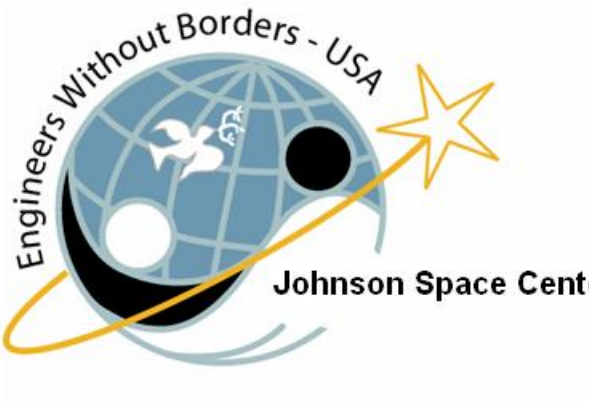

BYOW Water Filtration System Installation
South Nuevo Leon, Mexico
Engineers without Borders – JSC Chapter
Mexico Project

Post – Implementation Report

www.ewb-jsc.org

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Document 526 - Post Implementation Report
JSC-South Houston Professionals
Puerta de Aguilar, Mexico
BYOW Water Filtration System Installation in South Nuevo Leon, Mexico

1.0 Travel History

Dates of Travel	Assessment or Implementation	Description of Trip
March 2007	Assessment	Traveled to South Nuevo Leon to identify several potential community candidates suffering from public health challenges. During this trip 5 communities were identified: Three from the dry semi-arid region (La Puerta de Aguilar, El Milagro and Jesus Maria) and 2 from the Mountains (La Siberia and La Joya). All presented the same challenges so the team had to identify the most in need. Water contamination is the most common problem in these communities. All of them rely on rain water as their source of drinking water. Aguilar was the first community to be selected (due to its location and eagerness to cooperate with EWB) to tackle the water contamination issue. .
November 2007	Assessment	The EWB-JSC team traveled to Puerta de Aguilar to conduct a full assessment of the community. Health Surveys, Community Surveys, Land Surveying, and Water quality and quantity tests were conducted. Through a village meeting with representatives of each household, the community voted on water contamination as the most important issue and asked for a method to have clean drinking water. Other issues identified were water quantity and agricultural challenges. A water committee was established as well as community relations and agreements. As a result of the assessment, it was determined a BYOW system was the most appropriate technology for the community to clean their drinking water. The water committee, the village leaders, and the heads of households voted on a location for the BYOW in the community for a future implementation based on their needs. It was also agreed they would provide labor to help build the BYOW.

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Post Implementation Report Part 2 – Technical Information

1.0 INTRODUCTION

Over a billion people in the world lack access to safe drinking water. While numerous technological, medical, and educational solutions have been implemented for the benefit of disadvantaged communities, there is no 'magic bullet'. Instead, development agencies must partner directly with these communities to address their public health needs through appropriate technology solutions backed up by education and assessment. Such trends of unsafe drinking water were found in isolated and impoverished villages in South Nuevo Leon, Mexico, most of them in dire need of access to potable water despite the State's reputation for being one of the most industrialized and one of the richest States in Mexico. In contrast with the relative wealth of in the North of Nuevo Leon, the Southern part remains rural and poor. Most of the South of the state is at the mercy of very dry weather conditions, which represent a major hurdle for the people due to the lack of clean water, agricultural, livestock, and economic development in the region. The villages identified by EWB-JSC during an identification/assessment trip in March of 2007 are part of an overall community project EWB-JSC plans to assess on a one by one basis to see what kind of needs can be addressed. These needs will be monitored over time to see if they have changed and if the appropriate technologies and solutions offered by EWB-JSC are still applicable or need modifications.

The following implementation report focuses on La Puerta de Aguilar, one of the villages identified in South Nuevo Leon, which falls under the umbrella of villages that are part of the EWB-JSC first Assessment trip Project in Nuevo Leon, Mexico. As part of the implementation trip, an second assessment of El Milagro and Jesus María were going to be conducted, however plans changed due to some delays of the implementation process. During the implementation phase of the project, a 13 member team from EWB-JSC spent 10 days in Nuevo Leon state, Mexico in the month of June 2008, installing a water treatment system for the partner community of Aguilar to address the problem of runoff contaminated drinking water, which represented the most health public hazard in the community. Over the course of nine months, EWB-JSC volunteers designed, developed and tested a pump-based gravel flocculator, rapid sand filter and electrical UV decontamination system. The completed system was installed with help from the local community, who provided electricity, building materials, and labor. The installed system

was tested during the trip and it was successfully eliminating bacterial contamination from the provided surface water. However, the high levels of fine clay in the water were not entirely filtered by the system (turbidity still present). The system is currently reducing the particulates in the water by 50-75%, and reducing bacterial contamination by 100%. The system will be operated by the Aguilar community water committee and EWB-JSC will return in a few months to evaluate the success of the system, and the community's response to determine if any design changes are appropriate, or if the system should be replicated as installed in neighboring villages.

2.0 PROGRAM BACKGROUND

In March of 2007, EWB-JSC team members traveled to South Nuevo Leon to identify several communities in need as recommended by the local partners. The EWB-JSC identification team visited the communities of El Milagro, Jesus María, La Puerta de Aguilar, La Siberia, and La Joya in from March 21-25, 2007 to identify communities in need of clean water and other public health needs. The trip was done with the help of local partners in Mexico, such as Instituto Tecnológico de Linares, Club AJeepear, the Consulate of Mexico in Houston, and the Rotary Club of South Monterrey.

The team conducted water quality testing, interviewed families, conducted health surveys and talked to villagers about the general public health needs. Based on survey information, the findings concluded these villages all depend on water catchment reservoirs and manmade-ponds for their water needs such as farming, drinking, and house hold chores. The majority of the villagers get sick really often from water related causes due to contamination, and the nearest health clinics are far away. The sources of drinking water are water catchment reservoirs, manmade water ponds, and bottled water (for a few families who can afford it). During the dry season when water is scarce, the reservoirs and ponds are empty and most villagers have to rely on the nearest villages or town. The most basic health needs for these villages are water purification for drinking purposes, improvement to water structures such as reservoirs, and a way to improve irrigations systems and farming to alleviate the problem of the lack of rain. The villages in the mountains have other needs such as electricity and power, and a source of fuel for cooking.

After the community identification trip, The EWB-JSC team made a decision to start the first project in Mexico in one of these communities based on several factors: Accessibility, nature of

the problem, possibility to expand with future projects, difficulties with implementation, rain water availability, and accommodation/receptiveness. The accessibility to the community was considered a major factor since this project would be the first one for EWB-JSC in Mexico and a sense of security was needed in case an emergency occurred. Based on all of the criteria and after analyzing results and discussing the pros and cons of each community, it was concluded La Puerta de Aguilar represented more needs. The rest of the villages are still considered for future expansion of EWB-JSC projects since they were part of the initial overall assessment in South Nuevo Leon and have similar problems as Aguilar.

Aguilar sits in a valley surrounded by mountains which provide rainwater runoff for drinking water. This runoff water is contaminated with bacteria, a major public health hazard. Aguilar requested EWB-JSC's assistance in addressing the bacterial contamination challenge. The village of 65 families relies on a small reservoir for drinking water and during the dry season, the water is rationed between families. EWB-JSC decided the BYOW system would be a good way to clean their contaminated water and therefore planned another assessment trip to Aguilar to confirm such technology would be appropriate for their needs. A more detailed assessment trip of Aguilar was conducted from Nov 10 – 14, 2007 to conduct water quality tests, health, energy and community surveys, and to do a surveying of the terrain. Before the travel, meetings with coordinated with the village leader, IT-Linares, and the Rotary Club to get everything ready for the assessment. IT-Linares decided to help conduct energy assessment in hopes of installing a bio-gas reactor as part of a joint project. During the assessment trip, a village meeting was held with representatives of each household, and the community voted on water contamination as the most important issue. A separate meeting was held with women of the village. After the meetings, it was concluded based on general consensus, the village needed clean drinking water. Other issues identified were water quantity and agricultural challenges. A water committee was established based on community votes (going through nominations and elections through their protocol meeting process) as well as community relations and verbal agreements. As a result of the assessment, it was determined a BYOW system was the most appropriate technology for the community to clean their drinking water. The water committee, the village leaders, and the heads of households voted on a location for the BYOW in the community for a future implementation based on their needs: The village requested a modification to the BYOW system such as an electric pump because electricity is available in the village and due to the age of the habitants who go retrieve water (mainly young kids and elderly women). It was also agreed they would

provide labor and construction material to help build the BYOW. At the end of the assessment, contact information was exchanged to keep the water committee informed about the planning process of the implementation trip and also so they could keep EWB-JSC informed about pre-implementation requirements, such as requesting the Electric Company to install an electric grid for modified BYOW to use a pump, decide on final location to install the water filtration system, and build a cement platform to hold the system. Also, as part of the final assessment, IT-Linares concluded it would be inefficient to install a bio-gas reactor due to lack of fecal supply (shortage of cattle) and the way each household manages their livestock individually.

