

“Water treatment is good, so why does two-thirds of the world not have it?”

- Lisa Farnen

LISA FARMEN

Following Her Bliss

By Janice Carter

Lisa Farmen's passion is water, and her vision is to provide clean, clear affordable water at a price even the poorest in the world can afford. Lisa asks: "Would I have tackled a project as big as bringing to market low cost water purification technology to the majority of the world's population if I had not gone back to school to get an EMBA degree focusing on International Business? . . . Not on your life! I'm sure my dreams prior to obtaining an EMBA from Golden Gate University would not have been that big."

Lisa's father died in a logging accident when she was three years old. Lisa's mother, who was then in her fifties, went back to college to obtain her four year degree and her master's degree. Her mother was a teacher who instilled in her two strong convictions: a college education is something that cannot be taken away from you, and a woman with a college education and two business suits can go anywhere.

While Lisa's mother was in college, she met a woman named Corinne Reiter, who became a mentor pointing Lisa in the right di-

reaction when difficult decisions had to be made. Lisa recalls, “The last time I saw Corinne was in Los Angeles in a Senior Center and she asked me where I wanted to be when I was 50. I was in her kitchen cooking breakfast for the two of us and realized Corinne was over 85 and I was the only person she could possibly be talking to and dang near gasped when I took in the word *FIFTY!* It shocked me all the way back home and I enrolled in GGU’s Executive Master’s in Business Administration (EMBA) program in Monterey immediately.”

Lisa found GGU’s EMBA program intense, but she liked the team approach where members went through the program together and made sure everyone in the cohort succeeded in the program. Lisa was then the lead engineer for a \$220 million dollar capital equipment expansion for Texas Instrument’s complementary metal–oxide–semiconductor (CMOS) fabrication (fab) plant in Santa Cruz. She worked seven days a week with two days off a month and ran a 16-acre farm in Watsonville. She says, “I have never pushed myself and produced more than during that two year period. I learned where my boundaries were and that I could, in fact, perform well at high levels of productivity.” Lisa credits the EMBA international trip to England and Ireland with helping her understand international business and learning how to set up a global business.

Ten days after she finished the EMBA program, Lisa received a phone call. She learned that her nephew had been paralyzed in a sledding accident the day after Christmas. She left her job and her farm and returned to her family’s home in Oregon. For the next five years, Farmen devoted her energies to helping her family deal with the aftermath of this devastating accident. She also helped elderly family members make the transition to senior care facilities.

But what about her dreams? Five years after obtaining her MBA degree, it was time for her to go back to work, but she had not yet “test driven” her EMBA. Lisa’s partner gave her the encouragement she needed.

“How you know you’re married to the right person,” Lisa explains, “is when they put your needs ahead of theirs or what they might want for you. My partner quoted Joseph Campbell’s advice to ‘Follow your bliss and doors will open where you did not know there were doors.’ Spoken like a true English Literature Major (the degree held by my better half), I thought. ‘Right,’ I replied sarcastically, ‘I’ll get right on that.’ ”

While Lisa was taking care of her family, she had plenty of time to think about her bliss. She could only think of one area she was still passionate about: clean water.

Her passion for clean water started in 1976. While she was a student at Colorado State, Lisa worked in a water laboratory for an environmental consulting firm, M&I Consulting Engineers, in Fort Collins, Colorado. The field work took her to Fort Saint Vrain, near Platteville, Colorado, where she sampled water for contaminants on a nuclear power plant site. Lisa says that the experience working for M&I “steered my career path from veterinary medicine to biology, chemical engineering, and radiation physics. Further analytical work at Rocky Flats, near Denver, also motivated me to consider working on the cleanup of contaminated water as a career option.”

After graduating from Colorado State in 1980 with a degree in biology, Lisa moved to the Silicon Valley and worked for EMCON Associates in San Jose, analyzing water, hazardous waste, and soil samples. Her employers encouraged her to find other water testing clients, so she developed accounts with electronics manufacturing

water fabrication facilities. When regulations were established requiring manufacturers to install water and wastewater treatment equipment, Lisa teamed with three people to form Ecology Protection Systems (EPS), which designed water and wastewater treatment systems to remove heavy metals, fluorides, and other toxic contaminants. She credits David R. Wood of EPS with “turning me into a better water chemist than I ever would have been on my own.” She praises Lacy Thomas of EPS for empowering her to learn engineering, manufacturing and design.

Farmen then started a capital equipment company, Waterworks Technologies, Inc., an early adopter of ion exchange technology to remove metal from water. She joined Texas Instruments’ worldwide water team and worked to expand their water fabrication facilities in Santa Cruz. While she was working on the fab expansion, she enrolled in and finished the EMBA program at GGU, completing the international finance portion in London and Dublin. After leaving Texas Instruments in 2001, Lisa worked with Sandia National Laboratories.

In 2005, she teamed with her business partner, Jim Harris, to write a grant for the National Science Foundation (NSF) Small Business Innovation Research (SBIR) program to develop nanotechnology which could remove both biological and chemical contaminants from water, at a cost the majority of the world’s population could afford.

