March 2007

Technical Update

Biosand Filter – Flow rate – Successful Program

The following is a list of key points that has been prepared based on feedback from successful projects. If these are generally followed, it will ensure the highest probability of success when implementing a biosand filter project.

Of particular interest to our alumni is a revision that has been made to the desired flow rate from the concrete biosand filter. Based on recent field tests and recalculations of the loading rate, we feel it prudent to reduce the maximum flow rate to **0.6 liter per minute** (or 100 seconds per liter) to improve the filter efficiency and assure consistent results. Since the flow rate is controlled by the screening and washing of the sand, the sand should not be washed as much to achieve the lower flow rate. In some instances, finer sand may have to be sourced and used.

The three key things that convinced us to change to the lower flow rate were:

- inconsistent results from the field – especially in Haiti last fall and especially from filters with higher flow rates
- comparison of the loading rates to that of conventional slow sand filters. The current recommended maximum of 0.6 liters/min is now still on the high side of recommended rates for slow sand filters, but the old flow rate of 1.0 liter/min was at least 40% above that range.
- our discovery of the suggested loading rate (600 liter/hour/square meter of surface area) by the developer of the biosand filter and recalculation of the surface area and flow rate for the concrete version of the filter.

Note that the flow rate of 0.6 liters/minute is measured when the top reservoir of the filter is full of water. This will ensure that this is the maximum flow rate that the filter will experience since the flow will drop off as the water level drops.

If you have questions on this list of key points or the lower flow rate, please contact your International Technical Advisor or Ron Lentz (rlentz@cawst.org)

Successful Biosand Filter Program

A biosand filter program will be most successful and work well when:

1. The filter is built and installed correctly:
    - box that doesn't leak,
    - screened and washed sand, (organic free, Uniformity Coefficient of 1.5 – 3.0 and an Effective size of 0.15 – 0.30 mm - a sieve analysis is required to determine these numbers)
    - well washed under-drain and separating gravel,
    - diffuser plate and lid
    - safe storage container,
    - maximum standing water level of 5 cms
    - start-up (maturing) time of 14-21 days

2. The filter is operated correctly:
    - using water from the same source regularly
    - water supplied from shallow wells and surface waters will develop a faster and stronger biolayer
    - water from rain water and deep wells may result in less of a biolayer however the quality from these sources should be better
    - water containing VOC's, insecticides, herbicides, heavy metals, lead, mercury industrial pollutants, algae, plankton, chlorine and salt should not be used in the filter
    - water with a turbidity of less than 100 NTU will still work with more frequently cleaning, water with a turbidity of < 50 NTU is preferred
    - maximum flow of 0.6 liters per minute when filter reservoir is full
    - pause period
    - intermittent cleaning to restore flow rate
    - proper "swirl and dump" cleaning process

3. Expected results under field conditions should be:
    - removal of turbidity to approximately 1 NTU
    - e. coli bacteria removal of > 95%
    - iron is removed
    - with adaptation of 5 kgs of iron nail, arsenic can be removed

    - Can not remove dissolved contaminants (salt, hardness - calcium, magnesium)
    - Can not guarantee pathogen free water

4. It is socially, culturally and economically accepted by the people it is intended to serve.
5. It is used in locations where no other water treatment exists or will not be forthcoming due to high costs or other technical reasons.