



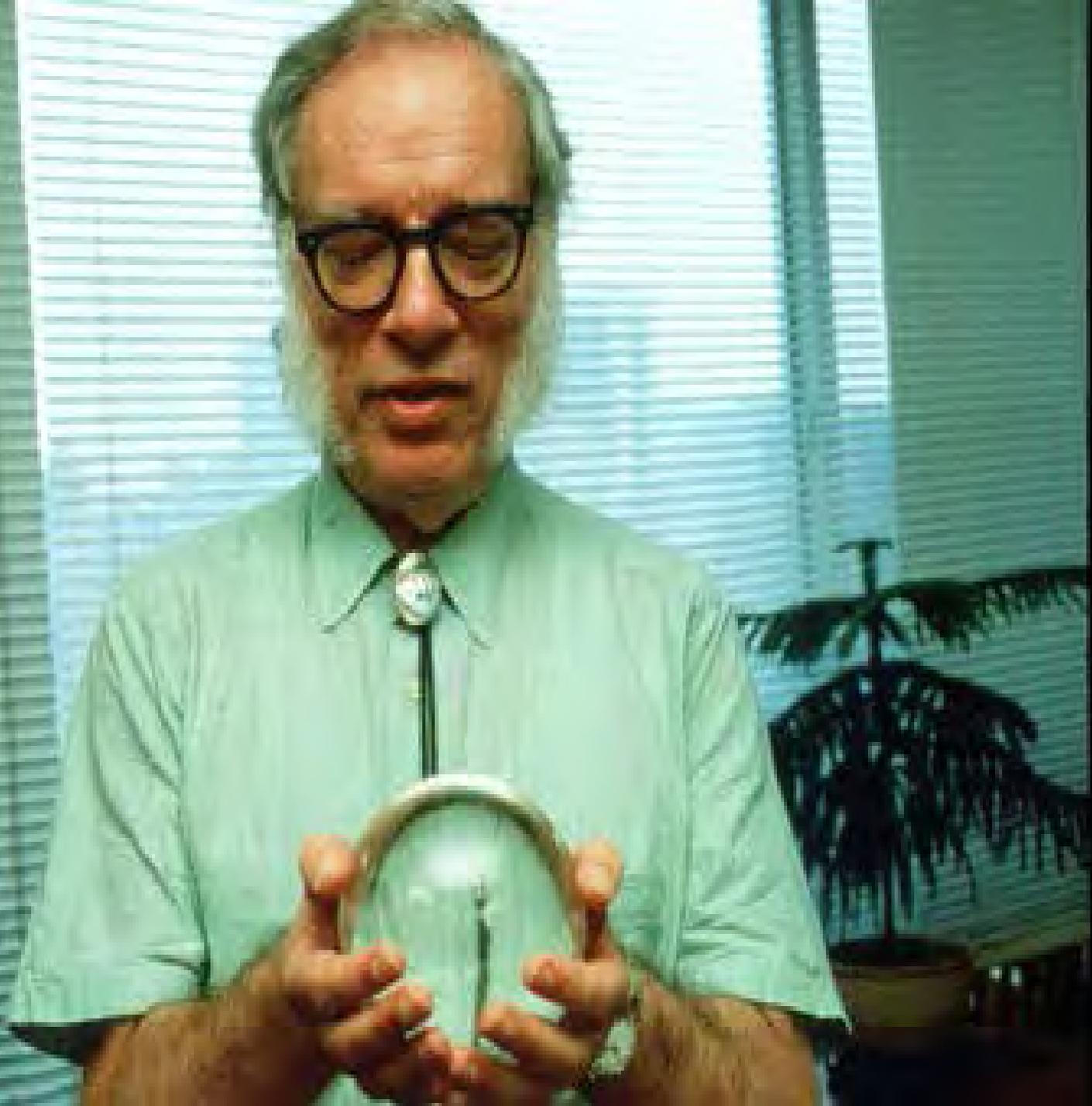
Simon Parsons

Royal Society of Chemistry  
Sustainable Water Lecture





Isaac  
Asimov,  
1964





#1



#2



#3



#1



#2



#3



# FULL-THROTTLE THRILLS!

JUDGE DREDD // AQUILA // BRASS SUN // BLACK SHUCK // JAEGIR



# 2000 AD



PROG  
1895





# Future Water Science Museum



What would you  
put in it?

