

# Outfall from the Flint, MI Crisis



**OTCO PROCRASTINATOR WORKSHOP**

**DECEMBER 5, 2017**

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# Flint Crisis in Perspective



- As of December of 2017, Flint Michigan is more than 3 1/2 years into their water crisis
  - The problem has been more than just about Lead:
    - ✦ There is much speculation about Legionella and coliform outbreaks
    - ✦ There are financial problems still not settled
    - ✦ There are ongoing efforts to replace service lines, to hire personnel, and to re-size the distribution system – these are only partially finished
    - ✦ The City has finally signed a long term water agreement

# Legalities: Residents are Suing City Employees



- Flint residents are suing some city and state employees for exposing them to lead-contaminated water and hiding the contamination
  - Plaintiffs argue in their 15-count lawsuit that defendants violated their property rights
  - On July 28<sup>th</sup>, 2017, a Federal court ruled that Flint residents who used lead-contaminated water can legally sue and seek financial damages against State and City employees

# Flint Court Trials



- Twenty-three law firms representing at least 9,000 people have been consolidated into 10 class actions and more than 50 personal injury lawsuits
- The former Michigan Department of Health and Human Services director is charged with involuntary manslaughter in a Legionnaires' death
- The Federal court, on behalf of Flint residents and businesses, has ruled that cases can proceed for damages

# Legalities: Three Plea Bargains in Court



- Three former government employees have taken plea deals and have promised to give the prosecutor information about the case:
  - May 2016, former water plant operator of record Mike Glasgow accepted a plea deal, admitting to filing false information about lead in Flint water and agreeing to cooperate in other in prosecutions.
  - September 2016, Corrinne Miller, retired director of the State Department of Health and Human Services' Bureau of Epidemiology, pleaded no contest to neglect of duty for her role in the water crisis.
  - Nov. 28<sup>th</sup>, 2017, Daugherty (Duff) Johnson, Flint's former utilities administrator, pleaded no contest to a misdemeanor public records charge rather than facing two felony charges -- false pretenses and conspiracy to commit false pretenses.



## Why tell the Flint story?

The story of Flint is the worst man-made drinking water disaster of our time

The story is worth reviewing so that we can learn from the mistakes made

The story might strengthen the relationship between Ohio operators and Ohio EPA

## Eight categories to review

1. Historic Timelines
2. Expert Opinions about Lead Toxicity
3. Flint Water Advisory Task Force (FWATF)
4. The Accused and the Accusers
5. Lead and Copper Rule review
6. What Happened Between Flint Operators and MDEQ
7. The Women of Flint
8. What Should Utilities Do Now?

# Flint Michigan Crisis



## **HISTORIC TIMELINES**

# Debt



- In 2011, the State of Michigan took over Flint's finances after an audit projected a \$25 million deficit. Flint is under the control of a state-appointed emergency manager
  - Even though Flint's water supply fund was \$9 million in the red, officials were using some of the water department money to cover shortfalls in its general fund
  - While a new pipeline connecting Flint with Lake Huron was under construction, **the emergency manager wanted to use the Flint River as a water source** during the two-year transition, thinking that this would cause no problems and save money

# Flint, MI Timelines



- **March 25<sup>th</sup>, 2013**
  - The Flint Emergency Manager begins to take steps to disconnect the Flint Water System from Detroit Water and develop its own source from the Karegnondi Water Authority (KWA)
    - ✦ KWA begins to construct a water main from Lake Huron
    - ✦ Distance between Flint and Lake Huron – 70 miles
    - ✦ Karegnondi raw water line had not yet been completed in 2013
    - ✦ No transition or contingency plan was put in to place for providing safe and reliable drinking water while the raw water line was going to be built

# Flint, MI Timelines



- April 25, 2014
  - The Flint City Emergency Manager weighs the choice of staying on Detroit's higher rate vs. firing up the existing Flint WTP
    - ✦ He is in negotiations with the Detroit Emergency Manager
      - Neither of the two men is a drinking water professional

# Flint crisis in a nutshell



- In April of 2014, Flint MI changes its source of drinking water
  - In order to reduce the water fund shortfall, the city switches water sources in 2014.
  - It quits taking finished water from Detroit - which it has been getting since the mid-60's and which has orthophosphate in it since the 1990's - and starts treating Flint River water and distributing it to customers
- Water from the Flint River WTP :
  1. Was not treated with a corrosion inhibitor
  2. Is high in chlorides, AND was treated with Ferric chloride rather than the aluminum coagulant that Detroit uses – so (chloride – sulphate) to carbonate ratio changed
  3. Had widely fluctuating chlorine residuals

# State DEQ sues Flint City Council



- On June 28<sup>th</sup>, 2017 the Michigan Department of Environmental Quality brings a lawsuit against Flint City Council
  - The suit alleges that City Council's refusal to back a long term deal with GLWA for drinking water is endangering public health
  - The State does not want Flint to make a change in water source a THIRD time, arguing that there is no other viable choice

As of 11/22/ 2017 .....



- The City Council finally voted (5-4) to choose a permanent water source - GLWA
- The consultant and the Mayor and the DEQ had recommended that the City tie into GLWA for thirty years
  - Some City Council members wanted to start the WTP again
    - ✦ The Mayor was facing recall, but she won the election
  - Flint continues to replace Lead service lines

# The new Flint contract with GLWA



- Under the deal, a Flint representative will be appointed to the authority's governing board
- The city will be relieved of debts owed to the Karegnondi Water Authority, the system that was intended to be Flint's primary water source after breaking away from the Detroit system
- The contract provides for \$750,000 to be granted to the city for water bill relief and \$100 million pledged for infrastructure improvements to be released immediately



# The Emergency Order



- Contains 15 separate requirements that Flint and the State of Michigan and the DEQ must comply with in an ongoing basis
  - The emergency order has 15 “musts” spelled out that are required of these entities
  - Some of them are: begin sampling and reporting WQ parameters in the system; inventory of home with Lead service lines; show proof that operators are capable of treating water; add orthophosphates so that water has about 3.2 mg/L; add chlorine so that water has a specified amount; engage a panel of nationally recognized experts to advise on water treatment; and more ....
- Reports of significant compliance data or milestones achieved are reported weekly on a public website



Flint began replacing Lead service lines in the system, and has made a statement that their goal was to replace all of the 16,000 lines in three years

The old Flint records don't always have reliable information in them

Nevertheless, Flint has made the correct decision to locate Lead service lines, and handle all of the cost to replace them when they are found

**Summary of Michigan Department of Environmental Quality Actions  
In Response to the  
United States Environmental Protection Agency Emergency Administrative Order  
Updated: 11/14/2017**

**EXECUTIVE SUMMARY:**

The United State Environmental Protection Agency (EPA) Emergency Administrative Order contains 15 overall items to be addressed by the Michigan Department of Environmental Quality (MDEQ). This update includes status only on items for which progress was made in the last week. It is anticipated that the next update to this summary will be provided on Monday, November 20, 2017.

