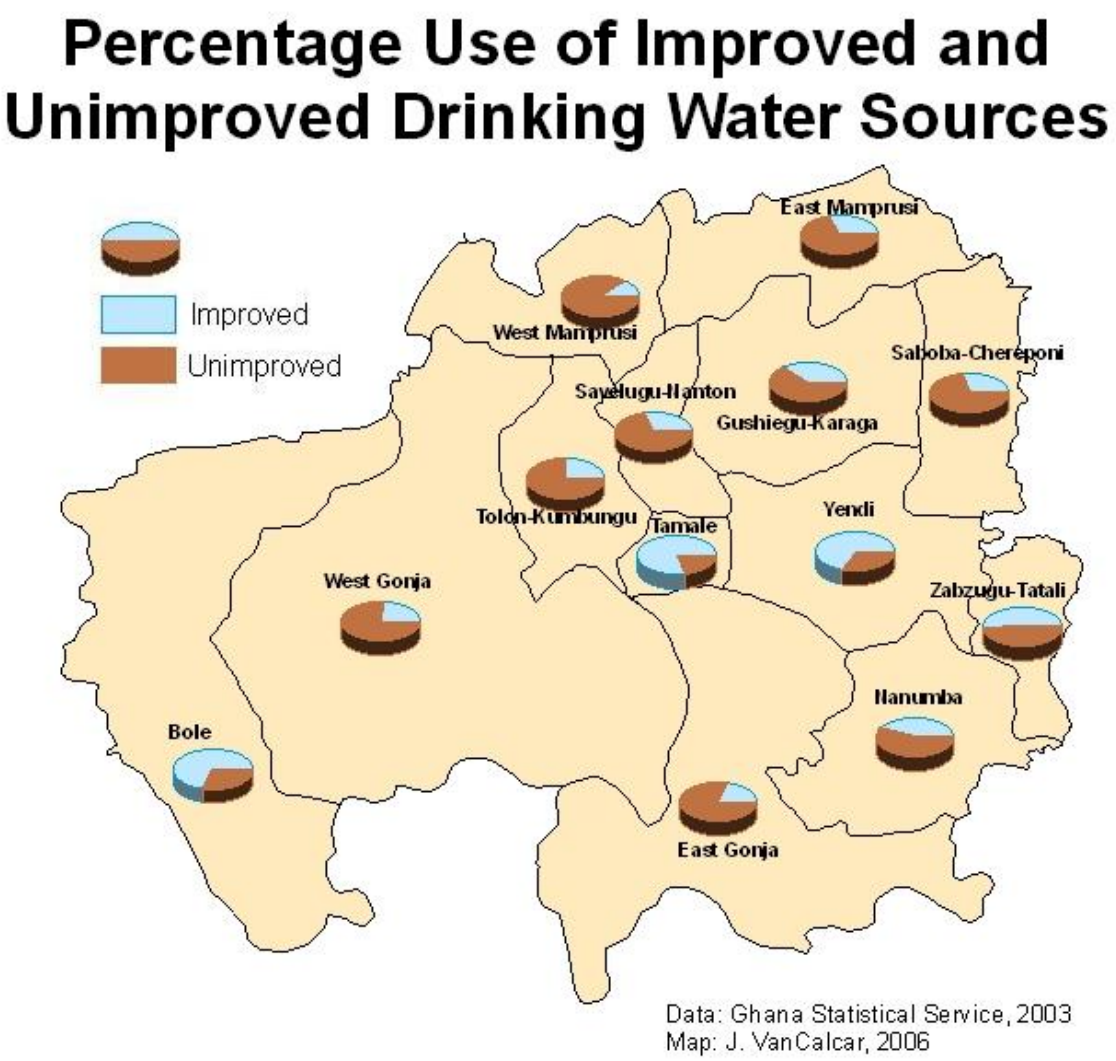
Ceramic Pot Filter Sales via Pure Home Water in Northern Ghana

Credit: M.Stevenson

Credit: A.Dia

Ceramic Pot Filter

50% (0.9 million out of 1.8 million people) in Northern Region, Ghana currently use an unimproved source



- Improved Sources
  - Boreholes
  - Household connection
  - Public standpipe
  - Rainwater harvesting
  - Protected springs and dug wells
- Unimproved Sources
  - All surface water sources
  - Unprotected springs and dug wells
  - Tanker trucks
  - Vendor water

