Household Water Treatment Systems: Applying a risk-based approach for the development of microbiological-reduction criteria

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Safe Drinking Water in Developing Countries - Current Challenges

- Drinking water: The Indian Scenario
  - Unsafe drinking water is a leading cause of diarrheal diseases.
  - Diarrhoea accounts for > 1600 daily deaths in India.
  - 22% of communicable diseases are linked to unsafe water (World Bank).
  - There has been good progress on Millennium Development Goal 7c, with 92% of the population having access to improved water sources (JMP 2012); however these figures do not reflect access to safe water.
  - Majority of improved water sources are contaminated due to various issues in distribution network and storage.

- 13% of rural ground water sources in India are microbiologically contaminated.

Microbiological performance targets for HWTS - A risk-based approach

- Waterborne pathogens are infective at very low doses. For bacterial pathogens such as Shigella, Salmonella, Campylobacter, and EHEC E. coli O157:H7, infectious doses are as low as 10 to 100 bacteria (Roberts et al., 1996; Laclerc et al., 2002; Blackburn and McClure, 2003). For viral pathogens it is 1 to 10 particles (Ford, 1999, Laclerc et al. 2002.) and for protozoan pathogens, such as Cryptosporidium 1 to 10 cysts (Ford 1999, Dawson 2005).

Waterborne pathogens such as Shigella, Salmonella, Campylobacter and EHEC E. coli O157:H7 can be highly pathogenic. Infections caused by these pathogens can lead to acute diarrhoea, dehydrating gastroenteritis, and other severe health outcomes. These pathogens are of particular concern in developing countries where access to safe water sources is limited. The risk of contamination in such countries is further compounded by poor sanitation, overcrowding, and insufficient hygiene practices.

CONCLUSIONS & RECOMMENDATIONS

- Public health experts are concerned about reducing overall disease burden in an identified population and achieving any significant reduction, not necessarily complete protection. On the other hand commercially marketed treatment systems target the family unit and the purchase decision is driven by an expectation of comprehensive protection against water-borne infections. Therefore a health-based target for achievable level of protection in individual consumers or households has little relevance.

- While tiered approach may be useful in achieving incremental health improvements under national schemes, donor programs in a population, for commercially sold HWTS, such a tiered evaluation criteria may pose severe constraints to inform consumer purchase decisions, especially around communication on differential protection and product labeling to indicate varying degree of removal.

- Locally relevant standards are needed to protect users. Risk-based standards should be derived using local source water quality data. We recommend surveillance programs at country levels to generate pathogen prevalence data in drinking water sources, which could serve as input to QMRA.

- From the consumer point of view a standard product by definition is a quality product with a set norm (absolute), multiple standards for the same product, especially for safety may be misleading. A specific unambiguous standard which is appropriate in the local context should be recommended.