**DETAILED INFORMATION:**

**Paragraph 54: Inventory of homes with lead service lines.**

- As of 11/14/2017, the City of Flint has replaced 5,587 service lines and identified 1,132 copper-to-copper lines.

**Progress on the replacement of Lead service lines is good, but there are issues along the way**

# Latest Response Information

Updated: 11/27/2017



- Summary of MDEQ Actions In Response to the USEPA Emergency Administrative Order
  - Paragraph 54: Inventory of homes with lead service lines.
    - ✦ As of 11/20/2017, the City of Flint had replaced 5,752 service lines and identified 1,185 copper-to-copper lines.
  - Paragraph 60: Long-term water source.
    - ✦ On 11/22/2017, the City Council approved a 30-year contract with the Great Lakes Water Authority (GLWA) to serve as the City's primary water source, and utilize Genesee County as a backup water source.

# Flint Michigan Crisis



**EXPERT OPINIONS ABOUT LEAD  
AS A TOXIC SUBSTANCE**

# Center for Disease Control (CDC)

## Current Policy



- **Blood Lead Levels in Children**
  - Protecting children from exposure to Lead is important to lifelong good health.
  - No safe blood Lead level in children has been identified.
  - Even low levels of Lead in blood have been shown to affect IQ, ability to pay attention, and academic achievement. And effects of Lead exposure cannot be corrected.
  - The most important step parents, doctors, and others can take is to **prevent Lead exposure before it occurs.**
  
- **On a related note .....**
  - ✦ In 2012, Congress decreases the budgetary allotment to the “Childhood Lead Poisoning Prevention Program” from \$30 M down to \$2 M dollars

# Statements from Dr. Joan Rose\*



- “Environmental health assessments need to look at Lead exposure pathways” .....
  - They’ve ignored water more than they like to admit as a source of elevated blood Lead levels in children
  - We have been told not to worry about our water because “your Lead problem is in your paint”
  - We don’t understand cumulative exposures unless we sample bone, which we don’t do
  - Taking blood samples for Lead only provides a “snapshot” of intermittent exposures

\*Journal AWWA roundtable discussion, July 2016

Note: Dr. Rose runs the Water Quality and Microbiology Laboratory, and is a professor at MSU

# Flint Michigan Crisis



## **FLINT WATER ADVISORY TASK FORCE (FWATF) FINDINGS**

# Creation and Findings of the Flint Water Advisory Task Force



- In Fall 2015, the governor of MI creates the Task Force to investigate what happened - and why - and to make recommendations
- In March 2016, the report is offered by the Task Force to:
  - “Fulfill our charge of determining the causes of the Flint water crisis”,
  - “Identify remedial measures for the Flint community”,
  - “Safeguard Michigan residents”
- From the Executive Summary of that report:
  - “The Flint water crisis is a story of government failure, intransigence, unpreparedness, delay, inaction, and environmental injustice”

# FWATF



- April 2016
  - Flint Water Advisory Task Force issues its final report
    - ✦ As mentioned, it blames the crisis on governmental failure at many levels
    - ✦ Some tasks are assigned to our sub – Committee according to experience
  - Three people – a Flint utility employee (Glasgow) and two MDEQ employees are indicted
    - ✦ Another Flint employee is found dead



Eric P. Rothstein is a principal at Galardi Rothstein Group, 3300 N. Lake Shore Dr., Unit 6C, Chicago, IL, and is a member of the Flint Water Advisory Task Force



“While the cascade of poor decisions, failures, and indifference in Flint was startling and ultimately heartbreaking, we cast it as an anomaly at our peril, and the peril of those whose health we serve to protect.”

“THE ISSUES IN FLINT WILL BE LONG-LASTING LOCALLY, BUT THE SITUATION ALSO HAS FAR-REACHING IMPLICATIONS FOR THE WATER UTILITY INDUSTRY AS A WHOLE.”

**ROTHSTEIN | 108:7 • JOURNAL  
AWWA | JULY 2016, page 41**

# FWATF report findings



- “The Michigan Department of Health and Human Services (MDHHS) failed to adequately and promptly act to protect public health.”
- “Both agencies, but principally the MDEQ, stubbornly worked to discredit and dismiss others’ attempts to bring the issues of unsafe water, Lead contamination, and increased cases of Legionellosis (Legionnaires’ disease) to light.”

# FWATF Report Findings Continued ...



- “Flint water customers were needlessly and tragically exposed to toxic levels of Lead and other hazards through the mismanagement of their drinking water supply. The specific events that led to the water quality debacle, Lead exposure, heightened *Legionella* susceptibility, and infrastructure damage are a litany of questionable governmental decisions ...”
  - Contains 36 findings
  - Contains 44 recommendations

# Flint Michigan Crisis



## **THE ACCUSED AND THEIR ACCUSERS**

# First 3 Flint Indictments



- Michigan Attorney General Bill Shuette indicts government employees:\*
  - A district water supervisor for the Michigan Department of Environmental Quality, and a district water engineer, (Prysbey and Busch) each face six charges.
    - ✦ Accusations include misleading federal regulatory officials, manipulating water sampling and tampering with reports.
  - A former laboratory and water quality supervisor who served as the city's utilities administrator, is accused of tampering with a lead report.
    - ✦ He (Glasgow) is charged with tampering with evidence, a felony, and willful neglect of duty, a misdemeanor.

✦ \*Detroit Free Press, April 2016

# Key individuals indicted



Prysby

Busch

Glasgow

# Plant Manager Mike Glasgow is indicted



- Michael Glasgow, the former Flint water utility manager, is charged with a felony in connection with the city's water crisis
  - He eventually reaches a deal with prosecutors.
- The Michigan Attorney-General states that “Glasgow tampered with a 2015 report, ‘Lead and Copper Report and Consumer Notice of Lead Result,’ and failed to perform his duties as a treatment plant operator”
- Under the terms of the plea deal, the felony charge of tampering with evidence was dismissed.

