



**PURE HOME WATER**  
*Safe Water for Every Household*

# Progress & Self-Sufficiency in Water, Sanitation & Reforestation in Northern Ghana

Susan Murcott

Environmental Engineer, D-Lab, MIT

April 2016



**Massachusetts  
 Institute of  
 Technology**

Credit: Alexandr Nishichenko



Credit: Mark Williams

# Pure Home Water

Pure Home Water (PHW): a social enterprise founded in Tamale, Ghana in 2005, has two goals:

1. Reach people most in need of safe drinking water, sanitation and hygiene (WASH) and environmental innovations in Ghana, especially in northern Ghana, the poorest part of the country.
2. Become financially and locally self-sustaining.



# Pure Home Water Videos

## “the Best Short Intro!”

- Pure Home Water
- <http://www.youtube.com/watch?v=rSQ36X-Lsel&feature=plcp>
- Dubai Expo Live 2020
- <http://www.youtube.com/watch?v=bfNQwlkMiPg>
- Women and Water, Access and Scarcity
- <http://www.youtube.com/watch?v=drU74lkzMcl>



Credit: Alexandr Nishichenko

Pure Home Water was founded by two civil  
& environmental engineers:  
Susan Murcott and Mary Kay Jackson



# Pure Home Water's Current Mgt

Operations Manager: Michael Anyekase

Factory Manager: Iddrisu Awal



Awal and Michael together



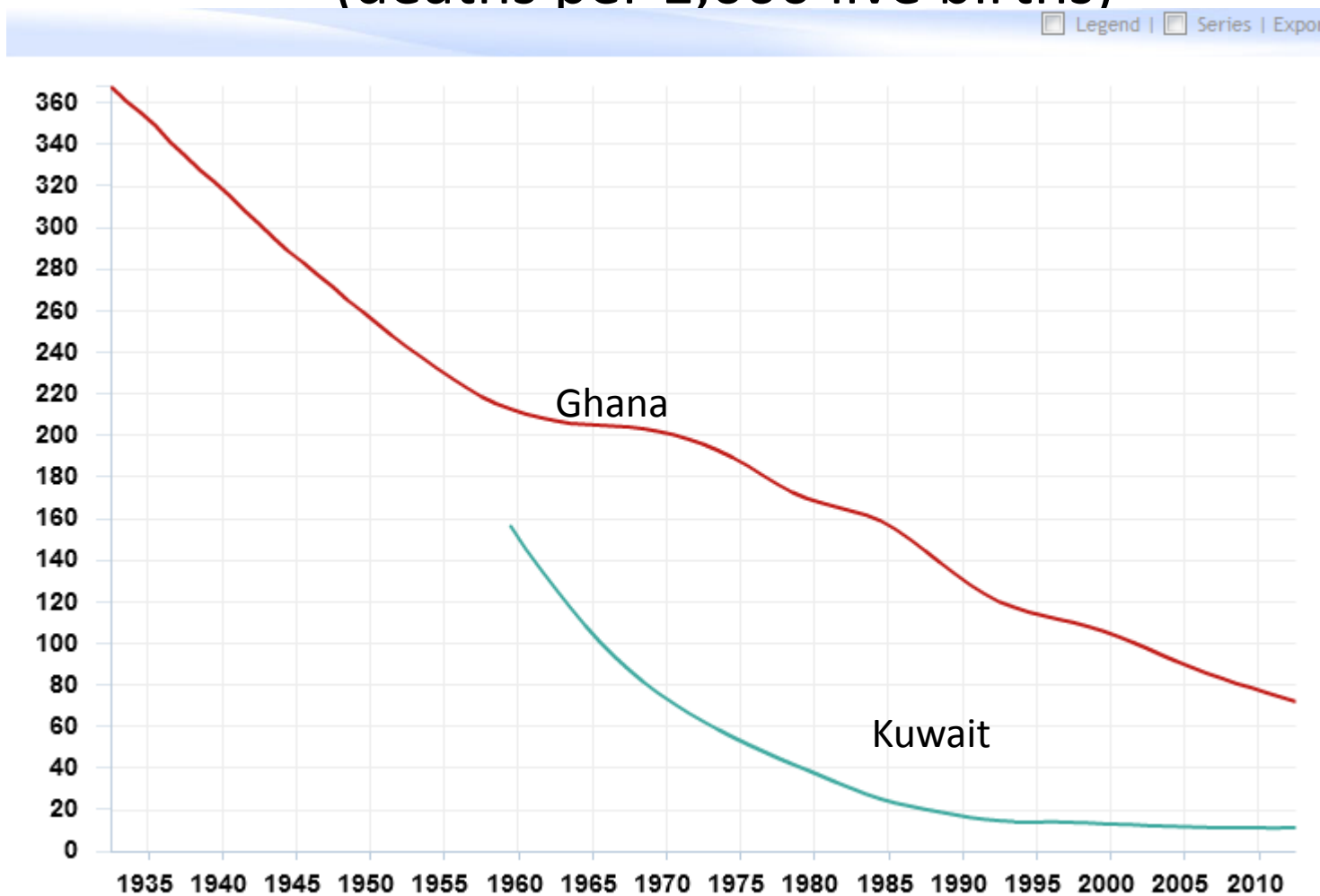
Awal eating lunch at the factory

# Typical Unimproved Water Supply in northern Ghana



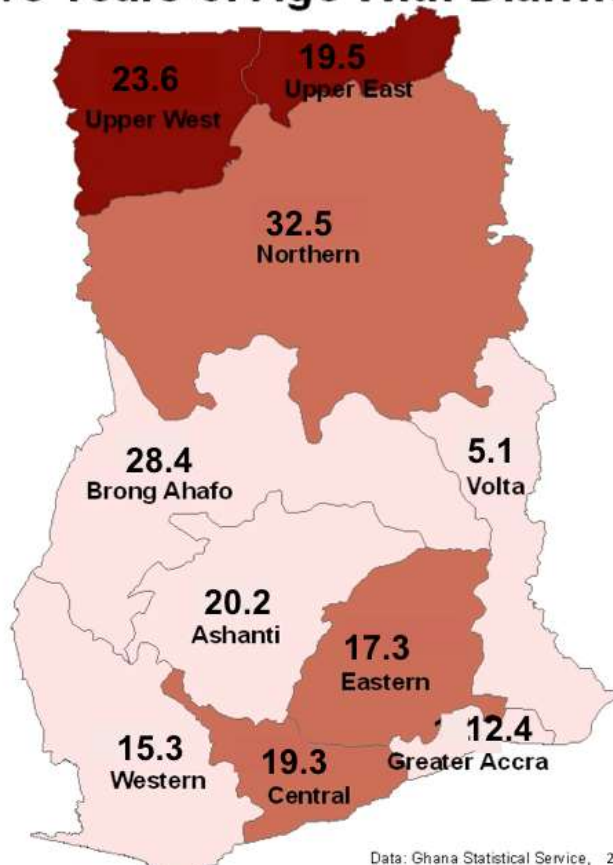
Taha Water Supply – water supply for the village adjacent to our factory

