Old Bio-Sand Filters (BSF) Preliminary Report

Water for Cambodia, Mach, 2014
Prepared by Seur Seang

Motivation

- The improvement of a water source is only the first step. Intended impacts for improved health and socioeconomic well-being can only be realized if the improvement is sustainable. For decentralized systems such as biosand filters, the user is responsible for operation and maintenance, which is why ownership is a key factor in water system sustainability.
- In order to continually improve its programs, Water for Cambodia would like to know
  - (1) how many Bio-Sand Filters (BSFs) are still being used and
  - (2) if they are not being used, why not?

Background

- Water for Cambodia began installing biosand filters (BSFs) in 2006 and has since installed over13,000BSFs in Siem Reap Province as well as over 1,000 BSFs in other provinces in Cambodia
- Typically Monitoring andEvaluation (M&E) is conducted for BSFs between 3 months and 1 year after installation
- Some studies have been done on older BSFs by other organizations, but the sample size of filters older than 5 years appears to be limited to <10 BSF

Methods

- Surveys were completed in person by two WFC employees trained in monitoring and evaluation of BSFs
- Surveying was conducted using the ViewWorld mobile surveying application on Samsung Tab2 tablets
- Of 1040 BSF built by WFC in 2007, the oldest BSFs were selected to be surveyed from a list of household names
  - 400 oldest BSF surveyed from June through July 2013
  - 400 more BSF were surveyed from October through December 2013
- The survey collected information about
  - Household health, hygiene, and socioeconomic status
  - BSF location, condition, functionality, and usage
  - Reasons any BSFs are not in use and any other problems
- 2007 monitoring data used for comparison is from a different random selection of 101BSFs *for lab testing*.

Water Sampling Protocol

- 101 BSFs (12.62%) were randomly selected from a list (every 8th BSF) for water testing (100 BSFs were actually tested from the random sample)
- If a selected BSF was not being used, then the next BSF from the list was selected for water testing instead
- For each BSF selected, 3 water samples were collected
  - A: Source water
  - B: Filtered water (directly from the BSF)
  - C: Storage container water
- Water samples were also collected for particularly interesting BSFs at the discretion of the surveyors but are reported separately from the random sample (1 BSF)

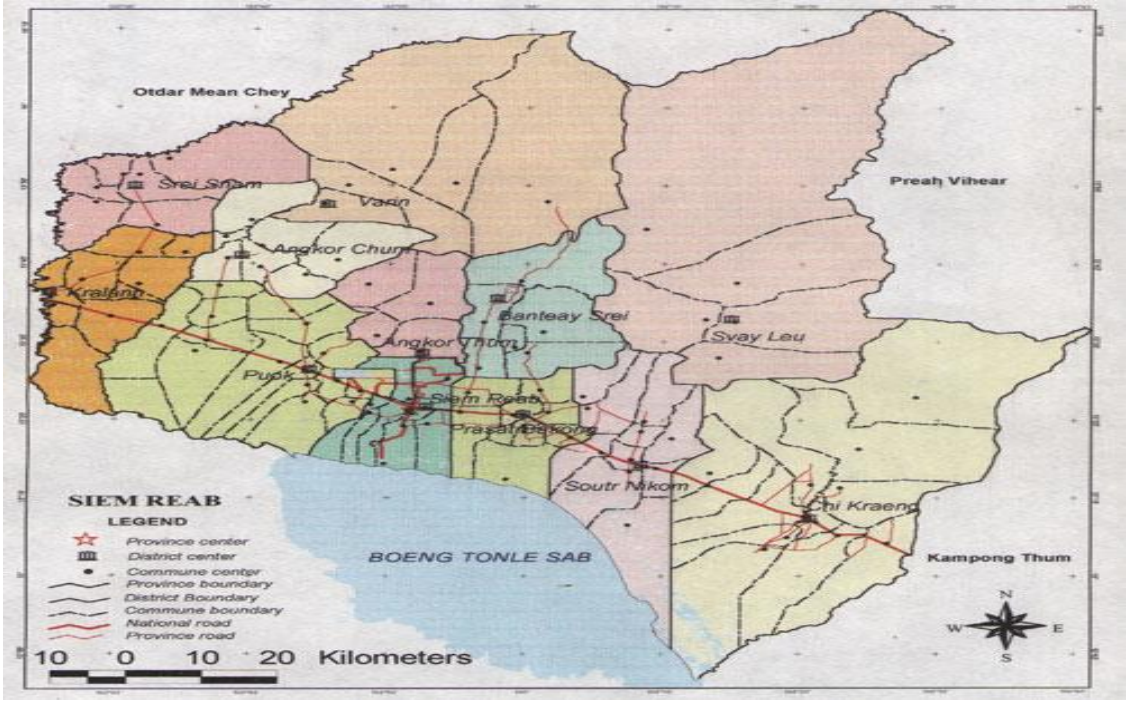
Results

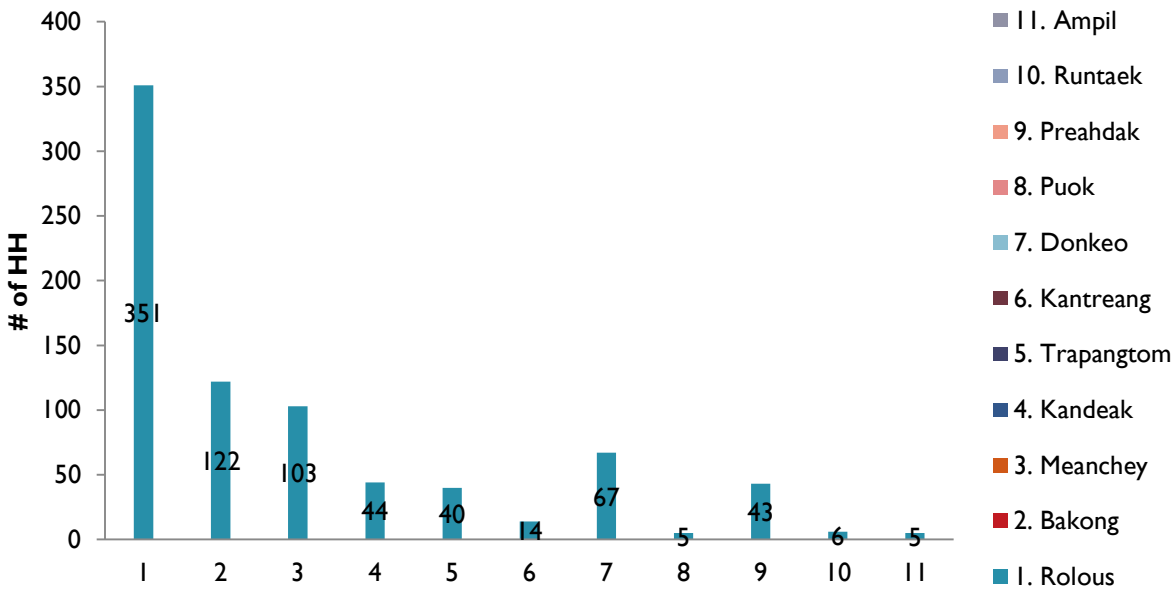
- Total number of villages
  - 38 villages with 800 BSFs
- Average number of surveys per day
  - 10 HHs per day per surveyor
  - Each survey consisted of an introduction, taking measurements (flow rate & sand depth), completing the questionnaire, and completing quick repairs if possible
    - Average questionnaire length of time
      - Old BSF M&E with tablets: 9 minutes per HH
      - Previous BSF M&E without tablets: more then15 minutes per HH

Many BSFs were found still working well



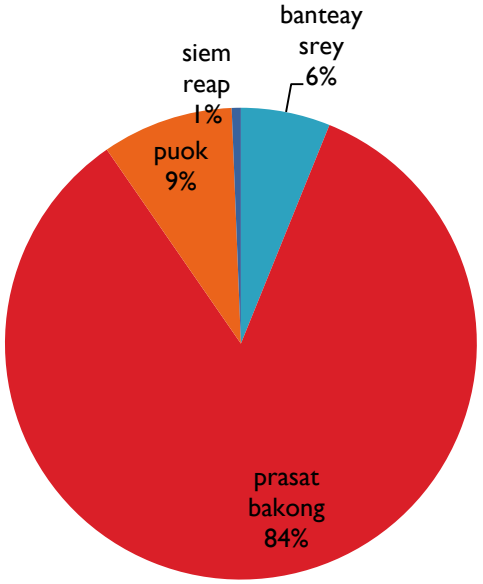






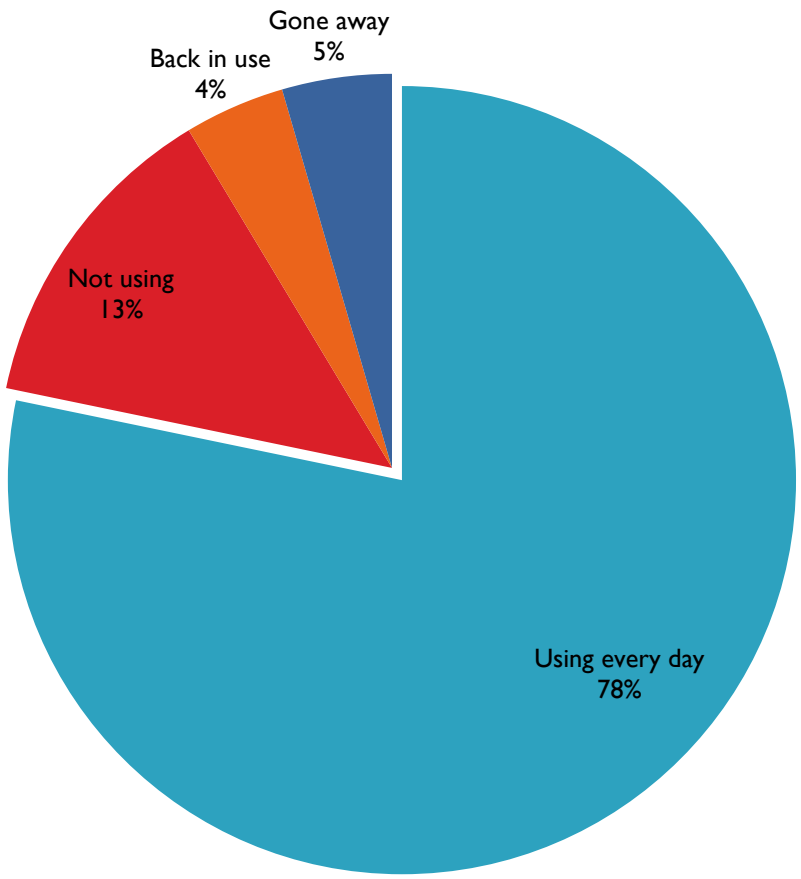
Location of HH

The survey included HHs located in 11 different communes within 4 different districts in Siem Reap Province