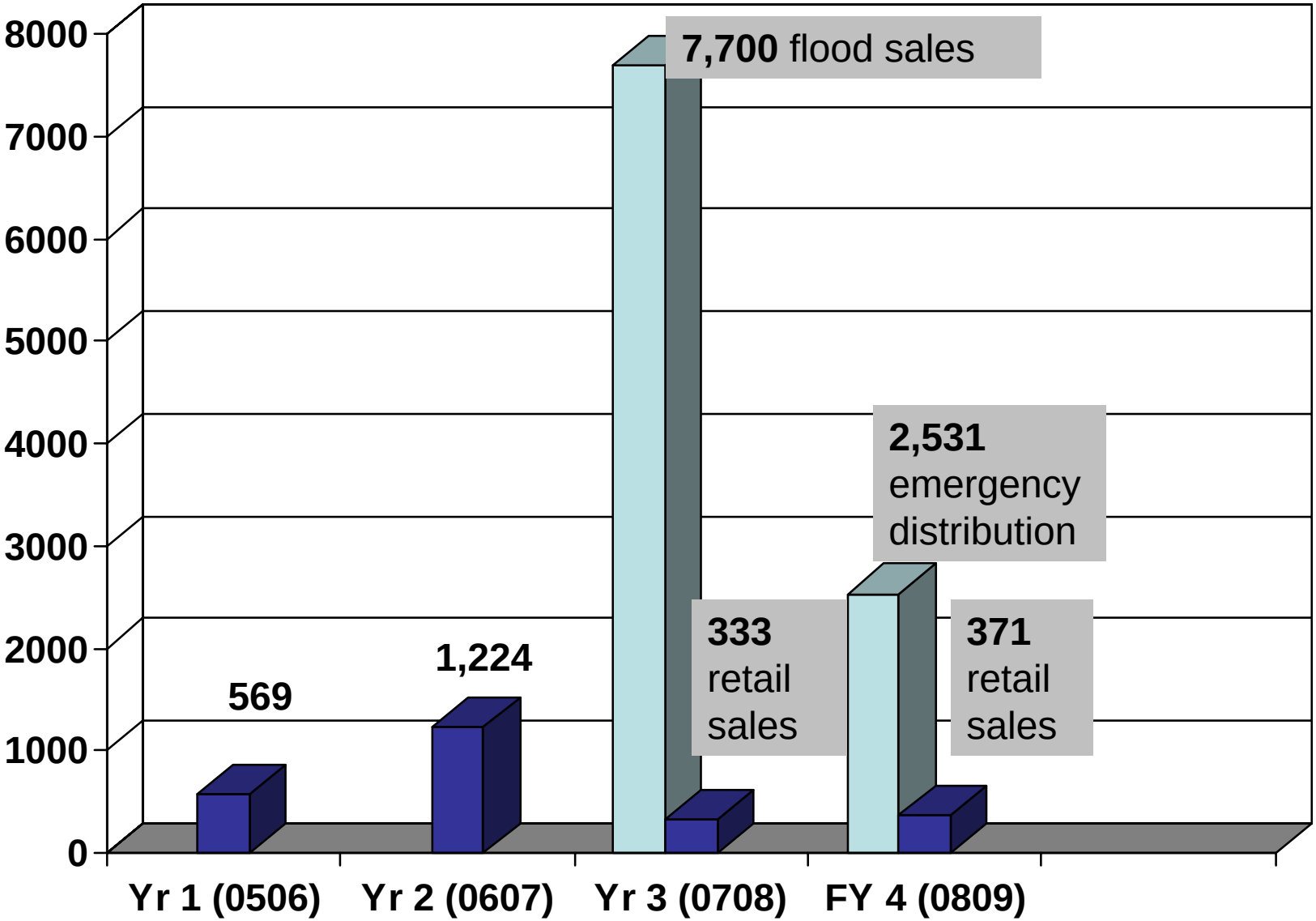
Ghana has the 4th lowest rate of sanitation coverage in the world *(contributing to unsafe drinking water)*

