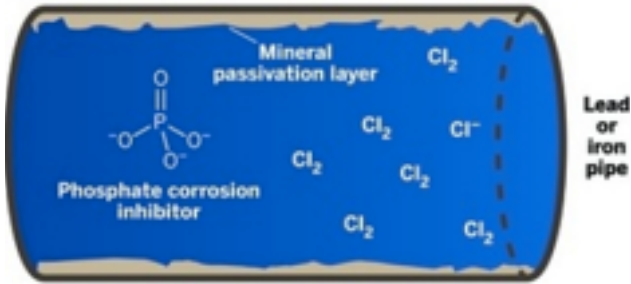


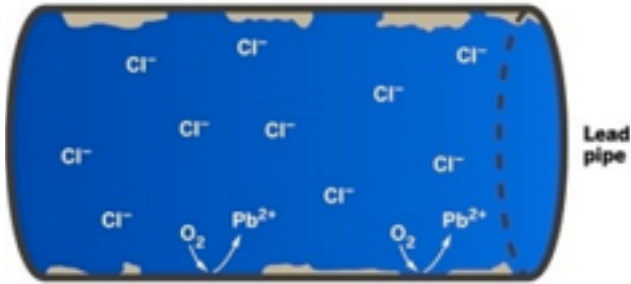
Before: Treated Detroit water

Phosphate corrosion inhibitor helps maintain a mineral passivation layer on the inside of Flint's pipes, protecting them from corrosion. With little corrosion, chlorine disinfectant levels remain stable.

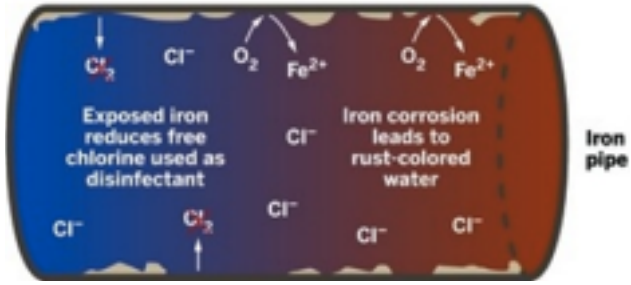


After: Treated Flint River water

Lack of a corrosion inhibitor, high chloride levels, and other factors cause the passivation layer to dissolve and fall off, leading to increased corrosion in Flint's pipes. As the pipes corrode, chlorine disinfectant breaks down.



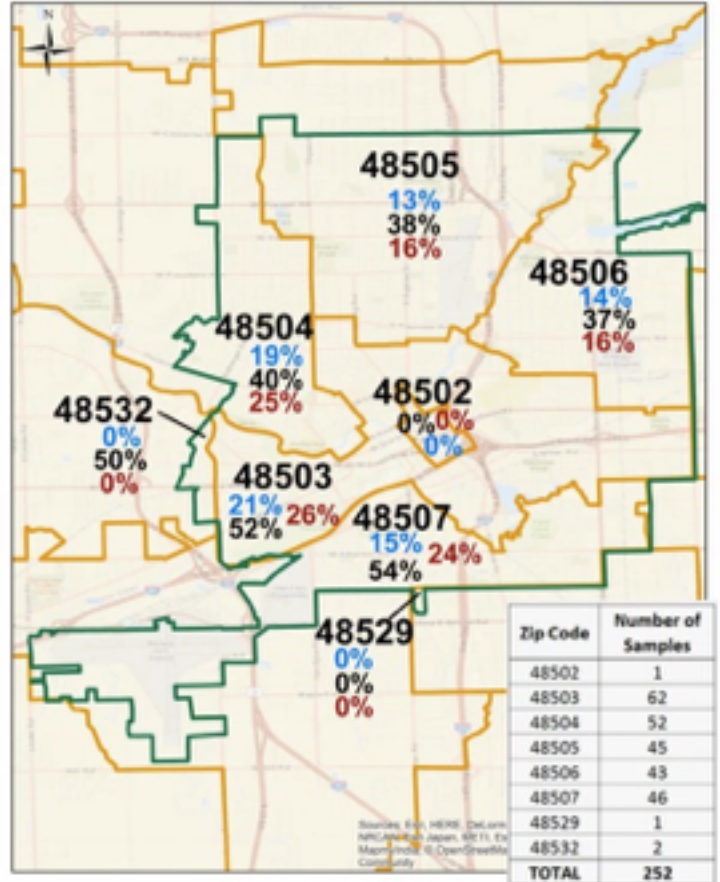
Oxidants such as dissolved O₂ corrode pipes and leach soluble metal.



