

## Senior Design Project Data Sheet

Project #	Project Name	Project Track	Project Family
P07401	EPA Water Disinfection	Sustainable Products, Systems, and Technologies	P07400 Sustainable Technologies for the Third World
Start Term	Team Guide	Project Sponsor	Doc. Revision
2006-2	Dr. Rob Stevens	EPA	3

### Project Description

#### ***Project Background:***

Venezuela and other nations with poor agrarian communities have a serious problem providing clean drinking water. Every year, over five million people die from unsafe drinking water and improper sanitation. Solar water pasteurizers offer a solution to this problem. Many areas within Venezuela still lack electricity, as well as technical education. Considering this, low-tech water pasteurizers can be designed using simple parts and powered by the heat that the sun gives off. In the past, much effort has been devoted to making drinking water safe in urban areas, but this project will focus specifically on helping rural communities.

#### ***Problem Statement:***

There are approximately 1.1 billion people in the world who do not have access to clean drinking water. The solar powered pasteurizer that we are developing would be one solution to this problem as it would be low-cost, low-maintenance so that it can be used by a family, small school or clinic where there is currently no clean drinking water available.

#### ***Objectives/Scope:***

1. Develop a solar pasteurizer with an integral heat exchanger.
2. Use inexpensive and readily available materials and fabrication techniques in order to minimize the cost and maximize the availability.
3. Develop a method of testing the water to ensure it is safe for consumption.
4. Develop directions for use and maintenance that can be easily followed by a person with little education.
5. Ensure that the final product is durable and sustainable.
6. Test the performance of the pasteurizer for a range of environmental conditions.

#### ***Deliverables:***

- Senior Design Conference Paper
- Senior Design Project Poster
- Engineering Package of Final Design
- Construction Plan
- Operation & Maintenance Manual
- Working Prototype of Solar Pasteurizer
- EPA Final Report (due 4/6)
- National Sustainable Design Expo (due 4/24-4/25)

#### ***Expected Project Benefits:***

The WHO/UNICEF Joint Monitoring Program for Water Supply and Sanitation stated that there are over a billion people, primarily children, to whom safe water is not accessible. Most existing water purification technologies that make use of centralized water systems are not operable in rural areas where populations are more isolated and means of power supply are untrustworthy, even practically nonexistent.

The Solar Pasteurizer with Integral Heat Exchanger (SPIHX) will integrate the solar energy together with the resources and materials readily available in the developing world by targeting at overall cost reduction and potential mass production therefore increasing the likelihood for stress-free adoption and maintenance of the system. The decentralized nature of this water treatment technology will satisfy the needs of rural populations.

The benefits of SPIHX also include being suitable for small scale applications, for instance, use for home or clinical applications without need for additional power source other than solar energy.

In this way, the high mortality rate as defined by WHO/UNICEF will be reduced. The children will be given the opportunity to grow up and be contributing members in their communities. What is more, access to safe water will also relieve the burden on the healthcare system as well as enabling adults to be more productive individuals. These benefits ultimately form the core of the developing communities.

#### ***Core Team Members:***

The multidisciplinary team to design, build, and test solar pasteurizer as part of RIT's

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Multidisciplinary Design Experience consists of:  
**Sang Lee** – Mechanical Engineering  
(Project manager)  
**Elaine Aiken** – Mechanical Engineering  
**Kellen Buchner** – Mechanical Engineering  
**Drazen Hadzialic** – Mechanical Engineering  
**Nathan La Croix** - Mechanical Engineering  
**Sulen Gonc** - Industrial & Systems Engineering  
**Alexander Kinlock** – Industrial & Systems Engineering

- Manufacturing with a low budget due to designing for developing countries.
- Removing air bubbles from the water chamber, as it has been an issue in past SPIHX products.
- Environmental criteria must be integrated with regular cost/production criteria to drive the solution, forcing initial DFX efforts to focus on the 3P's (People, Prosperity, and the Planet).
- Producing water that has not been effectively treated could risk many lives of people who consume the water.

## Strategy & Approach

### Assumptions:

1. The designed pasteurizer will not remove metals from the treated water, which may or may not be present in the water that is being supplied.
2. The United States water quality standards for pathogen contaminants will be used as acceptable baseline standards for drinking water. The water quality will be judged based upon these standards.
3. Majority of the design and fabrication of the pasteurizer will be completed by the team members, with limited outside resources being provided.
4. The water that is treated will contain bacteria and pathogens that are commonly present in untreated water, and will not contain unforeseen impurities, unless further data becomes available.
5. There is a water supply system within the community, in whatever form it may be, such as water well, supply line, etc.

### Constraints:

1. The project will be completed within the allotted budget, as well as by April 6, 2007, as agreed upon by the EPA.
2. Main customer needs must be satisfied fully.
3. The team will not have an opportunity to survey the location of installation in Venezuela, and will have to rely on 3<sup>rd</sup> party information regarding the conditions of the location.
4. The testing weather conditions in Rochester, NY, will require appropriate measures and modifications to be taken, in order to extract the full testing potential and mimic a true operational environment.

### Issues & Risks:

- The deadline for the final report going to the EPA is April 6, 2007, requiring swift action.
- The project will require effective communication with faculty consultants that have worked with solar power and heat transfer, as well as with representatives from Venezuela, the end user for the project.
- The product will be designed for non-educated people, requiring universal pictures and good human factors knowledge