Countries with low improved sanitation coverage

	Improved sanitation coverage (%)		Number of people who gained access to improved sanitation (thousands)
	1990	2006	1990-2006
Eritrea	3	5	143
Niger	3	7	714
Chad	5	9	646
Ghana	6	10	1,465
Ethiopia	4	11	6,858
Sierra Leone*	-	11	147
Madagascar	8	12	1,353
Togo	13	12	222
Burkina Faso	5	13	1,365
Guinea	13	19	991
Haiti	29	19	-162
Congo	-	20	-
Rwanda	29	23	38
Somalia*	-	23	605
Côte d'Ivoire	20	24	1,905
Mauritania	20	24	340
Sao Tome and Principe*	-	24	11
Micronesia (Federal States of)	29	25	-1
Nepal	9	27	5,922
Cambodia*	-	28	3,026
India	14	28	198,442
Senegal	26	28	1,324
Afghanistan*	-	30	1,894
Benin	12	30	2,025
Nigeria	26	30	18,849

(UNICEF / WHO, 2008)

Pure Home Water Filter Sales (2005 – 2009)



of People Reached
(July ’05 to Feb. 09)

	Units Sold	People per HH	# People Reached
Urban/Retail	2,297	6	13,782
Emergency (free)	10,231	5	61,386
Schools & Clinics (free)	115	40	4,600
Intern’l-Burkina Faso	200	6	1,200
TOTAL			***81,968***

Largest Sales to Date

•2008 Flood Emergency Distributions (sales to UNICEF, Oxfam, CLIP)

•2009 Guinea Worm Emergency Distribution (sales to Gov't of Ghana, UNICEF)

Current Targets & Plans

- Reach 1 M people in N. Ghana in next 5 years with household water treatment products

- Build ceramic factory in 2010 to manufacture filters

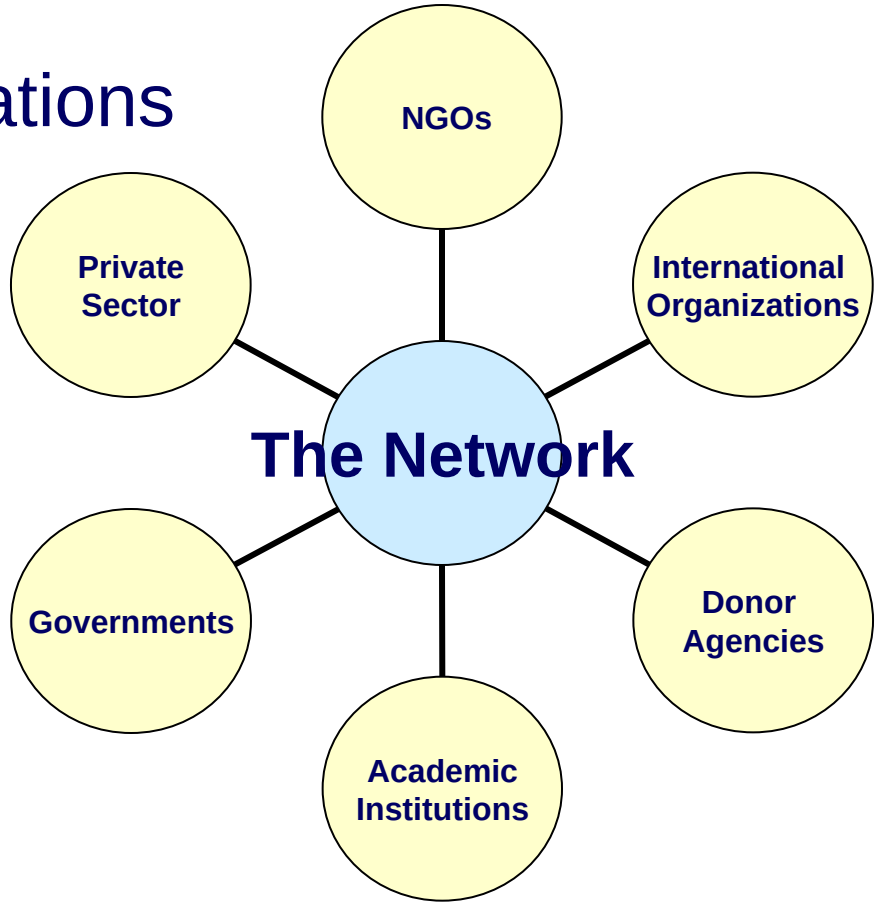
- Raise $100,000 to build factory
- Seeking investors, shareholders and donors!
- <info@ purehomeh2o.com>

Solution 3.

