

UV-Tube Project

*Making clean water available to those
who need it most.*



Rachel Peletz, Environmental Engineer, UC Berkeley
Engineers for a Sustainable World-Berkeley

The Need

- 1 in 4 people lack access to an “improved” water supply



- 1.8 billion children fall ill annually from preventable waterborne diseases
- 5 million of these children die

A child dies every 8 seconds!



No Perfect Solution...

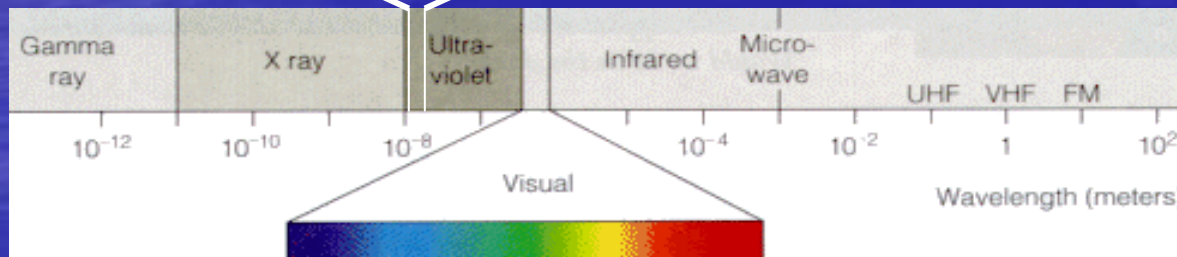
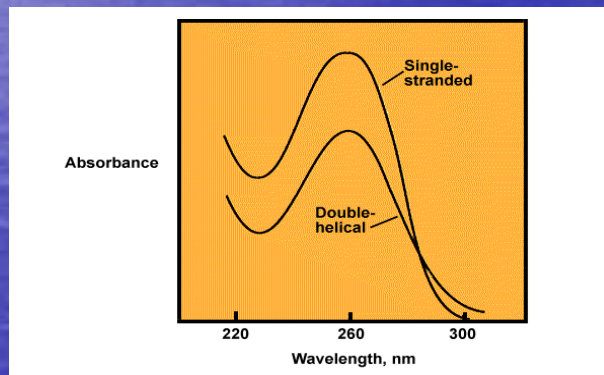
Technology	Disadvantages
Treatment plants	Expensive, infrastructure, difficult to reach rural areas
Boiling	Energy intensive, expensive, time consuming, bad taste
Bottled Water	Expensive, transportation energy intensive, packaging
Chlorine	Difficult to dose, wait time, bad taste
Solar (SODIS)	Time consuming

UV: A new tool for the toolbox?