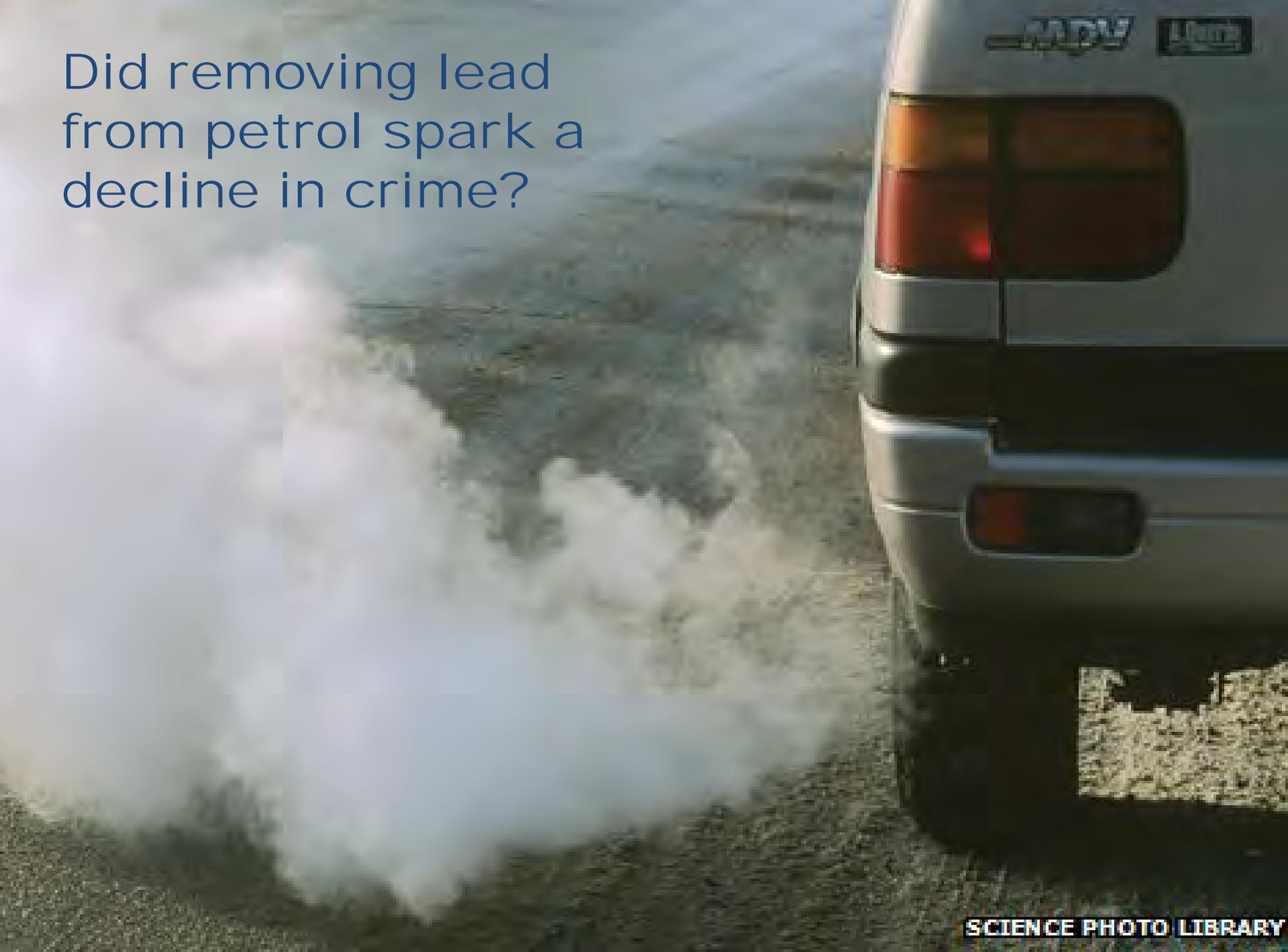
twitter 

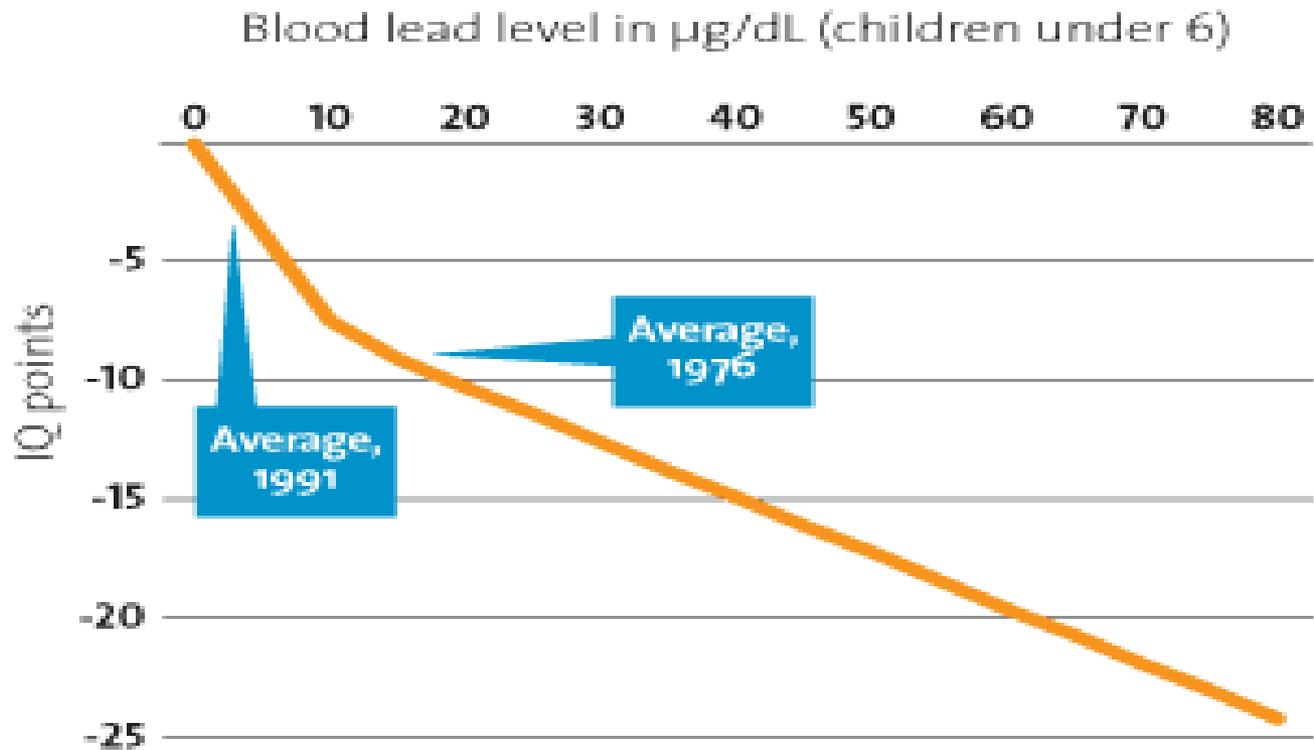
@parsons\_simon



#1 Lead

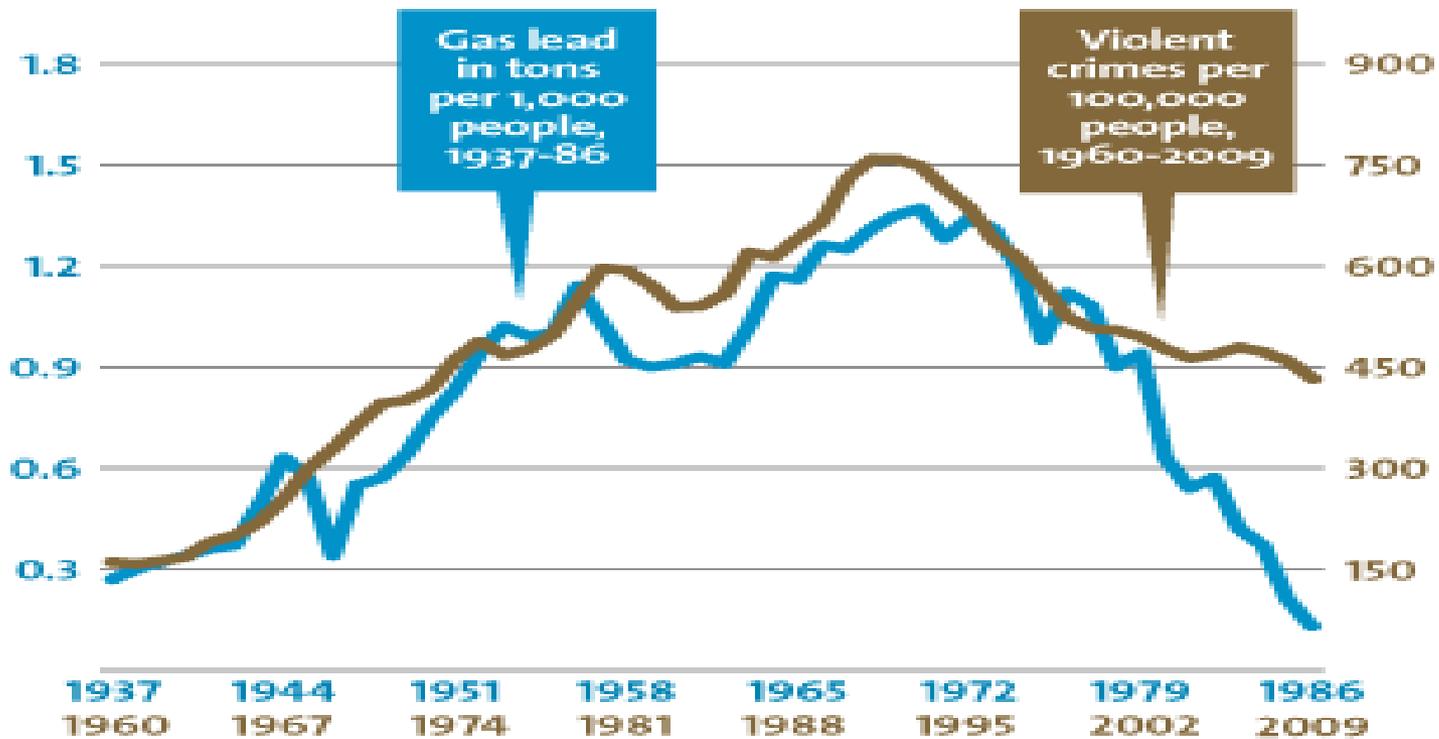
Did removing lead from petrol spark a decline in crime?





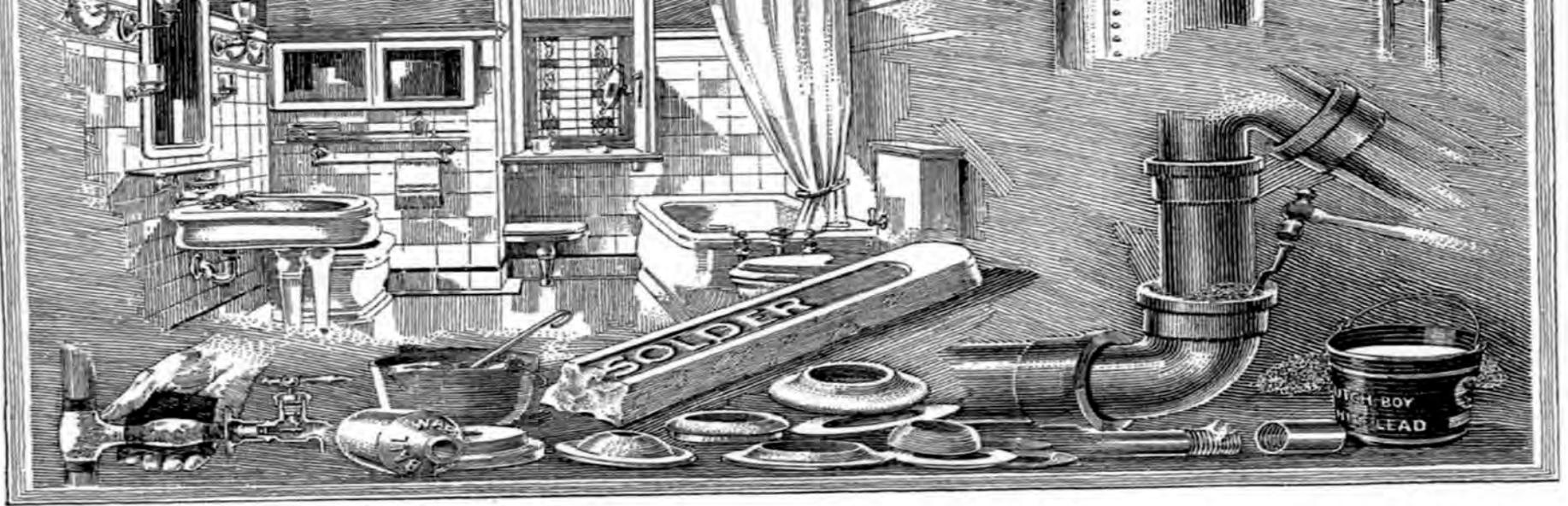
Sources: Rick Nevin, CDC

Mother Jones



Sources: Rick Nevin,  
USGS, DOJ

Mother Jones



## Lead helps to guard your health

**Y**OU wouldn't live today in a house without an adequate plumbing system. For without modern plumbing, sickness might endanger your life.

Lead concealed in the walls and under the floors of many modern buildings helps to give the best sanitation.

In some cities today the law specifies that lead pipe alone may be used to bring water from street mains into the building.