ARTIFACT A

Flint, MI

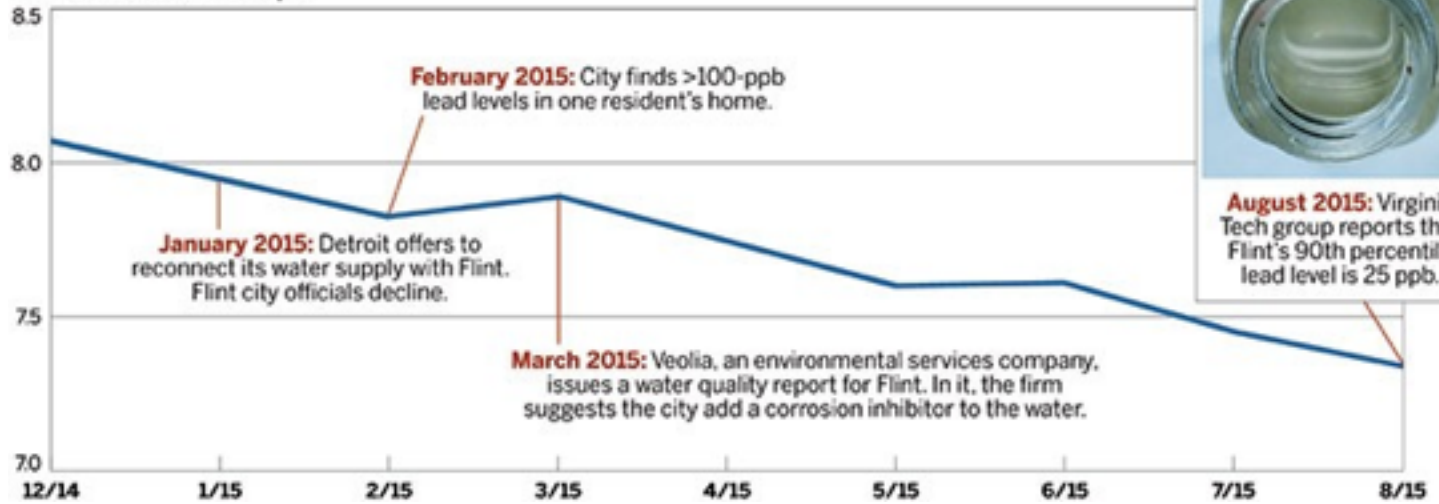
Legend:
 Blue %: Percent First Draw Samples over 15 ppb
 Black %: Percent Any Samples over 5 ppb
 Red %: Percent Any Samples over 15 ppb