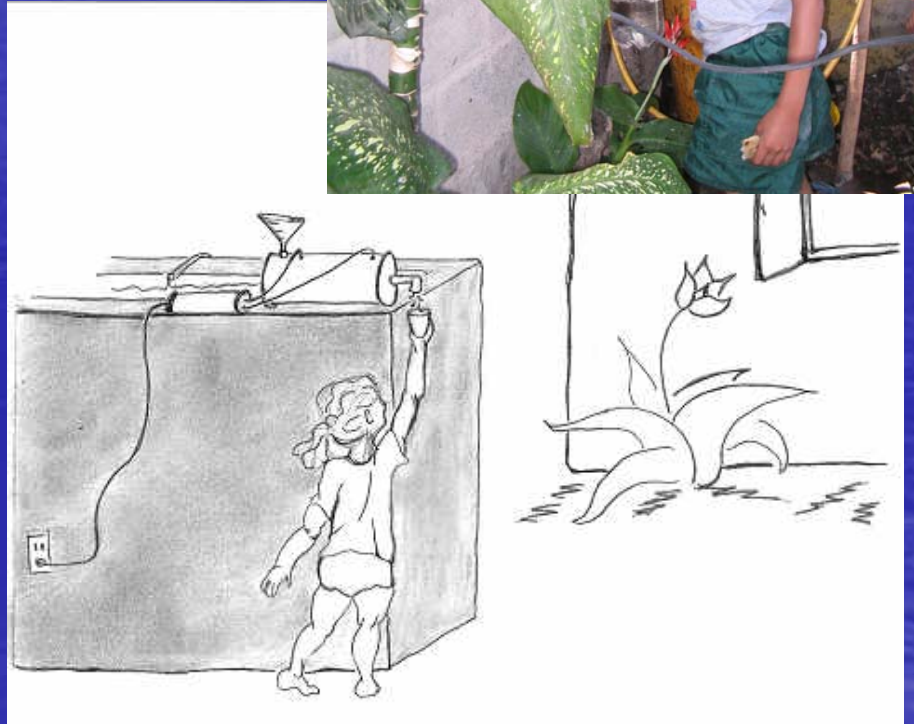
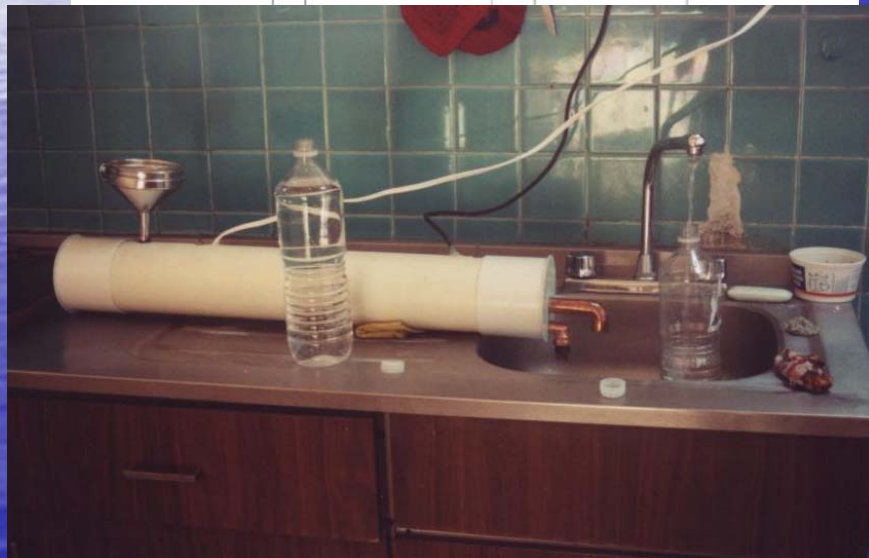
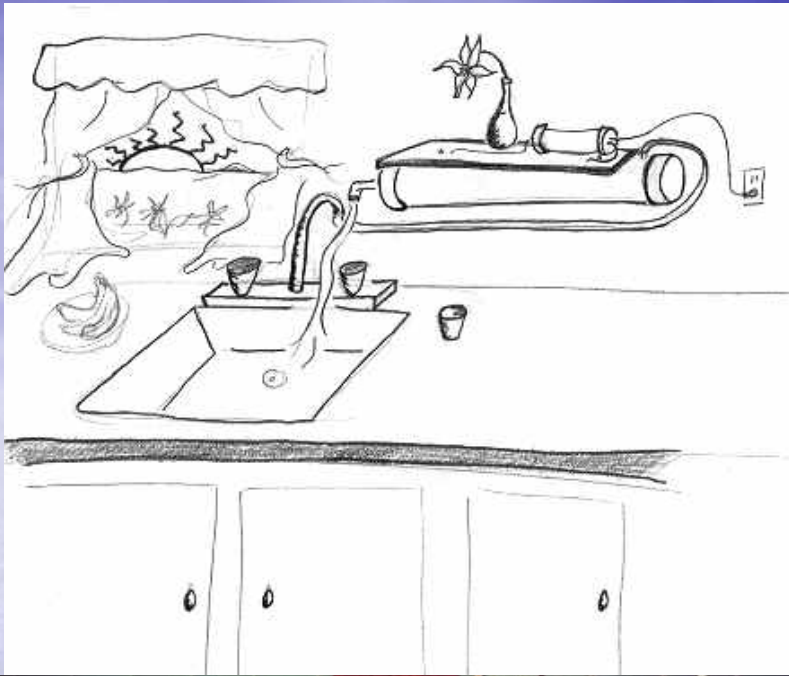


Ultra-Violet Light For Water Treatment

- UVC disrupts DNA of pathogens (~260 nm)
 - Formation of Pyrimidine Dimers (T-T) prevents DNA replication
- Mercury light bulb: UVC at 254nm

