Water Crisis in Flint Michigan
What happened?
Lessons Learned

2016 Spring Joint Technical Conference
April 7, 2016 Exton, PA

Preston Luitweiler, P.E.
Water Resources Engineer, Retired
Lead and Copper Rule

“Maintain Optimized Corrosion Control”

DWSD used a phosphate inhibitor would require frequent testing for P in the distribution system.

MDEQ required no corrosion control, Required 2 consecutive 6-month periods of testing.

If 90\textsuperscript{th} percentile numbers were <5 ppb for lead, system would be “deemed optimized.”
E. Coli Violations

August 2014
September 2014
# TTHM Violation

## December 2014

**Table 1 – 2014 DBP Test Results**

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>1st Qtr 5/21/14</th>
<th>2nd Qtr 8/21/14</th>
<th>3rd Qtr</th>
<th>1st Qtr 5/21/14</th>
<th>2nd Qtr 8/21/14</th>
<th>3rd Qtr</th>
</tr>
</thead>
<tbody>
<tr>
<td>3719 Davison - McDonalds</td>
<td>162.4</td>
<td>145.3</td>
<td></td>
<td>64</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>822 S. Dort Hwy - BP Gas Sta.</td>
<td>111.6</td>
<td>112.0</td>
<td></td>
<td>52</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>3302 S. Dort Hwy – Liquor Palace</td>
<td>96.5</td>
<td>127.2</td>
<td></td>
<td>48</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>3606 Corunna – Taco Bell</td>
<td>106.4</td>
<td>181.3</td>
<td></td>
<td>55</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>2501 Flushing – Univ. Market</td>
<td>75.1</td>
<td>196.2</td>
<td></td>
<td>38</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>3216 MLK – Salem Housing</td>
<td>82.2</td>
<td>112.4</td>
<td></td>
<td>41</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>5018 Clio – Rite Aid</td>
<td>88.2</td>
<td>144.4</td>
<td></td>
<td>49</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>6204 N. Saginaw – N. Flint Auto</td>
<td>79.2</td>
<td>118.3</td>
<td></td>
<td>50</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1: LeeAnne Walters shows samples taken from her home on January 21 and January 15 this year to Flint’s emergency manager Jerry Ambrose during a January 21 forum (Image courtesy: The Daily Mail/AP)
Sample results and graph are provided courtesy of Virginia Tech

Figure-2 Results for lead in sequential sampling (1L water samples taken consecutively) at low, medium and high flows — Results range from 200 to 13,200 ppb
The difference two data points can make
The Michigan Department of Environmental Quality's analysis of Flint's water supply

If the DEQ had **included all of the water samples it took**, federal law would have demanded further steps ...

... but the **exclusion of two high-lead samples** put the city's water supply below the threshold for mandatory action.

**LEAD LEVELS IN WATER SAMPLES**

<table>
<thead>
<tr>
<th>Not Detectable</th>
<th>15 ppb</th>
<th>25</th>
<th>50</th>
<th>100</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><img src="image1" alt="EPA ACTION LEVEL" /></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PERCENTAGE OF SAMPLES EXCEEDING 15 PPB**

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>25</th>
<th>50</th>
<th>75</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2" alt="Action Required" /></td>
<td><img src="image3" alt="Sample Excluded" /></td>
<td><img src="image4" alt="Sample Excluded" /></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Michigan Department of Environmental Quality

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**Fivethirtyeight**
Water sampling in two separate studies
How the sampling and results from city and state testing and the Flint Water Study compare, by ward

**WATER SAMPLES**
- BELOW EPA ACTION LEVEL (15 PPB)
- ABOVE ACTION LEVEL

**Michigan Department of Environmental Quality**

**Flint Water Study’s analysis**
Elevated Blood Lead Levels in Children Associated With the Flint Drinking Water Crisis: A Spatial Analysis of Risk and Public Health Response

Mona Hanna-Attisha, MD, MPH, Jenny LaChance, MS, Richard Casey Sadler, PhD, and Allison Champney Schnepp, MD
FIGURE 1—Comparison of Elevated Blood Lead Level Percentage, Before (Pre) and After (Post) Water Source Change From Detroit-Supplied Lake Huron Water to the Flint River: Flint, MI, 2013 and 2015

*Note. WLL = water lead level.*

*P<.05.*

Note. BLL = blood lead level; WLL = water lead level.
How blood lead levels changed in Flint’s children
Before and after the city’s water source was switched to the Flint River in April 2014

Percentage of children younger than 5 years old with elevated blood lead levels

Share of water samples containing at least 15 ppb lead (EPA action level) as of Sept. 26, 2015

SOURCE: AMERICAN JOURNAL OF PUBLIC HEALTH
Figure 6.5  Dissolved inorganic carbonate versus pH: No phosphate, $I = 0.01$, $T = 25^\circ C$
Figure 6.7  Dissolved inorganic carbonate versus pH: With phosphate = 0.5 mgPO$_4$/L, I = 0.005, T = 25°C
$12 Million
$6 million from the State of Michigan
$4 million from the Mott Foundation
$2 million from the City of Flint
Bottled Water and Filters

MDHHS and the Genesee County Community Action Resource Department (GCCARD).
Lead Poisoning - Attention Flint Parents
Children Ages 18 and Under May Be Eligible for Financial Compensation Due to Lead Exposure

Exposure to high levels of lead in contaminated water from the Flint River has caused serious injuries to children.