3.0 TRIP DESCRIPTION

The duration of the trip was 10 days and the 13 member team was divided in 2 teams to cover the number of days planned for the implementation trip, to avoid overloading the village with a large number of people, and to give better focused tasks to each member of the team. Prior to traveling, the EWB-JSC Mexico Lead Dorothy N. Ruiz-Martínez coordinated the logistics and documentation to transport material for the BYOW System across the border through the Consulate of Mexico in Houston through the Consul of Community Affairs, José V. Borjón and through the Center of Attention to Migrants (CEM) of the State of Nuevo Leon Director Alejandra Ocadíz Hernández, whose office help NGOs with processing of paperwork, logistics and foreign donations to the State of Nuevo Leon in Mexico for rural communities. A more detailed description of the trip is given in a day to day basis below.

Day 1: Travel Day for Team #1:

The team traveled in two groups (air and ground) to transport the BYOW material installation across the border. Chris Gilmore, and Jose Moreira (EWB-Houston Chapter members) transported the BYOW System material with Dan Garguilo (EWB-JSC Chapter Vicepresident) from Houston to the Border early in the morning. Mean while, Dorothy N. Ruíz –Martínez, traveled by air to Monterrey and met with a representative of the Center of Attention to Migrants in Nuevo Leon and drove to the Mexico-U.S. border to meet with the BYOW Material Ground team. At Colombia-Solidarity International Bridge, the EWB-JSC ground team, transferred the BYOW donated material to another vehicle, showed the proper approved paperwork to the Mexican Customs Authorities, and traveled to Monterrey to meet the rest of the arriving team (Angela Cason, Mike Ewert, Dean Muirhead, Ross Muirhead & Jose Ruíz) at Mariano Escobedo

International Airport. The Office of Attention to Migrant offered a vehicle for the EWB-JSC team use while in Mexico to avoid paying vehicle rental fees during the trip and it was delivered at the airport so the team could drive straight to South Nuevo Leon the same day. The trip took about 4 hours from Monterrey to Matehuala along with the BYOW material. The team stayed in Matehuala at a hotel during the 10 day implementation trip. The community of Aguilar is about 1.5 hrs away from Matehuala, so the team commuted on a daily basis both in the morning in the evening. As a precaution and for safety concerns, the team always drove during daylight hours.

At the border, EWB-JSC and EWB-Houston Chapter members ready to transfer materials to another vehicle.

Day 2: Meeting with the Water Committee and Greeting Protocols:

On the second day of travel, Team 1 drove to Aguilar and met with Julio Avila, the head of the BYOW Water Committee (BWC) and with the Chief of the Village to make an assessment of the location the BYOW System would be installed on, to discuss previous arrangements made by phone on the location, manual labor details, expectations from the community, and plans for the rest of the trip. The BYOW material was also delivered that day by the CEM driver and all the material was unloaded and locked in the community room. A few expected preparations were not done by the Water Committee as discussed via phone, which caused a delay in the BYOW installation and also a replanning of the rest of the trip. For Day 2, it was originally planned the team would start assembling the BYOW System to get it ready for installation the next day in the location chosen by the community; however the cement platform EWB-JSC for the BYOW System was not built. Another unexpected problem was the electric grid; there was a cement grid

built with an electric meter, however it was not connected to the electricity lines (this had to be done by the Electric Company). The BWC mentioned they had contacted the electric company 3 months prior to our arrival, however they never went to the village and Julio mentioned this was very common. Despite the change of plans, the team decided to go ahead and start assembling the BYOW System in the Community Room. The community room was used by the EWB-JSC team throughout the entire duration of the implementation trip with permission of the village Chief, who provided the team with a key so the room could be locked on the team's return to Matehuala in the evenings. All the tools and materials were kept there and the room was used by the team to hold meetings and discuss day to day plans, as well as to have meals (although at times, the team was invited to eat different houses throughout the village). Before EWB's return to Matehuala, the BWC started to build the platform so it could dry overnight and mentioned local masons from the community would also help in the process.

Platform being built by BYOW Water Committee and other community men

Days 3: Assembly & Installation, and training of BYOW System:

The next Day, Team 1 arrived and the platform had already been built by the community, however it was not completely dry. Due to this delay, the team focused on water quality tests from different water sources (houses, ponds, trampa, pila, aljibe), further assessments throughout a few houses in the village, and assembly parts of the BYOW in the community room. For the rest of the days, additional tasks were divided among team members, including: photography, BYOW Assembly and installation, transporting water from the pila and the ponds to the BYOW

System location, priming and testing the BYOW System, training the water committee, searching for the water boys the EWB-JSC chapter had identified in previous trips, making a presentation about clean water at the local school by one of our members, and meeting with women and men of the village for training and operation of the BYOW System.

Once the BYOW cement platform was dry, the Assembly team started to transport all the assembled parts to the location for measuring purposes (to make sure the System would be spread correctly throughout the platform and to include UV Box). The material was then transported back to the community room so the BWC could start building walls around the platform to secure the BYOW System and to prevent exposing it to sunlight.

Outline measuring of BYOW parts on the platform

Later during the day, the water committee started to build the room to house the BYOW System with local masons using materials paid by the village. The approximate cost of material the village provided was about $300 USD including labor. An additional cement platform was also built to hold the UV box inside the room. The Water Committee assured the EWB team they would put a permanent roof later and also a door so the system could be locked to avoid anyone playing with the BYOW System or to prevent the pump from being stolen by someone (two pumps had already been stolen from a well that is currently not working due to other mechanical problems and insufficient underground water).

Local masons building wall to house the BYOW System

Day 4: Transfer of BYOW assembled parts to permanent location:

The next morning, Team 1 arrived to Aguilar to find the walls had already been built by the local masons, so the team decided to transfer all the assembled parts from the community room to permanent BYOW location. The assembly team started to put together the system connecting all the tubing, inserting the mesh screens into the drums, and pouring gravel and sand to each filter (for more details in section 5.0). The rest of the team helped by bringing additional tools needed to complete assembling the system in place from the community room. Meanwhile, other team members were reading bacterial results from the different water quality tests taken at different sources from previous days. The water quality tests results were pretty similar to the ones taken during the assessment trip with a high incidence of bacteria in the drinking water from the aljibe and the trampa. Also on this day, meetings with the women and the water boys of the village were coordinated so they could be trained once the system was up and running. To finalize the assembly of the BYOW System, other team members transported water from the ponds to prime the drums and seal them.

Day 5: BYOW System Final Assembly and Testing: The next Day, assembly of the BYOW System and the UV Box was finalized in the morning. The rest of the day, the

team and a couple of local men helped ground the electric connection from the electric grid to the UV Box by excavating a small trench.

Electric wire grounded by the team from the BYOW location to the electric grid

Despite not having electricity connection from the electric grid, Julio who is an electrician decided to temporarily bring down the electricity from the electric lines by using two wires (this is a common practice in rural communities since the electric companies take so long to connect electricity in requested houses) so the EWB-JSC team could start testing the BYOW System. José Ruíz, the EWB-JSC member in charge of the UV-Box, tested the UV System and made sure it was safe to handle the electric grid the wire running from the grid to the system. He also tested the pump once the BYOW was running. The team brought more drums of contaminated water from the village's main source of drinking water (aljibe) to start priming the system with cycling water. At the end of the day, clean water was coming out of the BYOW System; however this still needed to be confirmed with petrifilm test results on the next days. One of the problems encountered with the water output was a high turbidity, even after long cycling of water throughout the system.