The process Lisa and Jim developed also removes pharmaceutical drugs found in drinking water. Lisa explains, “I am pursuing the vision and dream for low cost water purification because people will not stop using water to wash away their waste products. There will always be chemical and biological contaminants discharged into water supplies that eventually become the raw water source for

drinking water. So being able to remove these contaminants from drinking water is crucial.” The problem is especially severe for children, because children under the age of 12 “bioaccumulate these contaminants at a rate ten times that of an adult.”

Lisa is concerned that neurological disorders such as autism and Alzheimer’s could have a root cause in bioaccumulation of toxins in water and/or food. She feels that contaminants in water can be taken up by agricultural crops and enter the food chain. She cites studies indicating that rocket fuel (per chlorate) was found in women’s breast milk in Southern California.

In an article she wrote for the *Global Child Journal*, she pointed out that one fourth of the earth’s population does not have clean water and two-thirds have a severe water shortage. An estimated 4 billion people (two thirds of the world’s population) suffer from diarrhea, due to poor quality water. Diarrhea results in 2.2 million deaths per year and most of those dying are children. In developing countries, as many as 80% of the deaths are water related. It is estimated that over 1.8 million people die each year from water-borne diseases including cholera, typhoid, guinea worm disease, diarrhea, polio, dengue fever and trachoma.

High levels of arsenic have been found in water supplies in many parts of the world. In Bangladesh, more and deeper boreholes were sunk to obtain better quality water, but the water obtained was heavily contaminated with arsenic. Long term consumption of arsenic causes arsenosis, which can cause cancer and death. Seventy million people are at risk for arsenosis in India, China, Vietnam, Pakistan, Nepal, Myanmar and Cambodia.

In February 2005, Lisa Farmen met Lenore McDonald, then Alumni Director for Golden Gate University, at a GGU alumni ex-

cursion to the San Francisco Ballet. Lenore, inspired by Lisa's commitment to developing inexpensive ways of purifying water, introduced Lisa to me. Other staff members of the University Library and I were delighted to work with Lisa, to assist her on the research she needed to bring her dream to fruition.

Lisa and Jim Harris formed Crystal Clear Technologies, Inc., to pursue the National Science Foundation SBIR grant opportunity. David Kent, Associate Professor and Chair of the Management and Operations Department at Golden Gate University, had met Lisa on her EMBA international trip to London and Dublin. He encouraged Lisa to submit a proposal for an EMBA team to develop strategic plans for Crystal Clear Technologies.

Several members of EMBA Cohort 54 worked on a U.S.-focused strategic plan for CCT throughout their EMBA program. It was a challenge because Lisa seems to move faster than the speed of light, and opportunities were constantly increasing. At the final project presentations, Nabil Rageh, Operations Management Professor and Project Manager for the EMBA projects, commented: "and the situation has changed entirely in the last three minutes, as Lisa was speaking."

Bruce Wasserman, Strategy Professor for the EMBA program, wrote: "If anything points to the real world nature of our EMBA projects, this is it. The project was a real world lesson that the world is dynamic, so be prepared to build it while you fly it!"

Debi Bucciarelli, the EMBA student serving as team lead for the project, added, "It was an honor to be a part of this project, and it is exciting to see how GGU helped Lisa on her journey."

It became especially exciting when Crystal Clear Technologies was chosen to compete in the 2006 California Clean Tech Open.

From the 200 business plans submitted, five top winners would be chosen: one in each of five categories.

At the final awards ceremony in September 2006, Lenore McDonald, Therese Martin from the EMBA cohort team, and I were all sitting with Lisa at San Francisco City Hall, listening to the winners accepting awards for . . . energy efficiency, renewable energy, smart power, and transportation. Water was, of course, the last category, and we held our breath, then stood up and cheered as Crystal Clear Technologies was named the winner and Lisa went to the stage to accept the award.

“Water treatment technology is good, so why does two thirds of the world not have it?” Lisa asks. “I have been building state-of-the-art water treatment systems for 30 years. The reality is that the reason there is not clean water for all has nothing to do with technology. It has to do with one word and that word starts with ‘m’ – MONEY. The big thing we’ve found is a way to purify water at low cost.”

As Lisa and Crystal Clear Technologies explained in a recent grant proposal, “The overriding issue to providing clean drinking water is cost, for the individual and for the government. For individuals earning less than \$5 per day, water needs must be met for a fraction of that amount. The technical challenge is [developing] a water purifier which can process water of uncertain origin to at least World Health Organization drinking quality levels for less than \$0.0004 per liter operating cost. In addition, the water purifier must operate within cultural and infrastructure constraints.”

The water purifier models CCT has developed can use alternative energy sources. One model is human powered, using a hand- or foot-driven generator to pump water and generate electricity for

the ultraviolet module. Other models use solar energy or electricity from a grid. The modules can be configured to be portable, stationary or attached to a bicycle. Another version of a purifier can be powered from a car battery. Modules are scalable for household or small village use. Filter media can be manufactured in the country where the filter is being utilized.