# Flint Timelines – Flint WTP Manager Mike Glasgow



- In an email sent April 17, 2014 -- eight days before Flint switched its water source -- Mike Glasgow mentions problems with the monitoring schedule and his staffing ahead of the switch.
  - "I do not anticipate giving the OK to begin sending water out anytime soon. If water is distributed from this plant in the next couple weeks, it will be against my direction," Glasgow wrote to state officials, including Busch and Prysby. "I need time to adequately train additional staff and to update our monitoring plans before I will feel we are ready. I will reiterate this to management above me, but they seem to have their own agenda."
- In an interview with CNN, Glasgow alleges that DEQ employees Busch and Prysby told him to alter water quality reports and remove the highest lead levels.\*
  - \*CNN - Updated 11:45 PM ET, Wed April 20, 2016



May 4<sup>th</sup>, 2017

Mike Glasgow has his charges dropped

"Mr. Glasgow attempted to call the police -- that would have been the (Michigan DEQ) -- and they never responded," said Ruth C. Carter, special assistant Michigan attorney general.

"Mr. Glasgow sent the flares up when nobody else did. He's the reason that we were able to get started because he did try, and no one responded to him."



"A judge has dismissed the criminal case against former Flint utilities Administrator Michael Glasgow after prosecutors requested it, saying he has "cooperated significantly" with their investigation into the city's water crisis."

[www.Mlive.com](http://www.Mlive.com) – May 4, 2017

# Glasgow speaks to the Press



- "I was a key figure in this -- I am operating the treatment plant and seeing some of the sampling," he told CNN in March, before the charges were filed.
- But Glasgow said then that he had always tried to do the right thing, raising concerns to those above him at the city and state level. But he said he felt he did not have the authority to override the decisions that eventually led to Flint's toxic water.
  - Mike – in his late 30's at that time, has a wife and young baby at home during this period and like most individuals in that situation, needed that paycheck

# December 2016 indictments – 4 more



- On December 19<sup>th</sup>, 4 more individuals were indicted
  - **Darnell Earley** -
    - ✦ He was the state-appointed emergency manager in charge of Flint in April 2014, when the city switched its water source from Lake Huron water provided by the Detroit water system and began drawing water from the Flint River.
  - **Gerald Ambrose** –
    - ✦ He was the state-appointed emergency manager who took Earley's place, and he rejected a Flint City Council vote to return to Detroit water.
  - **Howard Croft** –
    - ✦ He was Flint's public works director at the time of the lead contamination. Croft held the post from December 2011 to November 2015
  - **Daugherty Johnson** –
    - ✦ He was Flint's utilities administrator at the time of the lead contamination.

# More Accusations



- July 29<sup>th</sup>, 2016
    - Six more DEQ and State employees are criminally charged by the Michigan
  - As of this time - the charges are ongoing, and 13 persons have been indicted – three have made a plea bargain
  - When indicting these six State employees, Shuette is quoted as saying:
    - "They had knowledge and ability to stop the problem, but they failed"
- ✦ The following press releases were taken from the Detroit Free Press on 7.29.2016

# Legionnaire's Death - Manslaughter Charges Brought



- June 2017
- ***“5 Charged With Involuntary Manslaughter in Flint Water Crisis”***
  - *New York Times, June 14<sup>th</sup>, 2017*
    - ✦ Nick Lyon, the director of the Michigan Department of Health and Human Services, was charged with involuntary manslaughter and misconduct in office, felonies that could lead to as much as 20 years in prison.
    - ✦ Dr. Eden V. Wells, the chief medical executive for the department, was charged with obstruction of justice and lying to a peace officer, and could face up to seven years if convicted.

# Manslaughter Charges Explained by Bill Schuette



- In charging Mr. Lyon, and four others who already faced other charges in the water case, with involuntary manslaughter, Mr. Schuette said they had failed to properly alert the public about increases in Legionnaires' cases, allowing the problem to continue and withholding crucial information from residents, who might have avoided the water had they known.
- An examination of government emails from 2014, 2015 and 2016 [revealed that officials were aware](#) of the pattern of Legionnaires' cases, but that they failed to act swiftly on the revelations and tended to become mired in jurisdictional battles over protocol and responsibility.
- Mr. Lyon knew of the Legionnaires' outbreak by late January 2015, court documents claim, but did not notify the public for another year. At one point, the documents allege, he said that "he can't save everyone" and that "everyone has to die of something."

# Flint Employee pleads guilty on 11/28/2017



- A former City of Flint employee has plead guilty to a misdemeanor Tuesday in the Flint drinking water case and agree to cooperate with prosecutors
  - Daugherty (Duffy) Johnson, 49, of Flushing, the former city utilities director, became the third defendant to agree to a plea deal since Attorney General Bill Schuette launched his criminal investigation into the lead contamination of Flint's drinking water and deadly outbreaks of Legionnaires' disease in the Flint area that some experts link to the contaminated water

# Flint Michigan Crisis



**REVISIT THE LEAD AND COPPER  
RULE**

# Refresh your memory on the Lead & Copper Rule



- Back in the 1990's:
  - A system had to formulate a plan, and take 2 sets of first-draw samples from residences for two periods
    - ✦ Perform a table-top study – tell EPA about your treatment strategy
    - ✦ Sample periods were 6 months - number of samples based on population – prove or disprove your strategy
  - Required to identify Tier 1 homes if possible
    - ✦ (Lead service lines, or homes built during the few years prior to 1987 when Lead solder banned)
  - After two periods –sample results were tabulated:
    - ✦ If 90<sup>th</sup> percentile was met, you kept with the program
    - ✦ If 90<sup>th</sup> percentile exceeded, you had to do a corrosion study to determine new treatment scheme