N = 800

Total BSFs still in use after 6 years



N = 800

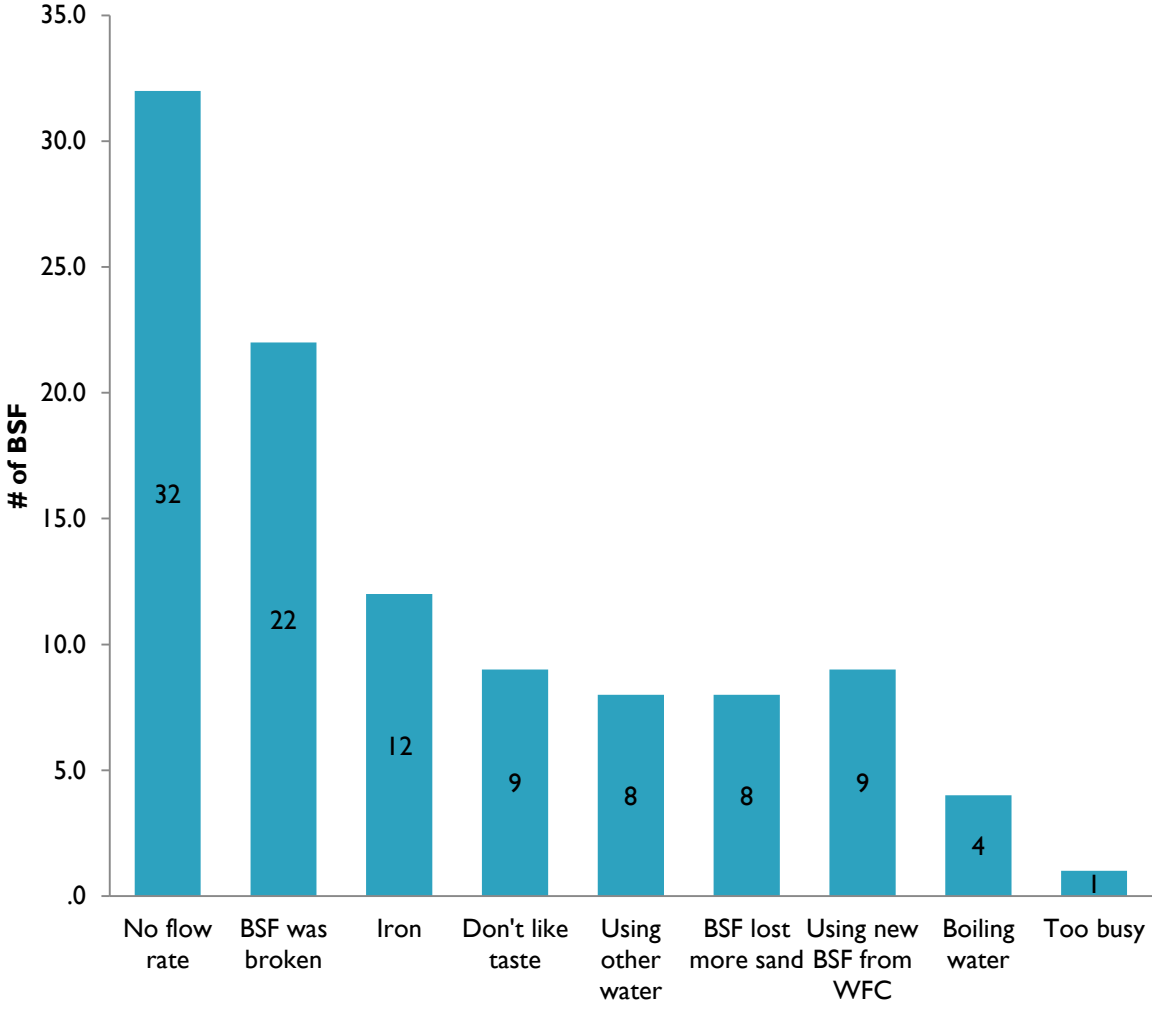
- 626 HH (78%), the owners were still using the BSF.
- Of the remaining 174 HH (22%):
  - 33 HH (4%) Required repair and back in use
  - 36 HH (5%) Were no longer there or sold the filter
  - 105 HH (13%) Were in active

NB: 13% of the filters not working could not be fixed due to owners absence.

“If you no longer use your BSF, why not?”

Responses were categorized into 9 different reasons

- “No flow rate” was the most common problem, usually due to insect nests and breakage which they tried to fix themselves
- “Broken BSF” was the second most common problem, usually due to damaged concrete shell (e.g., dropped, knocked over by livestock, leak, and stopped remove turbidity, iron)

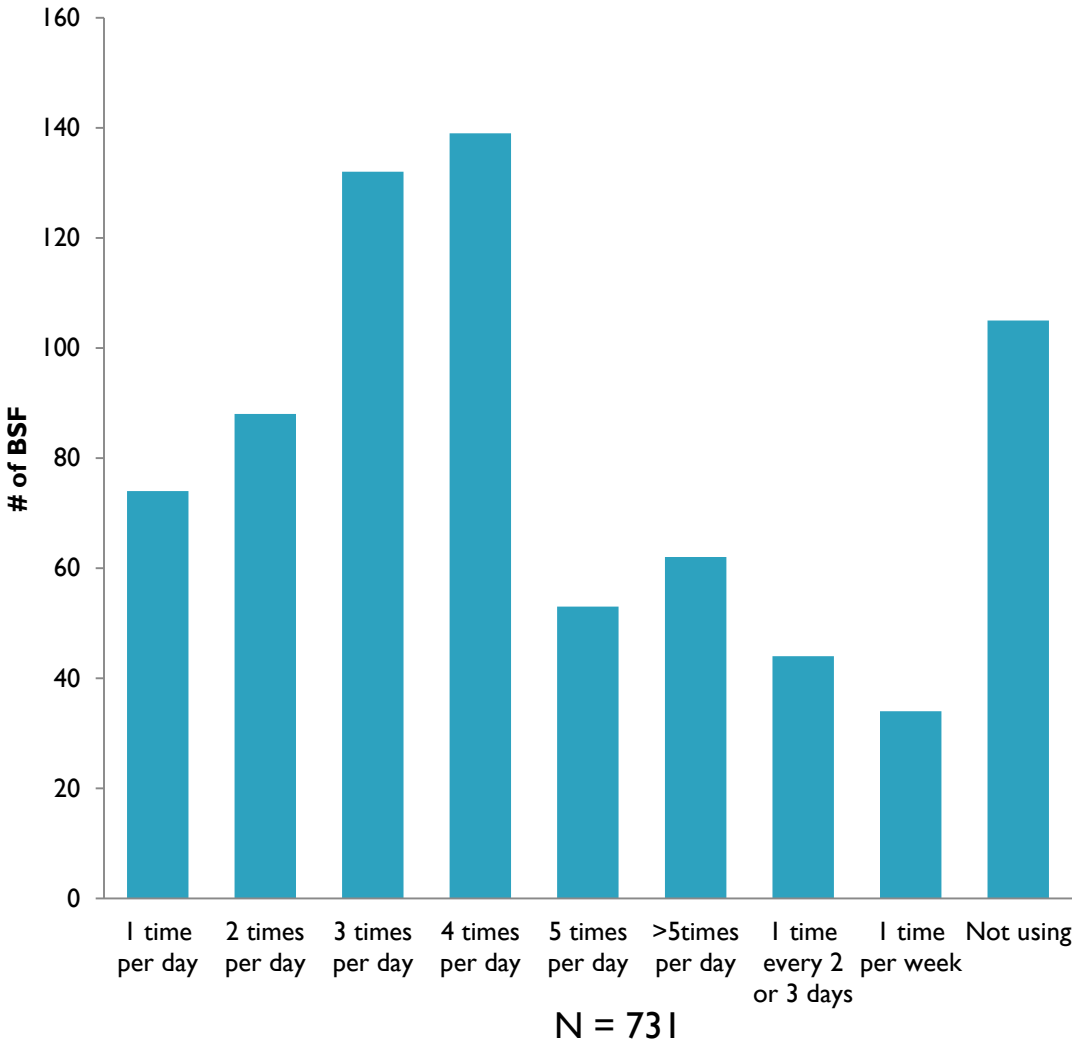


N = 105

“How many times per day do you pour water into your BSF?”