During the two previous Days, Dorothy Ruiz-Martínez and Mike Ewert visited a local bottle company in Matehuala to see if they were interested in selling "'garrafones"' or empty 20 Liter bottles at low cost to the Aguilar community to promote use and ownership of the BYOW System, however they declined to sell any bottles because the use of the BYOW in the community would represent competition to their company (they

are the main distributors of bottled water in rural communities in the area). On the next day, the same two EWB-JSC team members traveled to the town of Dr. Arroyo (main municipality for the village of Aguilar) and had a meeting with the major of the town. The team members explained the concept of sustainability and ownership of the project, and the difficulties with finding a local company who was willing to sell plastic containers for bottled water. The major of the town was pleased to hear about the progress of the project in Aguilar and he offered to donate 70 plastic containers (20L bottles) for each household in the village and ordered these containers to be delivered the next day. On the way back to Aguilar from Doctor Arroyo, the team saw a representative from the office of CEM (along with others accompanying him) who was video-taping the already installed BYOW System and said they wanted to document this as part of their helping efforts to foreign NGOs. Team-1 concluded successfully the assembly and testing of the BYOW System for the first 5 days of the trip (despite the unexpected delays) and they returned to Monterrey the next day to fly back to the U.S. All the people driving in Mexico were authorized to drive and are pretty familiar with the roads and traffic laws in the area.

Days 6-10: Phase 2 Testing of the BYOW System and Training:

On Day 6, Team-2 (Evan Thomas, Angela Frankze, Tien Nguyen, Will Little and Mike Martinez) arrived to Monterrey by airplane and had an "informational handover"' with Team-1 about the Assembly and Installation of the System at the airport. Four members of Team-1 remained in Mexico for the rest of the trip to make sure the second team was up to speed and to keep conducting water quality testing output of the BYOW System. During the handover meeting, the main focus now turned into reducing the water turbidity to lower levels and finding out why the turbidity was not able to go down as expected from previous installed BYOW systems in Rwanda. Team-2 drove back to Matehuala with a team-1 member and arrived in the evening. The next days were dedicated to modifications of the BYOW assembly, more cycling of the BYOW system, water quality testing, analyzing bacteria results, and operational training of the BYOW System. The last two days, Spanish speakers of the EWB-JSC team trained the Water

Committee, a group of women from the village, and two water boys on the operation of the System.

Training women, children, and men on the Operation of the BYOW System

The training efforts on operation of the BYOW were not as focused due to the unforeseen problem of the water turbidity; the technical team wanted to make sure the system was running in good condition before doing rounds of training. The rest of team finished painting the EWB logo on the wall to indicate the System was installed in that location (a few kids helped). Results from the petrifilm throughout the days of testing indicated the output water was clean with no bacteria. The turbidity had been reduced to more acceptable levels; however it wasn't reduced to an optimum level (mainly due to the fine clay particulate in the water, autonomous to the region) which could cause the UV light to kill bacteria less efficiently in the future. Also, as part of the water quality testing,

members of the EWB-JSC team conducted test in each house from their water drinking sources (containers where water is stored or collected from the roofs and water filtered by the families).

Girls from the village painting the EWB-BYOW mural in Aguilar

The results showed both the water collected from the roof and the filtered source were contaminated with bacteria. The water collected from the roof, even though is rain water, is contaminated mainly because the containers used are not cleaned on a regular basis and the water is not exposed to sunlight. On the other hand, the filtered water is still contaminated with bacteria due to run-off animal feces, even though the water looks clean, it is still contaminated. One of the common practices in the region to filter water at home is through a homemade funnel with some kind of plastic material and pieces of clothing (to remove large particulates from the water). Since the water still remains turbid despite this process (due to the fine clay), people in the region use "'nopal cuijo"' (cactus) so the water can be "crystal clear"' as they call it. To do this, they get a cactus grown within the vicinity, then grill it with fire wood, open it up, and stir the water with the burnt nopal. After stirring the water, it becomes clear and it is poured into another container, leaving the sediments (fine particulate at the bottom). This observation was really interesting, because the sticky gum like substance released by the nopal after being heated acts as an effective flocculator (this local material will be taken into consideration for future EWB-JSC water treatment projects in the region).

Local family hangs a homemade filter on a tree, the water is then collected in the blue drum and stored for drinking and cooking.

The last day in Aguilar was focused on passing out the bottled containers to each family, and bringing the community to the BYOW System location so they could practice operating the system, get clean water, and taste it. The people liked the tasted of the BYOW output water and mentioned the taste remained the same (something that could be seen as a benefit) as opposed to commercial bottled water (people in the rural communities of this region don't like the taste of bottled water because they are used to the clayish taste per previous assessments made by EWB-JSC). The only concern expressed by the people was the water still looked "'yellowish"', which could translate into the community thinking the water is not clean, despite the UV light killing the bacteria. This concern will be taken into consideration and more tests will be done throughout the year to see if the output water remains turbid and if this reflects into a problem of contaminated water perception within the village.

As part of the final wrap-up activities in Aguilar, a verbal agreement was made with the BWC on continuing constant communication with EWB-JSC, on the use and operation of the system, and on monitoring the BWC's management of the BYOW. The BWC decided they would allow families to use the system on a daily basis for a few hours (to

allow someone to monitor use of the system due to fear of operational misuse) and would charge a bi-monthly fee to each household for maintenance of the system and to cover electricity costs. The installed system is now successfully eliminating bacterial contamination from the provided surface water. However, the high levels of fine clay in the water are not entirely filtered by the system. The system is reducing the particulates in the water by 50-75%, and reducing bacterial contamination by 100%. The system will be operated by the Aguilar community water committee and EWB-JSC will return in a few months to evaluate the success of the system, and the community's response to determine if any design changes are appropriate.

Clockwise: Girls getting water from the BYOW system, EWB-JSC team members in the community with bottles donated, a man trained by an EWB-JSC member on the operation of the BYOW System and filling up his bottle

4.0 COMMUNITY

4.1 Description of Community

La Puerta de Aguilar has an altitude of 1, 8000 meter above sea level, and it is midway located in a desert valley 30 Km away from the municipal city of Dr. Arroyo in the Southern State of Nuevo Leon and 45 Km away from the town of Matehuala in the bordering State of San Luis Potosi. The size of the village is about 1,660 hectares, of which 828 are for common use, 770 for temporal use, and 60 for urban use. The climate is desert biome/semi-arid having the hottest months of May, June, July and August, most of the rain occurs during the months of May, September and October. The average temperature is from 16-20 centigrade. The dry conditions of the area are a major stagnation factor in the economy's development. Aguilar has a population of about 215 people, a total of 62 families who sustain themselves on their only source of income: agriculture y livestock. Their income is obtained from corn and beans from the temporal territories. Other income comes from the sale of milk, cheese, and meat. The main type of food consumed is beans, tortillas (corn), rice, cheese, meat, eggs, chiles (peppers), spinach/mustard greens, palm flowers and Mexican squash. The village of Puerta de Aguilar has one kinder garden school and one elementary school; kids who are beyond elementary school go to the nearest village of San Ramon. The handling of personal, food, and water hygiene deficiency (as well as waste problem) is very poor, which results in a frequent incidence of gastrointestinal diseases and dermatitis. The houses are built from adobe, rocks, wood, vigas, mud, and lime. Only about 2-3% of the houses are made out of concrete. Houses have electric service inside, and outside in the village there is limited public lighting. The households cook with hydrocarbon gas, which is bought from outside suppliers and stored in tanks and also with wood when cooking foods that require major fuel consumption (like cooking beans or maize for masa). Water for human consumption and for domestic labor is obtained from a man made pond, which is located down the village and from a small deposit of water (reservoir) called "trampa" to trap water from the rain. The water is supplied by rainwater but there is no protection. For this reason, it is normal for the water to get contaminated from trash, animal fecal matter and waste. Three major problems exist in Aguilar: lack of access to potable water, limited quantity of water due to storage inefficiency, and serious contamination due animal fecal matter. The greatest need for Aguilar is clean water. As a result of unsanitary conditions, gastro-intestinal diseases are really common. During the dry season (March-May) the water becomes completely scarce and the

villagers only depend on one of the reservoirs (the smallest) since the other one becomes empty and it's hardly used due to contamination. This water is rationed between families every Sunday (200L/family) and people have to improvise on water management for their household chores, cooking and to feed the animals. Water consumption is less then 20L per person, the walking distance for water and wood recollection is about 8Km, the villagers pay 30-40% more than urban areas for basic services such as water, gas and electricity. Approximately 40% of its inhabitants migrate to the U.S. in search of jobs and a way to provide for their families who are separated and left back home. The cycle of water shortage, agricultural stagnation, and the diasporas of young and adults who go to bigger cities and cross the U.S. border produce a bogus economy and self-sustained village ran by the ones left to struggle with the local burdens: the women, the children and the elderly.