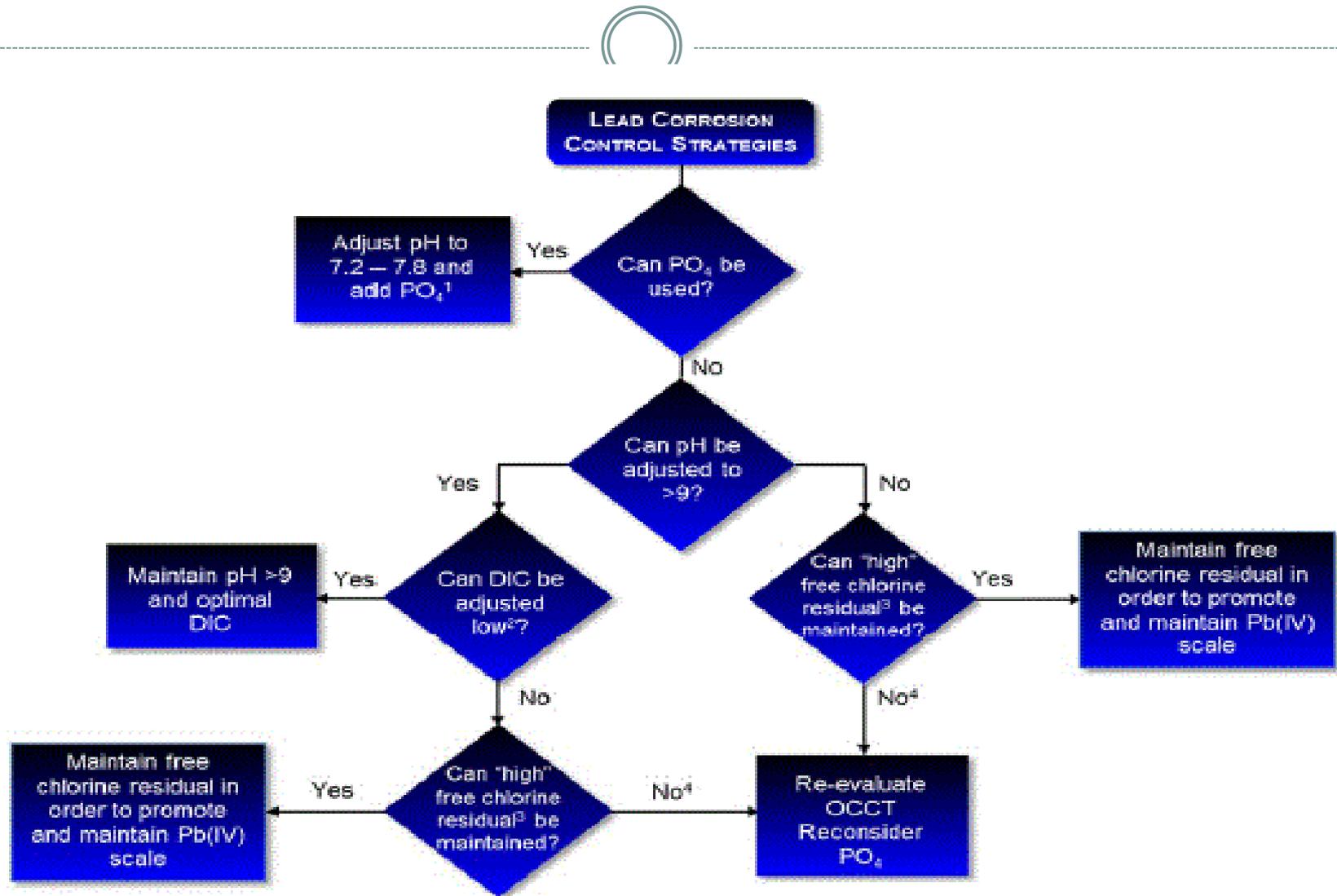
During this time, you did not have a violation regardless the sample results

# Corrosion control for Lead



- From an operational perspective, and for any given drinking water, lead dissolution is mostly dependent on:
  1. the pH of the water
  2. alkalinity or Dissolved Inorganic Carbon (DIC),
  3. the ionic strength
  4. the temperature
  5. the presence of phosphate
- The role of the operator is to produce a finished water that minimizes the chance that lead will dissolve
  - Manipulate what parameters you are able, and educate the consumer on the rest

# Simplified decision tree for operational strategy



# Flint Michigan Crisis



**WHAT THEY SAY HAPPENED  
BETWEEN REGULATORS AND  
OPERATORS**

# MDEQ Tells Flint how to proceed



- MDEQ tells Flint operators that they should proceed with two sets of 6-month samplings for lead and copper
  - MDEQ is treating Flint as if it is a new water system that hasn't been in the program of taking the samples for years
  - As samples begin to come in with high lead levels, MDEQ interprets the lead and copper rule as a “new” effort in flint, and tells them not to reveal the high levels to the public
  - MDEQ is thinking that the lead levels will come down over time
    - ✦ But flint had previously been getting water from GLWA – with PO<sub>4</sub> in it
    - ✦ When the PO<sub>4</sub> is suddenly cut off, the lead phosphate begins to dissolve

# Flint WTP

- Is a turbidity removal / lime softening plant retrofitted in 2000
  - Ozone, Ferric Chloride, raid mix/flocs and plate settlers for turbidity, GAC filters
  - Lime softening and recarbonation for hardness removal
  - Since the retrofit, it had been operated only 4-5 days at a time about three times a year
    - ✦ It did not put finished water into the system during those times
    - ✦ **Staff was not prepared for 24/7 OPS**