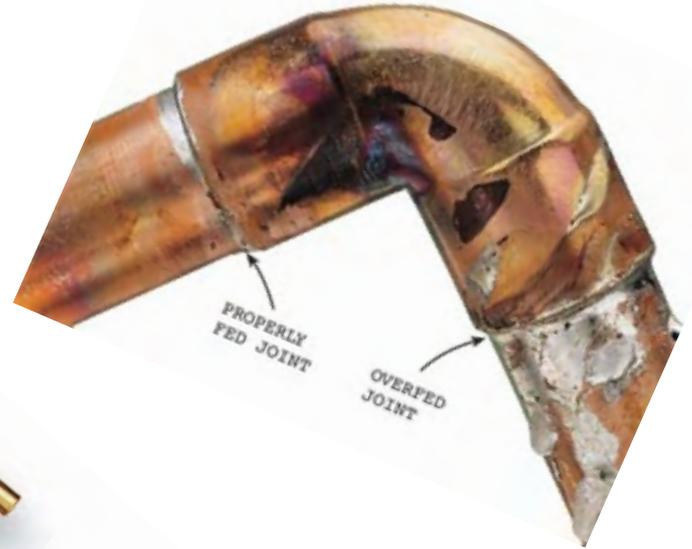


Edited From Ad in National Geographic 11/1923

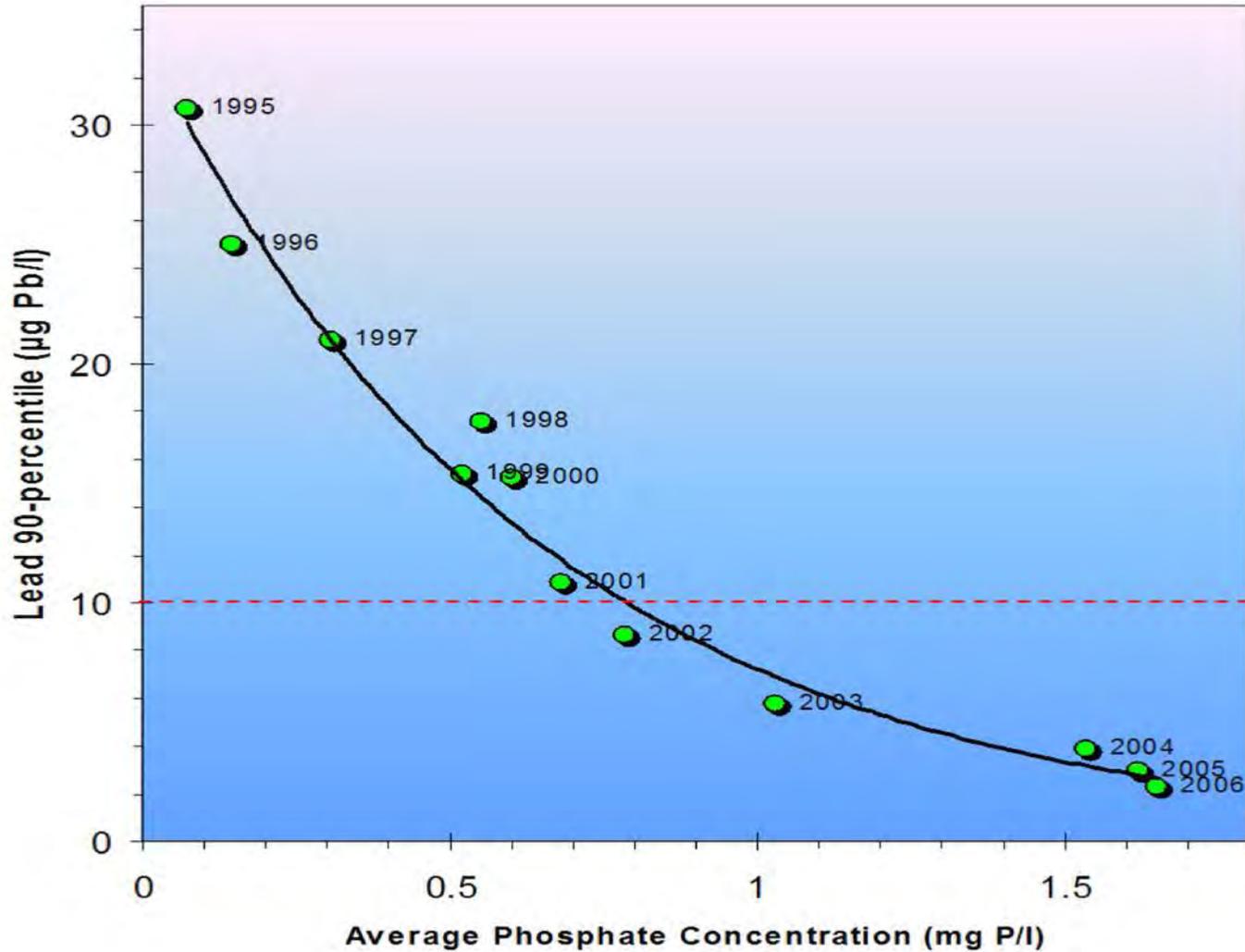
**NATIONAL LEAD COMPANY**

New York, 111 Broadway; Boston, 131 State St.; Buffalo, 116 Oak St.;

# Its not just the pipes



# Phosphate dosing is effective

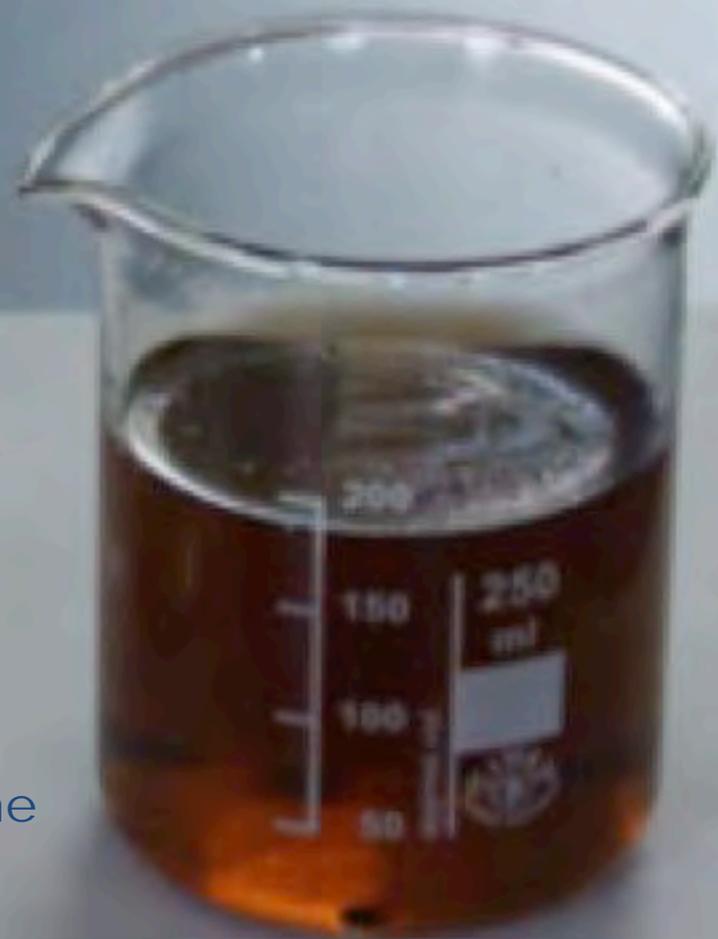




#1 Lead?

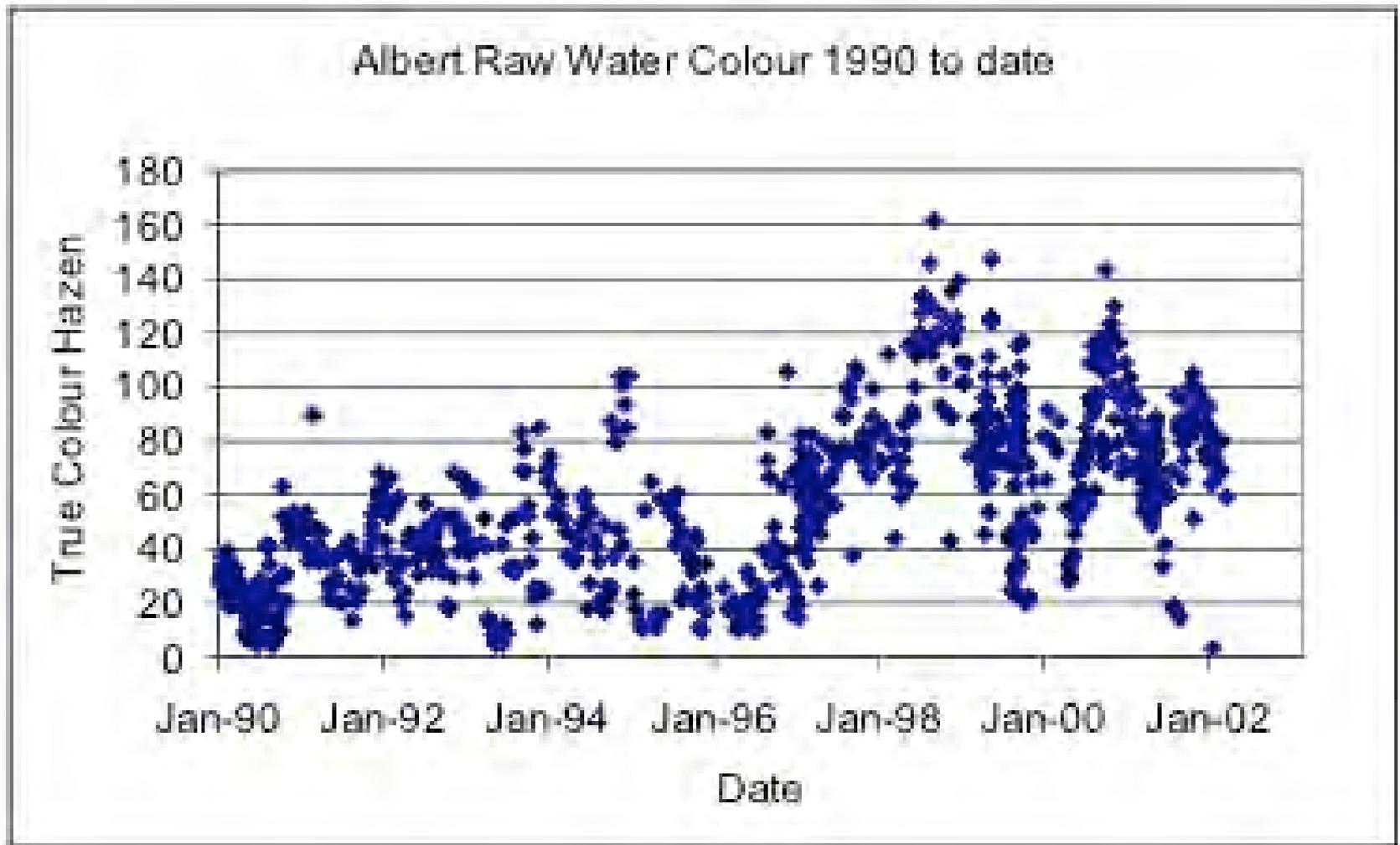


# #2 Colour



Hazen, A., "The Measurement of the Colors of Natural Waters,"  
American Chemist Journal, 1896