ARTIFACT B

ARTIFACT C

Treated Flint River water pH

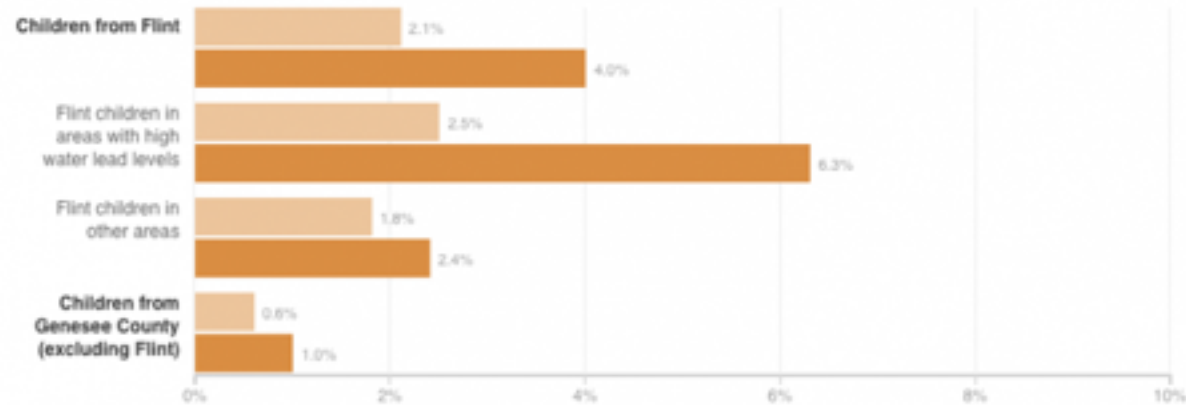


More Children With Elevated Lead Levels After Water Change

The city of Flint, Mich., started drawing its water from a local river in April 2014. Recently, doctors at Hurley Medical Center compared lead levels in Flint children with those from elsewhere in Genesee County.

Share of children under age 5 with elevated levels of lead in their blood

Before the Flint water switch After the Flint water switch



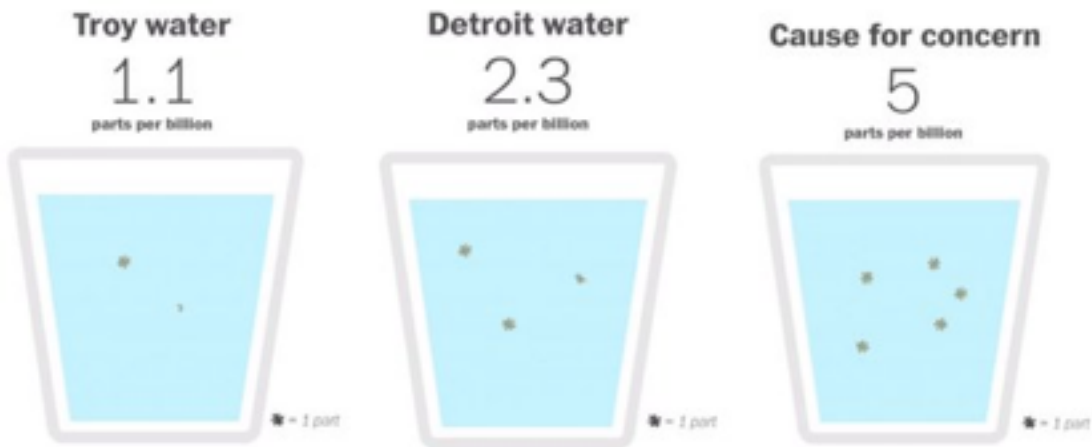
Notes

This chart compares blood lead test results at Hurley Medical Center from before the switchover (Jan. 1 through Sept. 15, 2013) and after (Jan. 1 through Sept. 15, 2015). Blood lead levels of 5 µg/dL are considered elevated.

