

University of Arizona

Solar Nano filtration training

Dec 7-9th 2020

Intro/ Background:

In March of 2020 the US government approved the CARES ACT to help fund communities fighting against the effects of COVID. A part of that included helping local Dine community member's increase access clean drinking water. In October, I was identified by TLE to help install rainwater catchment systems into the homes of dine community members with no running water. Along with water catchment tanks, the program also delivered water to those systems. We wanted to ensure the water delivered would be safe for consumption so we began to look for different water filtration methods.



There are many different water filtration systems and each have their strengths and weaknesses. For the past few years I have been a member of the University of Arizona FEW external board and recently observed a presentation by Robert Arnold where I was able to hear about the Solar Nano filtration systems. This was an exciting development because we have many community members that don't have electricity or running water and this seems like a step in the right direction. I reached out to Cara

Dunkin, was passed on to Bob Arnold where we were able to discuss the potential of our team coming down to the University of Arizona and working with their instructors to learn about the coarse UV design as well as the Solar Nano Filtration model. One, a Solar Nano filtration system, is able to filter out heavy metals and uranium utilizing a nano membrane that blocks the particles from passing through, the other system is a less intense coarse UV filtration system that is good for places where there isn't much concern about dissolved solids and heavy metal contamination issues, it



will make water safe for human consumption.

With Kern Collymore as project lead, Dr. Tommy Rock and 4 members of the water catchment teams we travelled to Tucson to meet with the University of Arizona team working on the water filtration systems in hopes of learning more about its potential for use in Dine communities.

University of Arizona Training

Primary objective; to provide a detailed introduction to the elements of design and construction of both (i) solar nano-filtration systems (SNF) that can provide a couple of kWhs of energy for night-time indoor

lighting, phone recharge, and etc. and (ii) a solar-powered UV disinfection system that can provide a similar amount of excess energy for night-time use. Yaser Mehdipour, Bob Arnold and I worked to create an agenda that provided limited classroom-like discussion along with practical training in parts acquisition, system operation, and construction techniques.

Due to the very real threat of COVID most of the training was done out doors or in the open spaces of the University of Arizona work shop building which kept both its access doors open. Everyone wore masks and tried to maintain a 6" radius between all participants.

Day 1 12/7/20

- Introductions
- SNF unit
- Parts of System

We arrived in Tucson Sunday evening to allow an early start the next day. We started the day meeting with the University of Arizona Agriculture faculty, after brief introductions we jumped into a presentation facilitated by Yaser and Bob where we were able to see the SNF unit in action.



Our team was able to hear about the background of the unit, how it operates etc. We were able to run the system and see it in action filtering water. After lunch, we broke into two groups, one group was able to go over the equipment needed for the system and the other was learn about the backgrounds of our team, as well as taking time to hear from the University of Arizona professors staff and students involved in working on the SNF units.

SNF system/ Coarse UV components

- Frame
- Water filtration
- Pump, battery and Electrical

In breaking down the systems there is the electrical component which ran the pumps, controller and the UV filter, next is a filtration aspect which broke down to two (2) micron filters (a 10 micron to 5 micron filter) then the UV filter or in the Nano filtration system, the water then was pumped through an additional nano filtration membrane before going through the UV filter.



We spent the day looking at the system as well as navigating the University of Arizona shop where they are able to work on fabricating. Yaser was able to show how the parts on the filtration units worked and the group with Bob Arnold learned how to navigate the system, powering it on and off.

Day 2

- Electrical
- Parts of Filtration systems
- Frame

Tuesday, the Film crew was able to attend the training and began to film our crew. On day 2 we began to touch on the complications of the electrical system in the morning. Electricity provided by the solar panels is important because it runs the pumps that creates pressure to move the water through the different filtration units. The electricity is also used to power the UV filter which shines UV light on the water before its exits the system, ready for human consumption.



After spending the morning looking at the electrical system we returned to “parting out” the SNF unit with Yaser after lunch. As I mentioned earlier the system consists of a frame with different filtration modules and gauges attached, along with the electrical components and a battery that stores power that can be used to power lights or charge devices. By the second day our team had a good feel for the parts needed for construction of the system.