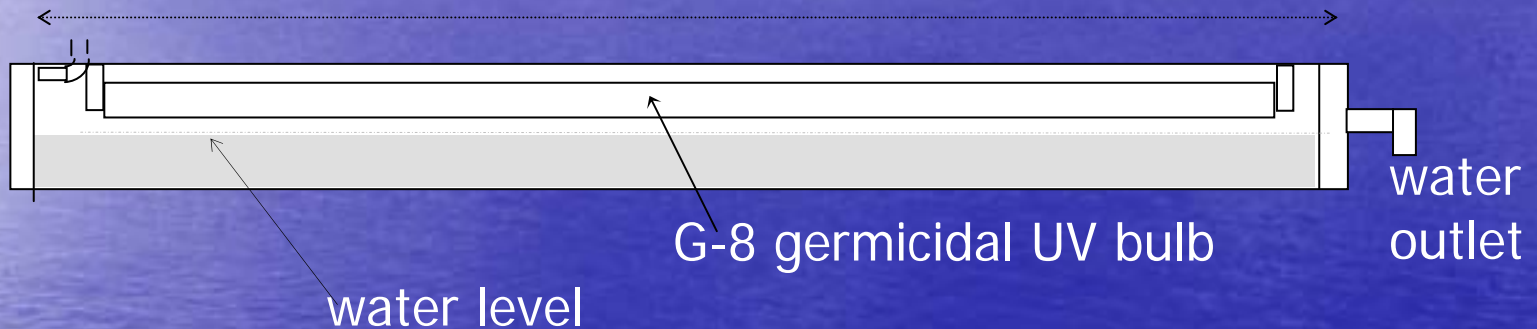


UV Water Disinfection Development



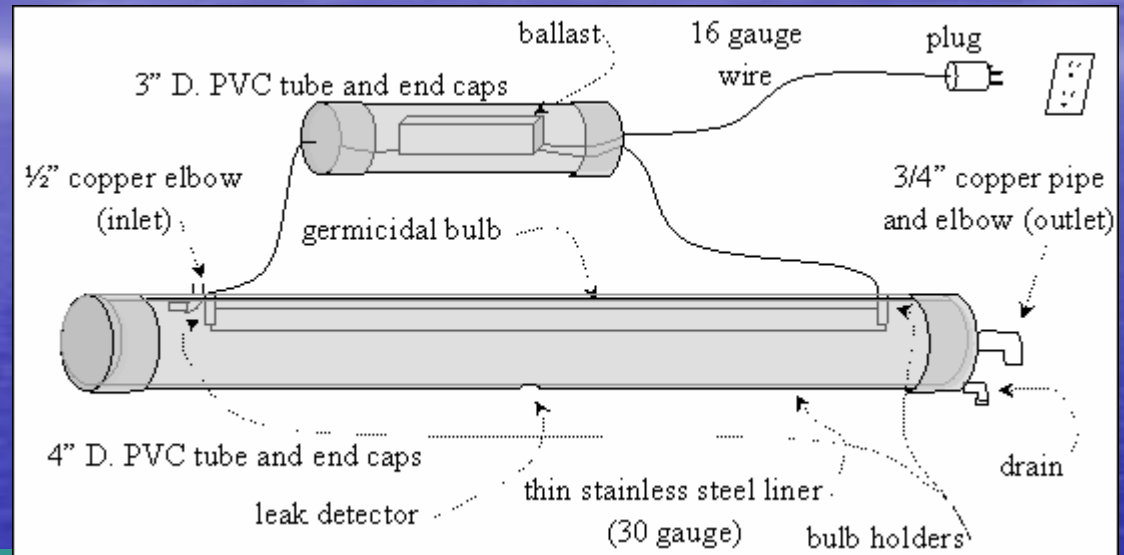
The UV Tube: A Design Concept

Side View
(transparent)



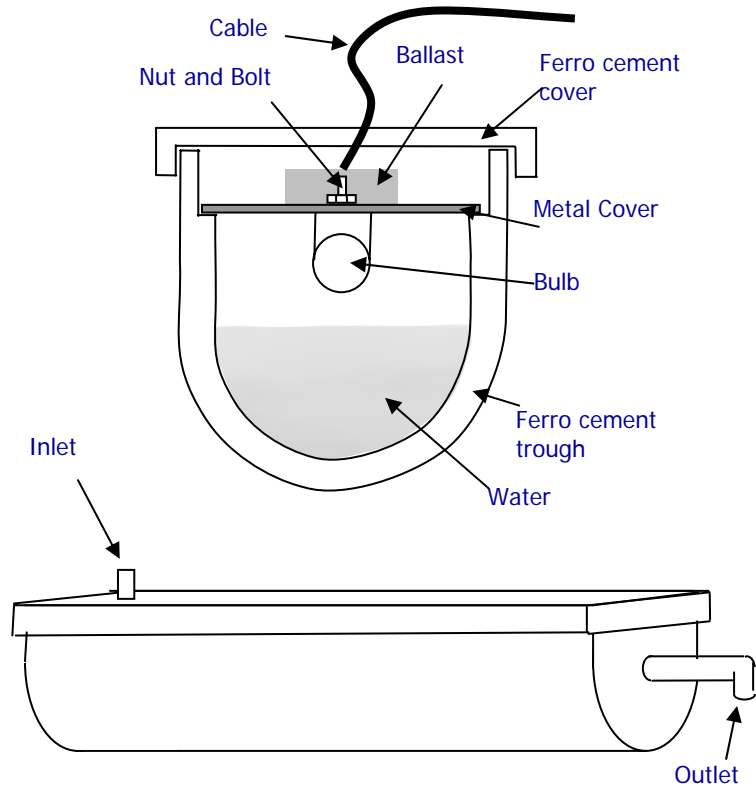
- Built with local resources
- \$30 to \$50 for household use
- 15 Watt bulb, powered by grid or solar panels