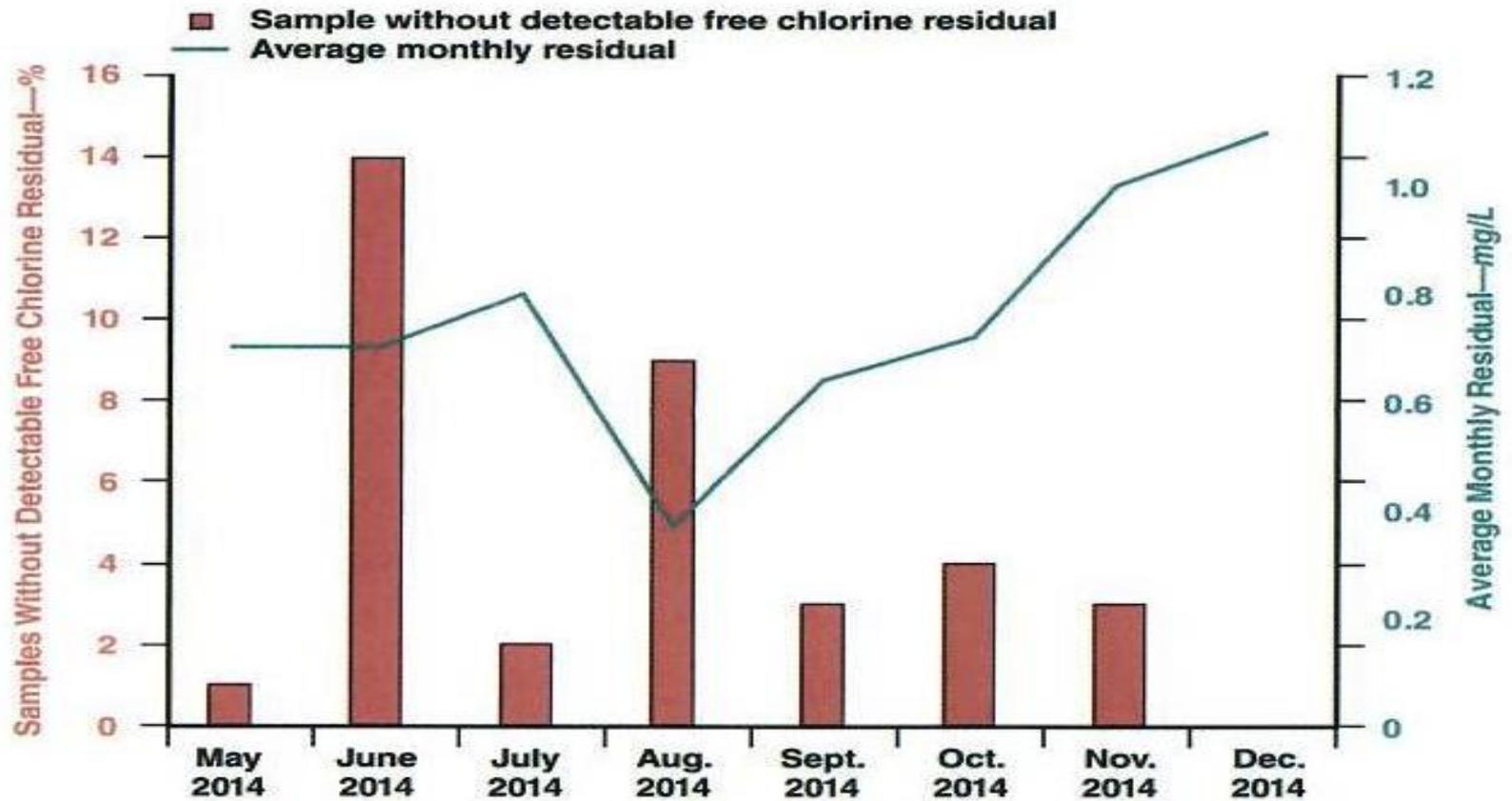


# Journal AWWA – December 2016

## Masten et. al.



**FIGURE 6** Chlorine residuals at monitoring sites in the Flint distribution system



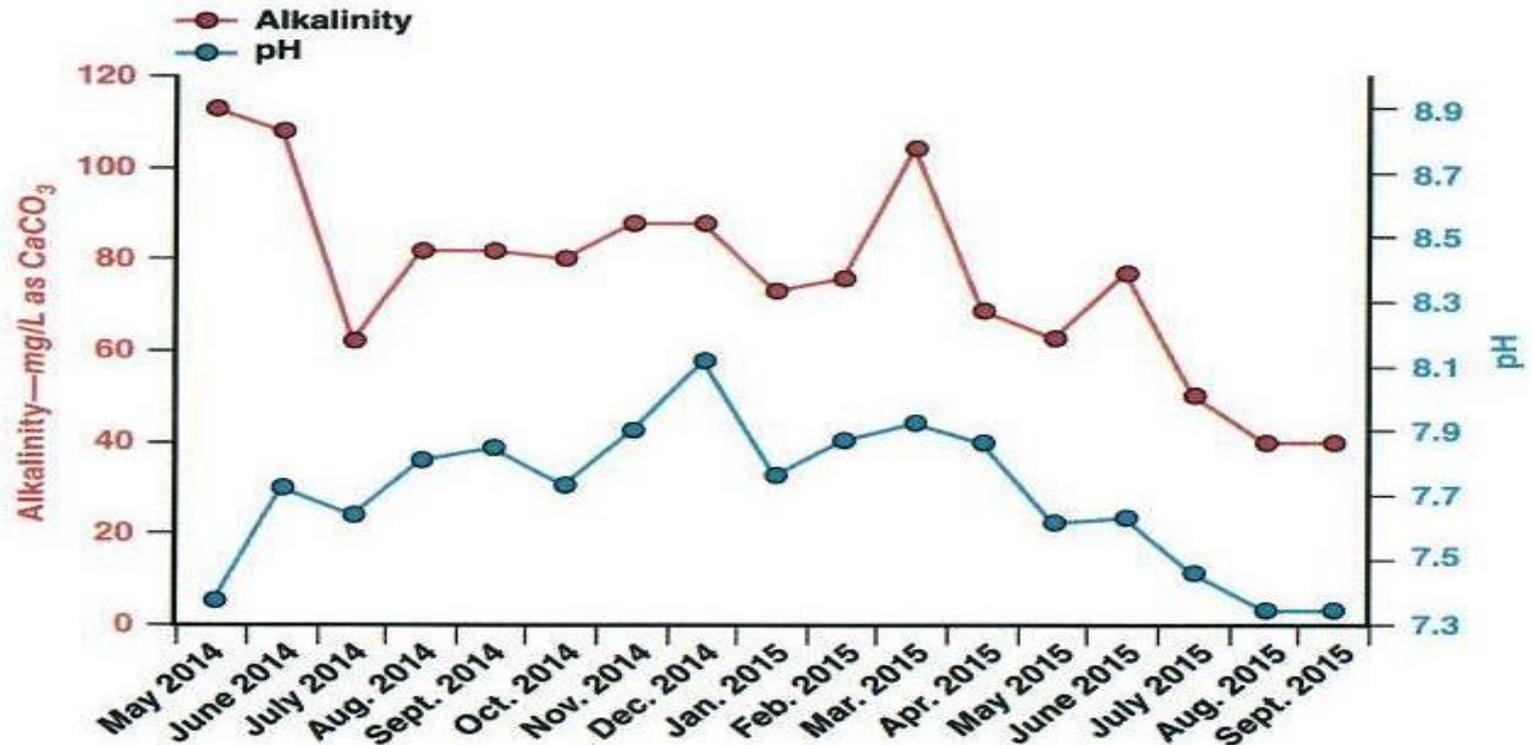
Source of data: City of Flint monthly operating reports

# Journal AWWA – December 2016

## Masten et. al.



**FIGURE 7** Monthly average pH and alkalinity in the treated Flint River water



Source of data: City of Flint monthly operating reports

CaCO<sub>3</sub>—calcium carbonate

# Plant Status as of Start-up (April 25)



- Plant had 4 to 5 days of polymer on hand
- Plant SCADA was incomplete and out for bid
- Filter head loss meters not operational
- Chlorine residual monitoring equipment not installed at the point of entry to distribution system
- Chlorination after filter not used until May 17
- Fluoridation not available until July 2
- **No corrosion control plan or equipment**
- No treatability study had been done
- Ferric chloride was only coagulant – which added to the chloride-sulphate/  $\text{CO}_3^-$  problem
- Ozone feed not able to be controlled sufficiently – bromates were produced in excess of MCL
- **In spite of all this and more, the emergency manager forces the operators to start the plant**

# A Gray Area



- Choices made by Utilities and Regulators regarding the Lead and Copper Rule are seldom “black and white” or well delineated
- Let’s examine how:
  - MDEQ interpreted the Lead and Copper Rule compliance for Flint
  - the choice was made to choose which Lead samples for reporting in Flint which resulted in the indictment of Glasgow, Busch and Prysby....
- Let me first ask this: Do you think these three people deliberately altered the results of the report in order to keep the Lead issues from the public?
  - ✦ Next slide .....