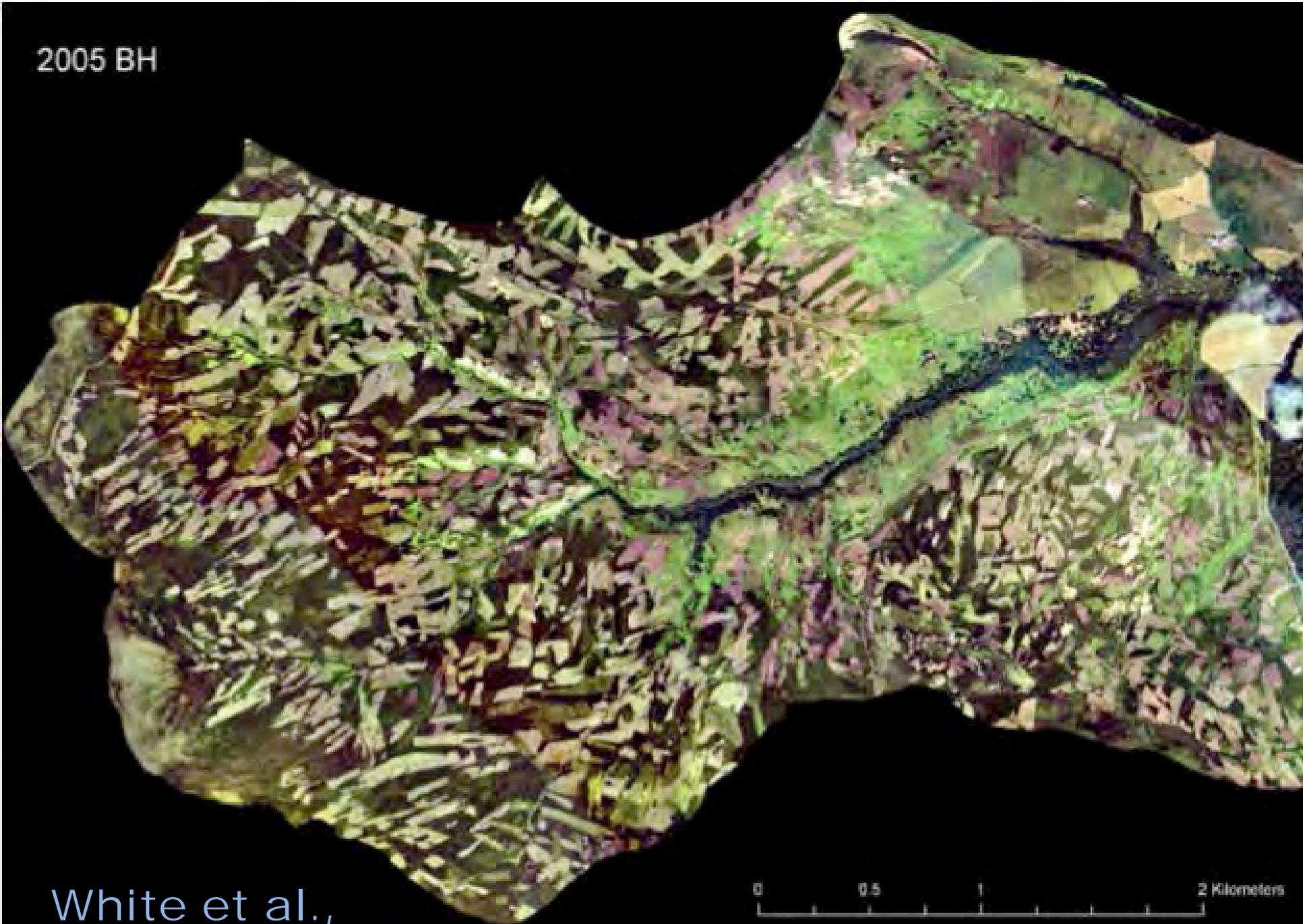
# Why, What and How?







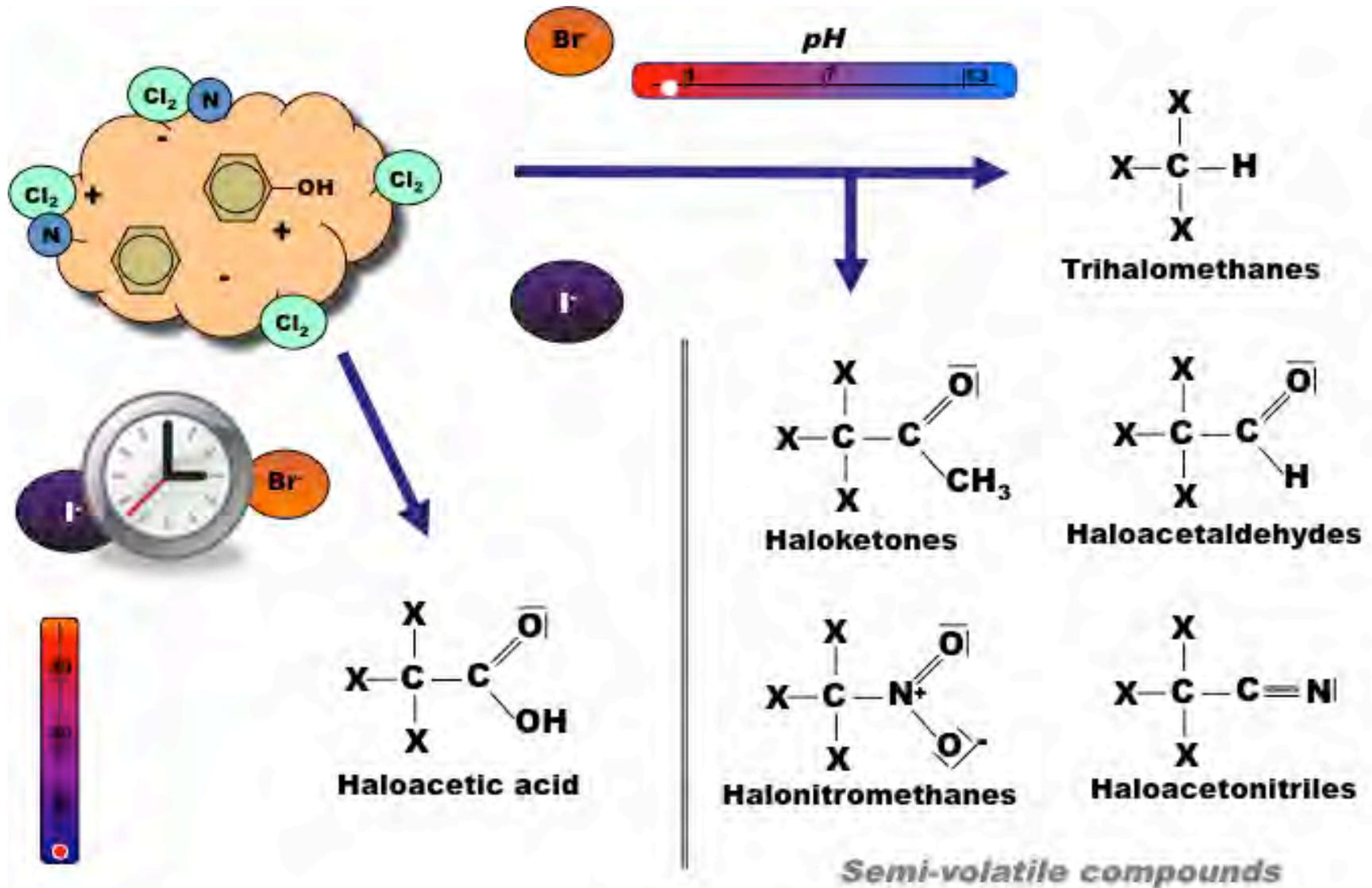
2005 BH



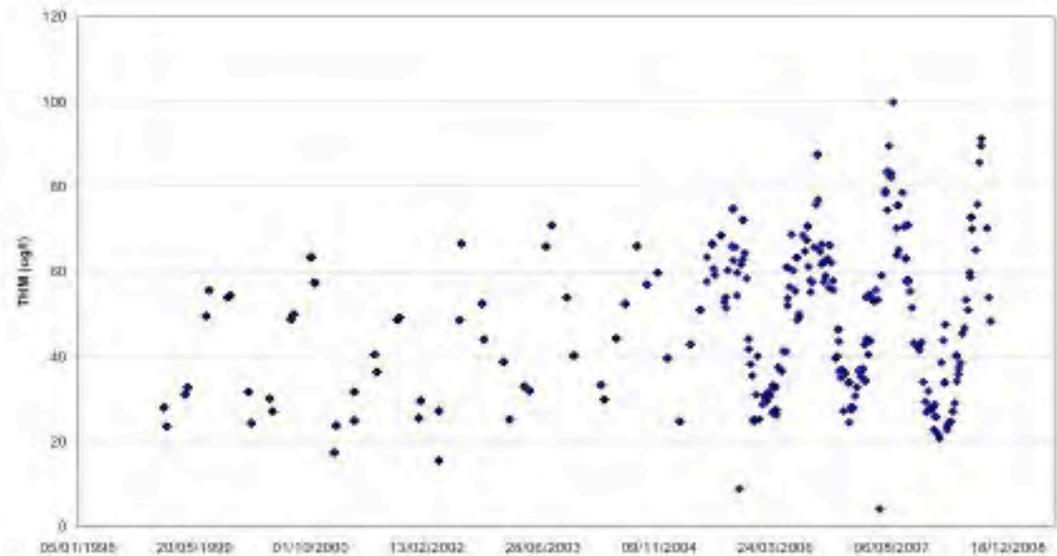
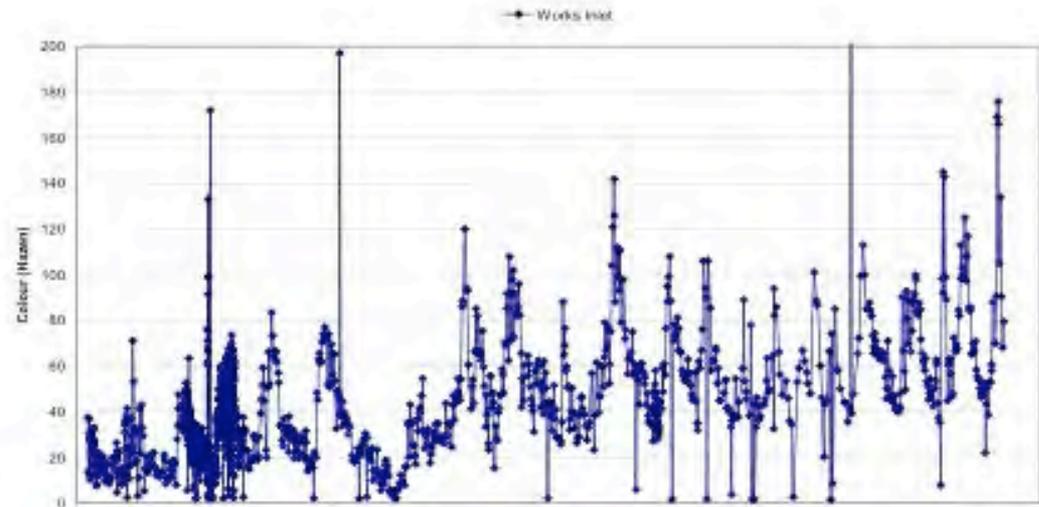
White et al.,