The Household Water Treatment and Safe Storage Network

Public-private partnership

From 20 founding organizations to over 120 organizations in 1st 5 years



Mission Statement:

To contribute to a significant reduction in waterborne disease, especially among vulnerable populations, by promoting household water treatment and safe storage as a key component of water, sanitation, and hygiene programmes.

What are Household Drinking Water Treatment and Safe Storage Technologies?

Traditional unsafe storage

Stone Filter – Peru, c.1600 (Photo: Tom Clasen)

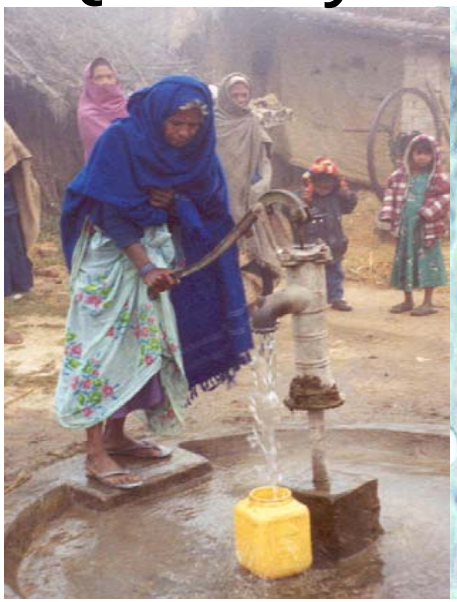
Post-tap filter for "luxury water"

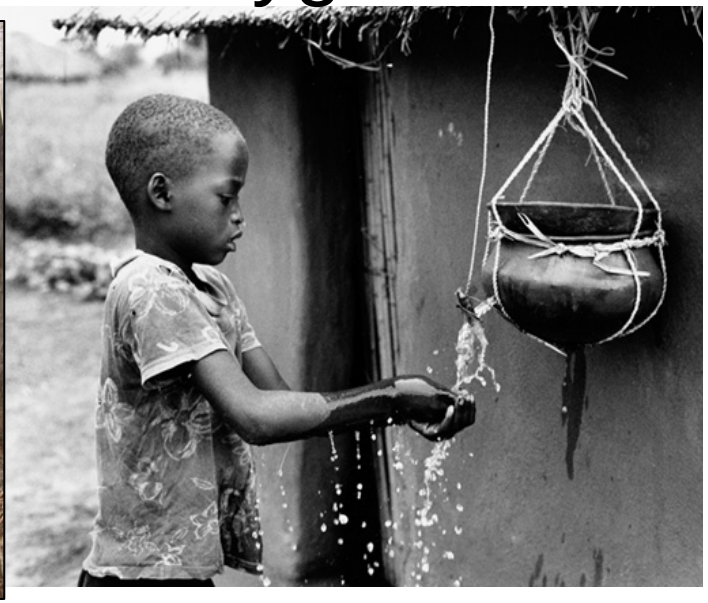
A cluster of innovative technologies invented or rediscovered only in the last 10+ years explicitly designed for the billions of people lacking SAFE WATER

HWTS are distinct from 1st World post-tap devices that give "luxury water," or to traditional water management practices, that may or may not give SAFE WATER

HWTS fall under the “water quality” category of the 4 major environmental interventions to address water-related diseases