# Data Difference – 60 samples were required, **but** 72 samples were taken 90%tile of 72 means that 7 can be high, but not 8



## 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 ...

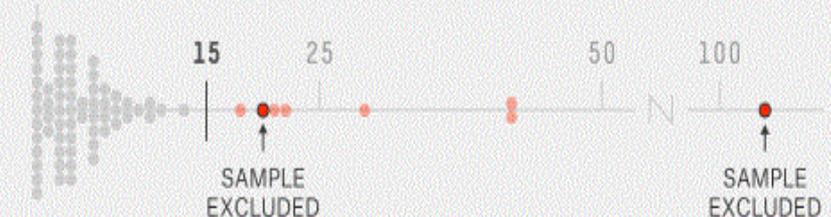
... but the **exclusion of two high-lead samples** put the city's water supply below the threshold for mandatory action.

### LEAD LEVELS IN WATER SAMPLES

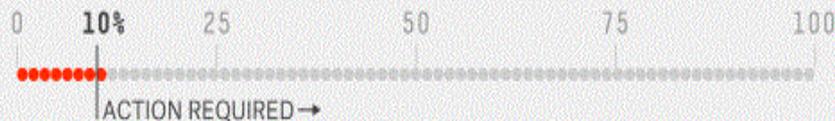
NOT  
DETECTABLE



NOT  
DETECTABLE



### PERCENTAGE OF SAMPLES EXCEEDING 15 PPB



# Flint Michigan Crisis



## **THE WOMEN OF FLINT**



## Ms. LeeAnne Walters

Shown here with two of her children – the twins.

She is the mother of four kids – an 18 year old daughter, a 14 year old son, and the twins Gavin and Garrett.

Gavin has stopped growing, and the daughter's hair fell out while taking a shower.

Ms. Walters lost her eye lashes at one point.



# Flint Timelines

- Feb. 18, 2015

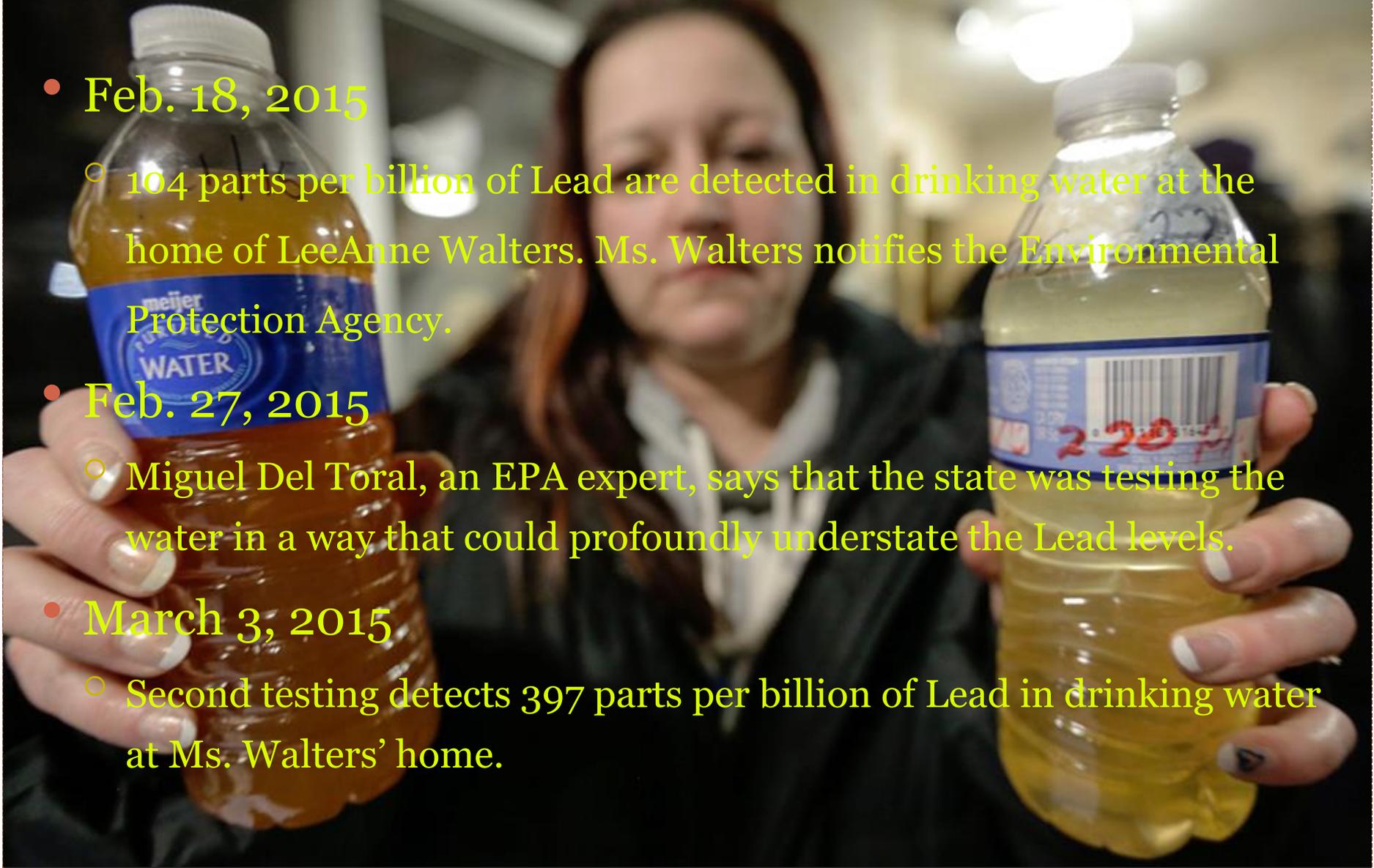
- 104 parts per billion of Lead are detected in drinking water at the home of LeeAnne Walters. Ms. Walters notifies the Environmental Protection Agency.