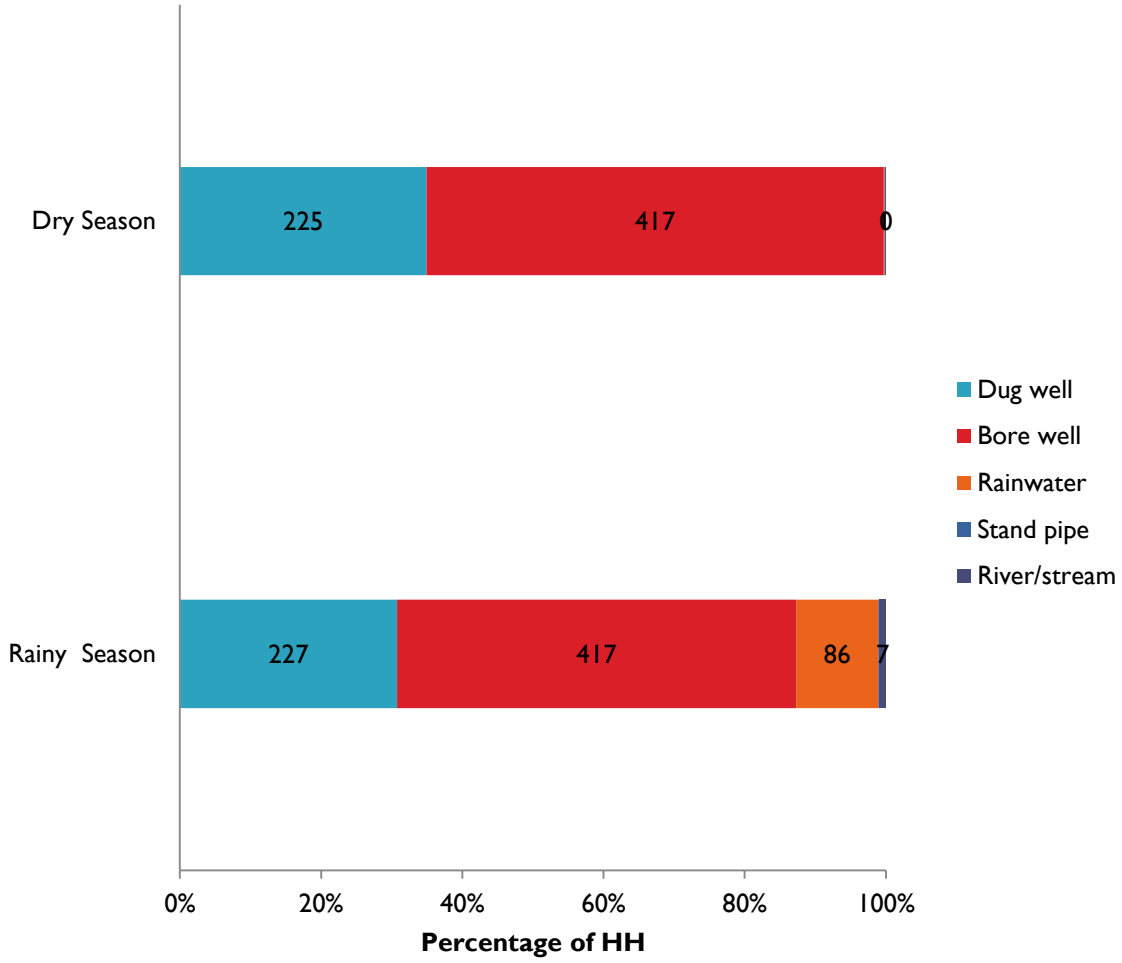
- WFC recommends 3 pours/day for 60l of drinking water:
  - First every morning
  - Second at noon time
  - Third in the evening
- 13% of HH were no longer using the BSF
- 11% of HH were using the BSF less than once per day
- 40% of HH were using the BSF 3-4 times per day so they following our recommendation
- 35% of HH were using the BSF 5 or more times per day
- **Key Finding:**

  No relationship could be established between frequency of use and E. coli in BSF water (B)



“What source of water is poured into the BSF during (dry/rainy) season?”

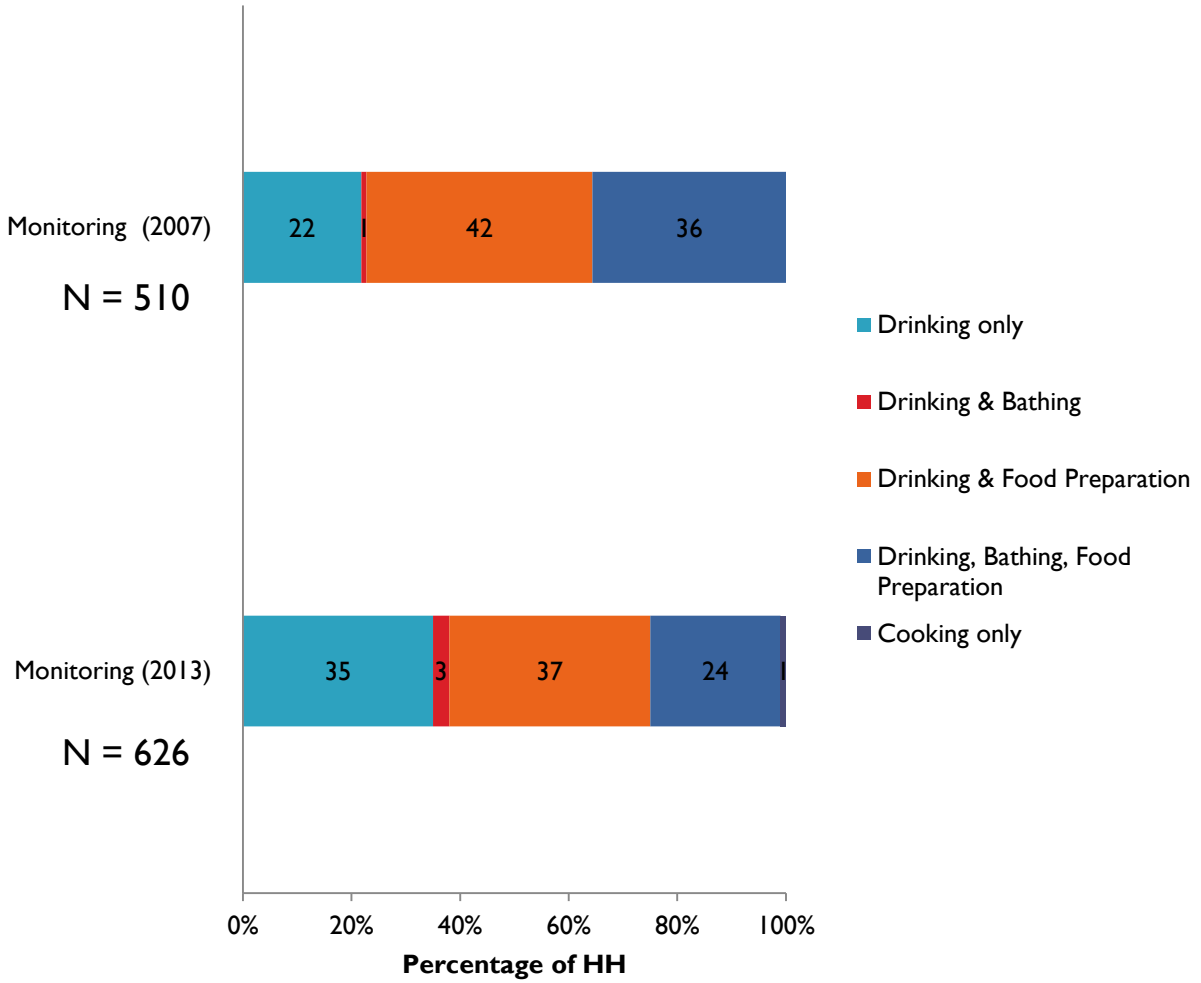
- For 626 HH were pouring water into the BSF both season
- Multiple responses allowed
- ~67% of HH reported using a Bore Well
- ~36% of HH reported using a Dug Well
- ~13% of HH reported using rainwater in the rainy season, but <1% reported using rainwater during the dry season
- <1% of HH reported using stand pipe water



N = 626

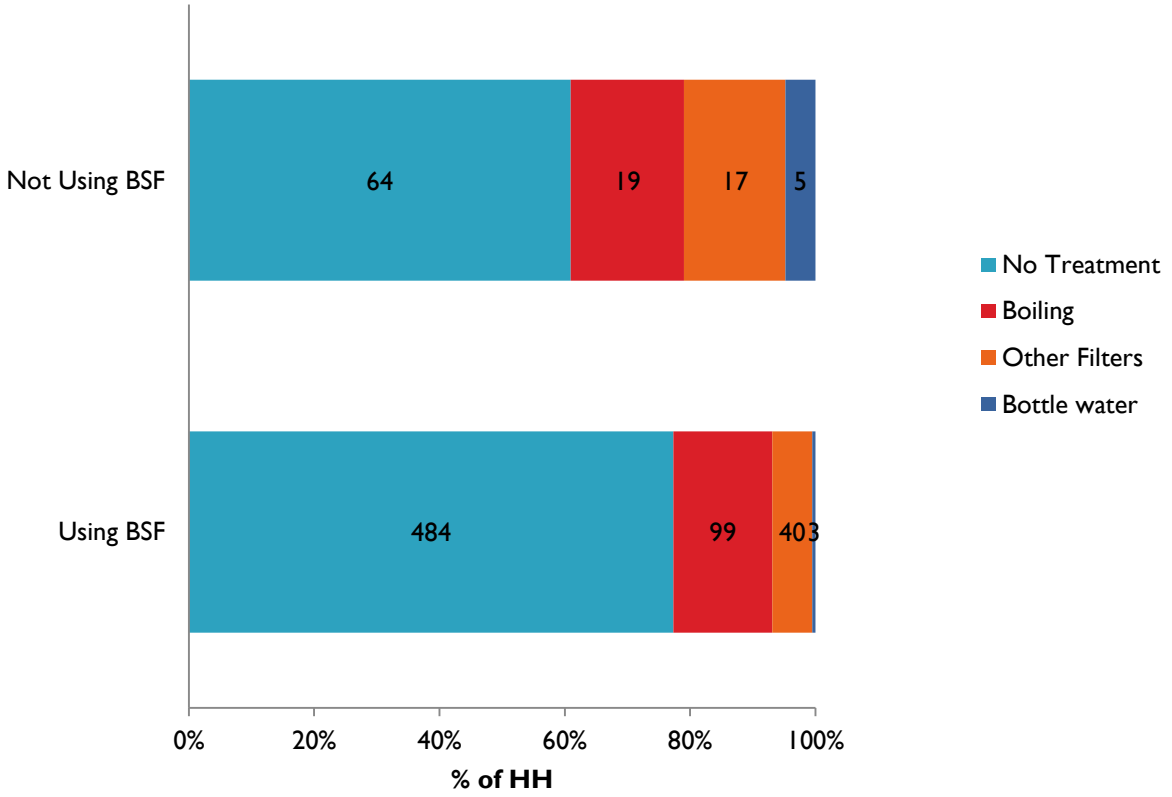
“What do you use the filtered water for?”