Source: Dr. Mona Hanna-Attisha, Hurley Medical Center

Credit: Ayson Hurt/NPR

ARTIFACT D



ARTIFACT E

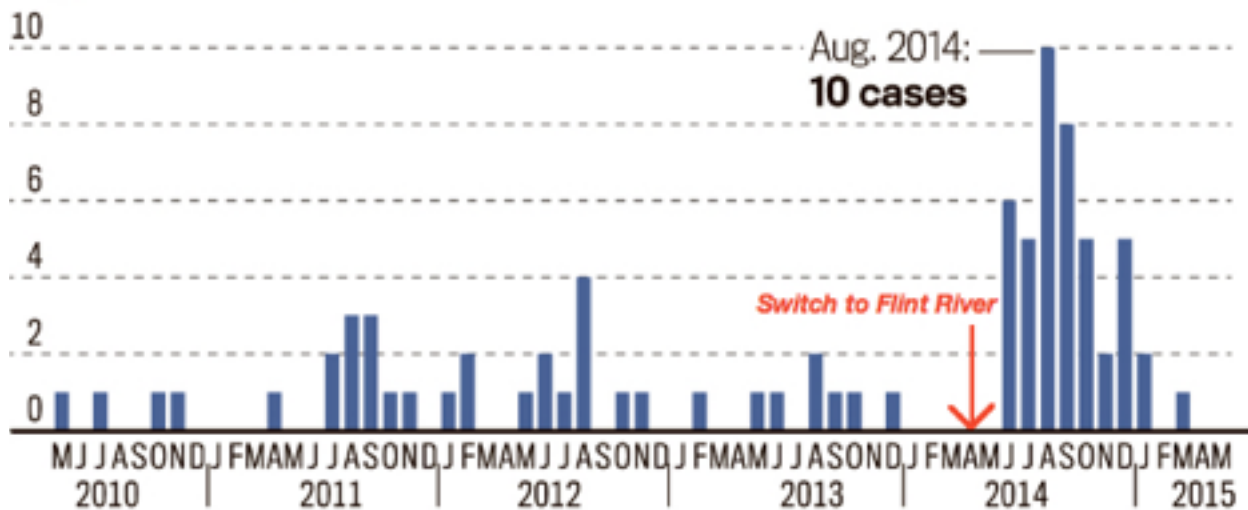


Legionnaires' disease cases spike

State officials reported a rise in cases of Legionnaires' disease over a year-and-a-half period that matches the time Flint was drawing its drinking water from the Flint River.