- Feb. 27, 2015

- Miguel Del Toral, an EPA expert, says that the state was testing the water in a way that could profoundly understate the Lead levels.

- March 3, 2015

- Second testing detects 397 parts per billion of Lead in drinking water at Ms. Walters' home.





## **Dr. Mona Hanna-Attisha**

Dr. Hanna-Attisha has been conducting blood lead level sampling of children in the Flint area as part of a state-wide effort to monitor and educate families about the dangers of lead

She noticed a spike in blood lead levels in her survey children after the Flint WTP went on-line

She tried to alert authorities

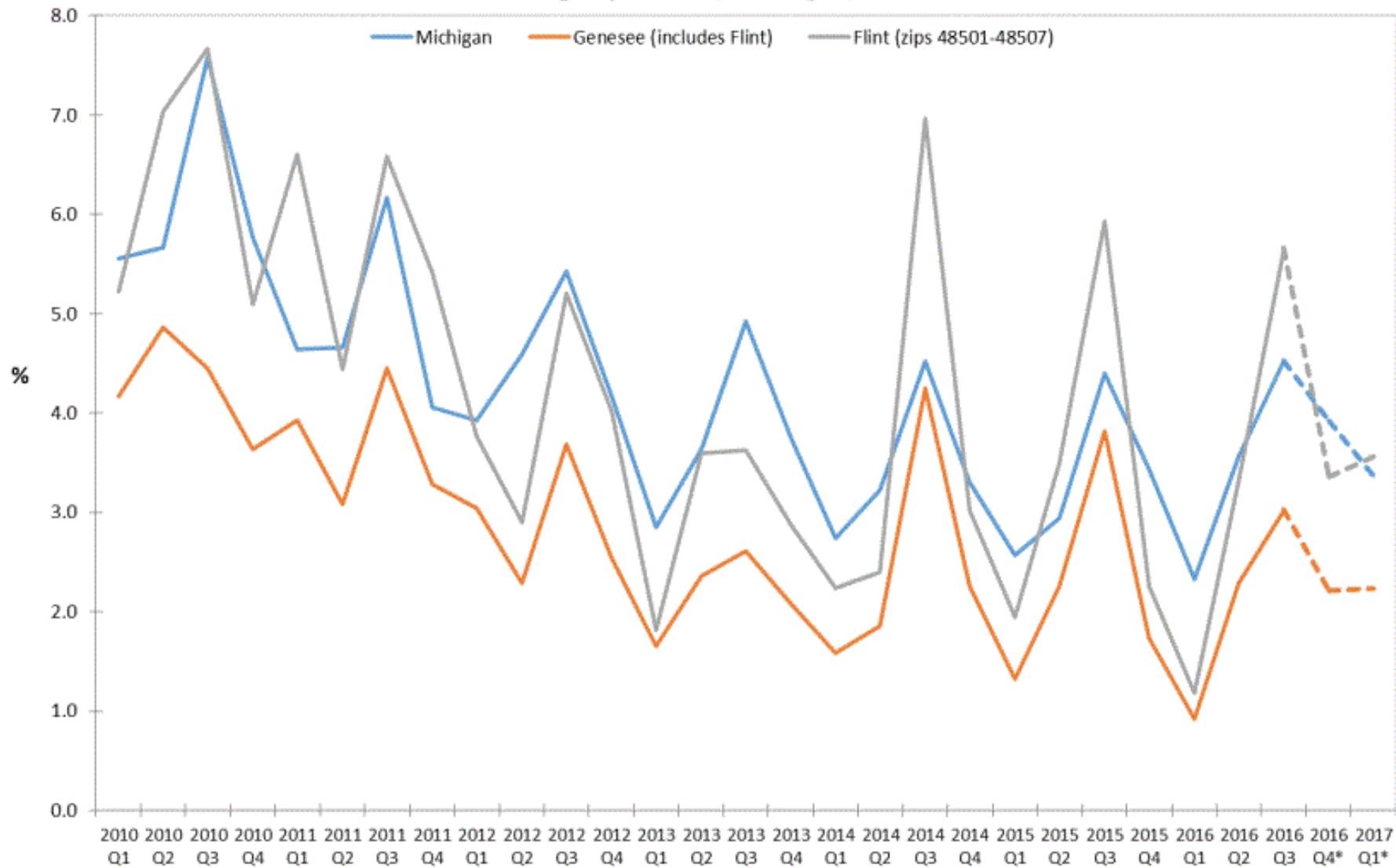


# Dr. Mona and her kids' blood lead levels



- Continued testing efforts by Genesee County Health Department, MDHHS, and local medical personnel have identified 160 children under age 18 in Flint with blood Lead levels greater than or equal to 5 mcg/dL (micrograms Lead per deciliter of blood) since 10/1/2015.
- Of children younger than 6 years old tested between 10/1/2015 and 5/27/2016, 2.2% had blood Lead levels greater than or equal to 5 mcg/dL.
- Nineteen of the 46 children (41.3%) younger than 6 years old with an elevated blood Lead level (tested between 4/1/2016 and 5/20/2016) had a previous test result greater than or equal to 5 mcg/dL.

### Annual Incidence of Elevated Blood Lead $\geq 5$ mcg/dL among Children <6 Years of Age by Quarter, Michigan, 2010 - 2017\*



# Flint Michigan Crisis



**WHAT UTILITIES SHOULD DO**

**(NOW THAT WE KNOW MORE THAN WE DID)**

# To do List



- **Eliminate Lead Service Lines**
  - Eliminate the service line – all of it –even the part that the customer might own
  - Have a written policy, and follow it. Provide filters for customers when necessary
- **Educate your public**
  - Help them understand what they can do to minimize lead in their water
- **Educate your administrators**
  - The City or Village elected officials must be made aware of the legalities of this potential time-bomb
- **Optimize your treatment**
  - Make sure you are treating your water optimally all the time
  - Make sure your operators know how to treat the water without ANY interruption of optimal conditions
  - Keep water fresh by flushing the mains