4.2 Community Relations

The community relations during the project implementation were pretty friendly overall. All the affected members of the BYOW project showed interest and helped out in any way possible. Women of the village were eager to cook for the EWB-JSC team even though it was previously expressed to them it wasn't necessary, and they invited team members to eat every day to different houses (women of each household took turns to host our team). The men of the village were also friendly; most of the time different men would come back from the fields in the afternoon to check on our progress and asked the team if any help was needed. The members of the Water Committee monitored the progress of the BYOW assembly and setup at the site and always helped when appropriate. The President of the Water Committee (Julio Ávila) seemed really knowledgeable in the technical operation of the BYOW and asked great questions about the maintenance and operation of the system. It was really helpful to have him around all the time when something unexpected was needed, mainly because he offered suggestions on what to use or how to handle the situation if it involved using local materials or construction methods in the area. Social protocols in these rural communities are extremely important, such as hand shaking and keeping close relationships with the people work is being done with. One example of this was when arriving to Aguilar; the EWB team had to stop by the Chief's house first to say hi and to inform him the team

was going to start working on the installation of the BYOW System, (the team had to also stop by Julio's house, the President of the BWC for the same purpose). This step is important to community leaders as a sign of respect to their title/position in the community and as an acknowledgement of their authority in the area to pursue any kind of project affecting the community to get the proper permissions. Another sign of bonding and trust in the community was attending the lunch invitations to the women's houses and tasting their food as a sign of acceptance. Last but not least, waving at each community member encountered during walks or while working, shaking hands, and a simple mile were important factors for establishing a trusting relationship with the community.

A few misunderstandings took place, before and during the implementation trip. Prior to the trip, communication with the Water Committee was constant to inform them about the team's date of arrival, building the concrete platform, cleaning out the area where the BYOW System would be installed, and contacting the local Electric company to connect electricity to the grid for the BYOW pump and the UV light to work. 3 months prior to the trip, Julio mentioned the Electric company had already been contacted and the BYOW future site was going to cleaned out 1 month prior to arrival. They also mentioned the construction material was going to be available to build the walls once the BYOW System was installed. It turns out, the Electric Company was contacted by the community one month prior to the trip, the construction material was never bought, and the electric grid was built about 2 weeks prior to the team's arrival. From telephone conversations, the EWB team provided measurements so the concrete platform could be built, however this wasn't done either. When the team arrived for the implementation phase of the project, the leaders of the community started to mobilize everything that was needed on the first day our team arrived to Aguilar. One of the Committee members explained things are usually not planned in advance (it is more like on the "spot"' method) and they really didn't think the EWB-JSC team was going to arrive on the Day they were expecting us (this is because during political campaigns, most people seeking votes travel through rural areas and promise delivery of items within certain time frame,

but it never happens). Despite all the communication mishaps which caused a delay in the implementation and shortened the training focus on the BYOW operations, things turned out well.

As mentioned previously, the Water Committee plans to charge a bi-monthly fee to each household to cover the electricity and unforeseen maintenance costs of the BYOW System. Each household will be allowed to get clean water from the BYOW twice a week (the EWB-JSC team suggested there shouldn't be any limit on how many times people can use the System on a weekly basis, however the Water Committee was concerned people would misuse it and brake the system, and they also wanted to monitor its use while operating the BYOW System for fear of someone stealing the electric pump). After EWB's suggestion to allow more frequent use, the BWC mentioned they would consider allocating more usage monitoring hours on a weekly basis and possibly allow people to operate it without being monitored, however they would have to take this issue to a community meeting and take it to vote to follow their community decision protocol. The BWC mentioned the different community project changes or decisions made on each project have to go through a voting system, so the BYOW System was not the exception. The EWB-JSC team provided BWC with a maintenance and operations manual of the BYOW System. It was agreed if any major part replacement was needed; the President of the BWC would contact us to discuss any actions to be taken and any costs incurred by the community, taking into consideration local providers to make any replacements. A sense of ownership of the BYOW System would be reinforced by paying a fee, by discussing use and operations on their monthly meetings, and by refilling the bottled containers donated with BYOW water. Also, the BWC promised they would contact the Electric Company so the electric grid could be connected to avoid any electric hazards with the temporary setup. The community seemed really happy to have the BYOW System up and running and expressed gratitude at the end of the implementation. EWB-JSC reinforced the continuing commitment with the community by asking them to keep us updated on the use or any future issues with the BYOW System and by providing contact information, and encouraging Open and honest communication.

5.0 PROJECT SUMMARY

5.1 Summary

The "Bring Your Own Water (BYOW) Treatment System" was uniquely designed to address the water treatment requirements of rural communities. The BYOW system consists of a roughing filter, rapid sand filter, and ultraviolet irradiation system. The BYOW system treats water collected in containers by local residents. The system treats water at a rate of approximately 10 liters per minute, and can provide up to 8,400 liters of treated water per day. The BYOW system performed successfully in long term tests in Houston, Texas, where wastewater (over 70 NTU turbidity, 3000 CFU / ml E. Coli) was inputted and the effluent water was significantly cleaner (less than one NTU, 0-2 CFU / ml E. Coli).

5.2 BYOW System Development History

The BYOW treatment system combines several water treatment approaches. The first treatment step in the system is the gravel roughing filter. Incoming water enters the roughing filter from the bottom of the inclined drum and flows upward through gravel media with an average diameter of 1". As the water travels through the gravel, gravity causes entrained sediment to sink downward below the distribution arms into a sediment catchment basin.

Next to this roughing filter is a backwash tank with a valve that automatically diverts a small portion of the input water and stores it for later backwash of the rapid sand filter. The bulk of the water is piped downhill, with the vertical drop of 10-15 vertical feet, providing pressure for the Plastic Drum Sand Filter (PDSF). The PSDF, a rapid sand filter, is built from a watertight UN standard 55 gallon drum with a removable lid. It is designed to operate under hydrostatic pressure to increase filtration speed. In this implementation, the PDSF operates at a maximum pressure of 14 feet of water (6 psi, 41 kPa).

Unfiltered water enters near the top of the filter drum and is distributed across the top of the media bed by perforated arms. The cross-shaped distribution arm is mounted on a PVC union fitting that allows the arm to swing upward and out of the way to facilitate maintenance access to the media bed.

Water is forced through the media by pressure from the column of water above it, removing particulates and bacteria. Because system pressurization is provided by each bucket of water added, the amount of treated water delivered to the user can be no greater than the amount introduced. Additionally, the water is provided within minutes, because the sand filter is already primed and pressurized with water added by previous users. The PDSF in the BYOW system differs from typical sand filters and borrows principles from both rapid and slow sand filter designs. The biggest departure from usual design is the minimal pretreatment before filtration. While typical filters have pretreatment processes or other types of influent control, the PDSF influent is quite variable with the only pretreatment process being the roughing filter. The predictable result of such a situation is that the filter will clog more rapidly and the effluent will be of lower quality then in a typical RSF (rapid sand filter) based plant.

During nominal operation, filtered water flows out of the PDSF into a solar powered electric UV reactor. The UV light deactivates much of the remaining bacteria in the water. The ultraviolet disinfection system utilizes a commercial-off-the-shelf disinfection unit and ballast, the R-Can Environmental Sterilight 12 or 20 liter per minute units. The system is stored in a waterproof, locked Zarges aluminum box. The necessary electrical and plumbing connections are also enclosed in the box. The system is operated by actuating an electrical timer switch on the side of the box. This switch turns on the UV system ballast, proving power to the light, while also actuating an electrical solenoid valve to allow the water flow to from the system. The UV system is powered by a 50 watt or 102 watt solar-panel power supply. The total draw of the disinfection system is

approximately 25-40 watts. The PV installation was sized to provide power to the system for about 7 hours per day, or about 8,400 liters per day.