Legionnaires' cases

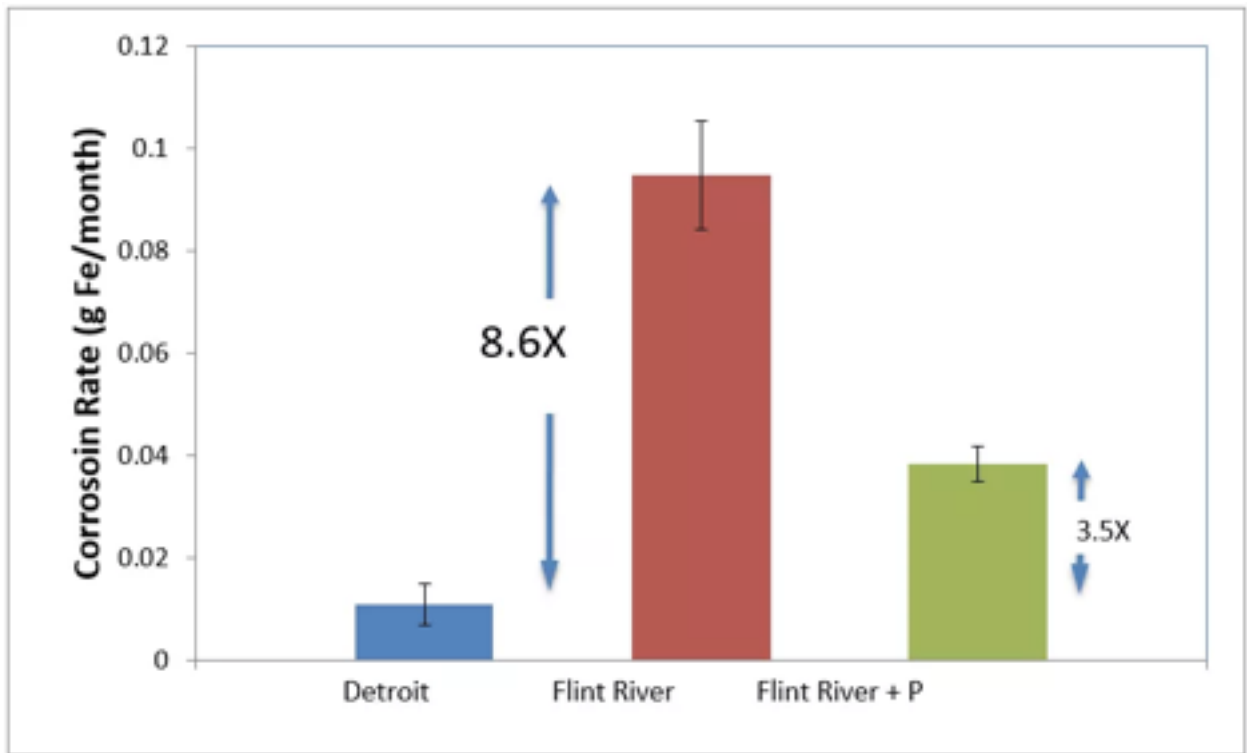
ARTIFACT F



Source: Michigan Department of Health and Human Services

The Detroit News

ARTIFACT G



GETTING THE LEAD IN

Tests show toxic lead is leaching into Flint's tap water. Here's how.

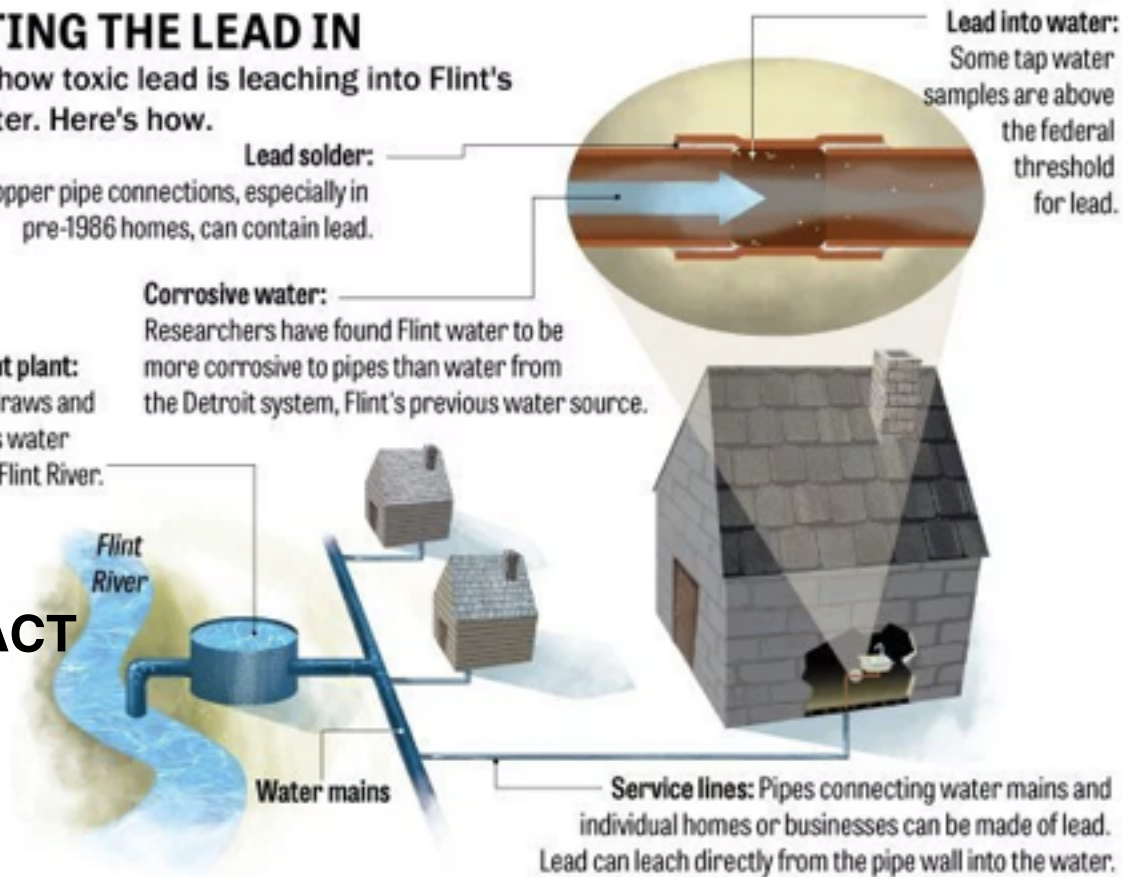
Lead solder:
Copper pipe connections, especially in pre-1986 homes, can contain lead.