# Madison, WI Lead study and replacement



- Madison began to fully replace Lead service lines in 2001
  - About 8,000 lines were found
  - Cost estimated at \$15.5 Million
    - ✦ The City faced problems because the service lines are private property and the public balked at using public funds for the replacements
  - The study revealed:
    - ✦ After replacement, it took 4 years before major spikes of Lead were no longer seen
    - ✦ Where service lines were Lead coupled to galvanized
      - Removal of the Lead portion caused the iron oxide to absorb Lead, then release it slowly – it took 8 years for lines to get below 5 ug/L

# Service lines in Flint



- The city records show that Flint water customers are served through  $\approx$  30,000 service lines
- The records indicate that over 15,000 of them are Lead
  - There is some conjecture that a number of those are simply services with a Lead gooseneck
  - As of November 27th, 2017 – the City has replaced >5,800 Lead service lines
    - ✦ The City has accelerated its efforts now that Federal funding has been allocated
    - ✦ They hope to do 6,000 this year
  - The city stated it will take perhaps three years to replace all the service lines

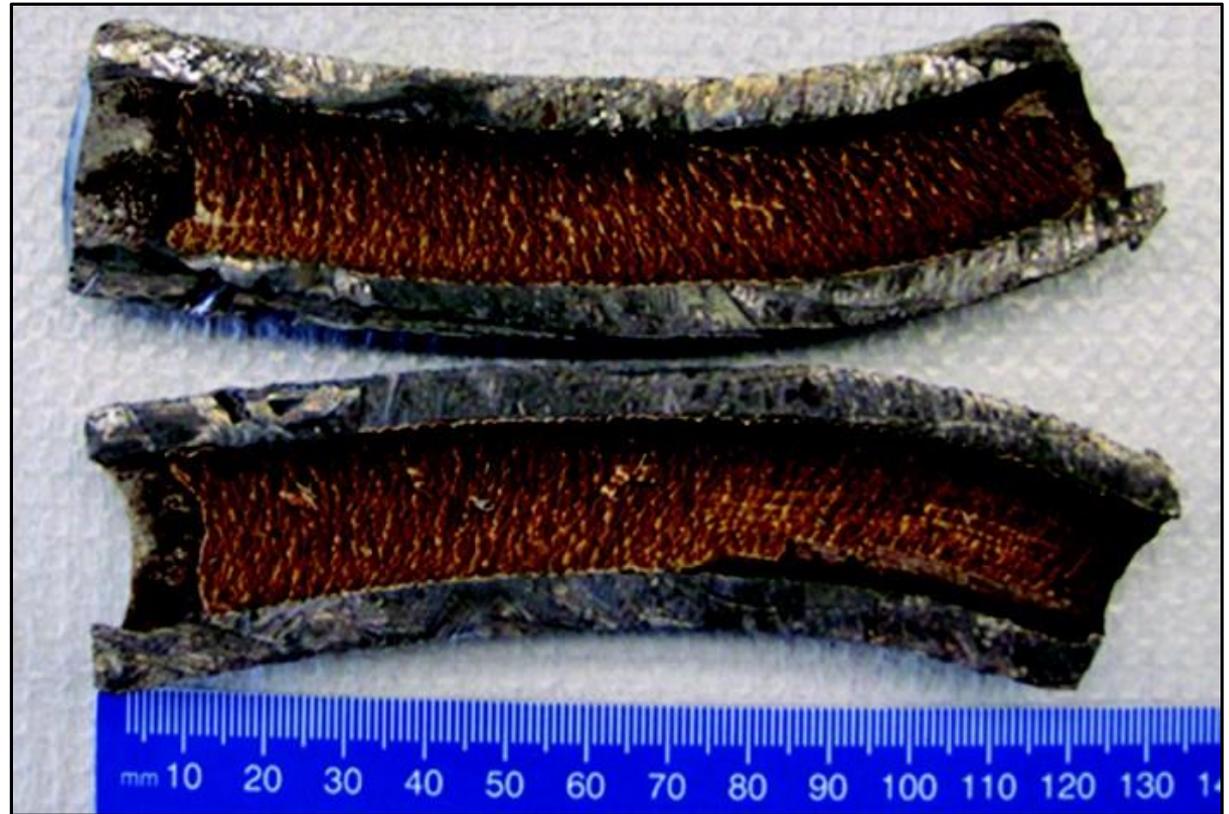


## Researchers estimate lead released from Flint water pipes

“Lack of orthophosphate corrosion control contributed to city’s water crisis, according to new analysis”

“Flint’s mineral lining was depleted in lead and phosphate, indicating selective release of lead phosphates after pipe corrosion. “

The study looked at the 300- $\mu\text{m}$ -thick mineral layer that lines the pipe interior



They determined that the pipes released about 2.7 g of lead per meter of service line over the course of the 1.5-year-long crisis, meaning that a lead pipe delivering water to a single Flint household would have released approximately 18 g of the neurotoxic metal (Environ. Sci. Technol. Lett. 2017, DOI: 10.1021/acs.estlett.7b00226). Credit: Courtesy of Terese Olson

# Lead service lines in this Country



- According to a recent national estimate, a total of 6.1 million LSLs—either full or partial—are in place today in US community water systems (CWSs)
  - Providing water to an estimated 15 million to 22 million people (Cornwell et al. 2016)\*.
- Lead is present in private plumbing systems, primarily in housing stock developed before 1986 when the use of Lead pipe was banned.

\*Cornwell, D.A.; Brown, R.A.; & Via, S.H., 2016. National Survey of Lead Service Line Occurrence. Journal AWWA, 108:4:E182.

<http://dx.doi.org/10.5942/jawwa.2016>

# Final Thoughts



- Back in time to the early 1990's
  - American Water Works Association argued against Lead service line replacement by Utilities
    - ✦ It lobbied the political establishment, stating:
      - The cost would be prohibitive to customers
      - Service line ownership is a confused jumble of rules that differ from one Utility to another – no “one size fits all”
      - The technology existed (orthophosphates) to passivate the Lead in service lines rendering them harmless
  - We now know of the dangers of interruption of phosphate feed and danger of fluctuating DIC levels, and so AWWA has changed its policy

# Final thoughts



- Nationwide, there are aggressive efforts
  - there are law firms looking at the practices of utilities to see if there is the potential to bring a lawsuit
    - ✦ They look for clues: population concentration of low-income families, old neighborhoods likely to have Lead plumbing, Lead and Copper reports that show a pattern for several years
  - There are companies that manufacture Lead testing kits, and they are talking directly to your customers to try to get them to take samples and mail them in
    - ✦ They look for clues: CCR, source water chemistry, Lead and Copper reports that show a pattern for several years
- **Commonality? – they use the fears of the public to divide and conquer**