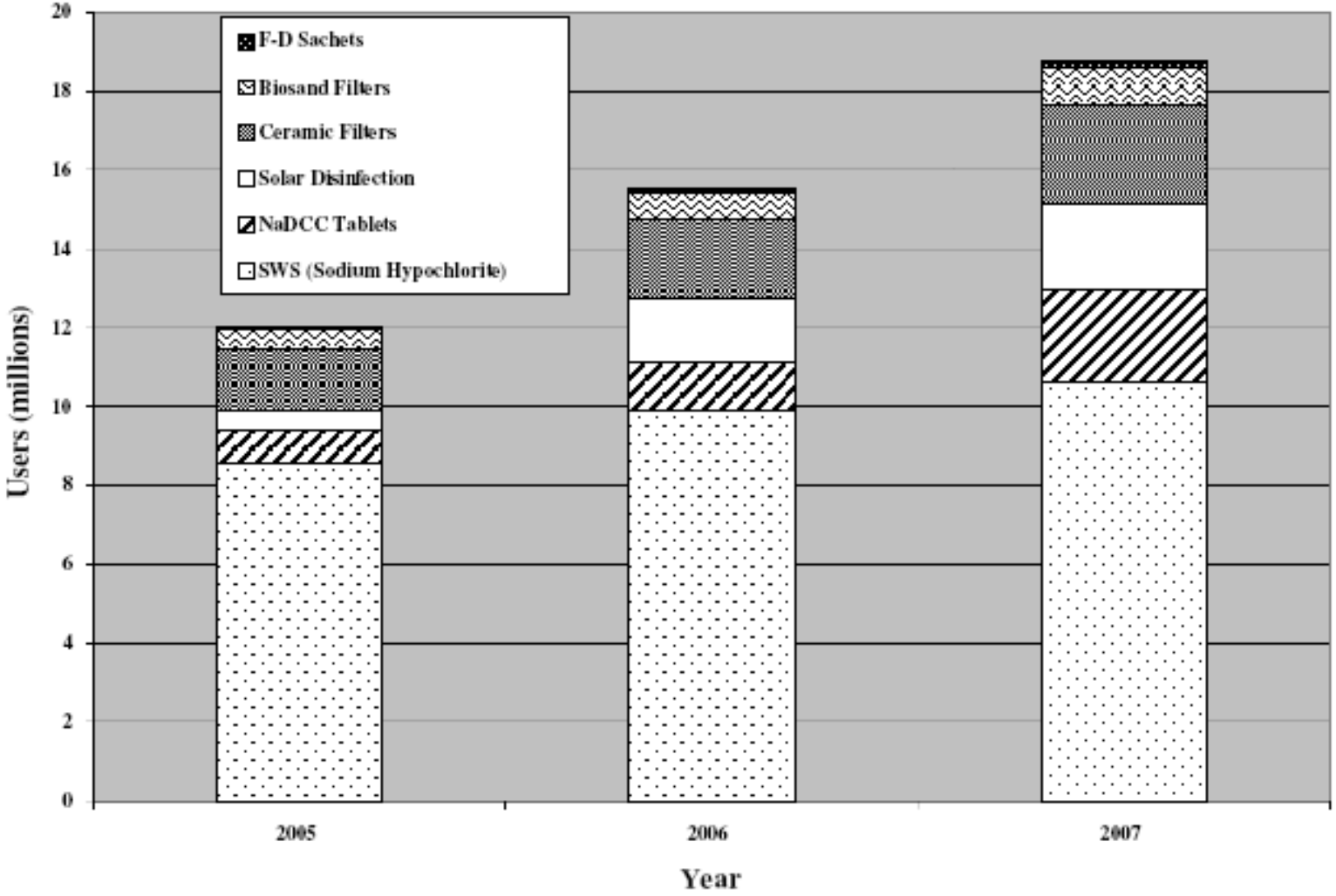
Quantity Quality Sanitation Hygiene





Achievements

Combined estimate of increased # of users of selected HWTS products (2005-2007)