Corrosive water:
Researchers have found Flint water to be more corrosive to pipes than water from the Detroit system, Flint's previous water source.

Lead into water:
Some tap water samples are above the federal threshold for lead.

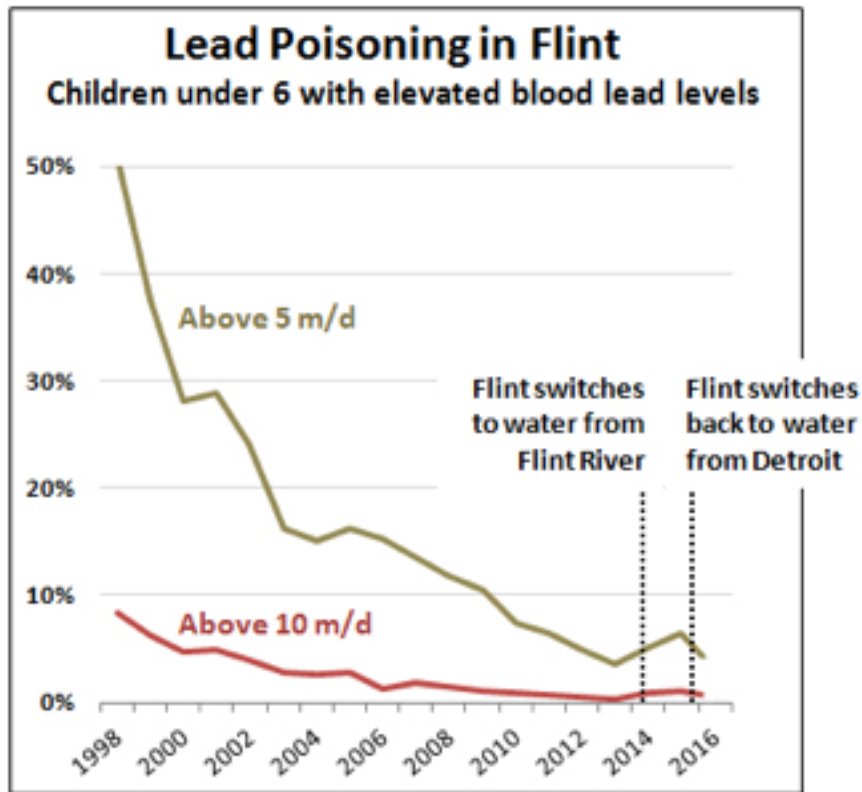
Water treatment plant:
The city draws and disinfects water from the Flint River.