- In 2007 65% of HH used the BSF water for drinking and food preparation. 36% of HH used it for bathing
- In 2013 75% HH reported using the BSF water for drinking and food preparation. Fewer families were using it for bathing (25%).



What other water treatment options do you use?

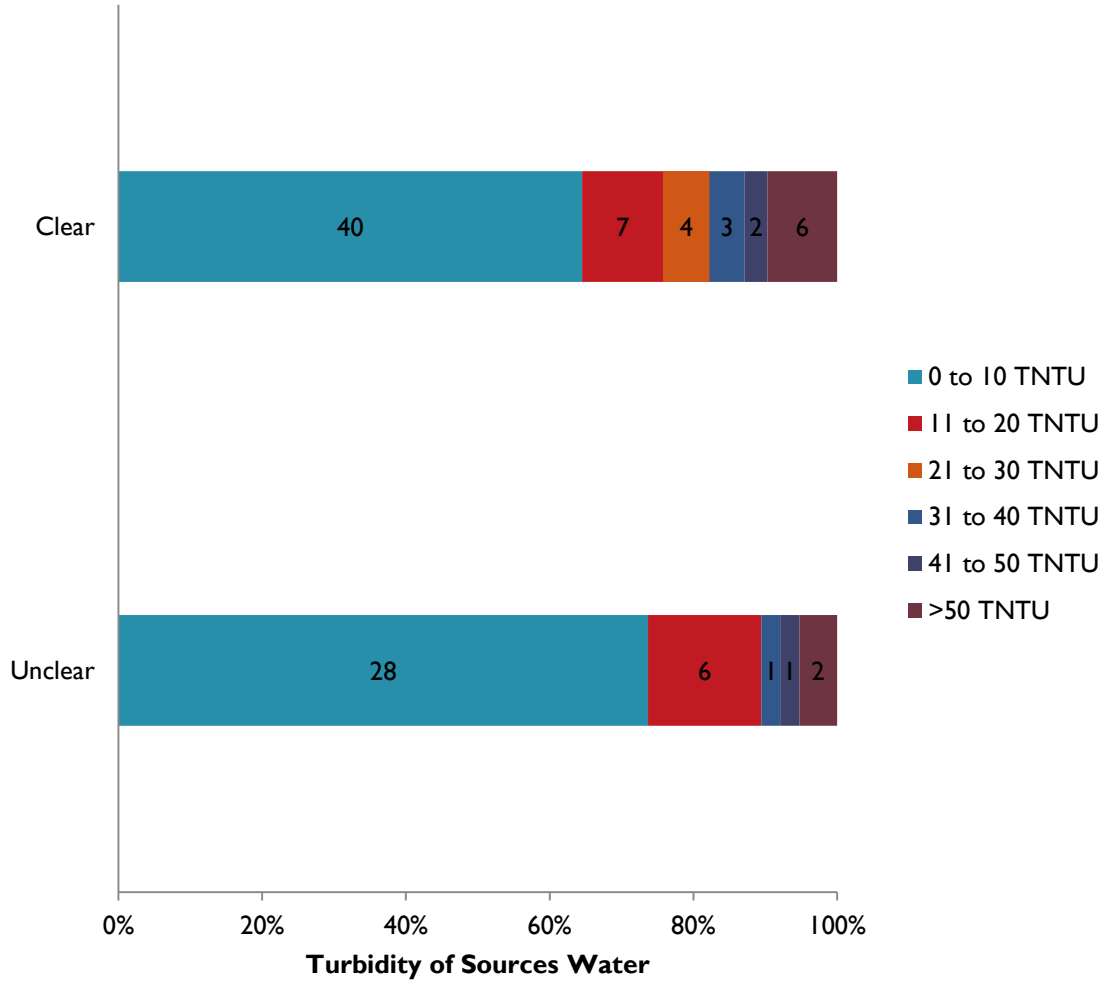
- 61% Of 105HH not using the filter reported not using any other water treatment method. 39% were treating their water by boiling, using other filters and buying water.
- There is less use of other water treatment methods among families still using filters (626HH)
  - 77% of HH not using other treatment methods
  - 22% of HH are using other treatment methods
  - 1% of these HH buy bottled water
- For HH using a BSF, the survey *did not* ask about whether other treatment was post-BSF treatment or done separately



N = 731

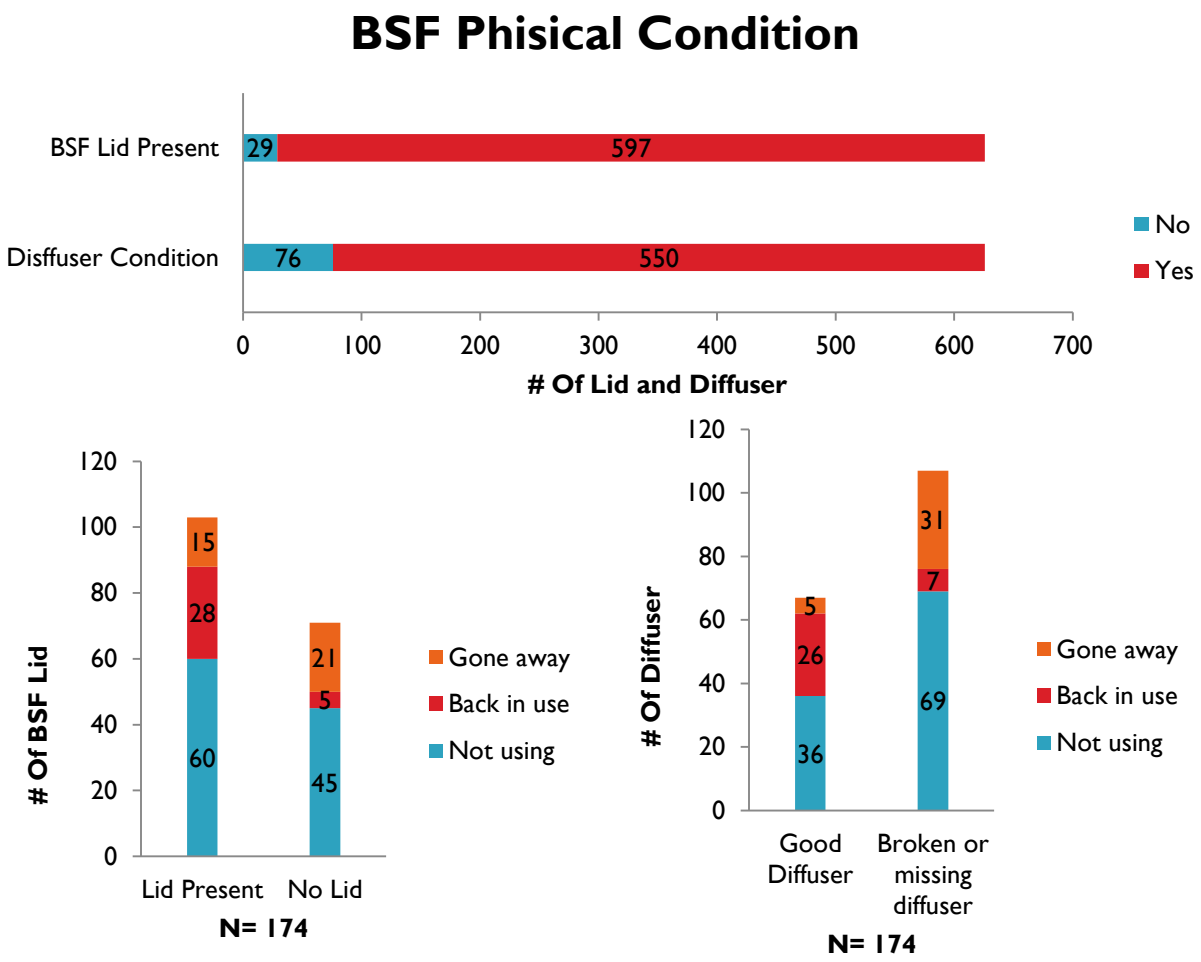
Is the source water clear

- 62% of HH were using with clear water, 38% were using with unclear water sources (Iron, Mud, and clay water)
- WFC recommended BSF should be used with low turbid water sources (turbidity <50 TNTU)
- Sedimentation methods should be used for water sources with high turbidity before filtration.