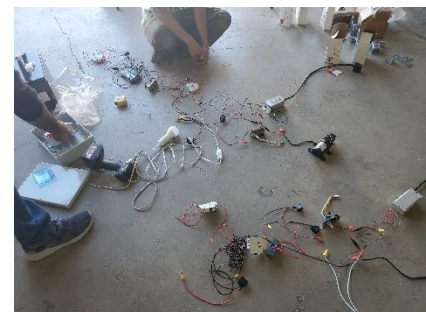
Unfortunately the purchasing from our finance team was having difficulties, so we were unable to move forward getting all the framing parts. Nonetheless our team was able to work with the available parts Yaser had at the shop to help us get an understanding of how the framing for the SNF was done.

The frame for the systems is one of the aspects that needs to be custom built. The frame supports all of the parts of the SNF systems including the battery, filters and electrical interface. While the frame size is based off the size of the SNF filter, our team was excited about working to see if we could customize a design based on community feedback. Since we don’t have a fabrication lab up on Navajo we worked with the easiest framing material available which were slotted bars that could be cut down to different sizes and utilized bolts and screws to hold the frame together. Although the material was easy to work with, it proved to be very heavy.

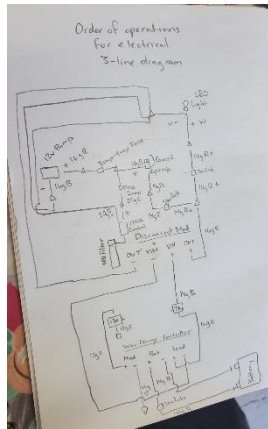
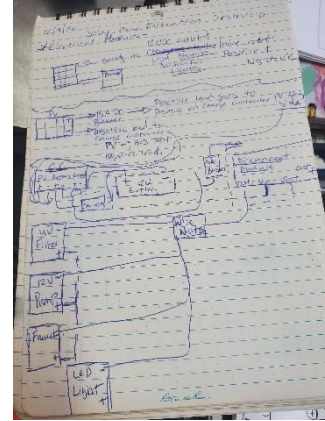


Day 3

- Solar Panels
- Electrical
- Frame



The last day was action packed as we worked to learn the wiring and electrical set up which was, in my opinion, the most difficult. Luckily 3 /4 of our crew had experience with electrical systems due to previous work installing solar panels across the West. The crew was able to work with Yaser as he explained how he put together the electrical system for the water filtration units. It was interesting seeing how the system worked together as well as how the system is connected to the panels, the battery, controller to the pumps. Yaser worked to connect the system together where we then



tested it by turning on the LED lights, next it was our turn to replicate the same task. Since most of the crew did not have prior electrical experience we were able to understand the the wiring and electrical system of the SNF system and replicate Yaser's task of completing the wiring.

Before we left the extension facility to return to the reservation, we worked to complete a frame for a coarse UV system. We were able to cut the frame to size and added supporting brackets to hold the battery and filters in place. The

frame and electrical were 2 of our biggest concern and it was satisfying to end the training having been able to grasp all the concepts behind the SNF system.



Conclusion

The training went really well for the amount of time allowed but wasn't without its hiccups. Due to spending issues our fiscal agent was not able to make purchases in a timely manner which hindered our progress in constructing the frames. We were only there for three days so we had to fit a lot of educational and hands on knowledge into a short amount of time. In the future we would schedule workshops and trainings that provide more time for instruction. It seemed like a lot of the information behind the actual design of the system came from Yaser, which at times created a bottleneck of information when one group had questions and Yaser was occupied. If it would be helpful, I would volunteer my time to collaborating with University of Arizona on how to structure future trainings to help maximize time and resources.

Moving Forward

It is our hopes to be able to construct and implement 2 SNF and 2 UV water filtration systems in dine communities in 2021. Along with the installation of the systems will come testing that will allow us to see how effective these systems are over time. Right now we these systems need more testing as well as long term data but we are excited about the SNF and coarse /UV systems ability to make water safe for consumption as well as the ability to provide additional power. Our team is really excited about working with this technology and making modification that would allow it to best fit into our local communities.



Attendees:

Dr. Tommy Rock

Kern Collymore

Shannon James

Parvanna Lee

Ryannen Tsosie Ahasteen

Sheldon Natonie

Arnold Roberts

Yaser Mehdipour

Sarah Abney

Vasiliki Karanikola

Ailyn Brizo

Cara Duncan

Sakya Calsoyas