ARTIFACT H



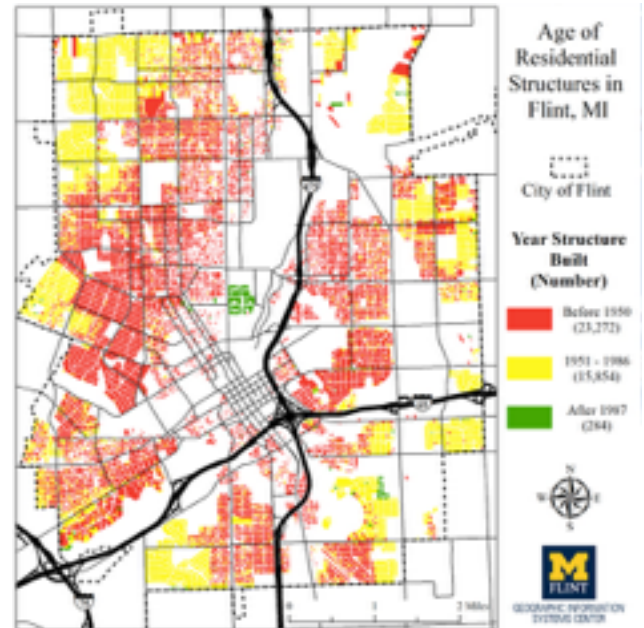
ARTIFACT

I



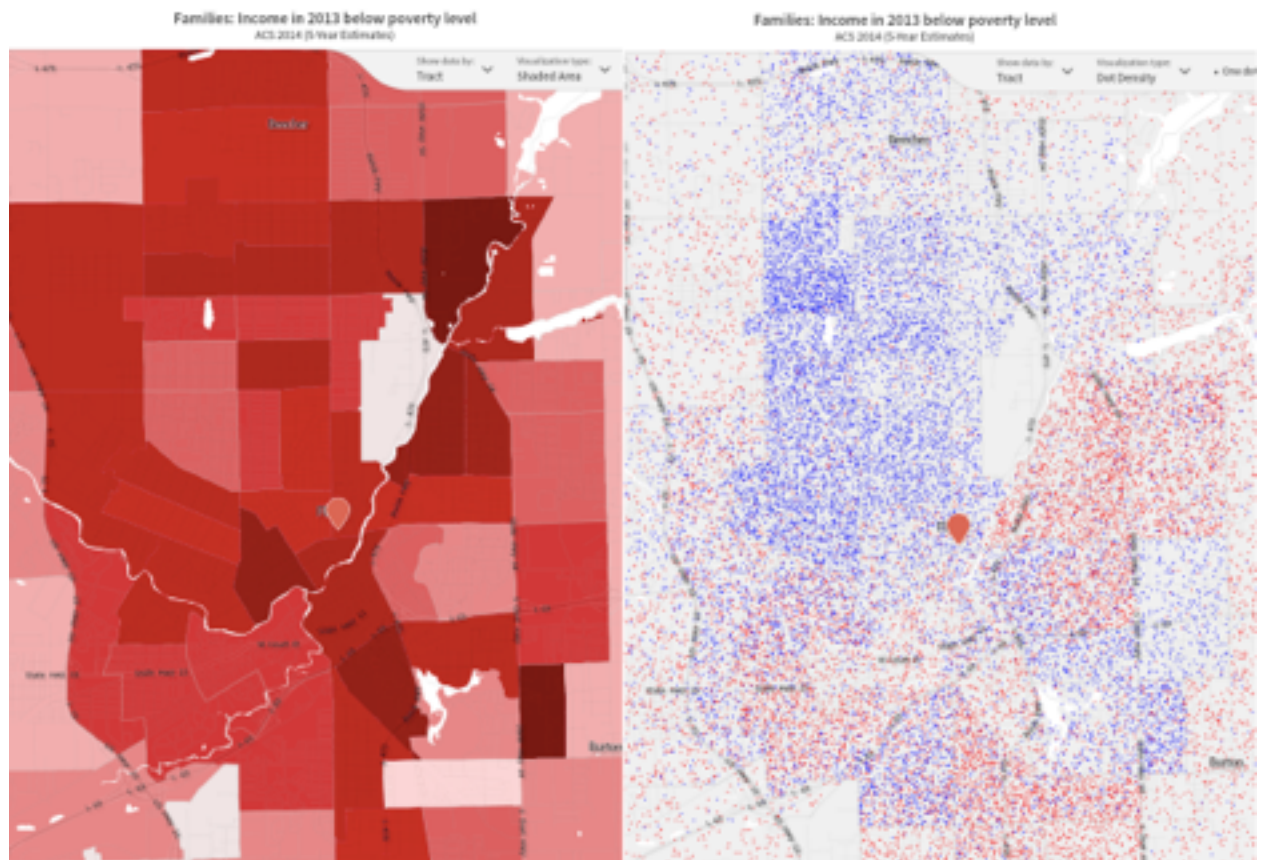
ARTIFACT

K



ARTIFACT

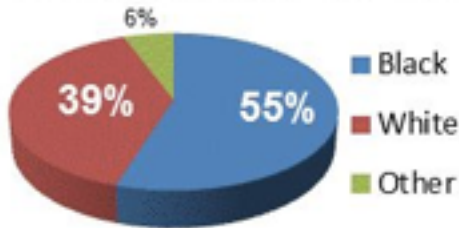
J



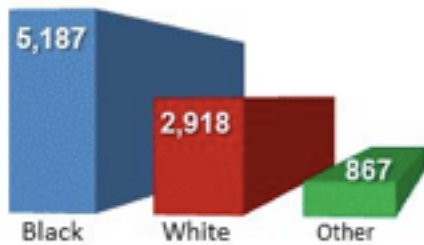
Flint, MI Demographics

Flint has deteriorated since the 1960s due to racial tension, factory closings (80,000 jobs lost), and depopulation. Flint's remaining residents both Black and White suffer from high unemployment, high poverty, and low educational attainment compared to the rest of the country.

Flint Population by Race



Children under 6 years old (most susceptible to lead poisoning)



Total Flint Population

Year	Population
1990	140,761
2000	124,943
2014	98,990

City Statistics

Government

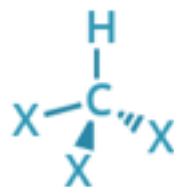
City Council members

	FLINT	MICHIGAN	ALL USA
BLACK	7		
WHITE	1		
			NA

City Demographics

	FLINT	MICHIGAN	ALL USA
Median Income	\$21,987	\$29,490	\$53,482
Poverty	46%	35%	16%
Unemployment	31%	21%	6%
Married	22%	31%	50%
Batchelors degree or higher	10%	13%	29%
Homeowner	48%	65%	64%
Rent	52%	35%	36%