Design: stainless steel-PVC



Ferro Cement UV-Tube

Figure 1: Cross Section and Side View of the Ferro Cement UV-Tube



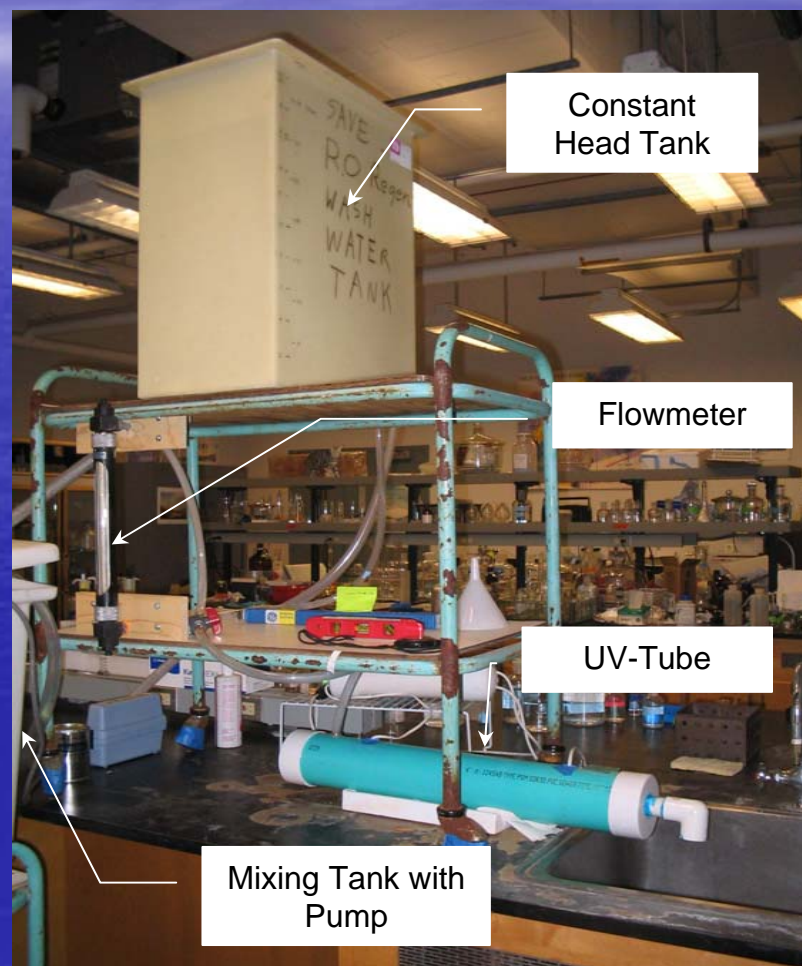
Laboratory Testing

All UV-Tube Designs

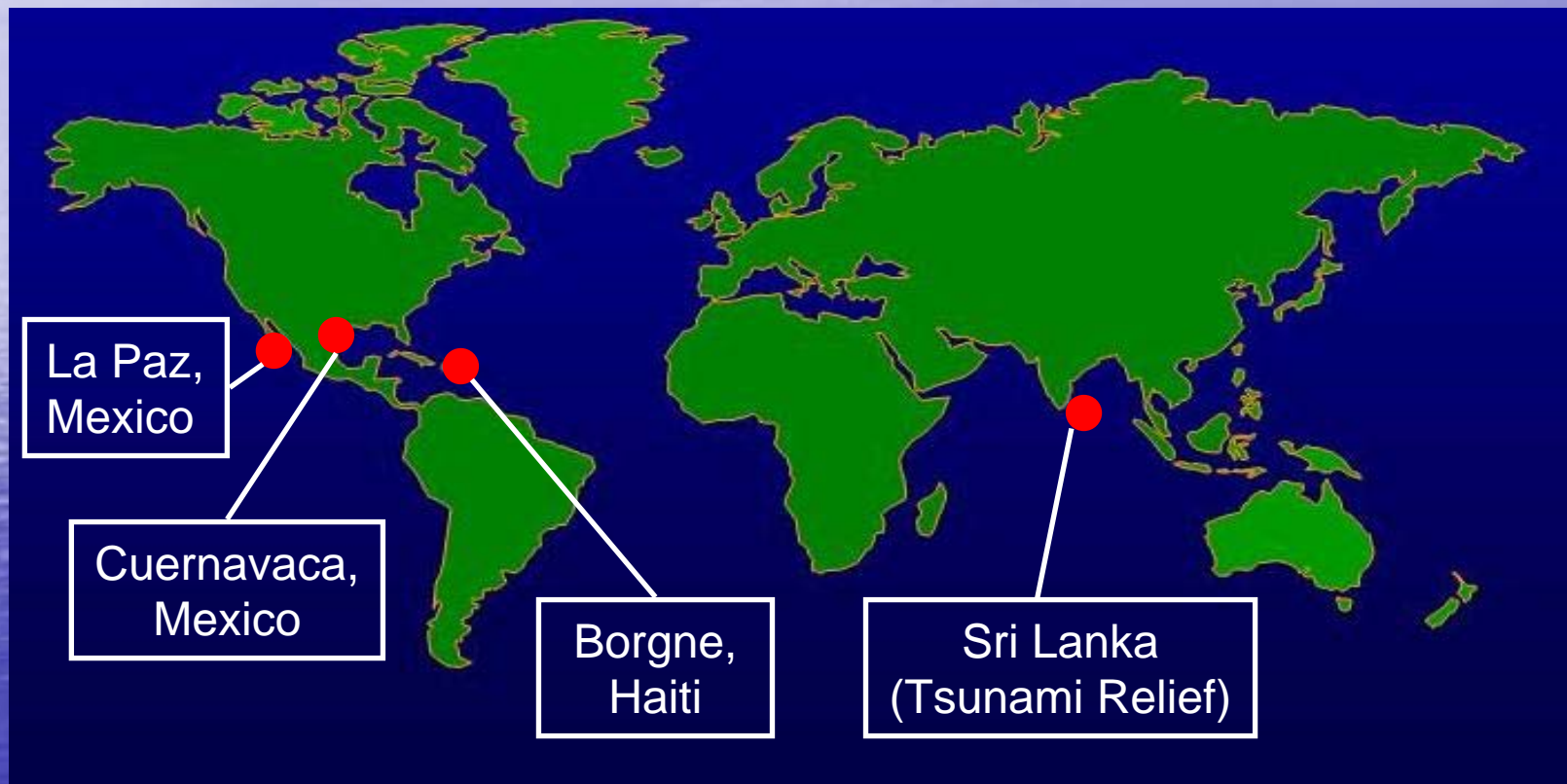
- Microbial Testing
- Materials Degradation Testing
- Hydrodynamic Tracer Tests

Bulb Studies

- Cycling
- Warm-Up Time



UV Tube Field Work



Field Work in Borgne, Haiti



The UV Tube in Haiti



- Community-Scale
- No electricity → powered by solar panels
- No PVC endcaps → Ferro cement design

Installation at the Sant Teknoloji: Bwase Lide



The Borgne, Haiti Brainstorming
Technology Center

Field Work in La Paz, Mexico

Fieldwork Last Summer

- Local Community Partners
- Visited 25 communities
- Background water quality and epidemiological surveys (300 adults)

Results

- 1/2 sources had fecal contamination
- Great interest in clean sources of water



This summer, 30 UV tubes will be installed in La Paz

Field Work in Cuernavaca, Mexico



Community Workshops building UV tubes

The Installed UV-Tube



Three families are participating in a year-long field study in Cuernavaca

Engineering Solutions to Societal Needs



"To the engineer is the job of clothing the bare bones of science with life, liberty and hope."

-Herbert Hoover

Acknowledgements

- Engineers for a Sustainable World, Berkeley
- Civil and Environmental Engineering Department, UC Berkeley
- Real and Appropriate Energy Lab (RAEL), Energy and Resource Group, UC Berkeley

- Faculty: Dr. Kara Nelson and Dr. Dan Kammen
- Students: Sarah Brownell, Fermin Reygadas, Forest Kaser, Micah Lang, Margaret Rhee, Aaron Dallek, Winthrop Williams, Alicia Cohn, Amy Pickering,

Thank You!

- 1 LOG (90%)
- ▨ 2 LOG (99%)
- ▩ 3 LOG (99.9%)
- 4 LOG (99.99%)

UV Dose (J/m²)

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300