# Comparison of Child Under 5 Years Mortality Estimates for Ghana vs. Kuwait (deaths per 1,000 live births)



# Diarrhea in Children under 5 Years of Age

## Percentage of Children Under Five Years of Age With Diarrhea

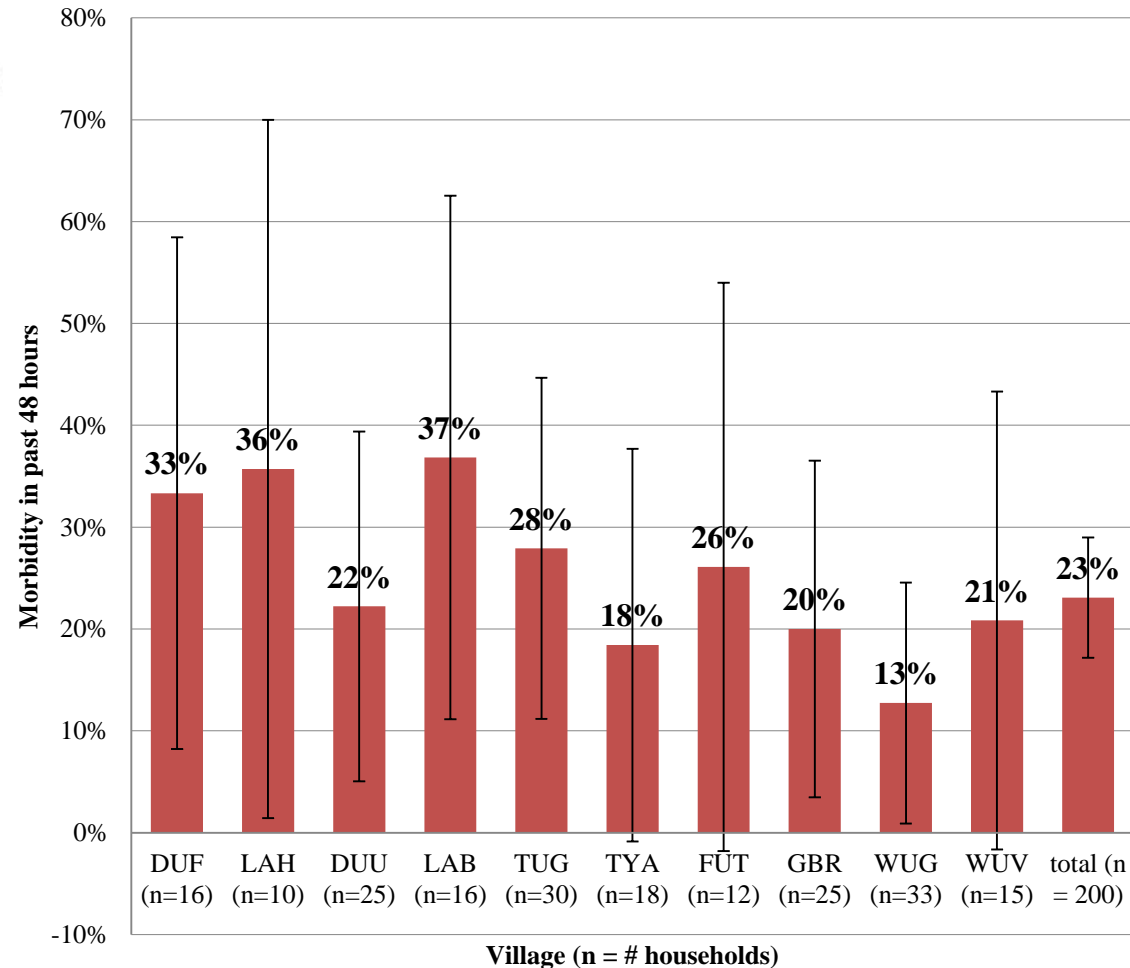


Data: Ghana Statistical Service, 2008  
Map: J. VanCalcar, 2006

Updated map: S. Murcott and C. Lo, 2012

The Northern Region & Brong Ahafo, two of Pure Home Water's target regions, have the highest rates of diarrhea prevalence in Ghana, 33% and 28% respectively, acc. to DHS 2009 survey.