SOURCE: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates, Census 1990 & 2000 decennial census, & cityofflint.com



TRIHALOMETHANES

Disinfectant byproducts; formed by the reaction of chlorine (added to disinfect the water) with organic matter.

X = halogen (commonly Cl or Br)

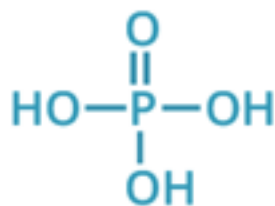
CORROSION: DETROIT VS. FLINT RIVER

0.45 vs 1.60
DETROIT vs FLINT

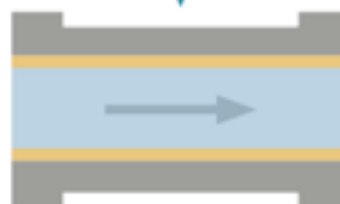
Chloride to sulfate mass ratio (CSMR); 0.45 = low corrosion; 1.60 = very high corrosion.

When high levels of trihalomethanes were detected in Flint's water, ferric chloride (FeCl_3) was added to improve removal of organic matter. However, this increased the water's already high concentration of chloride ions, and as a result made the water more corrosive.

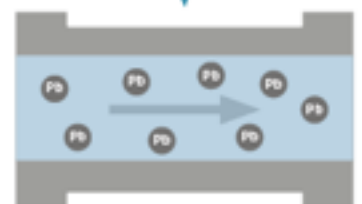
CORROSION CONTROL



WITH PHOSPHATES



WITHOUT PHOSPHATES



Orthophosphates are added to water to reduce the amount of lead leaching into it from pipes. They do this by forming a layer of low-solubility lead-phosphate complexes inside the pipe. This method of corrosion control was not used for the Flint River water supply.

ARTIFACT
M

ARTIFACT
L