0 0.5 1 2 Kilometers

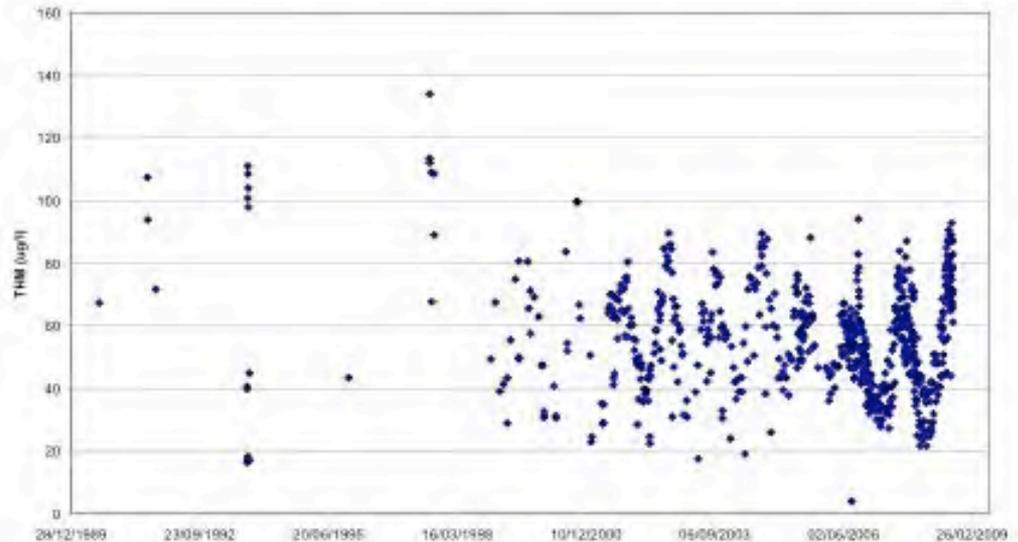
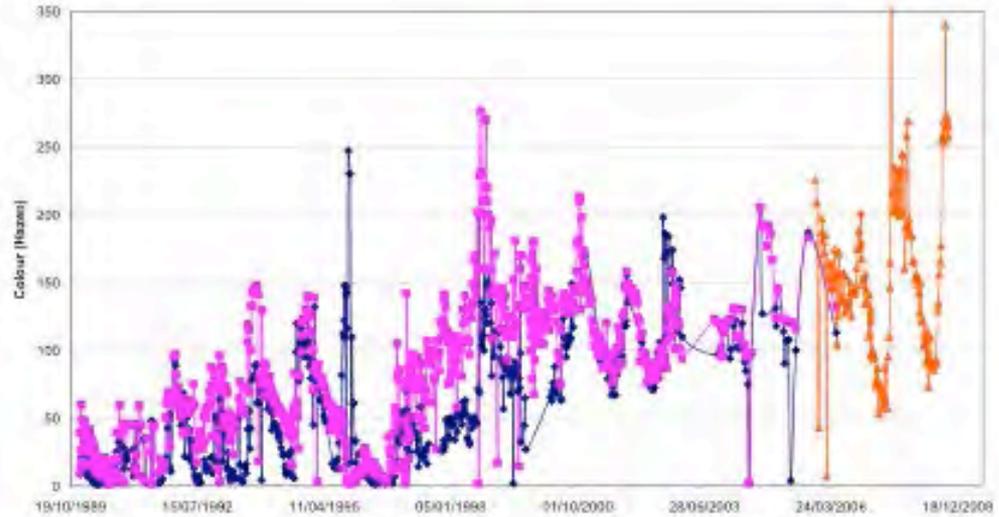
Disinfection byproducts form during the reaction between organic matter, inorganic ions and chlorine.



# Colour: sometimes it works...



.....but most of the time it doesn't



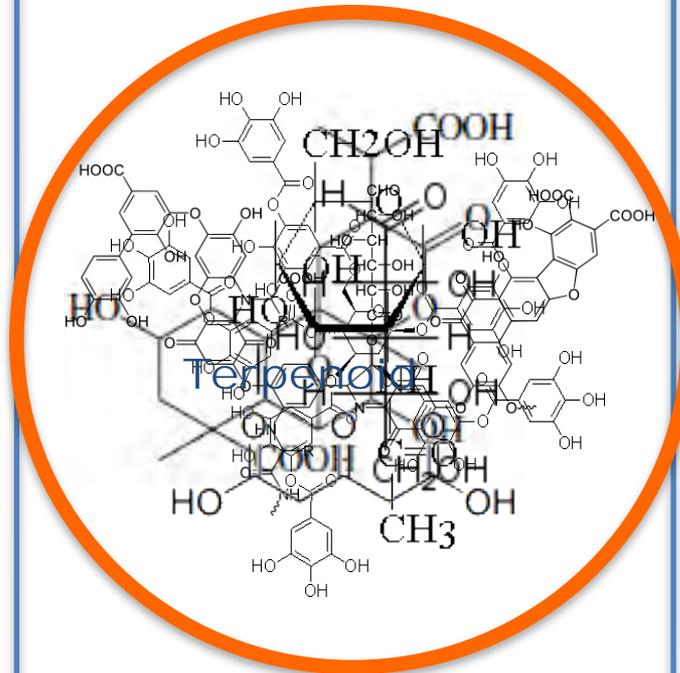
Organic matter is a complex mix of compounds all with different reactivity

More Hydrophobic

Transphilic

More Hydrophilic

Natural Organic Matter (NOM)



