



Flint, Mich. Toxic Muni Water Use Case, and Solution

St Luke's Center for Battered Women and Homeless Children

Site Description

St Luke's New Life Center is in Flint, Mich. It is a center for battered women, and for homeless children. The exterior doors are armored and locked from the inside, to protect the residents. St Luke's is located at 3115 Lawndale, Ave, Flint Mich, 48504. It was founded in 2002 by two Dominican nuns, Sister Carol Weber and Sister Judy Blake. This year, Sister Carol celebrates her 50th anniversary, graduating from "nun college". Sister Carol has also earned a MA, and a PhD. Sister Carol can be reached at (810) 239-8710, and by email at cweber@stlukenewlifecenter.com. The web address for St Luke's center is: www.stlukenewlifecenter.com St Luke's center serves over 3,000 people per week from their commercial kitchen from their pantry. These meals go to some of the most impoverished people in Flint, including battered women and homeless children.



Photo 1: St Luke's Center in Flint, Mich.

Poverty is endemic in Flint, Mich. The City of Flint is in financial receivership (i.e. bankrupt). Flint's tax base eroded, while historical pension costs remain. At one time, Flint's population exceeded 200k people, with over 80k General Motors employees. For several reasons, GM payrolls in Flint dropped to under 8k employees since 2008. Today's population of Flint is about 100k people, and most are impoverished.



Photo 2: Flint house, a couple of blocks from St Luke's Center. My eyeball suggests that about 30% of the houses are abandoned, or the house lots are vacant/torn down.

St Luke's is served by the Flint Municipal Water company, and shares the problem of toxic, Lead filled (and other contaminants) tap water.



Photo 3: collecting tap water at St Luke's in Flint, Mich.



Photo 4: a child resident of St Luke's Center, in front of a disconnected drinking fountain.

Solution Description

In 2015, the Merlin LLC engineers who live near Flint, sought to use their 3rd world solution to help out in Flint. Similar Merlin systems are currently deployed in Kenya (with a chief of the Maasai), in Nepal (for earthquake relief), and in California (for earthquake preparedness). The engineers performed extensive review and testing of both the input Flint municipal tap water and the output/ purified water at EPA certified labs, both in Toledo, Ohio, and in Ypsilanti, Mich. The Merlin engineers also sought advice from the American Water Works Association, a public water company in California, the Flint water emergency management team, and several other agencies involved in seeking solutions. Merlin engineers came up with an effective design for St Luke's, that met the needs of their commercial kitchen and center. A "Go Fund Me" campaign paid for the initial hardware.

This water purification system was installed in December 2015, and monitored for close to three months – before the Flint Emergency Manager gave "permission" for people to drink the purified water. During this period, the water was tested 2x per month at an EPA approved testing lab.



Photo 5: Merlin water purification system, installed at St Luke's Center in Flint, Mich.

At St Luke's, the purifier is attached to a wall. Electricity is provided via a standard wall outlet. No pump is needed; it runs off the water pressure in the muni water line. A manual valve redirects water into the purifier, or into the sink outlet. The water is purified via a three stage process; the purified water is stored in a tank. To fill the tank, an operator manually turns the system on and off. There is an automatic overflow set of pipes, in case the operator forgets to turn the system off. The tank gets re-filled 1-2 times/day, as needed, and clean water is produced at the rate of 0.6 gallons/minute. That

tank supplies water to the commercial kitchen, for all of the food preparation and cooking needs. That outlet is also used for drinking water, and is plumbed into an automatic ice machine (as far as we know, the only automatic ice machine in the effected area of Flint).

The St Luke's water purification system uses a three stage process to purify the water:

- **Stage 1:** the Flint muni tap water is first passed through a scrubbable, ceramic filter with 0.5 micron pores, to clean the particulates out of the muni tap water. (see photo 6) This Stage 1 scrubbed filter is scrubbed clean at least 1x/week, by hand with a soft brush under running water, and will last for 1-2 years with this kind of weekly maintenance. By removing all of the particulates down to 1 micron in size, this both a) dramatically extends the life of the Stage 2 chemical filter, and b) makes the Stage 3 UV blast 100% effective at sterilization. A clean, spare filter is located next to the purifier, for whenever it will be needed (in another year or two?).



Photo 6: Stage 1 filter (lower), before cleaning. Upper photo is of the Stage 2 Lead (chemical) filter. The brown scum on the Stage 1 filter accumulates within the first few hours of use, still, in July 2016.