## Prevalence of diarrhea in children under five (by community)



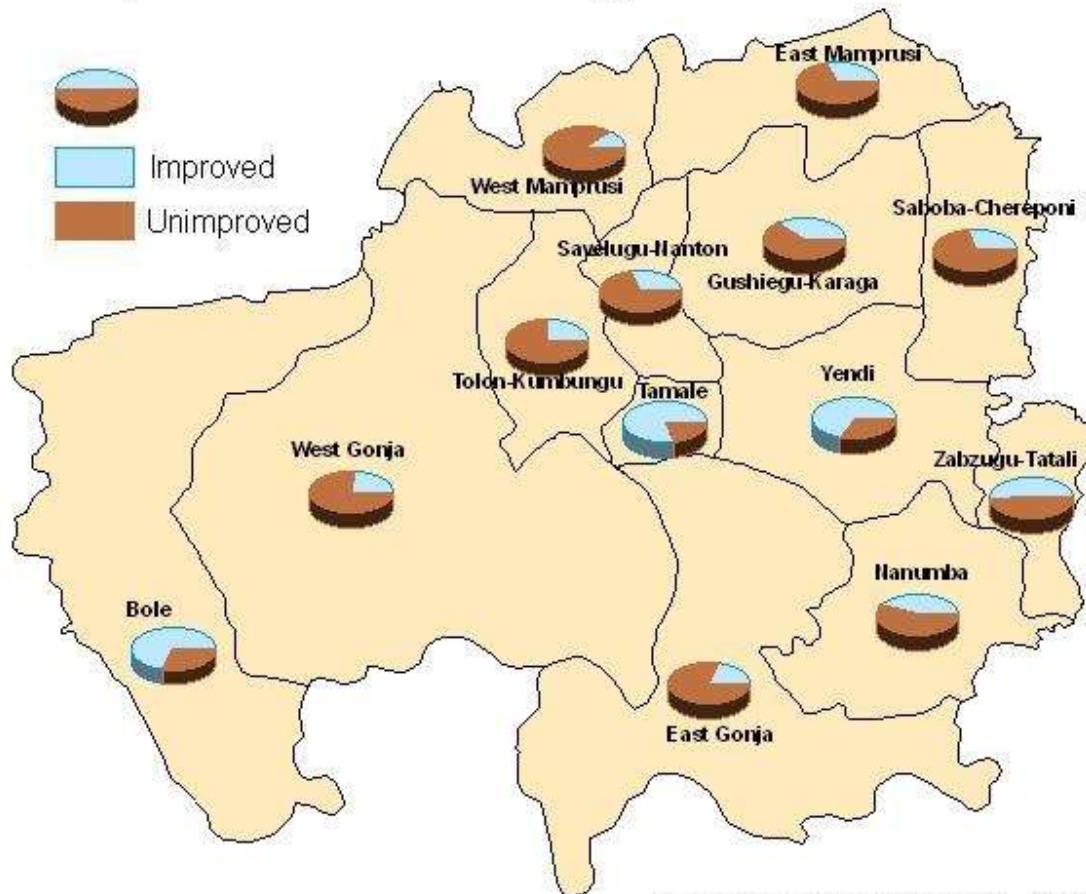
■ Diarrhea

Overall prevalence of reported diarrhea in children under 5 years averaged 23% across 10 baseline villages in Rotary 2012 survey (95% CI), N=200) (Lu, 2012)