Tannic acid

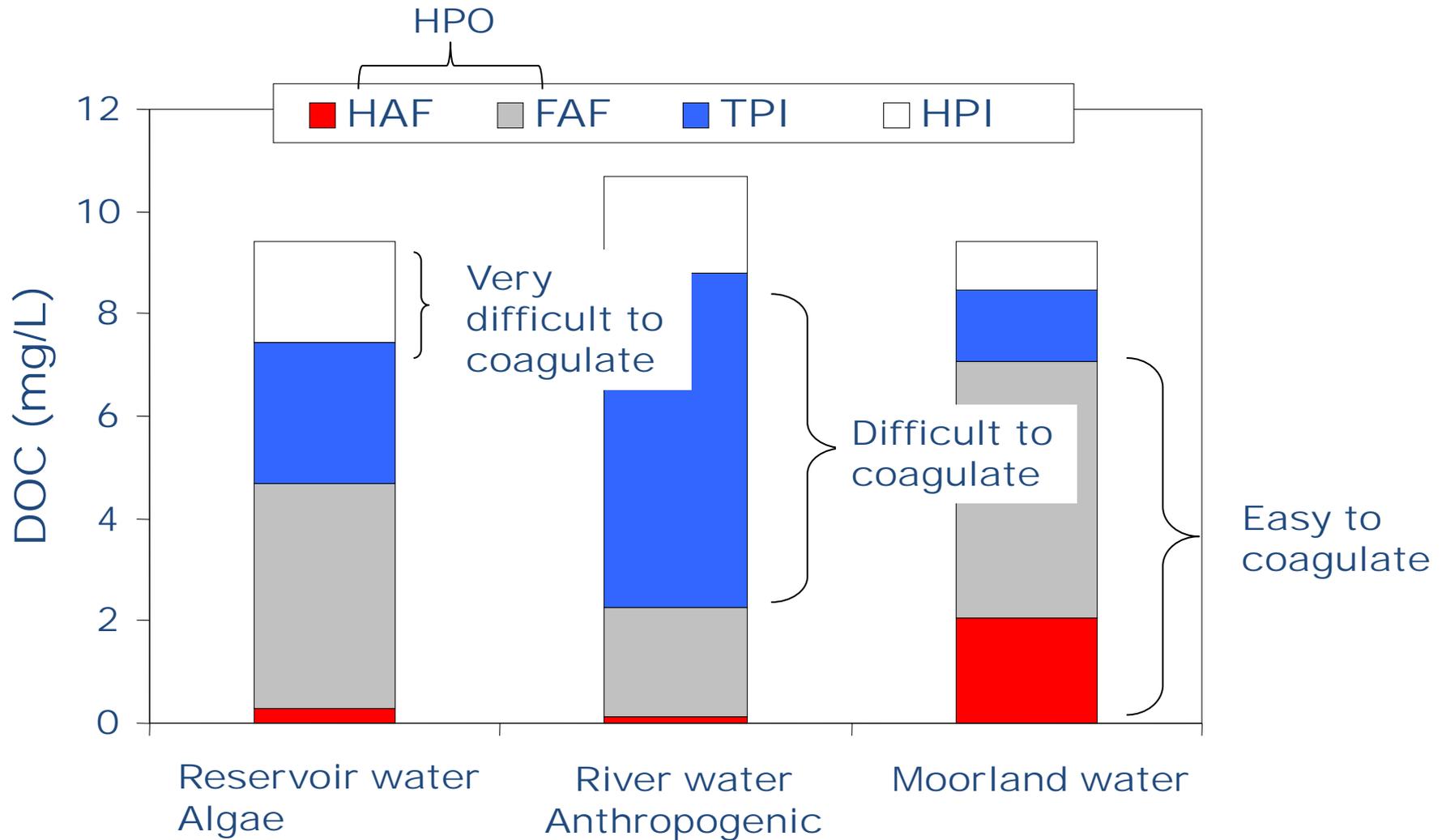
Amino Sugars

Humic Acid

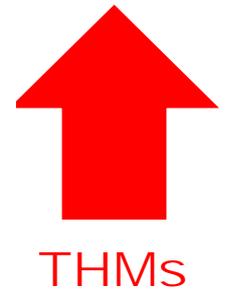
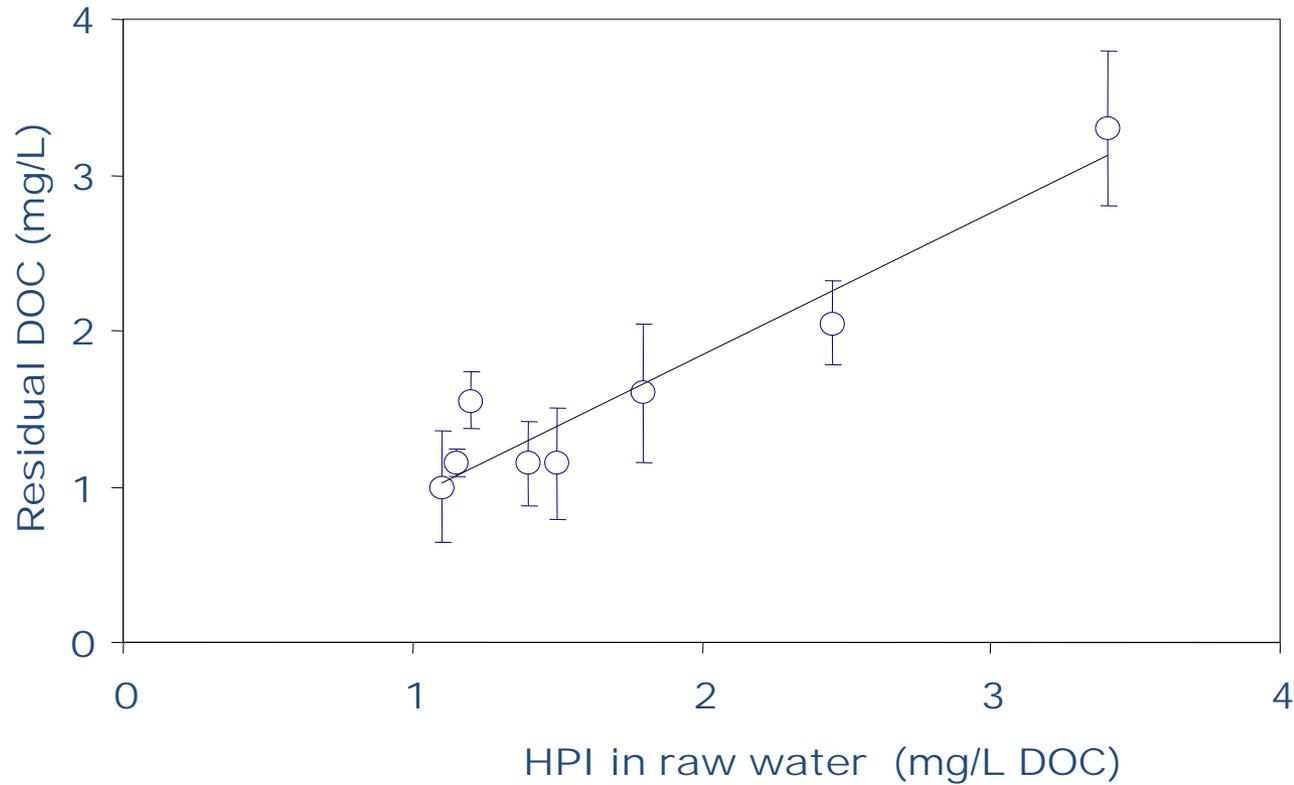
3-Acetonedicarboxylic acid