While the UV stage of the BYOW system is considerably higher technology than the PDSF and roughing filter, failure of the UV would not completely disable the BYOW system, as users would still receive filtered water better than the average input.

A schematic for the complete BYOW system is shown in Figure 1. This figure shows the nominal flow path of the water under treatment, as well as the water used in backwash mode. The input bucket, roughing filter and backwash tank are located above the PDSF and UV components. One of the innovative aspects of this system that is noteworthy is that the energy required to drive the system both nominally and in backwash mode is provided by the sun, the user, and gravity. The cumulative result of all the aforementioned features is a system that can treat a five gallon bucket (about 20 liters) of water in about two minutes using solar and human power alone.

The BYOW-II filtration system consists of the following components, corresponding to the numbers in Figure 1.

BYOW System Components

1. Input bucket	9. UV box inlet valve
2. Roughing filter	10. UV light
3. Backwash diversion valve	11. UV box manual bypass valve
4. Backwash tank	12. UV box solenoid valve
5. Rapid sand filter inlet valve	13. UV box outlet valve
6. Rapid sand filter	14. System “On” button
7. Backwash inlet valve	15. Roughing filter drain
8. Backwash outlet valve	16. Backwash drain

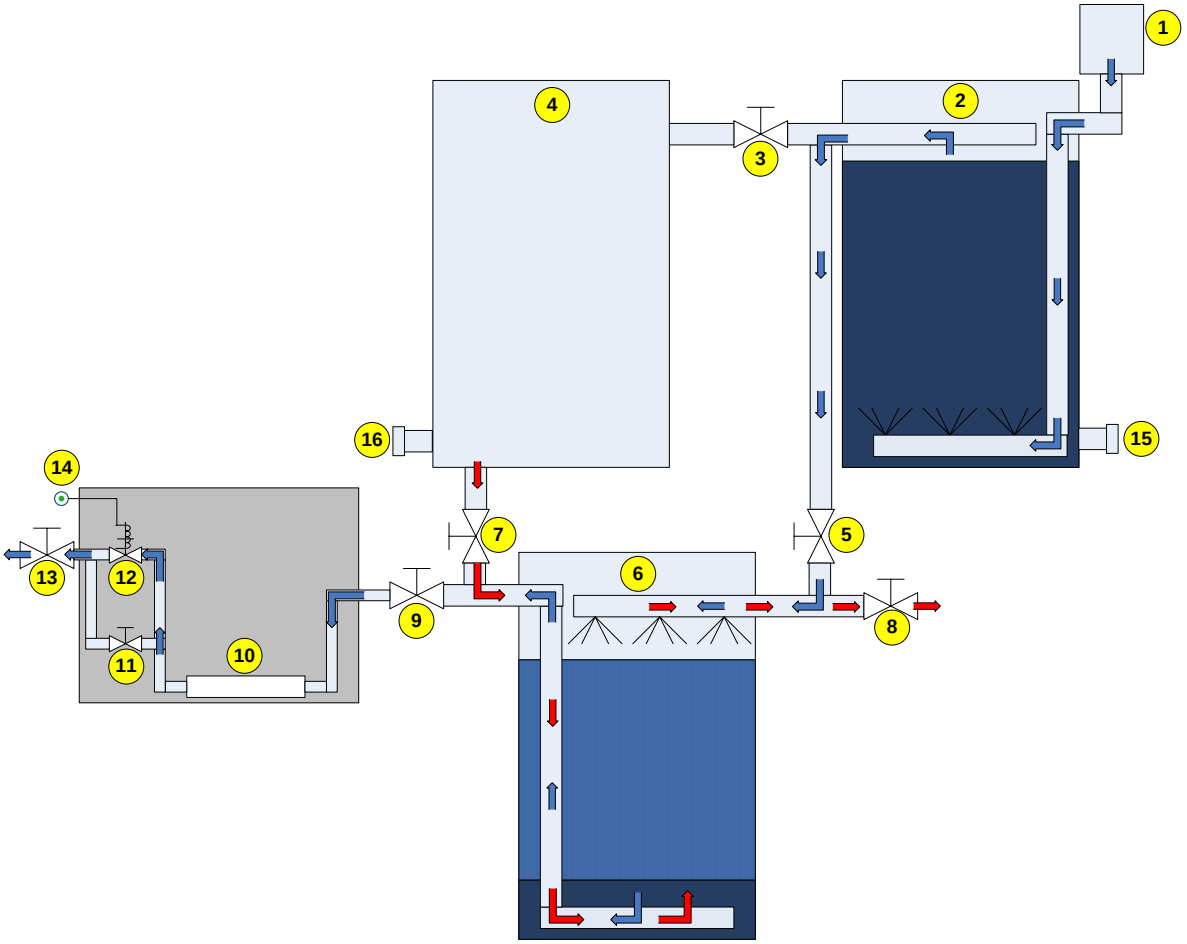


Figure 1: BYOW system schematic showing nominal water flow path in blue and backwash flow path in red

5.3 BYOW System Modifications for Aguilar

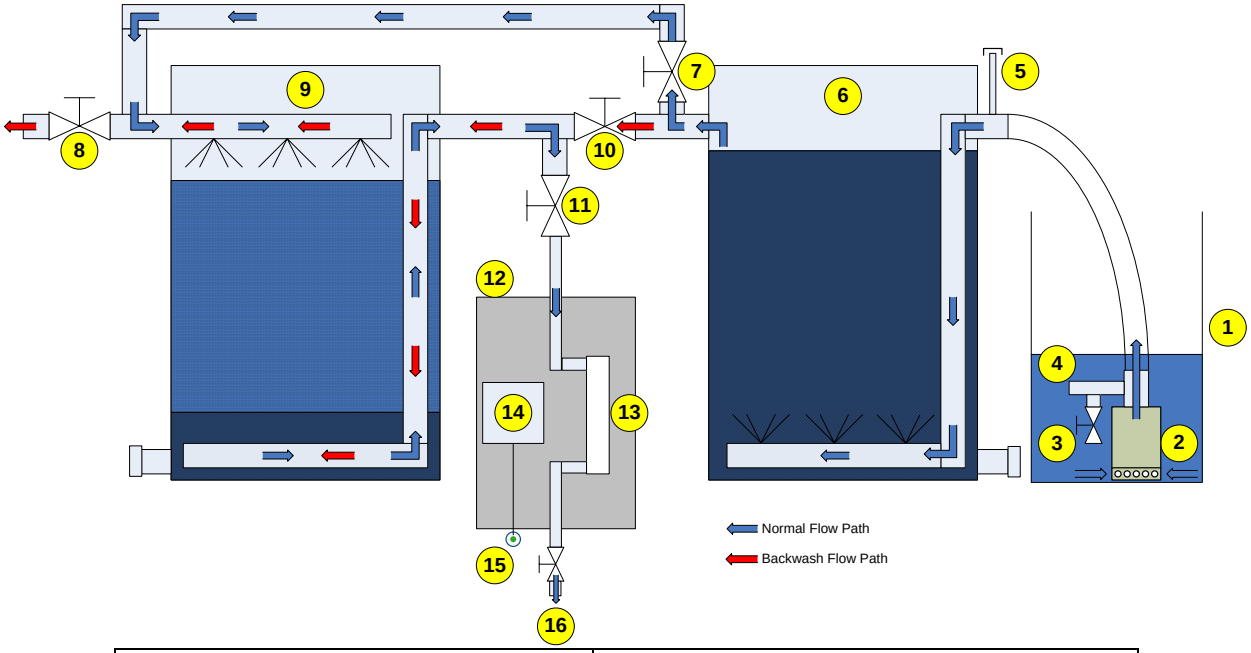
Previous installations of the BYOW system required harnessing alternate (and renewable) sources of energy to accomplish the treatment process. The pressure head needed to operate and backwash the rapid sand filter was obtained by building the system on a hill or platform. A solar array was used to power the UV light.

