

## **International Engineering Service Program**

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In Association with:  
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Universidad Tecnológica de Xicotepec de Juárez  
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and

Rotary International District 6000

### **Executive Summary**

The Colleges of Engineering at The University of Iowa and Iowa State University, the Iowa Section of Water for People, the Universidad Tecnológica de Xicotepec de Juárez, and Rotary International, have agreed to work together through the International Engineering Service Program (IESP) to provide an educational and service internship experience for students that emphasizes environmentally and economically sustainable engineering projects. The program involves substantial interaction between university-level students, faculty mentors at the respective universities, the Iowa Section of Water for People and members of Rotary International in the USA and Xicotepec, Mexico. Together, the team has begun to develop and execute a long-term plan aimed at improving the infrastructure of drinking water and waste management systems in Xicotepec, Mexico. Specifically, the goals of the International Engineering Service Program are:

- 1) Through a combined on-campus academic experience and student travel abroad, provide Water for People project leaders and Rotary District 6000 with engineering and water resource expertise needed to support its development efforts in Xicotepec, Mexico.
- 2) Produce engineering graduates who have a sense of international responsibility in their profession.
- 3) Develop students with the personal skills necessary to work on a multi-disciplinary team with colleagues from another country on a common project.
- 4) Develop professional skills by participating in project planning, execution and evaluation.
- 5) Partner with Iowa Section of Water for People to carry out specified projects sanctioned by their professional society in cooperation with Rotary District 6000.

## **Program Description – Phase I: Survey of Engineering Requirements**

Phase I of the program focused on an assessment of engineering needs necessary to advance the standards of water quality and sanitation services for the city of Xicotepec, Mexico. To date, a one-week site visit to Xicotepec (March, 2003) involving student participants from the University of Iowa and Iowa State University has been completed by a multi-disciplinary team that worked together on pre-visit research and planning, site assessment activities and preparation of a post-visit report. The team consisted of students from various engineering majors as well as urban and regional planning and was directed by faculty mentors at the respective universities.

### **Key Elements of Xicotepec Site Visit:**

1. **Task I:** Meet with local leaders: Rotary members, local government, academic/professional staff (engineering/healthcare) with a focus on health concerns, infrastructure concerns, social capacity concerns (education), and financial concerns.
2. **Task II:** Conduct a visual survey of the area: drinking/waste water systems, solid waste systems, flood control systems with a focus on management systems poverty relationships, and education issues.
3. **Task III:** Develop documentation: survey maps, water/soil analysis, interviews, photographs, financial information, and contacts.

### **Key Assessment Results:**

1. The current raw water source originates in the mountains over 42 km from Xicotepec (1282 meters above MSL) at an elevation of 2210 meters. The water is gravity fed through a steel pipeline once owned by the PEMEX Oil Company. The pipeline serves 2 major communities and 49 small villages before reaching Xicotepec. Local engineers have design plans to improve water flow through the pipeline, but expressed concern over the age of the pipe. A regional water authority has been proposed to oversee the maintenance of the line.
2. Clean drinking water is available to those that can afford to buy bottled water. Running water in dwellings isn't potable by U.S. standards, but many people are consuming this water daily. Many people feel that government cannot provide safe running water and many do not want to pay for such a service anyway.
3. Wastewater infrastructure is minimal with most industrial waste (i.e. coffee processing, etc.) and household waste being discharged directly to local streams. Local officials have plans for centralized wastewater collection and treatment, but acknowledge that government financial support for such a project isn't likely in the near future.
4. Many local people are much more concerned with everyday aspects of living than with developing environmental friendly, sustainable drinking water and wastewater infrastructure. The lack of a stable political structure makes long term project development and implementation particularly challenging.
5. Cultural awareness is a key factor to successful interactions between professionals from different countries. The students (and faculty mentors) from Iowa quickly learned the importance of having bilingual members on the project team and the subtleness required to exchange ideas in a helpful manner without appearing arrogant and "all-knowing".

## Program Description – Phase II: Curriculum Development

To use the assessment produced from Phase I to its fullest, a three credit hour class has been proposed with the goal of producing sustainable designs to be implemented in Xicotepec. The curriculum is under development, but the theme with regard to wastewater is clear - decentralization. Wastewater improvement curriculum will be based on a book by Ron Crites and George Tchobanoglous titled "Small and Decentralized Wastewater Management Systems". Wastewater topics for the course might include the following:

1. Introduction/Wastewater Characteristics
2. Fate of Constituents
3. Introduction to Process Analysis
4. Biological Treatment of Wastewater
5. Lagoon Treatment Systems
6. Wetlands and Aquatic Treatment Systems
7. Land Treatment Systems
8. Effluent Reuse and Disposal
9. Biosolids and Septage Management

It appears that in the near term Xicotepec will continue to rely on bottled water as the primary source of safe drinking water. Engineering solutions may be possible to provide more efficient distribution and treatment of bottled water in an effort to increase affordability and availability. Engineers can also play a central role in public education as to the dangers of drinking polluted waters and making the public aware that alternative sources of water exist.

For more rural areas, the IESP will also focus on a simple water filtering system designed to disinfect water on an as needed basis. The "Purifier System" (Figure 1) employs a double bucket design with porous treatment filters impregnated with amalgamated silver. Students in Iowa and Xicotepec could partner to further develop this approach or see that it is implemented in its current form.



Figure 1: The Purifier water treatment system uses silver impregnated ceramics to provide safe drinking water (<http://www.purifier.com.np>).

The course will also seek to foster cultural awareness through student presentations, invited speakers and with assistance from the University of Iowa International Programs Center. We also hope a three-week workshop on sustainable water treatment, with curriculum in Spanish, will be developed and taught at the Universidad Tecnológica de Xicotepec de Juárez.