Household Water Treatment Options in Developing Countries: Solar Disinfection (SODIS) January 2008

Household water treatment and safe storage (HWTS) interventions are proven to improve water quality and reduce diarrheal disease incidence in developing countries. Four of these proven HWTS options – chlorination, solar disinfection, ceramic filtration, and flocculation/disinfection – are widely implemented in developing countries. Organizations wanting to develop HWTS programs are often faced with the difficult decision of selecting which option or options are appropriate for their particular circumstances. The most appropriate HWTS option for a location depends on existing water and sanitation conditions, water quality, cultural acceptability, implementation feasibility, availability of HWTS technologies, and other local conditions. This series of fact sheets is designed to assist organizations in comparing, and ultimately selecting, the appropriate proven HWTS option or options. For more information on household water treatment, please visit www.who.int/household_water. For more information on solar disinfection programs in developing countries, please visit www.sodis.ch or www.fundacionsodis.org.

Solar Disinfection

Solar disinfection (SODIS) was developed in the 1980's to inexpensively disinfect water used for oral rehydration solutions used to treat diarrhea. In 1991, the Swiss Federal Institute for Environmental Science and Technology (SANDEC, EAWAG) began to investigate and implement SODIS as an HWTS option, to prevent diarrhea in developing countries.

Users of SODIS fill 0.3-2.0 liter plastic soda bottles with low-turbidity water, shake them to oxygenate, and place the bottles on a roof or rack for 6 hours (if sunny) or 2 days (if cloudy). The combined effects of UV-induced DNA alteration, thermal inactivation, and photo-oxidative destruction inactivate disease-causing organisms.

A woman using SODIS (SANDEC, EAWAG)

Lab Effectiveness, Field Effectiveness, and Health Impact

In the laboratory, SODIS has been proven to inactivate the viruses, bacteria, and protozoa that cause diarrheal diseases. Field data have also shown reductions of bacteria in water from developing countries treated with SODIS.

In four randomized, controlled trials, SODIS has resulted in reductions in diarrheal disease incidence ranging from 9-86%.

Benefits, Drawbacks, and Appropriateness

The benefits of SODIS are:

- Proven reduction of viruses, bacteria, and protozoa in water;
- Proven reduction of diarrheal disease incidence in users;
- Acceptability to users because of the simplicity of use;
- No cost to the user after obtaining the plastic bottles;
- Minimal change in taste of the water; and,
- Although SODIS does not have a chemical residual, recontamination is unlikely because water is served directly from the small, narrow-necked bottles with caps in which it is treated.

The drawbacks of SODIS are:

- The need for pretreatment (filtration or flocculation) of waters of higher turbidity;
- User acceptability concerns because of the limited volume of water that can be treated at once and the length of time required to treat water; and,
- The large supply of intact, clean, suitable plastic bottles required.

SODIS is most appropriate in areas where there is availability of bottles and community motivation and training for users on how to correctly and consistently use SODIS for treating household drinking water.

Using SODIS on rooftops (SANDEC, EAWAG)

Implementation Examples

Over 2 million people in 28 developing countries use SODIS for daily drinking water treatment. Experience has shown that SODIS is best promoted and disseminated by partner institutions based in the project area. Important partners are community-based organizations (CBOs) such as women's clubs, youth associations or self-help groups, well-established NGOs working on community development projects, institutional organizations such as health posts, hospitals, and teacher training centers, and government programs. Individuals, such as community and religious leaders as well as politicians and decision-makers, play a key role and should be involved from the beginning of a project. SODIS promotion in a new area begins with a pilot project of one year that reaches 2000-4000 families. In the second year, the project expands into the field of advocacy to scale-up the project. Examples of SODIS projects include:

- The CBO KWAHO promotes SODIS in the Kibera slums of Nairobi, Kenya. Over 250,000 people are reached by trained promoters using social marketing to disseminate knowledge about SODIS. Research-based information is given out by promoters to potential users, especially when users are skeptical about SODIS.
- In Latin America the promotion is channeled through a regional reference center, Fundaçion Sodis. The Fundaçion's strategy is to build and strengthen a network of partner institutions. The Fundaçion does not implement projects, but focuses on training trainers, technical assistance, and lobbying activities. More than 100,000 people are using SODIS in Latin America.
- In Assam, India, Assam University provided technical and training support for a SODIS promotion project with a local NGO. The dissemination phase targeted 20,000 households based on lessons learned during the pilot phase. An approach involving active participation of institutions such as village councils, schools, and health centers was adopted to ensure the project is community-owned and sustainable.

Economics and Scalability

SODIS as a virtually zero-cost technology faces marketing constraints. Since 2001, local NGOs in 28 countries have disseminated SODIS through training of trainers, educating at the grassroots level, providing technical assistance to partner organizations, lobbying key players, and establishing information networks.

The experiences gained have shown that SODIS is best promoted and disseminated by local institutions with experience in community health education. A long-term training approach and repeated contact with the community is needed to create awareness on the importance of treating drinking water and to establish corresponding changes in behavior. Both SANDEC/EAWAG and the SODIS Foundation provide technical assistance to NGOs implementing SODIS.

SODIS users (SANDEC, EAWAG)