The community of Aguilar is on an electrical grid which allows for changes to be made to simplify the system and accommodate the needs of a larger community. The PV array, charge controller, battery pack, and inverter were eliminated since the UV light easily runs on standard 120 VAC power (drawing a modest 40 W when activated). Since there are no natural elevation changes in Aguilar, a robust 15 foot tall platform would be required to hold the roughing filter and backwash drum. This platform would also have to be human rated as the roughing filter serves as the input point for the treatment system. In lieu of building this costly and complex structure the system was modified to generate the necessary pressure head using a robust, stainless steel, positive displacement sump pump.

Typically pumps are not regarded as sustainable solutions for a developing community—something our team was very cognizant of when making this design decision. Pumps are prone to failure, especially when used incorrectly, and require highly trained technicians to repair. However, the situation in Aguilar affords us the opportunity to utilize a pump while minimizing the risk of prolonged downtime. The rugged, stainless steel pump is design for moving sludge in corrosive environments—thus it is more than adequate for this application. It has been donated by a local Houston company that has volunteered to provide a replacement pump whenever required. The fact that Aguilar is a one day drive from Houston means we could have a replacement unit installed within days if needed.

The sump pump used to pressurize the system during normal operation can also be used to backwash the sand filter for maintenance. This eliminates the need for a third backwash drum and allows for greater flexibility and ease of system installation.

The new BYOW treatment system for Aguilar is shown in Figure 2.



1. Dirty source water	9. Rapid sand filter
2. Positive displacement pump	10. Backwash inlet valve
3. Backwash throttle valve	11. Sand filter outlet valve
4. Pump recirculation port	12. UV sterilization box
5. Vacuum relief valve	13. UV light
6. Roughing filter	14. UV electronics box
7. Sand filter inlet valve	15. System start button
8. Backwash outlet valve	16. Collection tap

Figure 2: Aguilar BYOW System Schematic

Normal Operation

The outlet of the pump is plumbed to a recirculation port (4), which ensures that if all the valves are closed the maximum system pressure does not exceed 5 psi (well below the drum maximum pressure limit.

The pump is placed in the source water container with the backwash throttle valve (3) open. This valve has been sized obtain maximum flow rate through the system (approximately 5 gpm) that the UV light can handle. The sand filter inlet valve (7), sand filter outlet valve (11), and UV outlet valve (16) are open. The backwash inlet valve (10), backwash outlet valve (8), and UV bypass valve (14) are closed. Pressing the system start button (15) on the UV box begins a one minute timer to warm up the UV light, at which point the pump (2) is started. See Figure 3 for details of the UV electronics box logic and wiring.

Water follows an up-flow path through the roughing filter (6) where flocculation occurs in the gravel bed to remove larger suspended particles. Water then enters the rapid sand filter (9) where smaller particles and bacteria are removed through the physical straining process. The final treatment step in the process directs the flow into the UV sterilization box (12) where the water is exposed to ultraviolet light which achieves a 99.99% reduction of bacteria, viruses, and protozoa. The clean water is collected at the collection tap (16).

Backwash Operation

Periodic backwashing of the rapid sand filter is required to remove collected particulates and increase flow. A minimum of 50 gallons is required to adequately fluidize the filter bed and purge the system. The pressure backwash throttle valve (3) is closed to maximize flow through the system and fluidize the sand bed. The sand filter inlet valve (7) and sand filter outlet valve (11) are closed. The backwash inlet valve (10) and backwash outlet valve (8) are open. The pump (2) is turned on and allowed to run until at least 50 gallons have been pushed through the system.

Backwashing intervals are a factor of system use and source water contamination. On the conservative side we will recommend the community backwash once a month. This can

be done with contaminated source water since backwashing does not rely on cleaning the sand. Bed fluidization is what removes the accumulated particulate, which only requires high pressure and high flow.

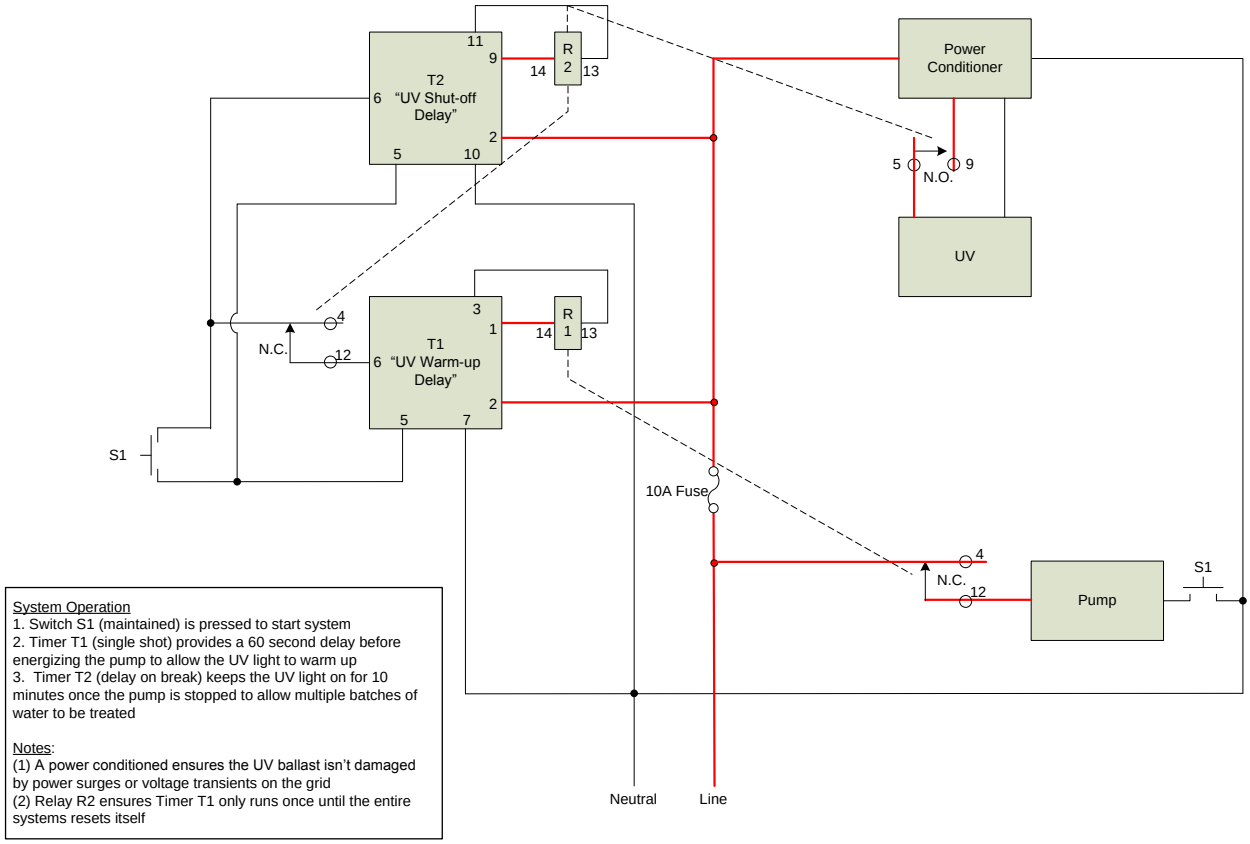


Figure 3: UV Electronics Schematic

6.0 PHOTO DOCUMENTATION

All of the photo documentation has been provided throughout the sections above to have a clearer understanding of the implementation process. Local community contact references and an itinerary of the trip are in the appendix section.

7.0 MONITORING AND EVALUATION:

The BYOW system was tested after installation to confirm effectiveness reducing water turbidity and elimination of e.coli and total coliforms. Source water was tested using 3M petrifilm plates and confirmed presence of both e.coli and total coliforms. Source water

turbidity was measured to be 40-45 NTU. Water treated by the BYOW system was anticipated to reduce turbidity to less than 10 NTU, however even after extensively running the system the lowest turbidity achieved was 23 NTU. Nonetheless, all samples showed no presence of e.coli or total coliforms. This confirmed UV operation and effectiveness over a wider range of turbidity. Water samples were returned to Houston for additional testing, and confirmed an onsite hypothesis that the sediment in the source water was primarily made up of clay. Clay particulate is much finer than silt or sand and is not easily removed via mechanical filtration (straining), which is the primary filtration mechanism of a rapid sand filter. While the water is considered safe to drink, the treated water maintains a yellow tint which has caused many in the community to believe it is not safe for consumption. To further reduce turbidity will require investigating alternative filtration techniques. These could include adding flocculent such as alum, reverse osmosis, or solar distillation. EWB-JSC is currently investigating these technologies to enhance the effectiveness and use of the BYOW system.

