



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Ansel Austin	Project Number S0301
Project Title Clean Water for All: A Novel Filtration and Maintenance Mechanism for Improving India Mark II Water Pump Performance	
<p style="text-align: center;">Abstract</p> <p>Objectives There is a widespread and urgent need to improve the quality of water that hand pumps, such as India Mark II, deliver. To achieve this, a filtration mechanism must be designed to purify pumped well water of dangerous contaminants. This device will potentially be used in the many India Mark II pumps throughout the developing countries that still rely on mechanical hand pumps for drinking water, such as India, Ghana, Uganda, and many others. By removing a secondary purifying process, communities will be able to get clean water directly from the pump, thereby reducing health risks. To address this problem, my goal was to design and prototype a filtration and filter-flushing mechanism that eliminates at least 99% of bacteria and protozoa utilizing an Ultrafiltration (UF) hollow fiber membrane and satisfies VLOM requirements.</p> <p>Methods After having assembled and installed India Mark II water pump at school with the help of my mentor, Mr. Stephen Huber, I did the initial research, took pump measurements, and performed calculations. I then designed the filtering and filter back-flushing mechanisms using Autodesk Inventor. I 3D-printed the two initial prototypes, and assembled the filtration and back-flushing mechanism utilizing Renovo UF hollow fiber membrane filters, custom laser-cut gaskets, a steel rod, and tubing. I manufactured the third, working prototype using a CNC machine, tested the water pressure and flow rate, as well as the resulting water quality. My school mentor helped me with the pump assembly and installation, operating the CNC machine, and advised me on the VLOM requirements for a community hand pump.</p> <p>Results The resulting filter with a filter-flushing mechanism is a working prototype for a filtration system, which meets the specified goals and constraints and can be installed in the India Mark II pump stand in order to purify well water, providing a low-cost and low-maintenance way of delivering safer water for the community.</p> <p>Conclusions It is feasible and desirable to modify India Mark II hand pumps with this novel filtration and back-flushing mechanism in order to significantly improve water quality and eliminate serious health risks associated with well water contaminants. While further development is needed to take this design to an industrial level, it meets the design constraints and can potentially improve the health of many communities worldwide.</p>	
Summary Statement I designed, prototyped, and tested a novel filtration and back-flushing mechanism to improve the quality of water delivered by India Mark II hand pumps, which are used by communities worldwide.	
Help Received One of my mentors at school, Mr. Stephen Huber, helped install the India Mark II pump at school, advised me on the VLOM requirements, and trained me in using a CNC machine. I did all the calculations, CAD, manufacturing, assembly, and testing by myself.	