D-xyllose

For treatment, hydrophobicity and charge are important



For DBPs its about knowing what's left after treatment



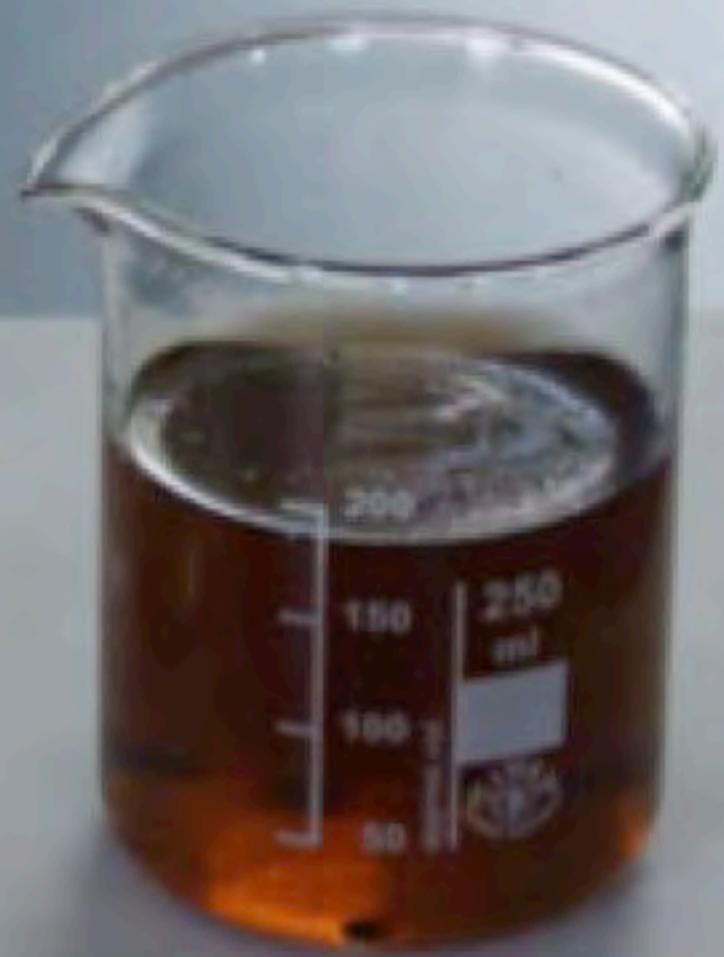
Sharp et al., 2006



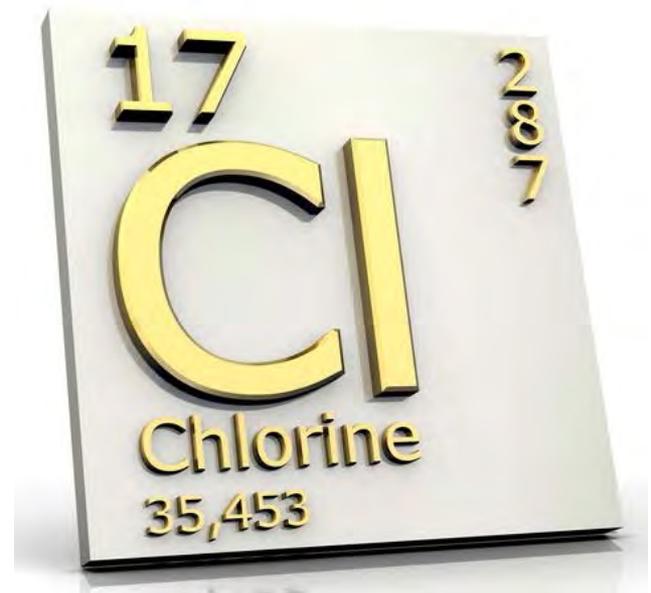


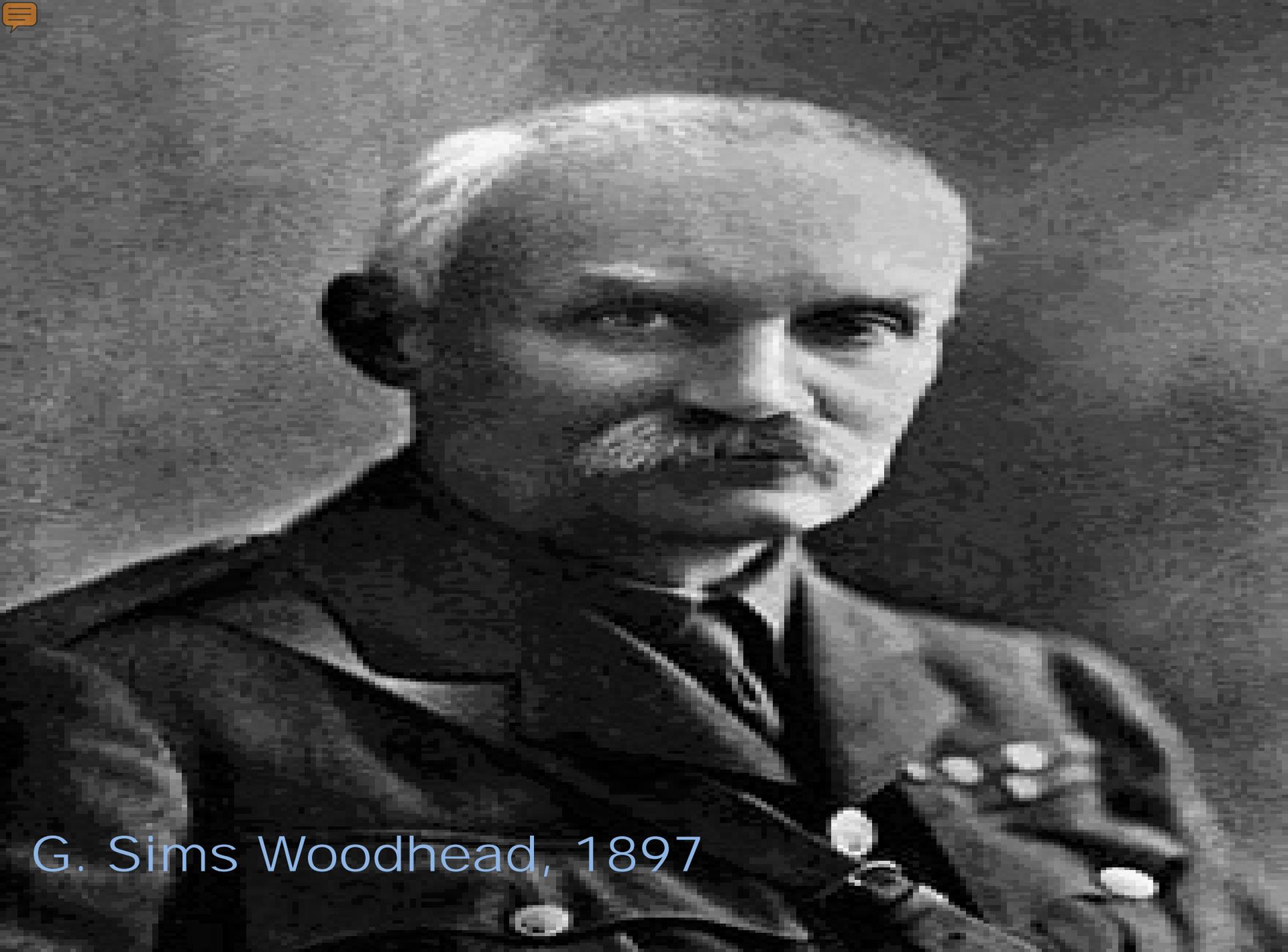


# #2 Colour?



# #3 Chlorine





G. Sims Woodhead, 1897



Harriet Chick,  
1907



Walkerton

WE LOVE THE PLEASURE OF YOUR COMPANY

# St. John Parish's water used to have too much chlorine, now it has none



Louisiana State Police are investigating the record keeping processes used by St. John the Baptist Parish water system in tracking data related to the discovery of a rare but deadly amoeba.

[Rebecca Catalanello, NOLA.com | The Times-Picayune](#)

1 / 7

Fullscreen

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Caption



By [Littice Bacon-Blood, NOLA.com | The Times-Picayune](#)

[Email the author](#) | [Follow on Twitter](#)

Print

on September 03, 2014 at 8:36 PM, updated September 03, 2014 at 10:57 PM

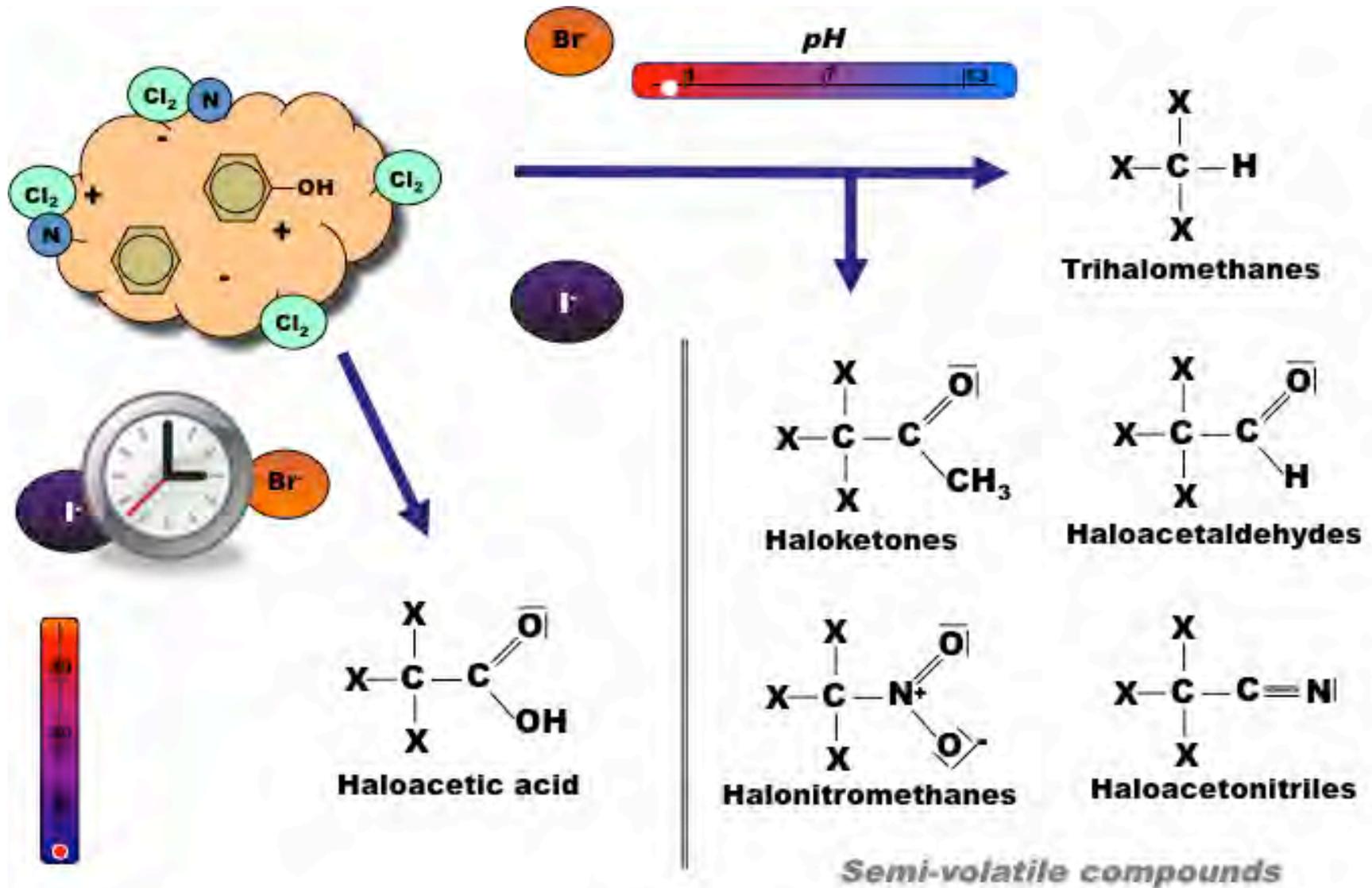
As St. John the Baptist Parish and state officials [investigate how a portion of the parish's drinking water system](#) became contaminated by a potentially deadly brain-eating amoeba after chlorine levels dropped to nearly nonexistent levels, a decade ago the parish spent millions on a filtering system because there was too much chlorine.

## BRAIN-EATING AMOEBAS NEWS

**Brain-eating amoeba in St. John water leads School Board to declare emergency**

**Brain-eating amoeba in St. John Parish**

Disinfection byproducts form during the reaction between organic matter, inorganic ions and chlorine.



# Poison in the kitchen...How tap water could damage your brain, blind or even kill you

By DR ROBERT MORRIS

Last updated at 23:46 30 April 2008



As he dipped his hand into the River Wear to quench his thirst, William Sproat could not have known he was about to unleash the horror of cholera on Britain.

Sunderland in 1831 was a hectic place. The Industrial Revolution was redefining our cities, while filth and squalor grew with urban populations.

# Chlorine in tap water 'nearly doubles the risk of birth defects'

By JO MACFARLANE

UPDATED: 23:47, 31 May 2008



[View comments](#)

Pregnant women living in areas where tap water is heavily disinfected with chlorine nearly double their risk of having children with heart problems, a cleft palate or major brain defects, a new study has found.

Scientists say expectant mothers can expose themselves to the higher risk by drinking the water, taking a bath or shower, or even by standing close to a boiling kettle.

The danger comes from chemical by-products in chlorinated water known as trihalomethanes, or THMs, which can be absorbed through the skin. They can then pass into the womb.