NMX™ Technology, which CCT developed in conjunction with the University of Oregon, uses inexpensive nanocoating ligands, which bind to the surface of low cost mineral substrates, transforming the substrates into adsorbative media. Adsorbed metals adhere to the substrate and do not leach away. No waste stream is generated. CCT has filed several patent applications in the U.S. and internationally on the NMX™ technology, including one jointly with the University of Oregon.

In 2006, Oregon Nanotechnology and Microscience Institute (ONAMI) awarded CCT and the University of Oregon a grant to support moving the developed nanotechnology from proof of concept to technology validation.

Currently, Lisa and CCT are teamed with Cascade Designs, Inc., to be the original equipment manufacturer (OEM) for the non-developed world market. The goal is to design, manufacture and bring to market low cost water purification technology that fits consumer needs and price points. CCT has teamed with several key partners for the U.S. underserved market and have identified partners in India, but have not yet set up manufacturing “off shore.”

CCT has developed a fully integrated water purifier for a well head where numerous families come to get water. This unit can be powered by either solar or human power for ultraviolet (UV) pathogen deactivation, and has CCT’s NMX™ nanocoated adsorptive fil-

ter media for removing arsenic, uranium and other metals and radionuclide's. This system also removes herbicides, pesticides and cyanide (of special interest for military markets). Lisa calls this system "the Cadillac version," with a cost of \$300 to \$500.

CCT can offer a cartridge for arsenic removal for about \$20.00. The cartridge will last for six months to a year before needing replacement. Replacement costs will be a few dollars.

The water purifier is modular, so CCT can make the components to remove pathogens, organics or inorganics or do all three. The purifier can be adapted to use passive technology and no power or can use utility power when that is available or human power when utility power is not available. CCT will use mechanical filtration (hollow fiber) and ultraviolet (UV) light to deactivate pathogens. CCT has just licensed technology from Georgia Tech for the UV component. Currently, CCT offers the only technology that can layer up metal contaminants to the point the media could be reclaimed for value, thus not becoming an ecological waste product.

In addition to her technological and business skills, Lisa has an amazing talent for seeking and finding alliances with social organizations as well as research and business associations. She worked as a volunteer engineer for the Northeast Community Center in Portland. There she met a possible business partner. After swimming in the Columbia River with him, she asked: "Do you know what was in the water through which we just swam?" Then she told him. One of her neighbors describes Lisa as a "cross between Einstein and Mother Teresa," because she brings together complex technical expertise and profound compassion. That description seems apt, though to be more accurate; one may need to add in the Energizer Bunny.

Early in the SBIR grant process, CCT identified several non-

governmental organizations as potential partners, including To Love Children Educational Foundation International and Village of Hope, working in Africa; The Mountain Fund, working in Nepal and Tibet; Engineers without Borders-USA for their various projects outside the United States; and PSI which is operating in 70 countries, including India.

Since CCT's mission is to commercialize affordable drinking water products in underserved regions, they are currently developing partnerships with Native Americans to test several water purifiers on a Navajo Indian reservation. The focus is on Native American communities which do not have the infrastructure to supply clean water and, in some cases, power. Approximately 60,000 Native Americans on the Navajo reservation in the "Four Corners" region of the Southwest are drinking contaminated water. As part of a plan to lower cost and improve quality of water to the Navajo reservation residents, CCT, in a recent grant proposal, outlined its plans to work with others in the area.

The goals are three: 1) Expand the social marketing initiative of the New Mexico University School of Public Health to help identify an acceptable technology and product solution for contaminated drinking water in the Navajo Nation. 2) Initiate a plan to minimize the cost of portable water to the Navajo underserved community [and] 3) Field test CCT water purifiers designed in accordance with New Mexico University's proposals to improve the quality of Navajo reservation water to EPA drinking standards.

On the Navajo Reservation it appears that every household has at least one pickup truck, and one version of the purifier can be powered from a car battery. Representatives of the Navajo Environmental Protection Agency and Health Committees are involved in

the planning with CCT for all phases of the project. Sandia Laboratories has been contacted to help work with CCT personnel to present information on the science and technology behind water treatment to students in the Pine Hill School.

The project could lead to development of a model which could be used with other underserved Native American communities in the U.S., and with underserved communities in other parts of the world. CCT anticipates setting up manufacturing of various components in New Mexico and in India. In the process, they will explore how an individual or family may generate an income with CCT water purifiers, providing not only pure water, but also employment.

Lisa Farmen has come a long, long way from her porch in Oregon. And, one day soon, portable, inexpensive water may be globally ubiquitous as a result of her dream.

Sources

Farmen, Lisa. "Water, Water Everywhere and Not a Drop to Drink," *Global Child Journal*, 2006, Vol 2, Number 1, pp. 8-11.

Henley, Mike. "Profile: Farmen Helps Launch Crystal Clear Technologies to Offer Better Treatment Technology," *Ultrapure Water*, March 2008, pp. 46-47.

Internal Crystal Clear Technologies documents provided by Lisa Farmen.

Interviews with Lisa Farmen on November 30, 2007, January 29, 2008, March 12, 2008, March 24, 2008 and April 6, 2008.

Janice Carter is Director of the Golden Gate University Library.