DISASTER RISK REDUCTION

CRS PAKISTAN
BIO-SAND FILTER
PROJECT
2008-2010

Clean-water system: Effective and affordable

Bio-sand filters give drought-affected communities inexpensive and sustained access to clean drinking water, and not only during crises[1]

Heavy rains, flash floods, dam breakages and widespread destruction were the result when Cyclone Yemyin hit Pakistan in June 2007. In the southern Balochistan and Sindh provinces, 2.5 million people were affected, and at least 70,000 were reported to be suffering from gastroenteritis, largely from drinking contaminated water[2]. CRS responded with emergency shelter and latrines, and also put funds towards emergency water treatment options.

This, and other flood responses, emphasized the need to better understand emergency water treatment options and to determine what would enable households to be better prepared for future emergencies and thus reduce disaster risk.

Sindh province—which faces serious and regular floods and droughts, and has groundwater that is often saline[3], bacteriologically contaminated[4] or has a high fluoride content[5]—was chosen as the study area. **Only 10 percent of Sindh's rural population has access to piped water.** Two organizations[6] that had already begun work on bio-sand filters in the area—the Society for Safe Environment & Welfare of Agrarians in Pakistan (SSEWA-Pak)[6] and the Society for Conservation and Protection of Environment (SCOPE)—became CRS partners. While the first used locally made clay pots in its filters, the second used a PVC/concrete pile column design.

CRS Pakistan decided to research bio-sand filtration as a way of providing access to clean drinking water in poor rural areas and to increase access to clean water during floods. This simple technology is a natural, basic and cheap way to remove disease-causing bacteria. Bio-sand filters have been recognized by international research institutes as providing effective treatment in areas where access to clean drinking water is limited.

The bio-sand filter is simply a home for "good microbes" that destroy disease-causing microbes. The sand acts as a surface on which the beneficial microbes live and multiply, and dirty water and oxygen are their food.

Photo: CRS Pakistan staff

Research builds on previous efforts

CRS Pakistan's research aimed at gaining a better understanding of the approach, community perceptions of the filtration system—when given other chemical and physical water treatment options—and how to encourage sustained use of the system.

The research was conducted in three phases. **Phase 1** aimed at gaining a better understanding of the work by CRS' partners in previous bio-sand filter projects, including testing the filters' effectiveness in removing contaminants, and gaining clarity on its adoption. **Phase 2** sought to find out what motivated households to use the filters; what supported or inhibited them; what their perception of the water quality was; and what their water-related actions were during emergencies. Recommendations were then drawn up to improve conditions and approaches, and train partners in them, in preparation for **Phase 3** which then implemented, field tested and evaluated the new approaches.

Six villages, including all 151 households within them, were targeted in the Phase 3, and filters distributed with instructions on use and maintenance.

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1 CRS (May 2011) *Operations Research Report Bio-Sand Filters in Pakistan.* **2** http://e-churchworldservice.com/Emergencies/international/2007/pakistanfloods.html. **3** Studies have shown that only 30% of Sindh has fresh (non-saline) groundwater. Pakistan Environmental Protection Agency (2005) *State of the Environment Report 2005* **4** Pakistan Council for Research in Water Resources found that 95% of shallow groundwater in Sindh is bacteriologically contaminated. World Wildlife Fund Pakistan, (2007) *Pakistan's Waters at Risk: Water and Health Related Issues in Pakistan & Key Recommendations.* **5** In the Tharparker area of Sindh, there is a high fluoride content in some groundwater. Pakistan Environmental Protection Agency (2005) *State of the Environment Report 2005.* **6** Budget constraints for Phase 3 of the project meant that only SSEWA-Pak continued as a partner for this phase. During the course of this research, this organization changed its name from LSRDA to SSEWA-Pak.

Photo: CRS Pakistan staff

Concrete pipe bio-sand filter

CRS' decision to use a "blanket coverage" approach—to provide filters to all households *in the target areas*—was based on early reviews showing that households that did not receive the filters did not filter water in any other way, and filters were more effective and better maintained at a household rather than community level.

The bio-sand filter proved cheap and robust as well as easy to construct, install and use. Communities favored it over other water treatment methods. The filter's design makes it easy to build using locally available material. Households contributed 300 rupees (about US$5.50) towards the cost of their filter, an amount that was affordable and enhanced the family's sense of ownership.

The filters removed almost all contaminants, and color, taste, odor, turbidity and fecal bacteria content were all improved. But one of the key findings was that while the water straight from the filter showed a vast improvement in quality, water tested in the storage containers showed a decline in quality (though it was still cleaner than the source water). This may have been as a result of a dirty container or through outside contamination eg a child dipping a cup into the container instead of using the tap. Hygiene messaging was used to emphasize the protection of storage containers from contamination.

Programming inclusive for all

Efforts were made to make programming appropriate for, relevant to, and inclusive of all community members, whatever their ethnicity or religion, and for women, men and children. **Water-handling messages were need-based, simple and delivered in the local language**. In previous projects, only men were trained in filter assembly, cleaning and use, but Phase 3 included the training of women, who proved particularly careful in protecting filtered water with cloth covers, keeping storage containers clean, and cleaning the filter according to the guidelines. Women also trained children not to dip cups into the filtered water. The study also showed that women-headed households found maintenance measures more difficult because they had a larger workload than those headed by men.

Women said the filters saved time, effort and, money spent on medicine. Saving money was most important to women, while staying healthy was most important to men. CRS and partner staff observed improved environmental, domestic and personal hygiene practices in targeted households, especially when dealing with drinking water.

Families reported a reduction in water-borne disease and symptoms, and a survey showed a significant increase in knowledge of these (*See table below*).

Another key challenge was that the capacity of the filter and its storage containers was not sufficient to meet all of a family's water needs, especially in summer. To ensure exclusive use of filtered water, additional storage containers are needed. The filters could also be installed in fields for farming families.

Other challenges included: (a) Because no flood occurred, individuals' intent to treat water in future emergencies could not be assessed and questions about use during flooding could not be addressed (b) Some families stopped using their filters for a few weeks when they saw that neighboring villages had not yet received filters; the assumption being that untreated water was now safe. To counter this, the project plan and a social mobilization strategy needs to be clear and systematic, with a message that water that looks safe isn't necessary.

Overall it was found that bio-sand filtration can be a cheap, efficient and sustainable water treatment option for reducing disaster risk in households in drought- and flood-prone areas, but it is critical that implementation processes are sound and adopt proven best practices.

While CRS' aim was to encourage people to use the filters during droughts or floods, the enthusiasm with which the people embraced the technology has made them a permanent fixture. Not only are the communities better prepared for future crises, their daily life beyond the crises has improved.

One hundred percent of the households in five of the six targeted communities had continued the use of filtered water by the end of the project.

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Increased household knowledge of illnesses resulting from contaminated water

% households showing knowledge of water-borne illness	ILLNESSES				
	Diarrhea	Cholera	Hepatitis	Indigestion/ stomach aches	Don't know
Pre-Intervention	5.3%	52.3%	72.8%	4.0%	5.3%
Post-Intervention	73.0%	98.0%	37.2%*	39.2%	-

*During project implementation, communities learnt that hepatitis can be contracted in other ways besides from dirty water. Thus fewer beneficiaries cited hepatitis as a water-borne disease, which brought down the percentage in post-intervention results.

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