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

## Percentage Use of Improved and Unimproved Drinking Water Sources



Data: Ghana Statistical Service, 2003  
Map: J. VanCalcar, 2006

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

# Open defecation is common in our project area of northern Ghana

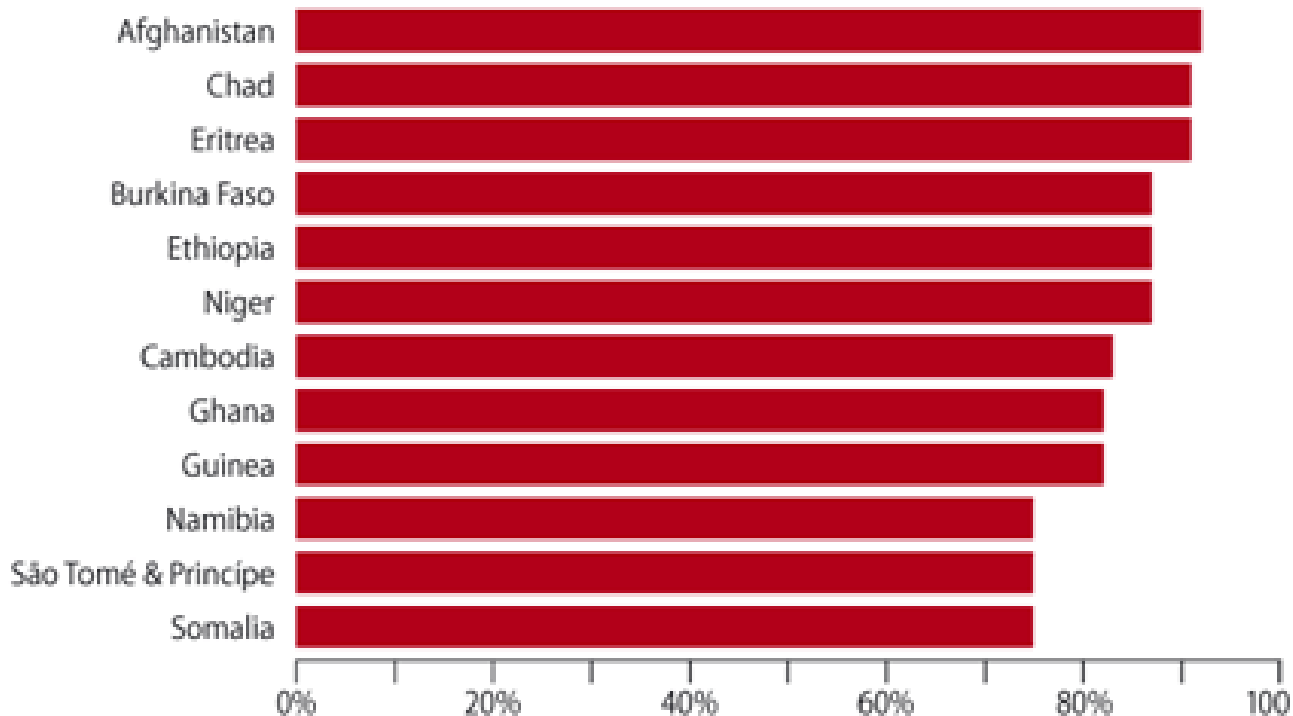


# 5 million Ghanaians (19%)

## defecate in the open.

Ghana has one of the worst records of access to sanitation in the world.

**Countries with most open defecation and worst access to sanitation<sup>3</sup>**



Deforestation - apart from Togo and Nigeria, Ghana has the 3<sup>rd</sup> highest rate of tropical deforestation out of 65 nations.\*



Tree cutting is typically for charcoal, pasture for livestock, or clearing for urban, rural or industrial purposes

\* <http://www.ghanaweb.com/GhanaHomePage/NewsArchive/Ghana-has-the-Highest-Rate-of-Deforestation-212616>

# Burning Bush – illegal but common, burning brings up new shoots for cattle to eat



(Photo: Kristine Cheng, MIT'12)

# MIT in Ghana

Since 2015, over 185 students from MIT's Master of Engineering Program, with support from MIT's Public Service Center and others, have provided technical and other service skills to PHW in Ghana



Pure Home Water's main product is the Afri-Clay™ ceramic water filter which we produce at our factory in Tamale, Ghana



# Filter Production - 15 Steps

1. Clay mining
2. Clay processing and drying
3. Rice husk sieving,
4. Mixing the clay, rice husk & water in proper ratio
5. Kneading and weighing
6. Pressing filter pots
7. Drying
8. Stacking in kiln
9. Firing
10. Soaking in water tank
11. Quality control - Flow rate tests
12. Bacterial tests
13. Silver application
14. Transporting, delivering and training
15. Drinking safe water