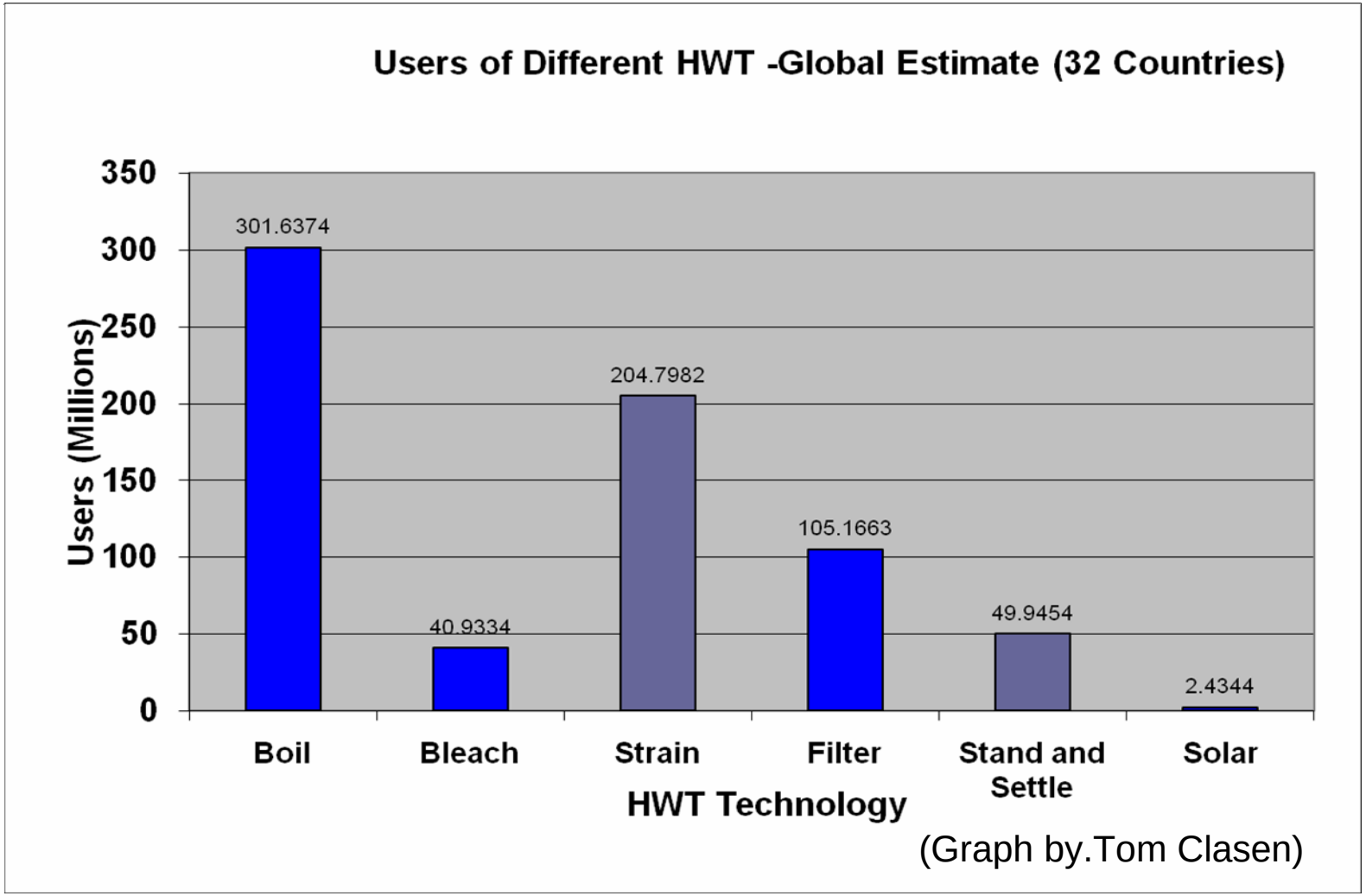


Clasen, T. “Scaling Up Household Water Treatment Among Low Income Populations,” WHO, Geneva. 2009

Achievements

Status of HWTS in 32 Countries (2008)