© PA

At risk: Scientists have now linked chlorinated water to specific birth defects

## PTI and PAT sit-ins: 'Poison' in water actually chlorine

By AFP Published: August 29, 2014

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PPPC detector seen chemical tests is result of water purification process. STOCK IMAGE



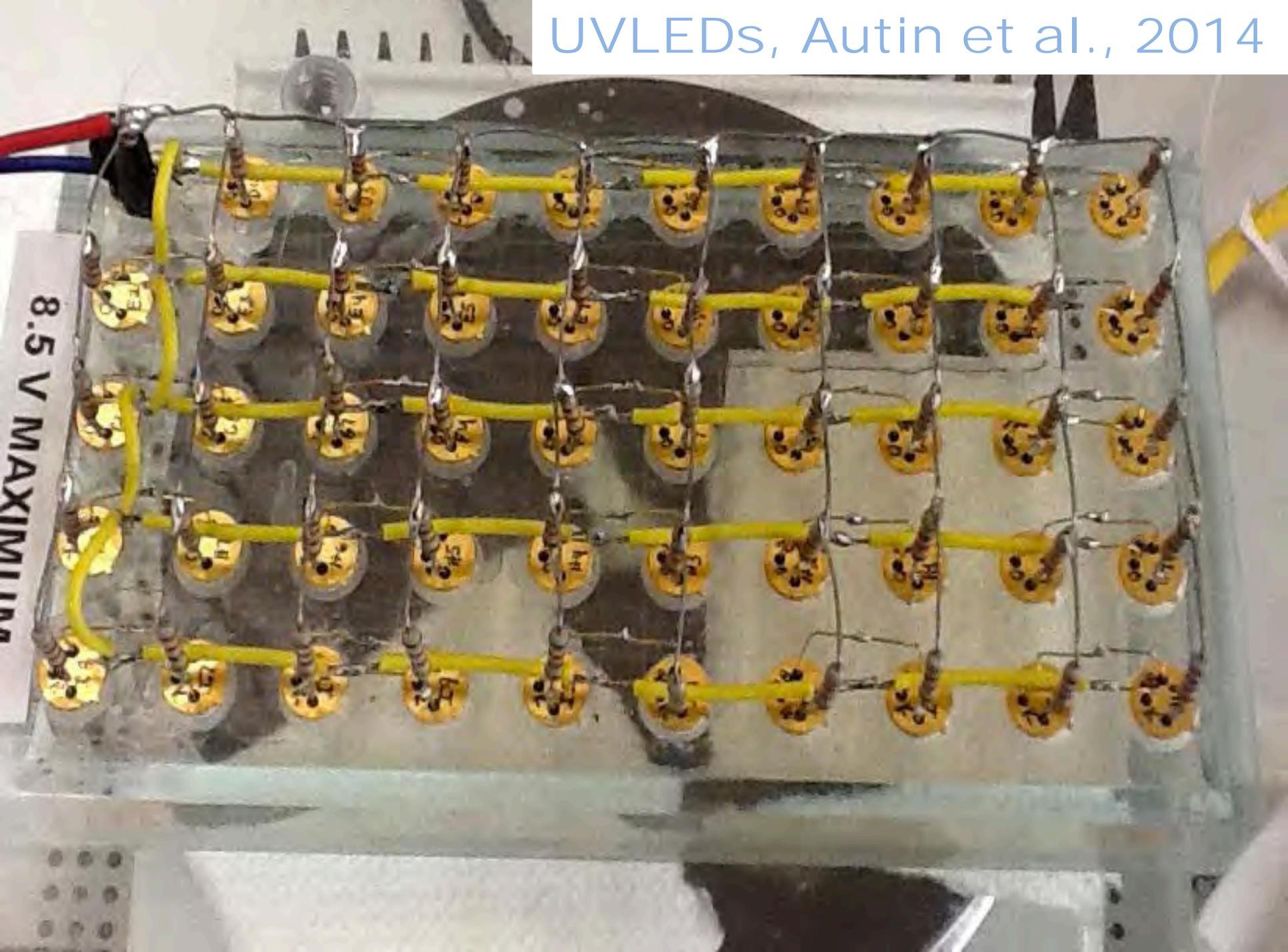
**Panton McLeod**



**50% REDUCTION IN  
THMS**



New York, 2013





# **The Dutch secret: how to provide safe drinking water without chlorine in the Netherlands**

**P. W. M. H. Smeets<sup>1,2</sup>, G. J. Medema<sup>1</sup>, and J. C. van Dijk<sup>2</sup>**

<sup>1</sup>Kiwa Water Research, Groningenhaven 7, 3433 PE Nieuwegein, The Netherlands

<sup>2</sup>Technical University Delft, P.O. Box 5048, 2600 GA Delft, The Netherlands

Received: 26 August 2008 – Published in Drink. Water Eng. Sci. Discuss.: 27 October 2008

Revised: 11 March 2009 – Accepted: 11 March 2009 – Published: 16 March 2009

**Abstract.** The Netherlands is one of the few countries where chlorine is not used at all, neither for primary disinfection nor to maintain a residual disinfectant in the distribution network. The Dutch approach that allows production and distribution of drinking water without the use of chlorine while not compromising microbial safety at the tap, can be summarized as follows:

1. Use the best source available, in order of preference:
  - microbiologically safe groundwater,
  - surface water with soil passage such as artificial recharge or bank filtration,
  - direct treatment of surface water in a multiple barrier treatment;



UK

99.97%

France

99.6%

Netherlands

99.99%

Ref:



UK

0.1 l/p/d

France

0.4 l/p/d

Netherlands

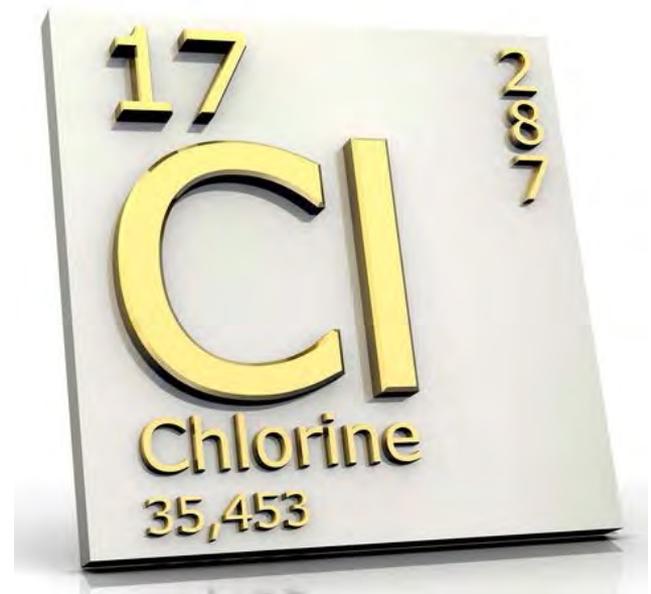
0.05 l/p/d



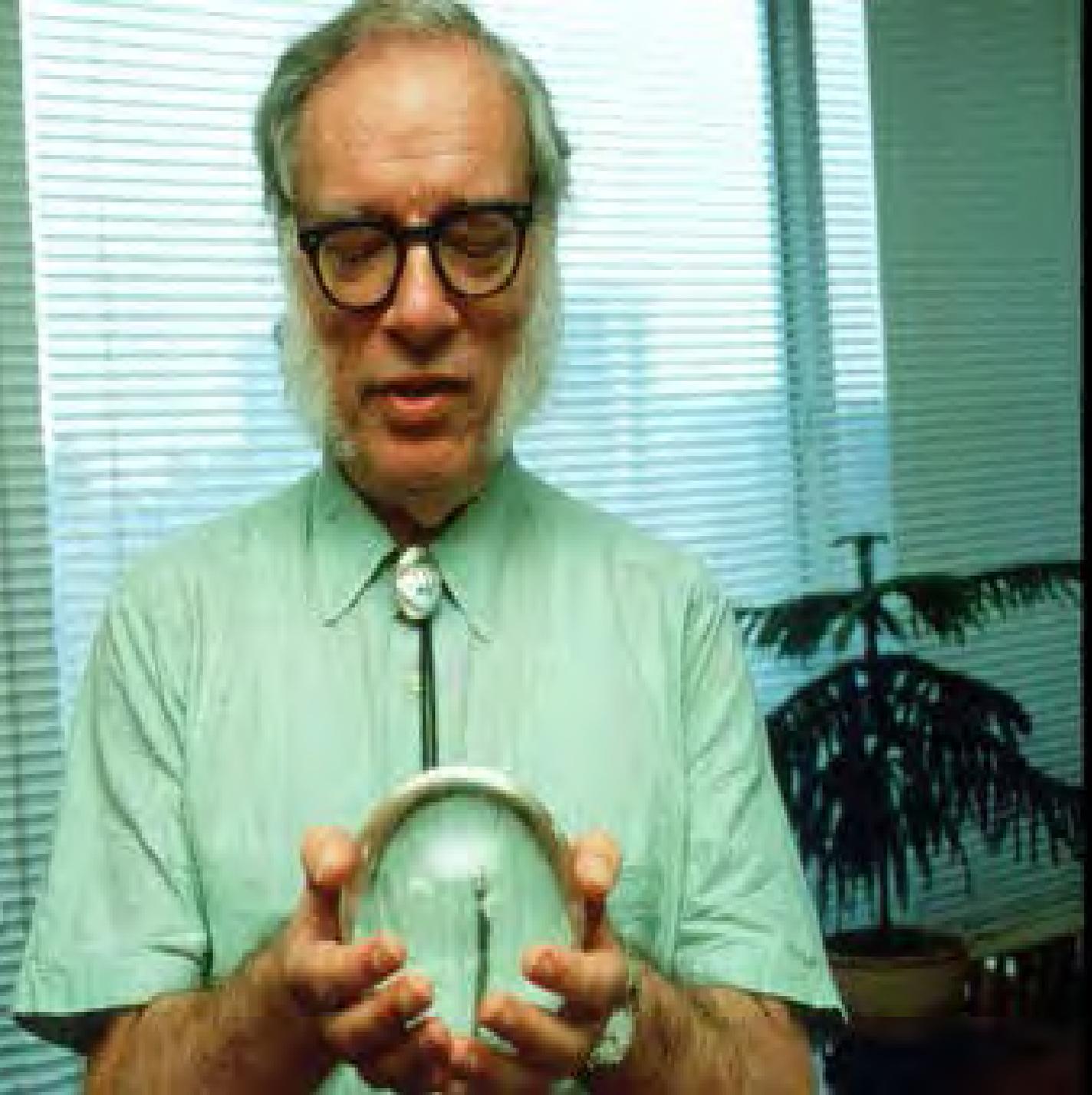
36357-10



# #3 Chlorine?



Sheffield,  
2015



**DU PONT**

REG. U.S. PAT. OFF.

**BETTER THINGS FOR BETTER LIVING  
... *THROUGH CHEMISTRY***



Thank you for listening