# 1. Procuring the clay and transporting it to the factory site



## 2. Processing the clay



### 3. Sieving the Combustible (Rice Husk or Saw Dust)

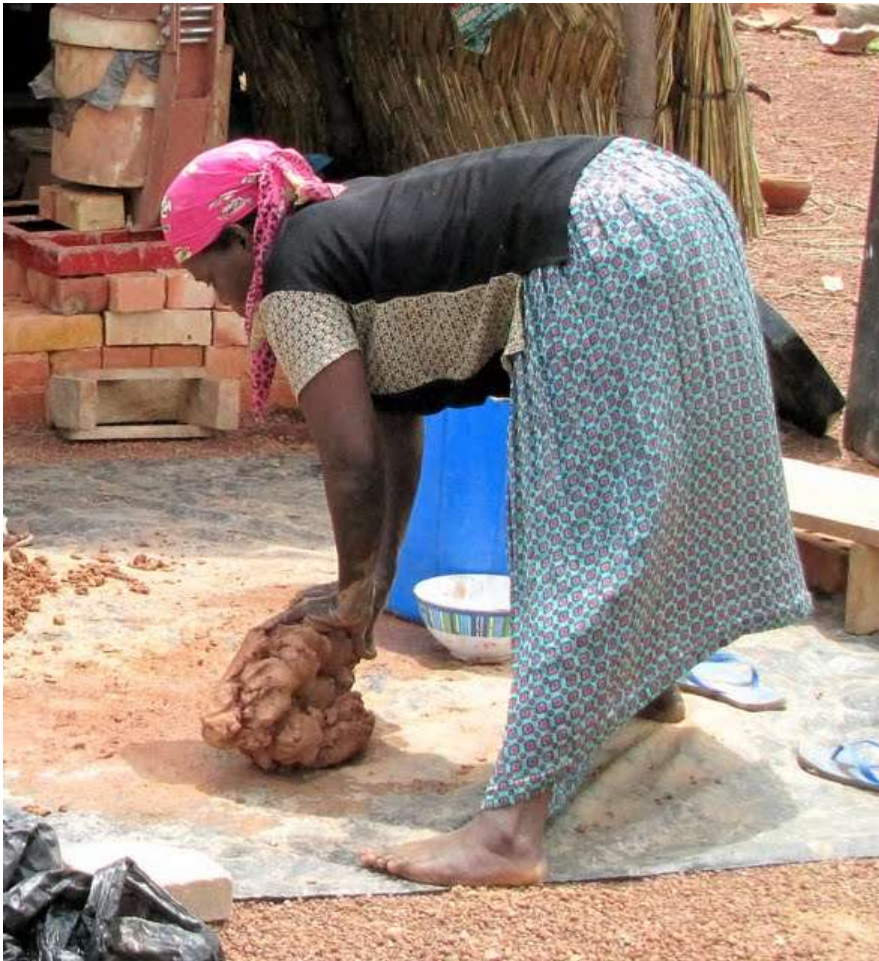


Credit: Travis Watters

## 4. Mixing the clay, rice husk and water in the proper ratio



# 5. Kneading clay until uniform mixture is obtained, then wedging and weighing



## 6. Pressing Filter Pots



# 7. Drying Pots

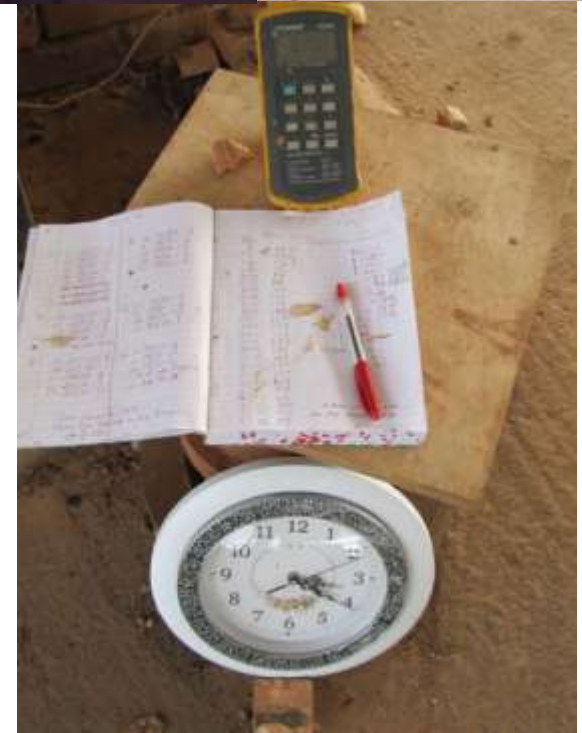


## 8. Stacking filters in the kiln





# 9. Firing the Kiln to the correct maximum temperature for the right time duration



# 10. Soaking pots for 12+ hours



# 11. Quality Control - Flow Rate Tests



Performed in one of two ways:

- (i) Filling filters to the brim and letting water drip into a collection bag for 15 or 30 minutes
