Water Disinfection Facility
SAN PABLO DE AMALI, ECUADOR

Project Description:

Our student organization supported the San Pablo de Amali Water Project, driven by the urgency to enhance water infrastructure amid the backdrop of the COVID-19 pandemic. We undertook thorough water quality assessments, revealing significant challenges such as elevated turbidity and organic carbon levels in the community's water supply. To address these issues, we engaged licensed engineers, ultimately opting for the implementation of an ultraviolet (UV) disinfection system. Working closely with professionals and suppliers, we designed and installed the UV system. Beyond remedying immediate water quality concerns, our project sought to establish a foundation for long-term sustainability and resilience within the community. Through collaborative effort and dedication, we delivered a reliable and effective water system, laying the groundwork for improved public health and well-being in San Pablo de Amali. If we are successful with this NCEES award, 100% of the award money will go towards our next water project scheduled in January 2025.

Ultraviolet Light Water Disinfection system able to clean up to 16 gallons / minute.

Knowledge or Skills Gained

Effective communication is paramount, particularly in problem-solving scenarios, especially within the field. In addition to fostering communication among students and professional engineers, our team recognized the crucial importance of engaging with the community to ensure alignment between expectations and outcomes. The establishment of a client-partner relationship with the community profoundly influenced the students, emphasizing the critical lesson that while a design may be technically sound, its value ultimately lies in its ability to meet the needs of its users. Understanding that prioritizing client needs is essential, the students gained a valuable skill set that they can apply in their future careers as engineers.

The travel team comprised of a Professional Engineer, University professional and multiple Engineering students.

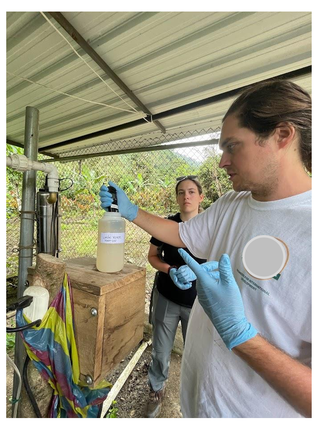
Collaboration of faculty, students, and licensed professional engineers

Since 2020, a team of approximately 20 students, along with several licensed professional engineers, faculty, and staff, have been actively involved. The project has benefited from the continuous guidance of a practicing licensed professional Civil Engineer since its initiation. Regular project meetings, held weekly for a little over a year, have provided a platform for collaboration and guidance, with Licensed Professional Engineers and/or Engineers in Training (EITs) actively participating. During assessment and implementation trips to Ecuador, students were organized into small teams, ensuring close supervision and support from a licensed professional engineer throughout the process.

A student collecting water quality samples from the source water.

Protection of health, safety, and/or welfare of the public

This project stands as a testament to public health and safety, delivering a dependable, clean drinking water system that mitigates waterborne illness risks through improved water quality and UV disinfection. Emphasizing community resilience, the project increases socio-economic development while prioritizing health standards. This comprehensive approach highlights the transformative power of engineering solutions on a global scale. Through hands-on participation, students gained vital insights into ethical engineering practices and developed a strong sense of accountability for long-term impacts, fostering a commitment to positive societal change.



A student testing the turbidity in the water supply after the UV system

Multidiscipline and/or allied profession participation

Electrical Engineering: With guidance from a professional electrical engineer, the design, implementation, and upkeep of essential electrical systems vital for the functionality of the disinfection system. We explored four potential power sources for the UV disinfection system. We conducted a thorough assessment of various power sources, including hydroelectric, solar, wind, and grid connections, considering factors such as cost-effectiveness, reliability, and environmental impact. After careful deliberation, we opted to connect to a nearby residential house, requiring a memorandum of understanding with the homeowner and the community. As a gesture of goodwill, the students collectively funded the initial year's electricity expenses ($34/year) during the implementation trip.

Field testing of the (800W at 48-Volts) Solar Array in the USA

Source water location for the microturbine. High up in the mountains.

Field testing the wind turbine in the USA (150W at 12-volt) system

Identifying the electrical company and the nearest power pole in Ecuador

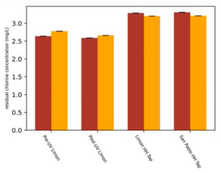
Mechanical and Control System Engineering: Working together with a Professional Engineer, we were able to select and implement a control system for the UV lamp. The collaboration enabled us to assess various options such as efficiency, precision, and compatibility with our existing setup. We identified the optimal control system that not only met our requirements but also offered an ease of usage for the Community. This hands-on experience provided invaluable insights into real-world engineering challenges and reinforced the importance of collaboration in achieving engineering excellence.

Setup and training of the Control Panel

A student digging the trench for the installing the conduits.

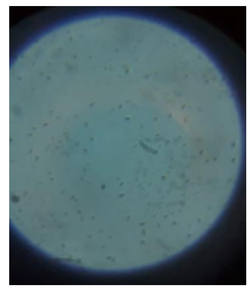
Civil Construction: Prior to the construction phase, the team consulted a Professional Civil Engineer to assist in developing a critical path method schedule, overall cost estimate, and safety plan. Due to the large volume of work that needed to be completed in the short amount of time, multi-tasking was necessary for various components of the construction. The team worked hard to finish the project on time and under budget with zero safety-related accidents.

Environmental Engineering: We integrated environmental engineering into our project by evaluating disinfection methods for the community's water system. With guidance from a Professional Engineer, we assessed water quality and ruled out liquid and granular chlorine due to elevated disinfection byproducts. Instead, we chose an ultraviolet (UV) disinfection system, considering factors like water demand and flow rate. Collaborating with local utilities and suppliers, we installed a filtration system to address high turbidity levels.



Data recorded and reviewed

One of our students working with University Professors to test the collected water samples.



Bacteria In the water supply viewed with a microscope.

Amidst the joyful laughter of his granddaughters playing in the background, on the last day an elderly man approached our student engineering team, his expression carrying a weight of emotion. With tears in his eyes, he shared a heartfelt moment, expressing the profound impact of the new water system on his life. He recounted how his son had been forced to move his wife and children (his granddaughters) several miles away due to the absence of clean water in the community. Now, thanks to the diligent work and efforts of our engineering team and against all odds, the community finally had a reliable source of clean water. He expressed his heartfelt gratitude to each member of our team. The result of this project was evident in the decision of the elderly man's son to return to the community with his new family, choosing to build his home next to his father's. But beyond the physical infrastructure, the most significant aspect of the story, he emphasized, was the newfound ability to enjoy the presence of his two granddaughters as they grow up, all made possible by the improved living conditions brought about by the new water system. This emotional testimony served as a powerful reminder of the tangible benefits that engineering projects can bring to individual families within a community.

Don Vincente, Community Leader, San Pablo de Amili, Ecuador – Jan. 2023

Emily Conrad
(Our host on the Left)
and
Don Vincente
(Community Leader on the Right.)