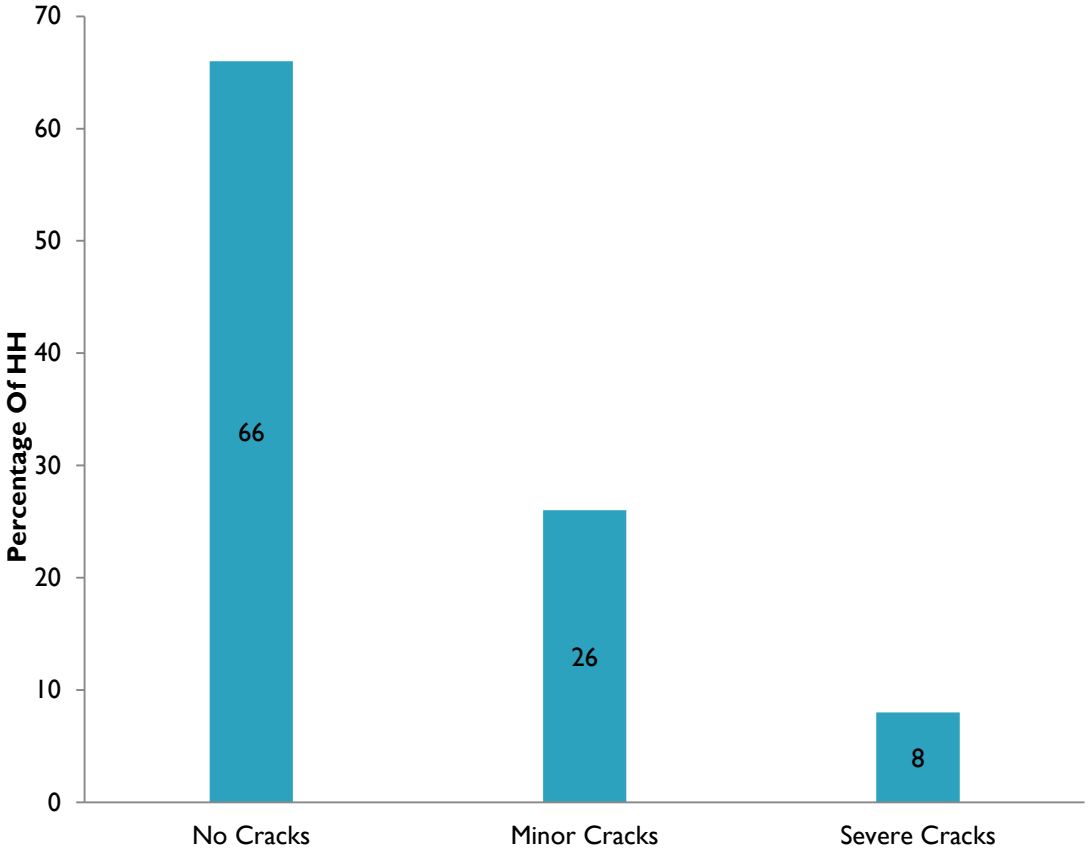
BSF Physical Condition

- 626 HH of the owners still using the BSF were 597 HH (95%) had lid, only 29 HH (5%) lid were broken.
- 626 HH of the owners still using the BSF were 550 HH (88%) had diffusers, only 76 HH (12%) were diffuser broken.
- Overall, 174HH of BSF lid had:
  - 105HH, 60HH were good condition, 45 were broken with household who not using.
  - 33HH, 28 HH were good, 5 HH were no lid with household back in use,
  - 36HH, 15 HH were good, 21 were no lid with household gone away.
- Overall, 174HH of BSF diffuser had:
  - 105HH, 36HH were good condition, 69 were broken with household not using,
  - 33HH, 26 HH were good, 7 HH were broken with household back in use,
  - 36HH, 5 HH were good, 31 were broken with household gone away.
- BSF in use are in better condition than BSF not being used
- This survey were completed 800 HH



Does the concrete shell have any erosion inside?

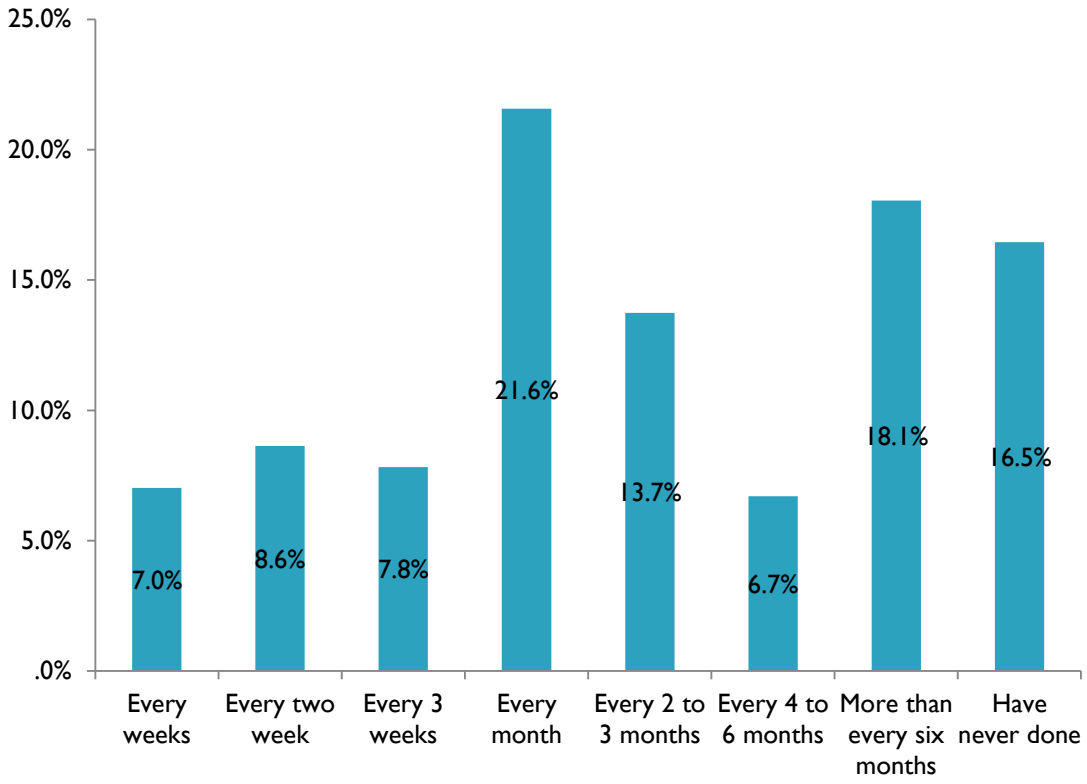
- 262HH, 66% of BSFs had no cracks,105HH, 26% were minor cracks, 33HH, 8% were severe crack.
- All BSF were using more than 6 years.
- For 400HH the first step did not ask about the question.



“How often do you maintain your BSF?”

HHs were asked to report how often they perform maintenance on their BSF

- 59% of HHs were maintenance their BSF every often between 2 weeks to 3 months,
- 25% of HHs were maintenance between 4 to more than 6months.
- Only 16% of HHs were have never done.



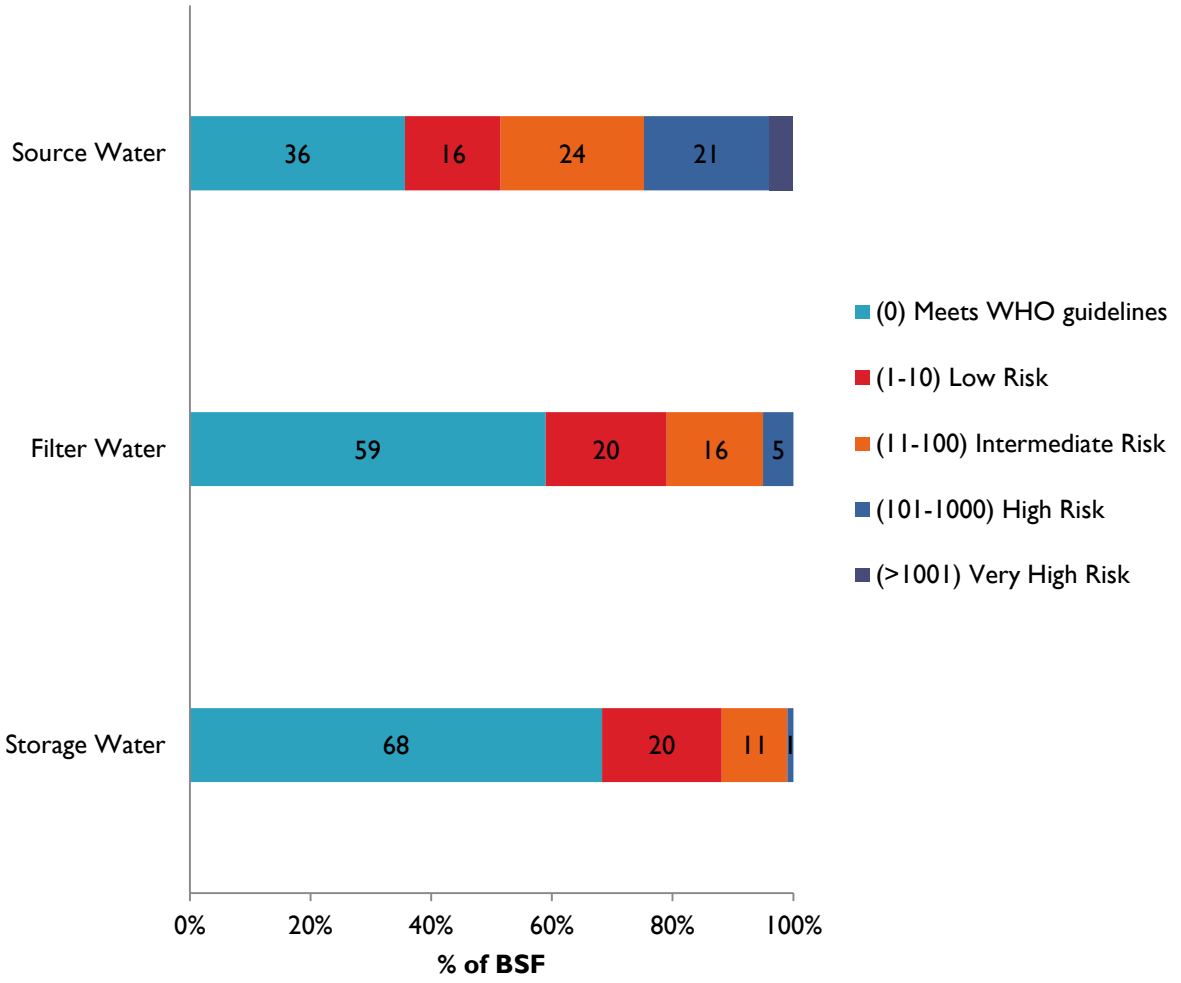
N (Using) = 626

Water Quality Summary of Tested Samples

- Turbidity, standard: ≤5 NTU
  - (A)50(49%) within standard
  - (B)94 (93%) within standard
  - (C)90 (90%) within standard
- pH, standard: 6.5 – 8.5 (Cambodia) or 8.0 (WHO)
  - (A) 88 (87%) within Cambodia standard
  - (B) 85 (84%) within Cambodia standard
  - (C) 92 (93%) within Cambodia standard
- TDS, standard: ≤800 mg/L (Cambodia) or ≤600 mg/L (WHO)
  - All samples within Cambodia standard