- (ii) Filling to brim and measuring with a calibrated “T” devise



# 12. Bacterial Testing in PHW Lab



# 13. Painting silver nanoparticles on pot filters



# 14. Delivering to Customers and Training in Proper Use



# 15. Drinking safe water from AfriClay filter



Progress



Pure Home Water estimates that the AfriClay filter has reached 100,000 people in rural northern Ghana with safe drinking water



Credit: M.K.Jackson.

# The Filter Works!



# Performance is good!

Gbalahi Clay	Wayamba Clay	Rice Husk
14 kg (64% w/w)	4 kg (18% w/w)	4 kg (18% w/w)

Flow Rate	Bacteria Removal	Turbidity Reduction
5 L/hr	99.7 %	92 %



Credit: Matt Miller  
(MIT '12)

Our factory is on the map, in close proximity to its village workers and clay source



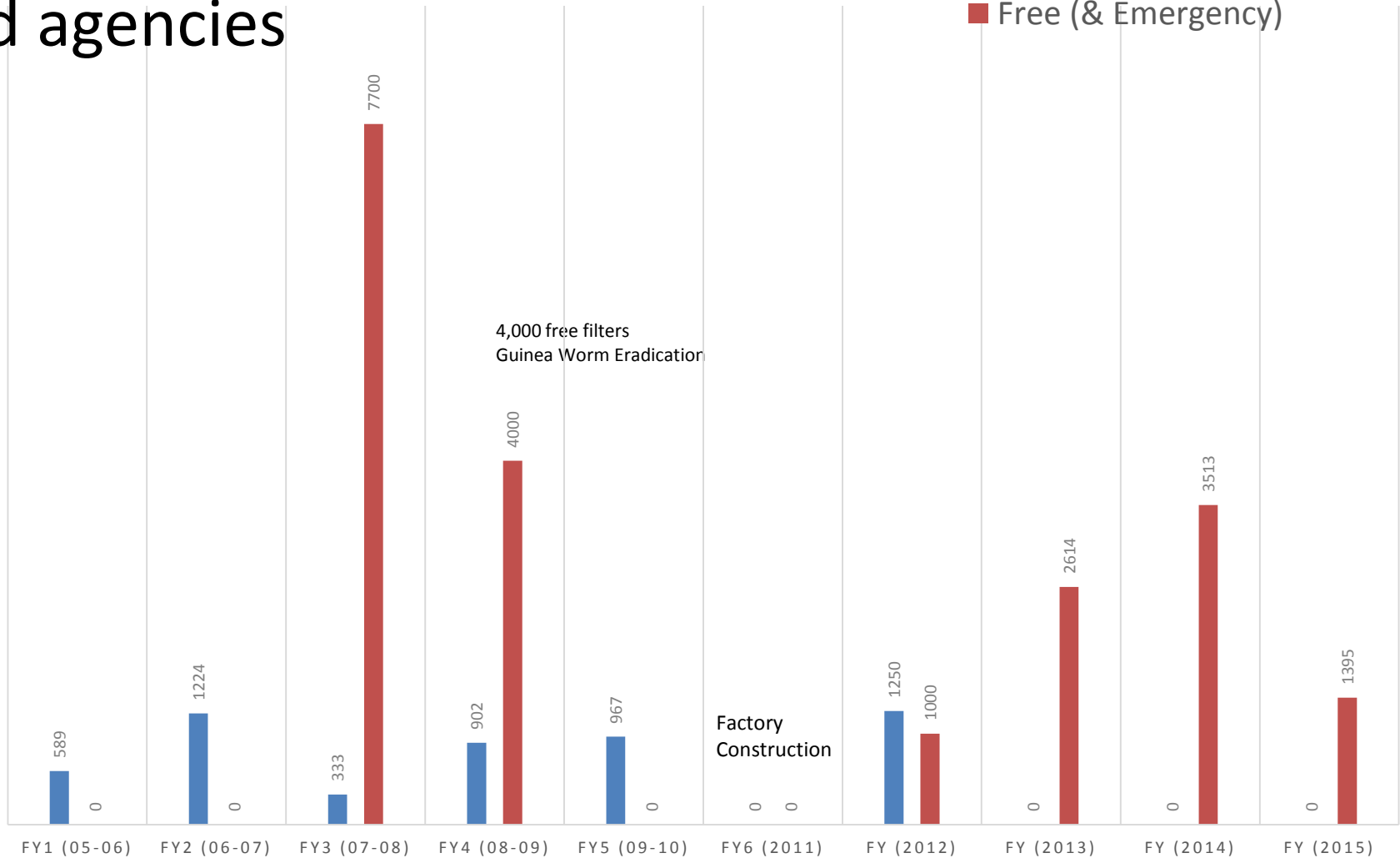
The filter price is \$25 - \$35,  
depending on services offered