U.N. Joint Monitoring Program Data

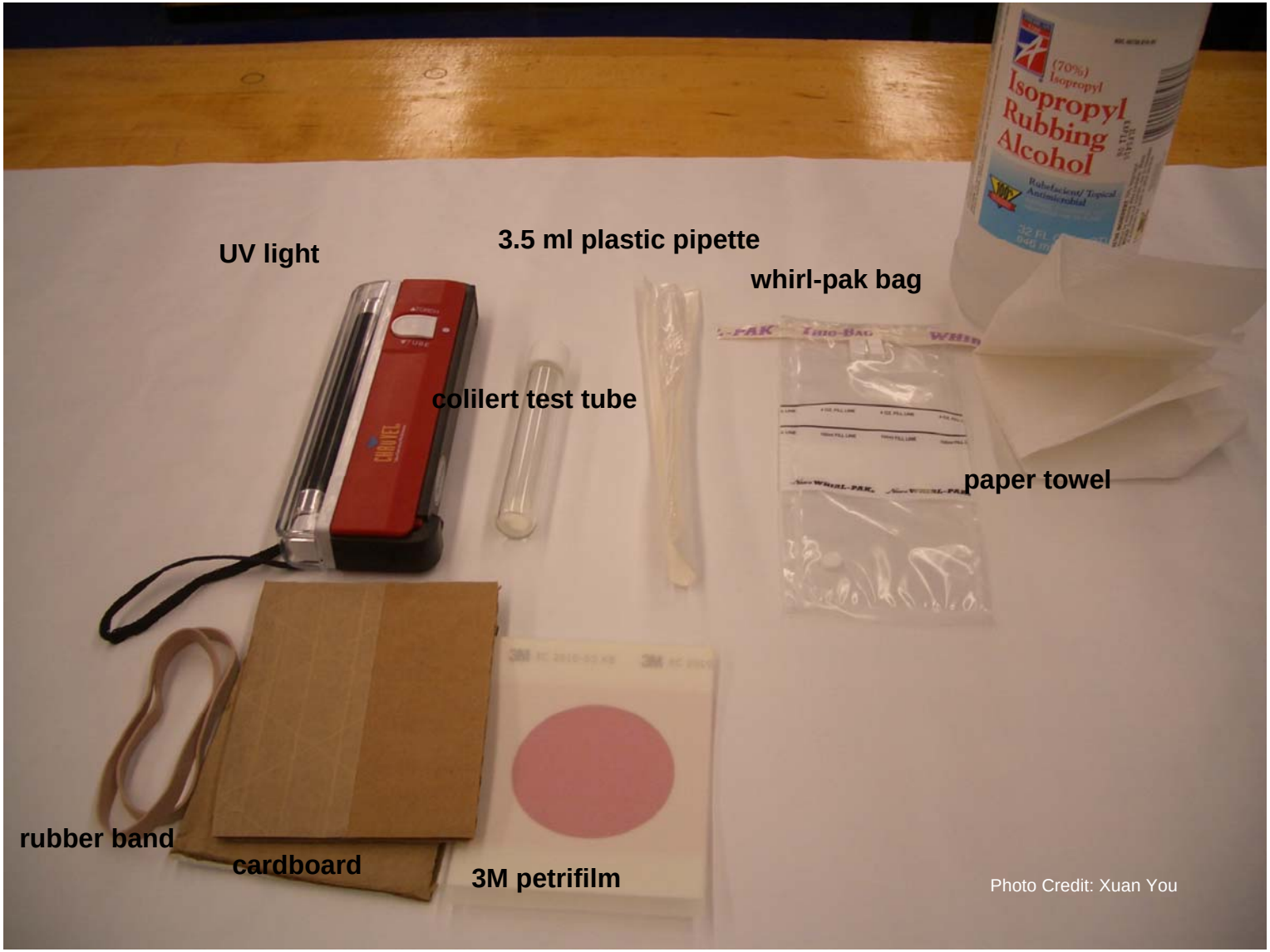


Rosa G , Clasen T (in preparation). The global prevalence of boiling as a means of treating water in the home.

Solution 4.

Safe Water Testing and Global Water Quality Mapping

EC-Kit Supplies



EC-Kit
Waist belt
Incubator

allows off-grid incubation using body heat

MIT Urban Studies (DUSP) student, Melissa Haeffner, using waist-belt incubator at Pure Home Water, Tamale, Ghana, June '09

EC-Kit Interpretation of Results

Risk Assessment of Water Sources

Risk Level	E. coli/sample	Colilert MUG	#Blue/Petrifilm
Low	**< 1/10 ml**	**-**	**0**
Moderate	**1-9/10 ml**	**+**	**0**
High	**1-10/ml**	**+**	**1-10**
Very High	**> 10/ml**	**+**	**> 10**

Robert Metcalf, 2009

Global Safe Water Mapping -- Home Page

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How clean is the world's water?

Citizen Water empowers communities worldwide to access healthy drinking water. It incorporates simple, inexpensive water quality test kits; clear, multi-lingual and multi-media instructions; and open source spatial mapping. This unique blend of community empowerment and global information exchange enables people —regardless of location, economic class or scientific training—to participate in improving drinking water quality in their communities.

