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**33rd WEDC International Conference, Accra, Ghana, 2008****ACCESS TO SANITATION AND SAFE WATER:  
GLOBAL PARTNERSHIPS AND LOCAL ACTIONS****Community use of H<sub>2</sub>S (hydrogen sulphide)  
as a verification tool for water safety plans**

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*Through the development of Water Safety Plans at the household level it is important that while the community understand their system of water delivery, measures are taken to protect their water source. It has been found that the cycle and introduction of Water Safety Plans will only be complete with the introduction of household's water treatment and safe storage. In the rural setting of Sri Lanka the households are often the producer of water, it is important that the household is empowered to mitigate risks and has a method to test their water for harmful microbiological contamination. The H<sub>2</sub>S provides a tool for verification and provides an extrinsic motivation for the use of effective purification methods. Through the implementation of the Water Safety Plans and the verification by the use of H<sub>2</sub>S Kit, can households be confident their water is safe to drink?*

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**Rural water safety plans**

To develop Rural WSP (Water Safety Plans) it is important that the individual household acknowledges and accepts their responsibility to safeguard and produce safe water for consumption. The Rural WSPs empower the individual producers of water to take charge and responsibility of their water producing system to systematically go through a series of activities safeguarding water from the catchment through to consumption. It is equally important that the community have a tool to verify that their water is safe to drink. A situation analysis of Sri Lanka has identified that the dug well is the most common source of drinking water in the rural setting of Sri Lanka, 63%<sup>1</sup> of the population in Matara District are using well water for drinking purposes. This system along with rainwater harvesting technology has been targeted to develop water safety plans. Generally through the verification of H<sub>2</sub>S, unprotected dug wells have been identified as unsafe and producing water unsuitable for drinking. It is therefore imperative that information, communication and education is offered to the community to administer regular sanitary inspections and that appropriate advice is given to the household members for them to decide which purification method is most suitable to the household. Finally, to give the household complete ownership and responsibility in completing the cycle, families should also be given the opportunity to test their drinking water.

The *Hydrogen Sulphide* method is an on site testing method for the microbial quality of drinking water and is based on the detection of hydrogen sulphide producing bacteria rather than the coliform bacteria (Manja et al. 1982). Human faeces contain a high concentration of sulphate reducing bacteria of up to 1010/g and some of the enteric bacteria such as Salmonella, Proteus, Nitrobacteria and some strains of lebsiella, also produce hydrogen sulphide (Levett, 1993). The hydrogen sulphide media is kept in sterilized glass bottle. The water sample is then filled in the bottle and left for 24 to 48 hours at room temperature (25 to 37 C). If bacteria are present the Hydrogen Sulphide they produce will turn the water sample black.

**Introduction of H<sub>2</sub>S at the household level**

The introduction of H<sub>2</sub>S testing kits at the household level (Figure 1) was intended to provide evidence that the water being produced for drinking is safe. The H<sub>2</sub>S is a powerful tool not only to empower the user to verify whether their source of water is suitable for consumption, but also to advocate for measures to be taken when they receive a positive result. The H<sub>2</sub>S therefore becomes an integral part to any rural water quality surveillance that can be administered at the household level. The test kit (H<sub>2</sub>S) is simple to use and affordable to the household. Through a small water quality surveillance study<sup>1</sup> using the H<sub>2</sub>S Kit it was found that over 93%<sup>2</sup> of well water samples were recorded as being unprotected. There may be many contributors to

the contamination of water but particular reference can be made to the position of latrines in location to the traditional and commonly used shallow dug well. Latrines are often attached to a soakage pit which allows contaminants to directly seep into ground water sources (depending on the soil type and level of the water table). Soakage pits are commonly found in close proximity to the dug well within the houses compound.

Identifying access to 'safe' drinking water is the priority concern of rights-holders once they have been able to test their water using the H<sub>2</sub>S water testing Kit. At this stage once the household has tested their water and received a positive result they need to be empowered with strategies for mitigating the risks of drinking contaminated water. The H<sub>2</sub>S is an effective and cheap tool for managing the verification of the water source for bacterial contamination. The initial distributed of H<sub>2</sub>S kits has been free of charge as a strategy to stimulate awareness and demand. The community are willing to spend between 0.50 and \$2 for the purchase of one Water Testing Kit<sup>3</sup>. The average income for the rural communities in Sri Lanka is 15,783 Sri Lankan Rupees or \$143 USD.