8.0 LESSONS LEARNED

The number one lesson learned for this trip is to expect the unexpected and to partner with a local NGO who can monitor the project and its progress closely. Mainly due to the things described in section 4.2, communication by phone is not always sufficient, someone local has to be present to help monitor and oversee the situation to work as mediators and verify if the things agreed by phone take place; that way, when coordinating and planning any construction plans for a future implementation project, the team won't be caught off guard and the process won't be delayed. For this particular situation, the main consequence of such delay was the training of the BYOW operation was not sufficient and appropriate, it did not extend to all the affected members of the village, and this caused the Water Committee to monitor its operation, therefore limiting frequency of use by the community due to fear of people not operating the System correctly. During the implementation trip, more days should've been focused on training, and reassuring the community the water was clean. For this trip, instead of talking to a group to go over the operation of the BYOW System, it would be more appropriate to

schedule one on one session with one or two people, go through a simple poster manual, operate the system with them, and finally, let them practice on their own. This could've worked more effectively, since the people would be less shy to ask questions if something was misunderstood. Also, showing people before and after petrifilm results of dirty and clean water would be an effective way to reassure them the water coming out of the BYOW system was clean despite the turbidity. Another aspect of the training being inappropriate was the language barrier, since the installation of the System was delayed; the person in charge of training had planned to leave 7 days into the trip (the System was not running yet by the 7th day. All of these lessons will be taken into account for BYOW Education Campaign trip planned for the summer of 2010.

9.0 NEXT PHASE OF THE PROGRAM

The next phase of the program includes monitoring the system by keeping close communication via telephone with the Water Committee and evaluating any issues that might arise throughout the use and operation of the BYOW. Also, another way of monitoring the System is through EWB volunteers who are native of the area and have expressed interest in following up with the community through side visits during personal travel trips. Finally, EWB-JSC plans to have post-monitoring trips to inspect the BYOW System and conduct community assessments of its use to measure use and success of the System throughout the village. The monitoring trips will also be used to conduct water quality tests to see if the System is still killing bacteria successfully and to quantify any reduction in gastrointestinal diseases in each household and gauge any need for re-training on the BYOW operation. Other reasons for follow-up assessments of the community will be to check on a possible reduction of the water turbidity, polling people on the effectiveness of BWC management of the System and how it impacts use within the village. Based on the follow-up assessments results on frequency of use, clean water efficiency, low costs maintenance, and reduction of gastrointestinal incidences in the village, the EWB-JSC chapter will evaluate the situation and determine if similar systems can be replicated in nearby communities if the need is warranted. There are two other projects in mind using nopal, a local cactus that grows in the region for reduction of the

turbidity in water that comes out of the BYOW System, and for a micro-enterprise project, which will be lead by IT-Linares, EWB-JSC's local partnering technical school in the State of Nuevo León.

10.0 MENTOR ASSESSMENT: N/A

11.0 Mentor Name (who wrote the assessment)

12.0 Appendix to Lessons Learned (section 8.0)

Updated on Lessons Learned Post-Implementation Trip (2009):

After the implementation trip, the EWB-JSC Mexico team contacted the President of the BWC in Aguilar several times by phone to check if the Electric Company had established electricity connection for the electric grid, and to also check on use and frequency of the BYOW System. During all the times the Water Committee was contacted, the EWB-JSC team was assured the System was being used by people and there were no problems on its operation. This was the case for the first 2 months post-implementation. However on the following months up to November, no one from the BWC answered phone calls, however the local operator in Aguilar kept reassuring the team everything was working fine and people were using the BYOW System. The village of Aguilar has a few stores, and one of the main stores has land phone lines were in/out phone calls can be made. The local families pay a fee per minute to use the phone and the owner of this store is the President of the BWC, and the local operator is his wife. After making so many phone calls and not finding anyone from the BWC, the local operator mentioned Julián was out of town for a long period of time due to work. This pattern of unanswered phone calls became suspicious and another source outside of Aguilar was contacted to find out what was going on. It turns the BYOW System was never used after its implementation due to lack of electricity connection and other internal problems. After finding this out, EWB-JSC volunteers who visit the area during the Holidays decided to go ahead and make a monitoring trip in November of 2008 (the monitoring trips are side trips done by volunteers who are from the region and travel to the region to visit family and who volunteer their time to stop by the community during vacation). The BYOW System was

inspected and one of the EWB-JSC team members talked to both the Chief and the President of the BWC separately. By then, electricity had been connected, however the System was never used (the UV-Box) was inspected and showed it had been used less than a day, which indicated a very low usage. After talking to the President of the BWC, he mentioned electricity was connected 3 months after the implementation trip, and the temporary setup was taken-off several days after the EWB-JSC team left, therefore the BYOW System was only used a few times by some families. Another reason for the System's low usage was due to internal conflicts between the BWC and the Chief and leaders of the Village. Due to these internal conflicts, the President of the BWC resigned and his team dissolved, so the men of the village elected another person (Melitón) to run the BYOW System. However, since the person elected was not trained on the operation of the BYOW System and the prior elected President of the BWC refused to train him, Melitón allowed people to run the BYOW System in the wrong configuration and the System stopped functioning. During the monitoring trip, the EWB-JSC team member trained Melitón on the operation and maintenance of the System and left a placard to be hanged in the location. The System was also inspected, backwashed, re-primed, and water quality test were conducted to check for effective water treatment. The post-water results showed no bacteria and the BYOW System and the UV-Light indicated proper function and operation. Pictures of the System were taken and it was noticed one of the drum lids showed a buckling effect while the System was running, which caused leakage despite the lid being sealed to the drum (see picture below). After the monitoring trip, Melitón and the Chief were reminded the System should be constantly operated to effectively kill bacteria (otherwise algae can accumulate in the filters). Melitón mentioned people in the village were asking to use the System, however since it wasn't running and he didn't know how to fix it, they decided to leave it off and put a lock on the door (place where BYOW System is housed) to avoid people running the System in the wrong configuration again.

Buckling of one the BYOW System'slid and water leakage – Nov 2008

Contact information was given to Melitón and to the Chief of the Village so they could contact the EWB-JSC team as soon as something went wrong with the BYOW-System. During the monitoring trip, a few people approached the EWB-JSC team member to ask if the System was working again and if they could get water. No retraining of people was performed due to the time limit of the trip (1 Day). Back in Houston, the EWB-JSC team member presented its findings to the rest of the team and another monitoring trip was scheduled for the Spring of 2009 by another team member from the area. The main purpose of the 2nd monitoring trip was to replace the Rapid Sand Filter plastic lid with a metal lid, to re-inspect the BYOW System, and to check on its function as well as use and management.

In April, 2009, a small group of volunteers took some of their days of vacation in Mexico to stop by Aguilar and monitor the BYOW System, and to take a side trip to La Joya and La Siberia (previously assessed communities). In Aguilar, one of the BYOW lids was replaced with a metal lid and the System was inspected. Water quality testing was going to be done, however Aguilar's sources of drinking water were completely dry and the volunteers were not able to run the BYOW System. People told EWB-JSC it was an unusual dry year because it stopped raining back in February and all their ponds and

reservoirs were empty. They mentioned by this time of the year, there is still some water left which lasts through the beginning of June. To solve the problem, the community requested the municipality of Doctor Arroyo to bring piped water in trucks and requested the government to build more reservoirs due to a recurring problem of water quantity in the area (specially in recent years when they have experienced more drought). However, they didn't know if they were going to get help from the municipality. Their temporary source of drinking water were the towns of La Lajita (it has piped water) and San Ramon at a cost of 16 pesos per 50 gallons. Some families without transportation (the majority) had to pay extra to pay someone to transport their water by different ways.

Aguilar in photos aboce: Water reservoir for drinking is empty, as well as ponds around the village.