Get More Info

Breaking News (3/4/16): Flint Resident Lee-Anne Walters Files Individual Lawsuit On Behalf Of Her Four Children, One Of 9 Individual Lawsuits Filed Today For More Than 20 Lead Poisoned Children By Our Law Firms (read more) (lee-anne-walters-and-8-other-lawsuits-filed.php)

Our Experienced Attorneys Have Collected Over $100 Million for Children Who Were Lead Poisoned

Lead is a neurotoxin that can poison a child's brain if it is ingested. The effects of lead poisoning are drastic and permanent, and more severe the younger the child. Children that have been lead poisoned suffer from acute learning disabilities; diminished IQ scores; and struggle to stay on grade level as they progress through school. Lead poisoned children are far less likely to graduate from high school, go to college, or get a post-graduate degree than those who aren't. There is absolutely no cure for lead poisoning.

The lawyers at Levy Konigsberg have recovered more than one hundred million dollars on behalf of lead poisoned children for their diminished earning capacities as adults; the shame and embarrassment of being left-back, picked on and made to feel less than, and for medical monitoring.

Get FREE Consultation

Your Name

Your Child's Name

Your Email Address

Your Phone Number

How Old Is Your Child?

Year of Flint Water Exposure?

Additional Comments


Perspective
FIGURE. Timeline of lead poisoning prevention policies and blood lead levels in children aged 1–5 years, by year — National Health and Nutrition Examination Survey, United States, 1971–2008

Abbreviations: BLL = blood lead level; GM = geometric mean; NHANES = National Health and Nutrition Examination Survey.


† NHANES survey period.
Geometric mean and selected percentiles of blood concentrations (in µg/dL) for the U.S. population from the National Health and Nutrition Examination Survey.

<table>
<thead>
<tr>
<th>Survey years</th>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% confidence interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99-00</td>
<td>1.66 (1.60-1.72)</td>
<td>1.60 (1.60-1.70)</td>
<td>7970</td>
</tr>
<tr>
<td>01-02</td>
<td>1.45 (1.39-1.51)</td>
<td>2.50 (2.40-2.60)</td>
<td>8945</td>
</tr>
<tr>
<td>03-04</td>
<td>1.43 (1.36-1.50)</td>
<td>1.40 (1.40-1.50)</td>
<td>8373</td>
</tr>
<tr>
<td>05-06</td>
<td>1.29 (1.23-1.36)</td>
<td>2.20 (2.10-2.30)</td>
<td>8407</td>
</tr>
<tr>
<td>07-08</td>
<td>1.27 (1.21-1.34)</td>
<td>1.40 (1.30-1.50)</td>
<td>8266</td>
</tr>
<tr>
<td>09-10</td>
<td>1.12 (1.08-1.16)</td>
<td>1.27 (1.20-1.34)</td>
<td>8793</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
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<tr>
<td>1-5 years</td>
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<td></td>
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<tr>
<td>99-00</td>
<td>2.23 (1.96-2.53)</td>
<td>2.20 (1.90-2.50)</td>
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<tr>
<td>01-02</td>
<td>1.70 (1.55-1.87)</td>
<td>1.60 (1.50-1.80)</td>
<td>898</td>
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<tr>
<td>03-04</td>
<td>1.77 (1.60-1.95)</td>
<td>1.60 (1.50-1.90)</td>
<td>911</td>
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<td>05-06</td>
<td>1.46 (1.36-1.57)</td>
<td>1.70 (1.60-1.95)</td>
<td>968</td>
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<tr>
<td>07-08</td>
<td>1.51 (1.37-1.66)</td>
<td>1.43 (1.34-1.55)</td>
<td>817</td>
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<tr>
<td>09-10</td>
<td>1.17 (1.08-1.26)</td>
<td>1.15 (1.03-1.27)</td>
<td>836</td>
</tr>
</tbody>
</table>
Don’t Forget the Fundamentals

Like Corrosion Control
Communication

• *Regulators*
• *Health professionals*
• *Customers*
You can never afford NOT to do the right thing.