### **Community acceptance of the H<sub>2</sub>S**

The introduction of H<sub>2</sub>S Kits was effective and well received as water producers were interested in testing their water source. It was noted that the introduction of the H<sub>2</sub>S kits must be handled carefully as communities have been drinking water from particular water sources for many years and can become concerned after a positive result. For example, a small group of the community have shown an adverse reaction to the H<sub>2</sub>S Kit, stating that the test gives a false indicator and that a marketing strategy is being developed to introduce bottled water to the market place! It has been emphasised through health promotion strategies that the H<sub>2</sub>S identifies a risk to the consumer and that precautions need to be taken to produce safe water. A metaphor can describe this... "you may have often stood under a coconut tree and not ever be unfortunate to ever have been struck by a falling coconut... however every time you stand under the coconut tree you take a risk" We can therefore minimise the risk by following and administering some WSPs incorporating HWTS (Household Water Treatment and Storage). The community suggested that access to H<sub>2</sub>S kits should be through the pharmacy as this was identified as the most appropriate mechanism for distribution to the wider community. The H<sub>2</sub>S does therefore need careful introduction as most communities clearly understand positive and negative but have trouble differentiating that H<sub>2</sub>S can be positive but still consumable.

### **Distribution of the H<sub>2</sub>S kit**

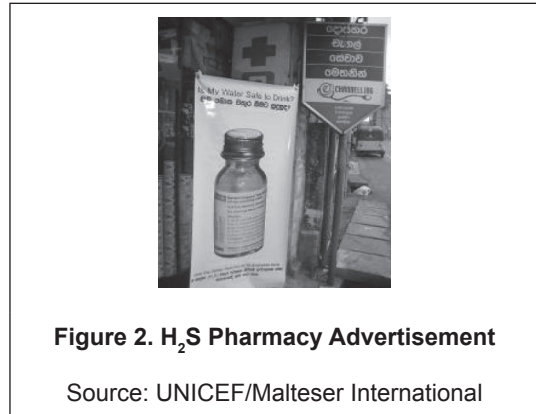
A total of 36,000 H<sub>2</sub>S Kits<sup>4</sup> have been procured for the distribution through Deputy Provincial Department of Health Services (DPDHS) and 5933 H<sub>2</sub>S Kits<sup>5</sup> were also distributed through Pharmacies in the Southern Province of Sri Lanka in a trial study (Figure 2). Urban areas tend to have access to piped borne water systems provided by the National Water and Drainage Board; therefore the H<sub>2</sub>S test kit bottles were distributed in more rural areas where the household's main access to water is the Dug Well, Rainwater Harvesting Unit or a rural water supply scheme. Test kits were also distributed and promoted during health and hygiene fairs conducted in community halls and villages. The strategy now is for the household to receive the H<sub>2</sub>S through the pharmacies and for the pharmacist to give relevant information to support their use. Promotional materials have also been developed for distribution with the test kits to give the household a strategy to implement HWT (Household Water Treatment) if their drinking water is identified as unsuitable for consumption. Post-cards were also advocated in pharmacies to encourage H<sub>2</sub>S kit users to send feedback, which could later be followed up if concerned clusters households were identified.

### **Hygiene promotion and introduction of H<sub>2</sub>S kits to schools**

It is widely acknowledged that the majority of diarrhea is caused by hand to mouth contamination and through the contamination of drinking water sources. To maximize the impact of this project, children were given the opportunity to test their water source at school through participatory lessons. The H<sub>2</sub>S kits were introduced to children during school health club activities, They were encouraged to test a variety of water sources both at school and in their immediate environment. The H<sub>2</sub>S gave them a quick water quality result an indication whether the water is protected and safe to drink. Additionally the children were encouraged to conduct experiments on their schools water supply during lessons concerning water purification and common treatment methods. These experiments allowed them to gain understanding of available treatment methods which could then be discussed and practiced at home and school. The 'Meena' a comic books and cartoon have also featured in the introduction of the H<sub>2</sub>S kits, and thereby used as a stimulus to encourage children to practice safe health and hygiene practices. The latest production being 'Is my water safe?'



**Figure 1. Community use of H<sub>2</sub>S leaflet and Test Kit Bottle**



**Figure 2. H<sub>2</sub>S Pharmacy Advertisement**

Source: UNICEF/Malteser International

**Household water treatment and storage (HWTS)**

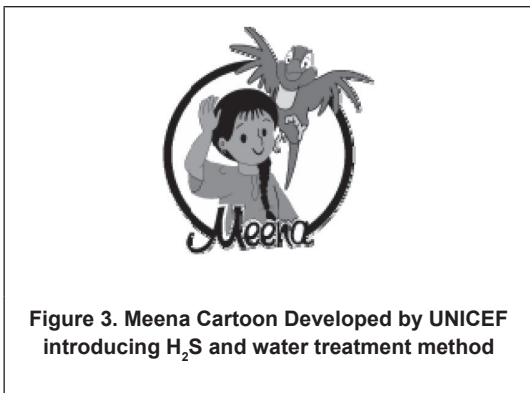
HWTS is a crucial component to the WSPs. Advocacy of existing low-cost technologies of water purification will continue directly with the household. Hygiene promotion activities on a community level will focus on water quality issues such as simple techniques for treating water at home and storing it in safe containers. Emphasis has been placed on four purification methods for individual households, giving them a choice to select the most appropriate;

- Chlorination (adding chlorine in liquid or tablet form to drinking water)
- Solar Disinfection (SODIS - exposing water in disposable clear plastic bottles to the sunlight)
- Boiling (boiling and cooling drinking water)
- Filtration (The use of Ceramic Filters once available in the market).