The volunteers talked to Melitón and other people in the community about the use of the BYOW. A quick survey was done around different houses, and the families mentioned several reasons for not using the BYOW, which include: The BYOW System's location is too far away from the main source of water (aljibe), it is not easy to access the System because it is always locked and the person who has the keys to the lock is hard to find sometimes (Melitón works as a farmer in the fields during the day), the water is cloudy, and the obvious reason; there is no water to treat. In conclusion, we found 4 types of groups in the village who get drinking water from different sources: 1) One group of familes (about 8 families in total) and the village Teacher and his family get water exclusively from the BYOW System. These families were using the system before the drought and mentioned they had no problems using the BYOW System, had confidence the water was clean, however they had limited access to it (always locked). 2) There is another group in Aguilar who has never used the BYOW System because they can afford bottled water and don't trust the water is clean because it looks "yellow"'. 3) The 3rd occasionally used water from the BYOW System but didn't use it on a regular basis due to one or more of the reasons explained above. 4) Finally, another group drinks water from the reservoirs but doesn't like to treat it nor use bottled water. Overall, the EWB-JSC team thinks the problem of turbidity can be solved with education (demonstrating to the village cloudy doesn't necessarily mean it is dirty) and the location has to be discussed with the community on a later trip. As far as use of the BYOW System, more people need to be trained on the operation of the BYOW System, the lock issue needs to be solved, and the water quantity needs to be addressed in the future.

Part of this side trip included a visit to La Joya de San Diego in the municipality of Zaragoza (a previously assessed community in 2006 as part of a big umbrella assessment of different communities in the region done by EWB-JSC) to check if the community was still in need of clean water (previously identified as their greatest need) and check for other immediate needs affecting the people's health. During the trip, the EWB-JSC volunteers found that the neighboring community of La Siberia already had clean water

due to a Water Treatment plant that was installed by the Government. The Plant treats water through a reverse osmosis process (the water is salty and comes from a well) and a person from the village is trained to pour other treating agents on a daily basis. The water is distributed to each household through plastic pipes and it is limited to 3 hours per day. Other updates to this community were the installation of latrines and cooking stoves on each house. The cooking stoves seem to reduce the heavy smoke produced by the firewood in the kitchens, and the consumption of firewood. The cooking stoves were built by a local government agency as part of a social program. Even though the latrines were installed by each family (per manuals and instructions provided) at a reduced cost, they are not used. The families interviewed mentioned it is difficult to get rid of the waste, and to dig holes every time the waste collection baskets are filled. The inhabitants of La Siberia expressed concern for the water treatment plant because after a year, the plant would no longer be subsidized by the government (it would probably go to a public water agency) and the village would have to start paying fees. They also mentioned once the plant is transferred to another agency, it will probably stop providing water once something goes wrong with the operation or maintenance of the system (this is something common) because it would take so long for the agency to send people to inspect it or fix it since the area is so remote. After finding out this community was in better shape now, EWB-JSC checked the next previously assessed community of La Joya. This community is a little more remote and still has a need for clean water. The community Chief mentioned they asked for cooking stoves and water from another community would be piped, however the request was made a year ago and it hasn't been met. The EWB volunteers took a few water samples of their main drinking water source (a small deposit on the ground where rain water is accumulated throughout the year). They think this source also gets replenished by a stream, but the EWB-JSC team thinks the water that comes from underground is just rain water. The volunteers did see huge containers that were brought to the community to store drinking water, however the source of water would come from a nearby community through a pipe, but such project has not occurred yet. EWB-JSC is interested in treating the surface water they use for drinking through a

similar BYOW System like the one installed in Aguilar. However, since the community lacks electricity, the UV light would be powered through a solar cell and instead of an electric pump, the team plans to design a manual pump (turbidity is not a problem in this water due to the type of soil, which is located in a mountainous region). The community of La Joya requested our assistance with water treatment; however our team decided to tackle the current issues in Aguilar first before moving on to the next community.

The volunteers had time to meet with researchers from the Water Institute of Monterrey and discussed the turbidity problem in the region of South Nuevo León. The Water Institute mentioned they ran into the same issues and this problem was very particular of the region due to the fine clay in the soil. To solve this issue, they came up with a water treatment using Reverse Osmosis like the water treatment plant built in La Siberia; however it is a very expensive approach. There were discussions on a possible future partnership with EWB-JSC to collaborate o n the turbidity issue.

Water treatment plant in La Siberia, Zaragoza in the State of Nuevo Leon

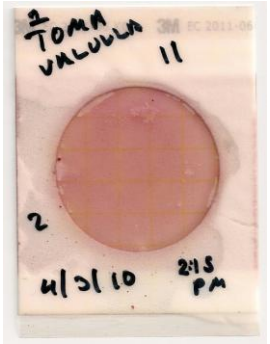
Top to Bottom: Main source of drinking water in La Joya. Common firewood layouts in the majority of kitchens at La Joya.

Update on BYOW Monitoring Side Trip, December 2009:

After the volunteers returned to the U.S., the EWB-JSC Mexico team decided to discuss the current issues in Aguilar with the rest of the team and come up with a temporary solution: Get a local volunteer from the region in South Nuevo León to monitor the BYOW System on a regular basis. Meanwhile, the Mexico technical decided to continue on prototype design for a manual pump and UV-light powered by solar electricity for a new and improved version of the BYOW System (something that could be installed in La Joya). The Mexico team contacted Luis Hernández Banda, a local hardware store owner from the City of Matehuala who had helped EWB find hardware parts for the BYOW System installed in Aguilar. Luis had offered help in the past (from previous trips) and our chapter contacted him. He was glad to volunteer and our team decided to send him manuals of the BYOW System, hold teleconferences to answer his questions, and plan a meeting with him through our recurring traveling volunteers from the EWB-JSC chapter who visit the Mexico area during the Holidays. The meeting took place in December of 2009, the chapter volunteers took Luis to Aguilar to show him the BYOW System and to train him on maintenance and operation. The volunteers introduced Luis to Melitón for future working relationships and future trip inspection of the System. Luis offered to visit Aguilar every 2 months, inspect the BYOW System, provide maintenance, replace any parts needed to be replaced, and take water samples. Luis will be EWB-JSC's main contact and will conduct surveys every now and then to explore in more detail the reasons why people are not using the System. Luis was trained on water quality testing and the EWB-JSC volunteers gave Luis a camera to document pictures, some petrifilms for water quality testing on future inspections, and a manual. The volunteers noticed a newly installed rain catchment container on top of the community roof for more water storage during the rainy season. When inspecting the BYOW System, some rusting of the valves was noticed. Also, the positions of some valves were not in the right configuration. Melitón explained someone had used the System and left it in the wrong configuration so they stopped using the System again. The volunteers configured back the valves to the right position and ran the BYOW System. The output water tasted a

little rusty (mainly because it was stalled for some time). Despite this, the EWB-JSC volunteers found no contamination (bacteria) in the treated water after taking water samples. The BYOW System is still running great as well as the UV-Light. In mid February of 2010, Luis traveled to Aguilar to make his first inspection of the BYOW System (previously teleconed with our chapter for further instructions) and sent all of his results via email, including pictures. The results showed no water contamination and the BYOW System is still in use, however not as often as the EWB-JSC Mexico team would like. The team asked Luis to see if the water from the BYOW System tasted like rust as it previously did back in December of 2009, and if so, the metal valves would have to be replaced by brass valves on a future inspection trip. He also tested the pressurized Vacuum Breaker (it broke lose after the bad valve configuration due to the excess of pressure) and his report indicated a good function and a decrease in rusty taste of the water. The chapter concluded immediate replacement of the valves is not needed as long as the BYOW System is used on a regular basis.

The EWB-JSC Mexico Team continues to rely on Luis for inspection of the BYOW System based on his reports and hopes to see an increase in the BYOW System's use within the village. The team plans to make a trip in the summer of 2010 to make a more detailed assessment on the use of the BYOW System, and mainly to focus on an education Campaign. As with many EWB projects around the world, most projects work great on a technical level, but fail culturally, and our chapter plans to address this problem and hopefully make our project work through Education.



Pictures show bacteria results: 1) Bacteria present from water samples in reservoir 2)Water samples in Valve #11 of BYOW System 3) Zero Bacteria after UV-Light in BYOW System

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JSC-South Houston Professionals
Puerta de Aguilar, Mexico
BYOW Water Filtration System Installation in South Nuevo Leon, Mexico

Picture on top: Clockwise from top left: Luis is trained by one EWB volunteer on water quality testing, BYOW System, volunteers talking to Melitón and Luis, Luis sealing one of the drum lids, Operation Manual inside the BYOW System room. Picture below: Rust build up in the water.