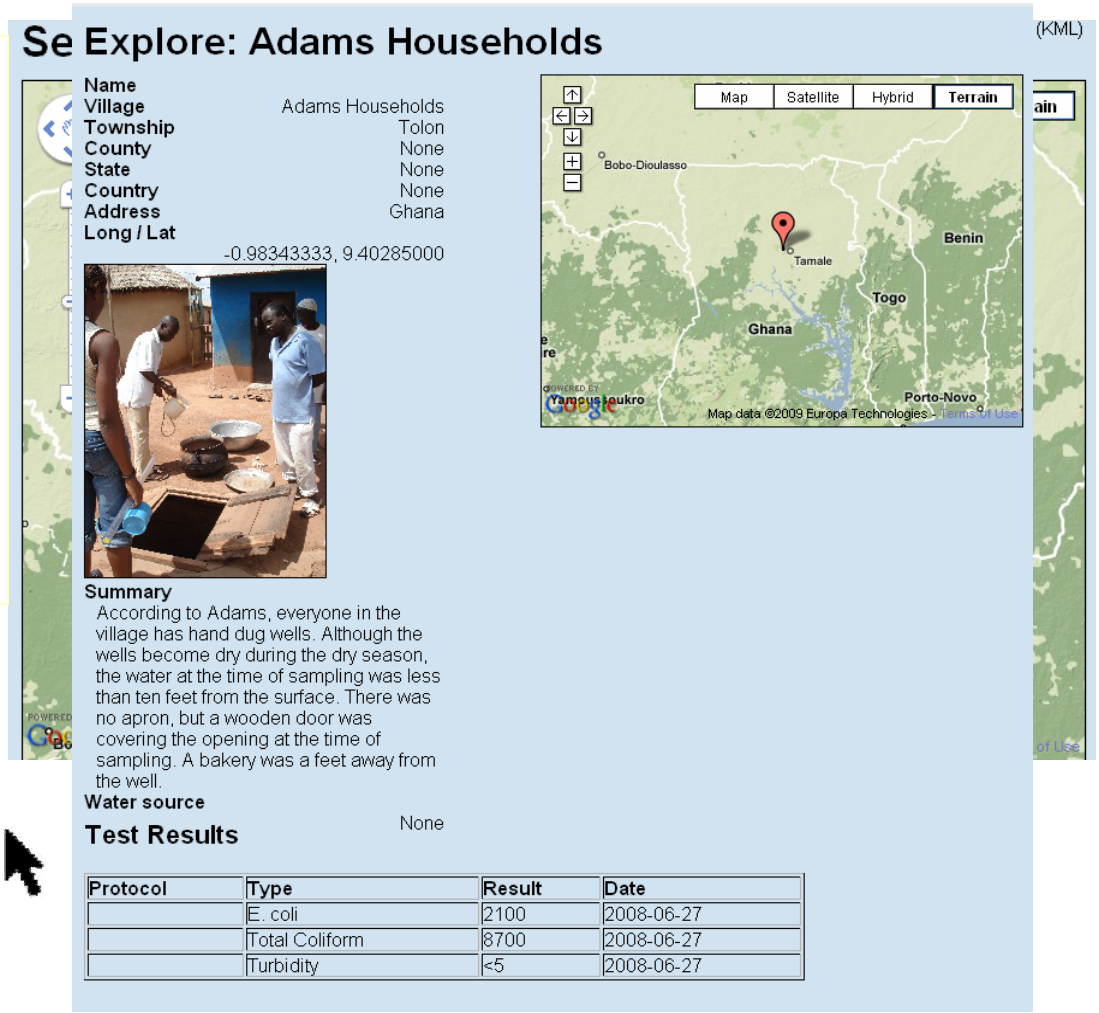
Global Safe Water Map –Explore Page

Mapping

USER INTERFACE

- Interactive Google Earth interface allows users to view data, or…

•enter data, pictures, text



Name

Adams Households

Summary

According to Adams, everyone in the village has hand dug wells. Although the wells become dry during the dry season, the water at the time of sampling was less than ten feet from the surface. There was no apron, but a wooden door was covering the opening at the time of sampling. A bakery was a feet away from the well.

Lat/Lng

-0.98343333, 9.40285000

Test Results

Protocol	Type	Result	Date (YYYY-MM-DD)
3M Petrifilm (CFU/100ml)	E. coli	2100	2008-06-27
3M Petrifilm (CFU/100ml)	Total Coliform	8700	2008-06-27
Turbidity Tube (TU)	Turbidity	<5	2008-06-27

Peter Roger's Overview and Challenge:

Facing the
Freshwater CRISIS

As demand for freshwater soars, planetary supplies are becoming unpredictable. Existing technologies could avert a global water crisis, but they must be implemented soon

By Peter Rogers

To a great extent, the technologies and policy tools required to conserve existing freshwater and secure more of it are known. What is needed now is ACTION.

More information

Safe Water for 1 Billion People

http://web.mit.edu/watsan

Thank You