- **Stage 2:** the water is then passed through a chemical filter, in order to extract the Lead (and other chemicals harmful to humans in drinking water). (Photo 5, top filter). Merlin has been running the same filter at St Luke's since Dec 2015, testing the water output 2x per week at certified EPA labs. In addition, Merlin uses a hand-held tool from Andalyze each week when we clean the filter and inspect the system; it provides an accurate reading of Lead in the water within 2 minutes- thereby avoiding the long feedback cycle from the EPA labs (3 days to 10 days).
- **Stage 3:** The water is then passed through a high dose Ultra-Violet light, to destroy any remaining viruses or DNA. WHO suggests hitting the water with a dose of 15,000 uW/cm**2/sec; this Merlin system, at 0.6 GPM, blasts the water with 75,000 uW/cm**2/sec. This additional step technically "sterilizes" the water, according to the EPA, the WHO, and to the

measured EPA lab test results. There is nothing alive remaining in the output water. Not any bacteria, not any virus, not any DNA.

This three Stage system is so effective, that in about 9 months of continuous operation at St Luke's New Life Center, there has never been any Lead or E. Coli detected in any of the Merlin purified water. This contrasts with the Flint Muni tap water, where the Lead levels continue to go up and down, and the E. Coli levels also continue to go up and down.



Photo 7: Raised tank of purified water, strapped to the wall. Joe Novitsky, principal engineer in photo.



Photo 8: Purified tank water, output into the kitchen through the blue hose. Purified water is directly plumbed into the ice machine – the only automatic ice machine in Flint (ironically in a center for homeless kids).

Engineering notebooks are available to anybody who seeks to understand both what is in the Flint Muni tap water, and how “clean” the St Luke's purified water is. All waters tests are performed by EPA certified labs.

In addition, the people in Flint cannot even use the Flint Muni tap water to irrigate fruits and vegetables. When gardens are watered with contaminated water filled with toxic metals, the crops take up not only the water, but the toxic metals. The toxic metals then concentrate in the fruits and vegetables. So Merlin also installed some water barrels at St Luke's to collect rain water off the roof of St Luke's center, in order to water the plants in the garden with "safe" (i.e. non toxic) water.



Photo 9: barrels to collect rain water from roof downspouts at St Luke's, water collected to irrigate the vegetable garden. Soaker hose coming off the rain barrels is visible.



Photo 10: a pair of kids who live at St Luke's in Flint, learning how to use the rain water from the barrels off the downspouts, to water their garden.

Economic Impact of This System:

This water purification system at St Luke's has a bill of materials of under \$4k, and labor costs (to design the system, to build the tank stand, to strap it to the wall, put in all the hoses, valves, overflow pipes, etc) of around another \$5k.

Flint Muni Water is planning to switch over to a new pipeline, in mid 2017. In the words of the American Water Works Association and of professional water engineers, this is a planned "disruptive event". They expect it to take about 1 year past the disruptive event, until the public/municipal water system "stabilizes". This means that the Lead oxides inside the city and residential pipes are thick enough to prevent Lead from leaching into the water in the pipes, and also that the E. Coli bacteria currently colonizing inside the Flint muni water system is held in check via Chlorine or other chemical methods.

So let us do the math for this St Luke's application. It applies to just about any site that operates a commercial kitchen/cafeteria. Let's assume we need to provide all the drinking water/food prep/cooking water/etc for 152 people per day.

- The WHO suggests using the figure of 10 liters/day/person, for all of the drinking water/cooking water/clean up (tooth brush, etc) needs. So 400 gallons supports about 152 people per day.

When we run the numbers:

- 1) Bottled water sells for \$0.50/liter, when you purchase it at the pallet level.
- 2) At 400 gallons/day, the cost would be \$760/day, to purchase bottled water.

Over the next two years, that works out to $(\$760/\text{day} \times 365 \text{ days} \times 2 \text{ years}) = \554k , to purchase bottled water at the pallet level!!! Whether it's the center, or the State, somebody will be paying that money for the next 2 years. This is just for one small center in one small corner of Flint, Mich.

There are some 10M sites in the USA, still with Lead service lines. So many people can benefit from this same technology. Whether for Lead removal, for Arsenic removal, for algae removal (Toledo, Ohio et al), etc. How can we help you?

References:

- 1) www.merlinecosolutions.com (EPA lab tests available)
- 2) www.stlukesnewlifecenter.com