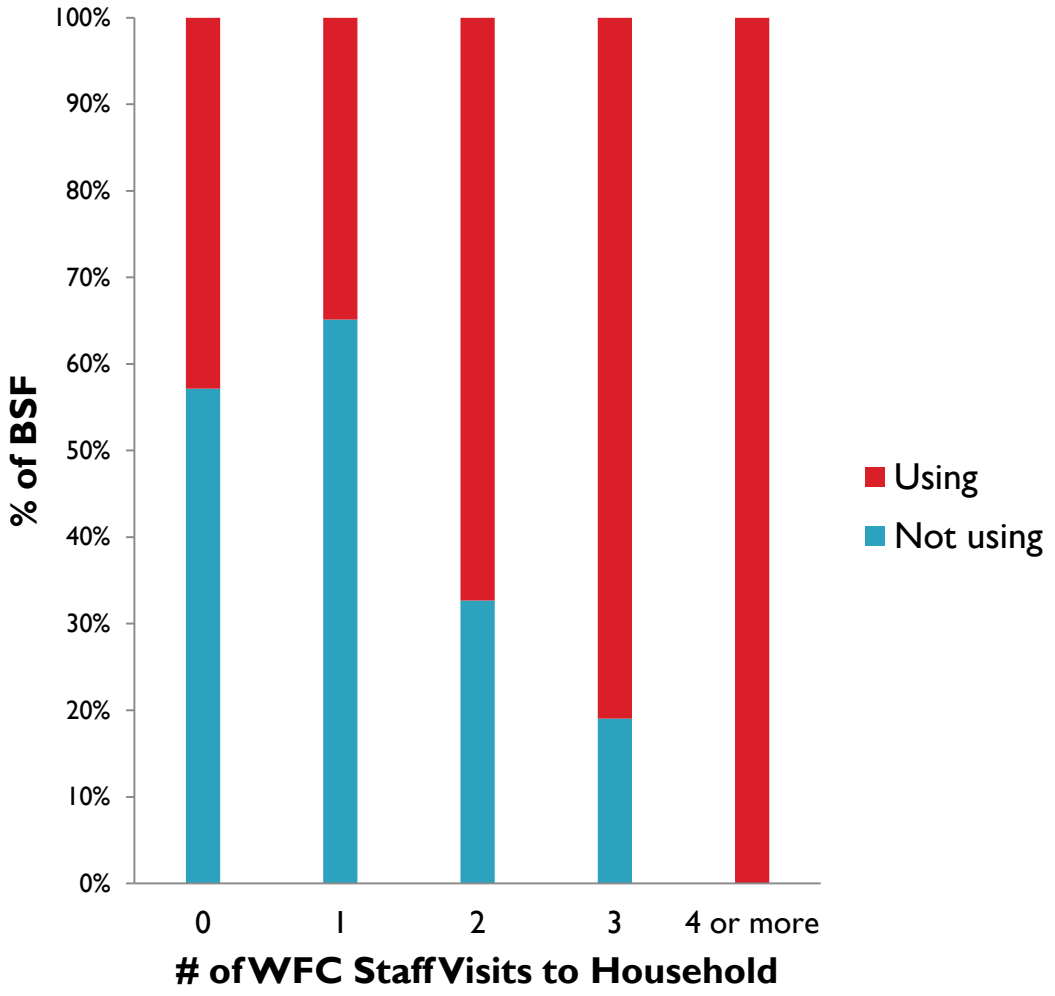
E. Coli Categories

- Filtering by BSFs improved safe or low risk source water from samples tested. 51% of source water sampled were in these categories before filtering 79% were in these categories after filtering.
- 88% of sampled stored water was found to be safe or low risk due to post filter treatment. (boiling or other filtering)
- BSFs provide substantial removal of turbidity.



"How many times has WFC staff come to check on the BSF?"

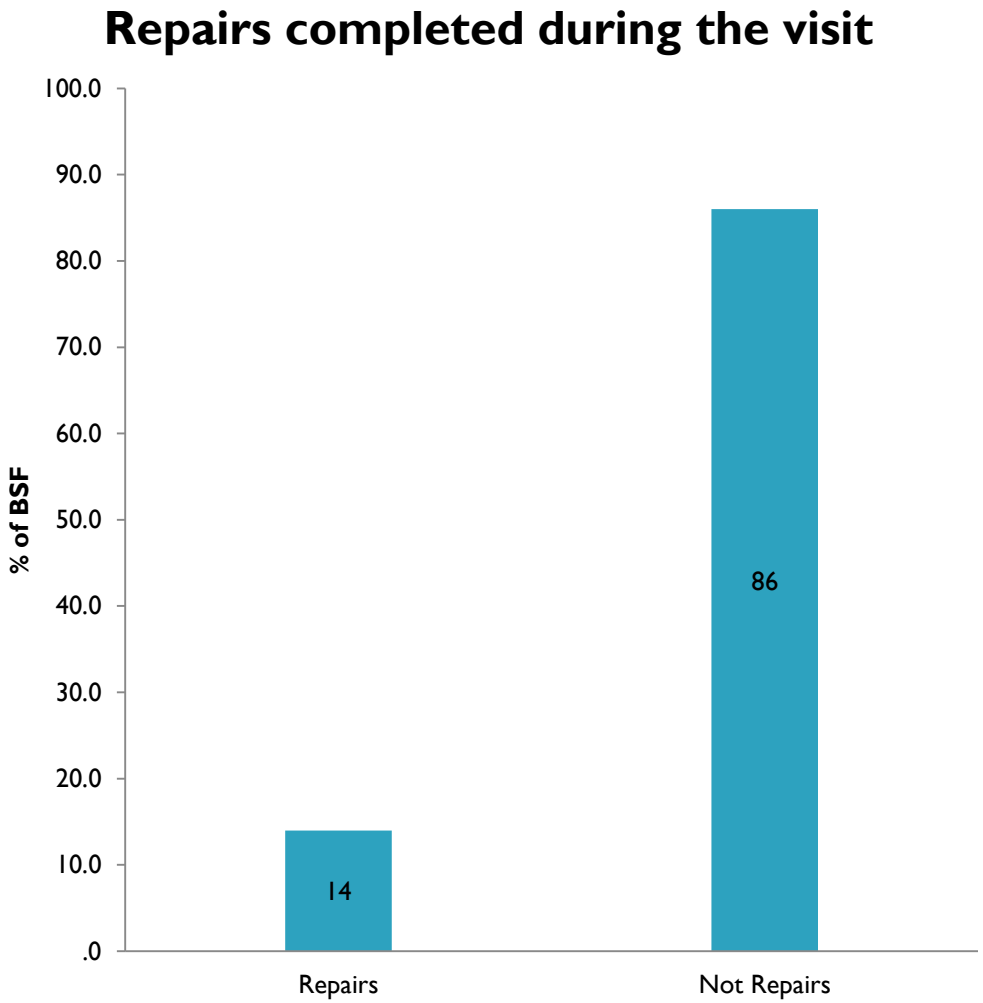
- The number of times that WFC staff have visited the HHs is related to the proportion of BSFs still in use
- The higher the frequency of WFC staff visiting the families, the more filters are in use.



N (Not Using) = 105; N (Using) = 626

Were any repairs completed during the visit?

