

Easy Water for Everyone

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Providing clean drinking water in rural areas with contaminated water sources and no power: repurposing reprocessed hemodialyzers.



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The drinking of water polluted with fecal material leading to diarrhea is the second most common cause of [death worldwide in children](#) younger than five. The absence of sanitation and ineffective hand washing also contribute to the high incidence of diarrhea. [Easy Water for Everyone](#)

(EWfE), a US NGO, brings an innovative water-purifying device to isolated villages that have no electricity or other power supply to filter the villages' contaminated water from rivers, streams, lakes, wells and boreholes, and changes it into pure water ready to drink!

EWfE follows the [brilliant, patented idea](#) of Professor Yoram Lass of Tel Aviv University, utilizing the hollow fibre [hemodialyzer](#) to purify water. The disposal of millions of hemodialyzers annually is a huge medical waste issue. To be repurposed for water purification, once-used hemodialyzers are resterilized and installed in the device as filters, taking advantage of the porosity of this synthetic membrane (polysulphone) and the robustness of its structure. The absolute pore size is 0.03 microns, which renders it impassable to all bacteria, viruses and parasites — essential for use in hemodialysis treatments and just right for making pure drinking water.

The volume of water produced is determined by the number of filters in the device and the rate of moving contaminated water through it. For example, an eight-filter device can produce 250 liters/hr. using a [gravity system](#), where the contaminated water flows from an elevated tank down to the device installed at a lower position; at 500 liters/hr. with a simple, easy to use hand pump and double that rate with solar power, to be considered when more affordable.

Practicalities and the degree of local village support influence the efficiency of operations but what really matters are the outcomes in regard to diarrhea. The connection between diarrheal illness and water quality has to be [understood by the villagers](#), before widespread acceptance of EWfE's approach. For each new water purification site, thorough explanation of the significance of the problem and demonstration of efficacy of the device are the aims. The [education of villagers](#), especially mothers and children, concerning the benefits of water purification is vital.

An obvious question is: "Who does the pumping?" The pump is usually operated by the village women, assisted by the boys, who eventually take some responsibility. However, when the gravity system is used, [anyone can](#)

[open a tap!](#) This is the future. In addition to normal operations of purification, the filters need to be backwashed at set intervals (about 3 times a day for 5 minutes). This is necessary because the source water used contains sediment which over time decreases the efficiency of the device. Backwashing can also be done with use of gravity. EWfE has found it most efficient in its routine operation to support a technical assistant in each village, at a cost of \$40 USD per month, to keep the 1000-liter tank full (accomplished by using a small gasoline fueled pump, taking 5 minutes to pump up the contaminated water) and to perform the backwashing.

At EWfE sites we are also collecting public health data quantifying the incidence rates of diarrhea and consequent hospitalizations for each village before and after device installation. Data collection, including house visits and screening of health centers for visits and stays, availability of sanitation facilities and of household size, have been approved by local authorities and Institutional Review Boards. These data can serve the longitudinal analysis of the outcomes with multi-level statistical models.

The spread of power (electrical or solar) to isolated rural villages in developing countries is slow and undoubtedly EWfE devices will be needed for a long time. EWfE currently has single devices functioning fully in 11 villages in Ghana. Two of these devices have been running continuously for over 3 years, and the others have been installed sequentially. Nine of the current devices are located in villages on estuarial islands of the Volta River, providing approximately 4,500 people with clean water. We plan to include all 22 communities on these islands (reachable only by [boat](#)) with the EWfE devices by early 2019, resulting in about 10,000 people having pure drinking water. Of note this can be accomplished at a very low cost. Based on a June 2018 year-to-date calculation including all direct operating costs, corporate overhead and small capital investment (the devices), the daily cost per person for clean water is \$0.07.

Anecdotally, when we make our biannual visits to the villages, our reward as founders of the organization is to be greeted by the statement that there is “NO more DIARRHEA here”.

Conclusion: a device derived from the hemodialysis world uniquely purifies water in villages without power, permitting complete reduction in infection

from contaminated water sources, a major aspect of the overall problem of diarrhea. We consider this process is highly scaleable; this is the future for Easy Water for Everyone.