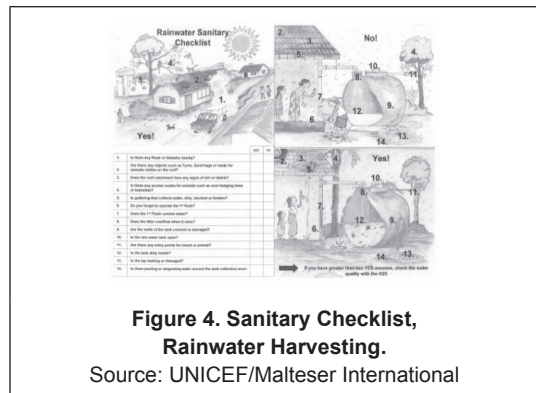
Water collection, transportation, safe storage and the use of water in the home will be essential areas to address when completing the cycle of the WSPs.

**Promotional materials**

Various health promotional materials have been designed and are being tested in the community. These include; Sanitary Checklists (figure 4); Community stories: (Where is our drinking water coming from?); H<sub>2</sub>S Leaflets (The leaflets have been developed as “instruction for use” of the H<sub>2</sub>S water test kits); Meena “Is my water safe?” Comic Book and Cartoon (Figure 3); HWTS promotion material (under development)



**Figure 3. Meena Cartoon Developed by UNICEF introducing H<sub>2</sub>S and water treatment method**



**Figure 4. Sanitary Checklist, Rainwater Harvesting.**  
Source: UNICEF/Malteser International

**Conclusion**

The H<sub>2</sub>S should not be used as a substitute for governmental recommended bacteriological tests but can be used as an effective vehicle to disseminate awareness on water quality. The H<sub>2</sub>S can also be an effective tool for the household to test whether their water treatment has been effective. The H<sub>2</sub>S Kit however does not give us any measurable parameters as to how exposed the drinking water is to bacteriological contamination. Despite this, the H<sub>2</sub>S is a method of testing that is affordable to households and many families are willing to pay for a test kit to test their water on a regular basis. A comprehensive social marketing strategy will need to be addressed, and a local producer of H<sub>2</sub>S Kits identified for it to be sustainable. WSPs should be

encouraged and developed with the community and HWTS should be emphasised with households being encouraged to select the most appropriate purification method for them.

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### References

- Calvert, P (2004). Ecological Solutions to Flush Toilet Failures: EcoSolutions.
- Levett (1993). Anaerobic Bacteria: A functional Biology Open University press; Milton, Keynes, Philadelphia.
- Manja, KS, Maurya.M.S, and Rao.K.M (1982). A simple test for detection of faecal pollution in drinking water. Bulletin of the World Health Organization 60:797-801.
- Meierhofer R., Wegelin M., (2002). Solar Water Disinfection – A Guide for the Application of SODIS – SANDEC report n. 06/02, Dübendorf, DE.
- Shahzadi, N, (2007). Meena Cartoon – ‘Is my water safe’; UNICEF.
- Sobsey M.D. (2002). Managing Water in the Home: Accelerated Health Gains from Improved Water Supply – WHO, Geneva, CH.
- Sobsey M.D., Pfaender F.K. Evaluation of the H<sub>2</sub>S Method Detection of Fecal Contamination Drinking Water – WHO, Geneva CH.
- Tanuja A. (2001). Quality of Collected Rainwater from Sri Lanka - Paper Submitted to 26th WEDC Conference in Dhaka, Bangladesh.
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### Note/s

- <sup>1</sup> DPDHS Matara District.
- <sup>2</sup> DPDHS Matara District- Preliminary report - based on a sample of 2,410 tests with H<sub>2</sub>S kits.
- <sup>3</sup> KAP survey conducted (Malteser International) with of rainwater harvesting right holders (236 samples).
- <sup>4</sup> H<sub>2</sub>S Kits procured by UNICEF Sri Lanka 2006/2007.
- <sup>5</sup> Supply and monitoring data base, Malteser International.
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### Keywords

water, h<sub>2</sub>s, rural, treatment, promotion, safety, test, surveillance, source

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