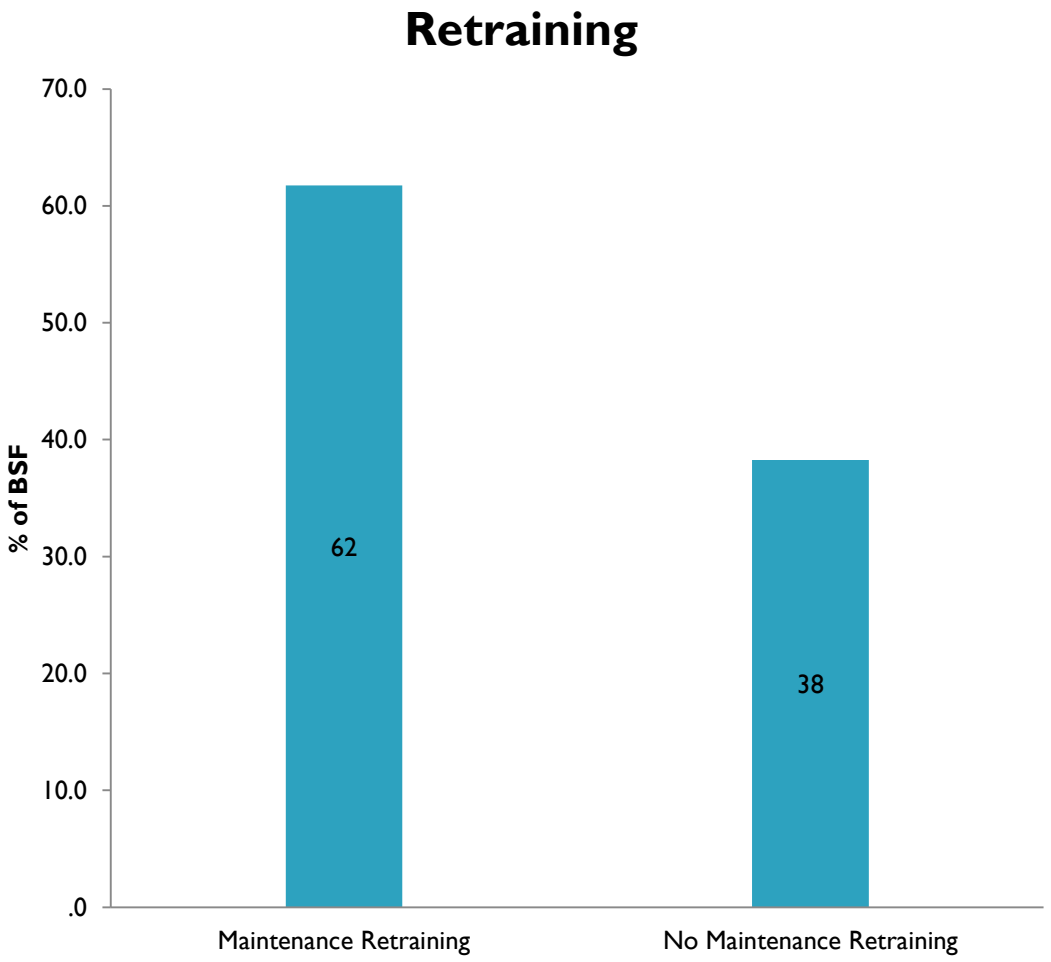
- No data survey in the first step
- Only 400 HHs were survey at second step.
- All HH visited had a repairs completed:
  - 14% reported were repairs
  - 86% reported were not repair complete. (Some of the filters not working could not be fixed due to owners absence)



N = 400

Was any maintenance retraining done during the visit?

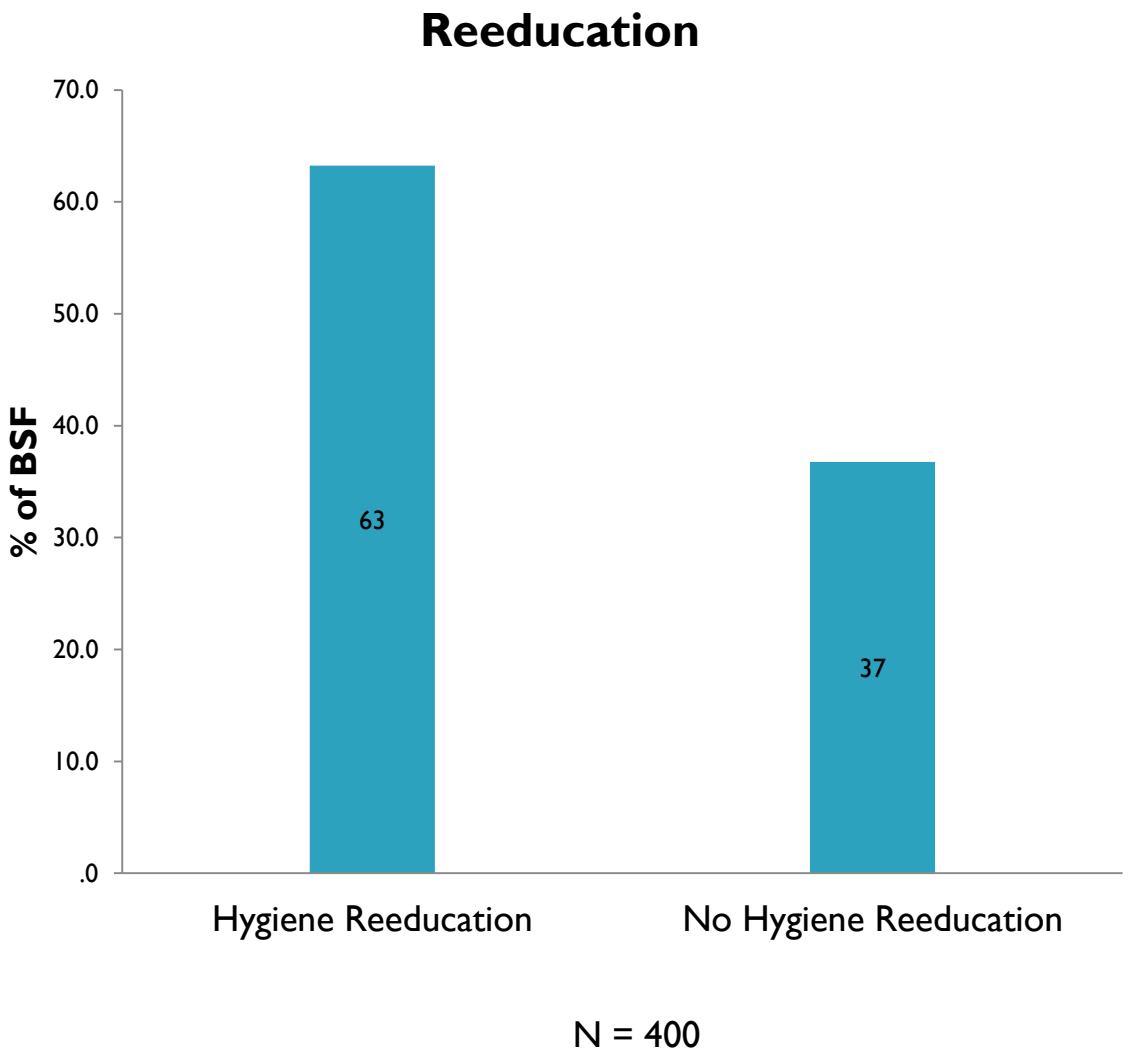
- No data survey in the first step
- Only 400 HHs were survey at second step.
- 247 HHs (62%), received further training on how to use and do maintenance of the BSF:
  - Washing BSF
  - How to pour water into filter slowly
  - How to fix flow rate
  - Keep safe drinking water
- 147 HHs (38%), portrayed clear understanding on use and maintenance of the BSF.
- All BSF were using more than 6 years.



N = 400

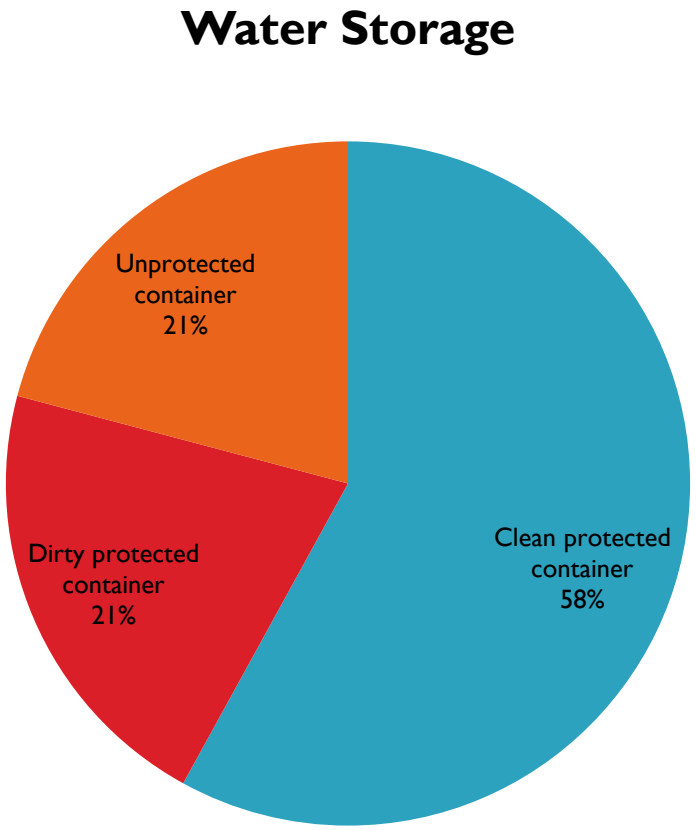
Was any hygiene reeducation done during the visit?

- No data survey in the first step.
- Only 400 HH were survey at second step, 253 HH (63%), received reeducation on maintaining their water safe for drinking:
  - Cleaning drinking water storage containers.
  - Hygiene and sanitation around the house and filter
- 147 HH (37%) demonstrated clear understanding of hygiene and sanitation practices.
- All BSF were using more than 6 years.