We have provided filters directly to customers and to emergency relief and aid agencies

## Filter Sales (2005 – 2015)

■ Sold at Various Prices  
■ Free (& Emergency)



# We have contributed to the eradication of Guinea Worm in Ghana

Our filters helped the 25+ year Guinea Worm Eradication Campaign to  
eradicate guinea worm from Ghana



Woman from Yesapi, Central Gonja, with bandage covering guinea worm- infected foot

We have built and expanded the factory





We employ 24 factory workers  
providing well-paid local employment



We have created  
diverse,  
multicultural,  
multi-religious  
multi-national  
teams of men  
and women  
working  
cooperatively  
and in peace



We have raised funds through the MIT Public Service Center and Indiegogo and built 2 public toilet blocks in local villages



# Taha Toilet Block Opening Ceremony



# Self-Sufficiency

some examples of PHW's success



PHW staff can build and repair the hydraulic press and can construct and maintain concrete molds, using all local skills and materials.



Rainwater Harvesting System – we have both a municipal piped water supply and our own supply





In 2014, PHW acquired land in the village of Gburma to offset the carbon emissions from wood-firing in the PHW kiln via reforestation.





<http://globalwater.mit.edu/ghana>

<http://www.purehomewater.org>

Pure Home Water  
marykay.jackson@yahoo.com  
PO Box TL 2261, Tamale, Ghana  
+233-246-560145

# For More Info on Pure Home Water



*Is your family's drinking water **SAFE?***

*Make sure! Use an*

***AfriClay Filter***

***by Pure Home Water***



*For more information, call **0573-333-355***

*or visit **purehomewater.org***

*This advertisement paid for by a grant from:*

Rotary Club of Sunyani Central  
Rotary Club of Cambridge, MA  
Rotary Club of Dunwoody, GA



Rotary Club of Malden, MA  
Rotary Club of Melrose, MA  
Rotary Club of Everett, MA



# Thanks to our Sponsors



MIT  
PUBLIC SERVICE CENTER



Gerard Health Foundation

21 Eliot Street # 10  
Natick, MA 01760-6085 [map](#)