“Does the household store water in a clean storage container?” (Hygiene Indicator)

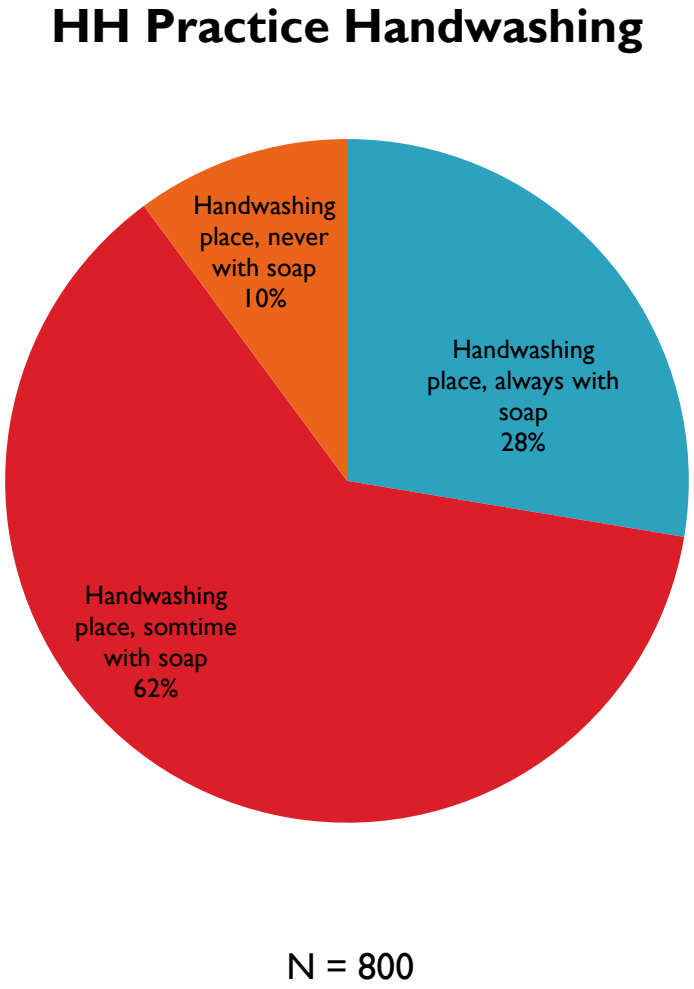
- 58% were storing their drinking water with clean protected containers
- 21% though had protected containers, they were dirty.
- Another 21% were unprotected containers.



N = 800

“Does the household appear to practice handwashing?” (Hygiene Indicator)

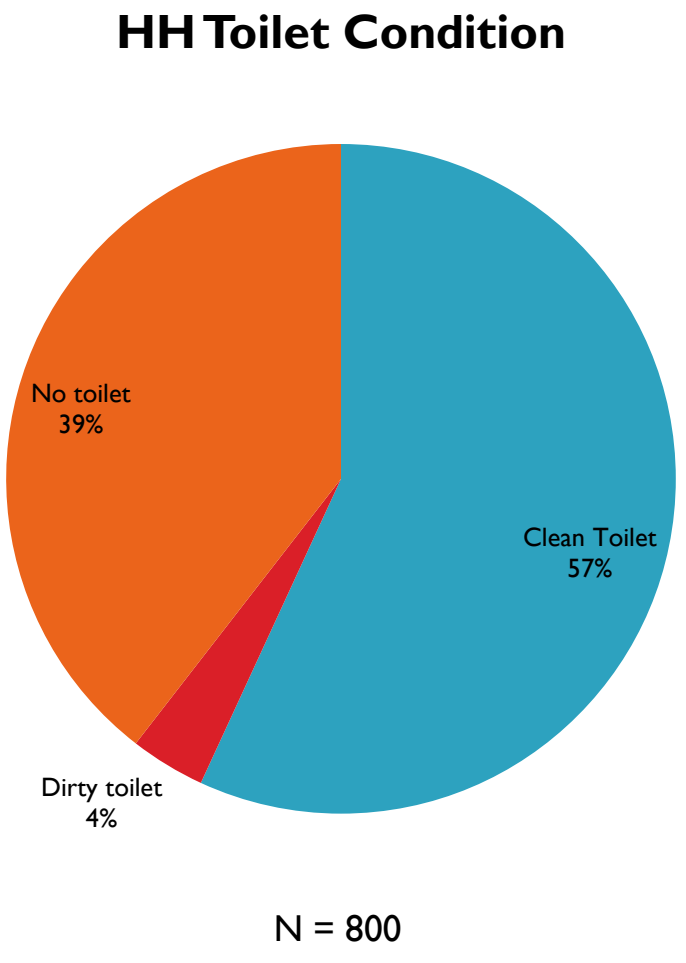
- No data survey in the first step
- All HH visited had a handwashing station
  - 28% reported always using soap
  - 62% reported sometimes using soap
  - 10% reported never using soap
- A significant relationship could not be established between this hand washing data and HH overall sickness, diarrhea, or child diarrhea



“Does the household have a latrine and is it clean?” (Hygiene Indicator)

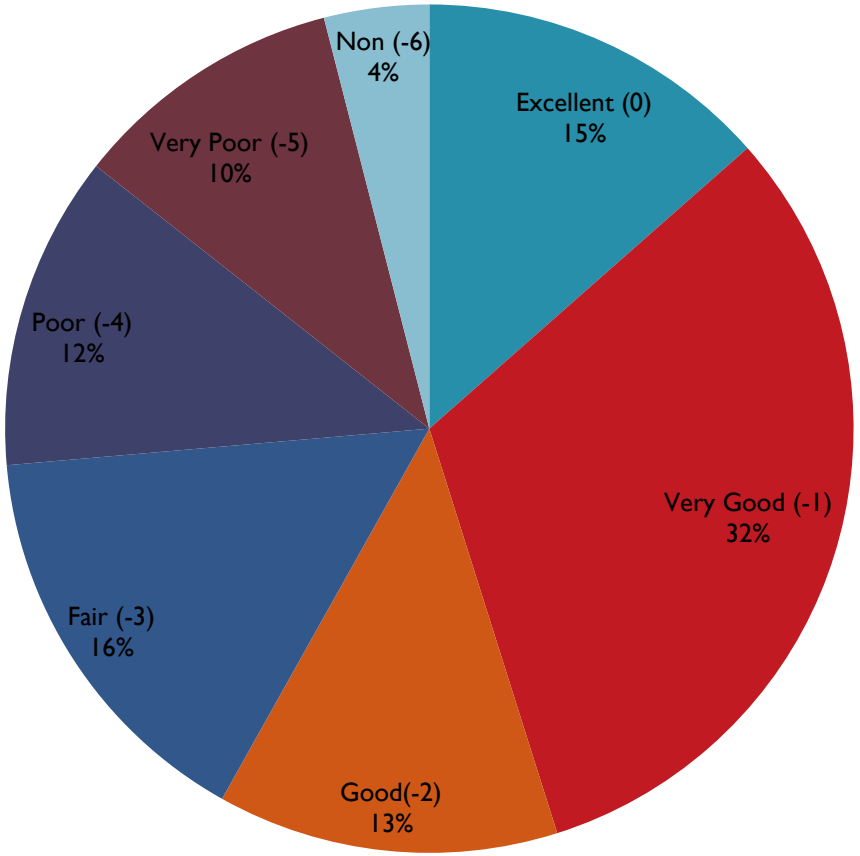
- 61% of HH had a latrine
  - 57% were using a clean latrine
  - 4% were using a dirty latrine
- 39% of HH had no latrine

These figures are more positive than the official WHO/UN statistic of 33% of Cambodians having access to safe sanitation from 2011



Total Hygiene Indicator

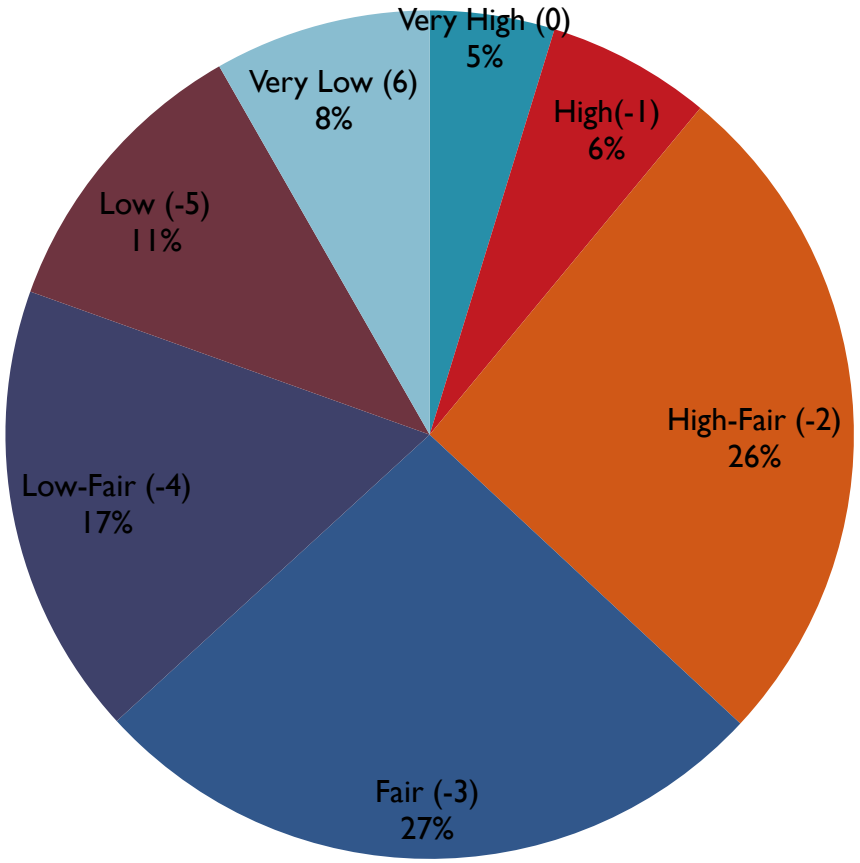
- For each of the 3 hygiene indicators, points were assigned as follows:
  - Best Case = 0 points
  - Middle Case = -1 point
  - Worst Case = -2 points
- 58% of HH had excellent, very good, or good hygiene



N = 800

Total Socioeconomic Status (SES) Indicator

- For each of the 3 SES indicators, points were assigned as follows:
  - Best Case = 0 points
  - Middle Case = -1 point
  - Worst Case = -2 points
- 63% of HH had very low to fair SES, note that this scale is relative to rural Cambodian villages.



N = 800