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# 10 Facts\* and 41 Informed Conjectures about the Health Effects of Fluoride

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*\*Currently 13 to be narrowed down to ten.*

# Background

- In 1902 it was discovered that modest levels of naturally occurring fluoride in the drinking water are associated with lower rates of tooth cavities.
- In 1950 the US Public Health Service officially endorsed adding fluoride to public drinking water and set target levels.
- US Center for Disease Control (CDC) calculations indicate that in 2012 74.6%—210 million Americans—on public water systems received fluoridated water, an increase of 15 million people since 2008.
- There is enormous controversy about the health effects of fluoride.

# What Can Economists Contribute?

- Used to multivariate specifications and enhanced statistical methods
- Specialty is natural experiments in which randomization is rare, covariates abundant
- Used to behavioral models and endogenous variables
- Model entire distributions of outcomes rather than only studying means
- Experience with large data, categorical variables

# Six F grant proposals submitted: All but one unfunded!

- National Institute of General Medical Sciences (2009)
- National Institute of Environmental Health Sciences (2010)
- National Institute of Environmental Health Sciences (2011)
- Worker's Compensation Research Council (2012) (funded for exploratory work, \$10,000)
- National Institute of Health Care Management (2015)
- Weiss Family Program Fund (2015)
- Vidal-Fernandez (2015) "Environmental Quality and Birth Outcomes"

# Why this presentation?

- Vidal-Fernandez et al (2016) shows that F really is bad for babies, and motivates trying to put all of the evidence together.
- One can quibble about individual results, but collectively it all points to something.
- Great motivator to have others explore F effects on their own.

# Fact #1

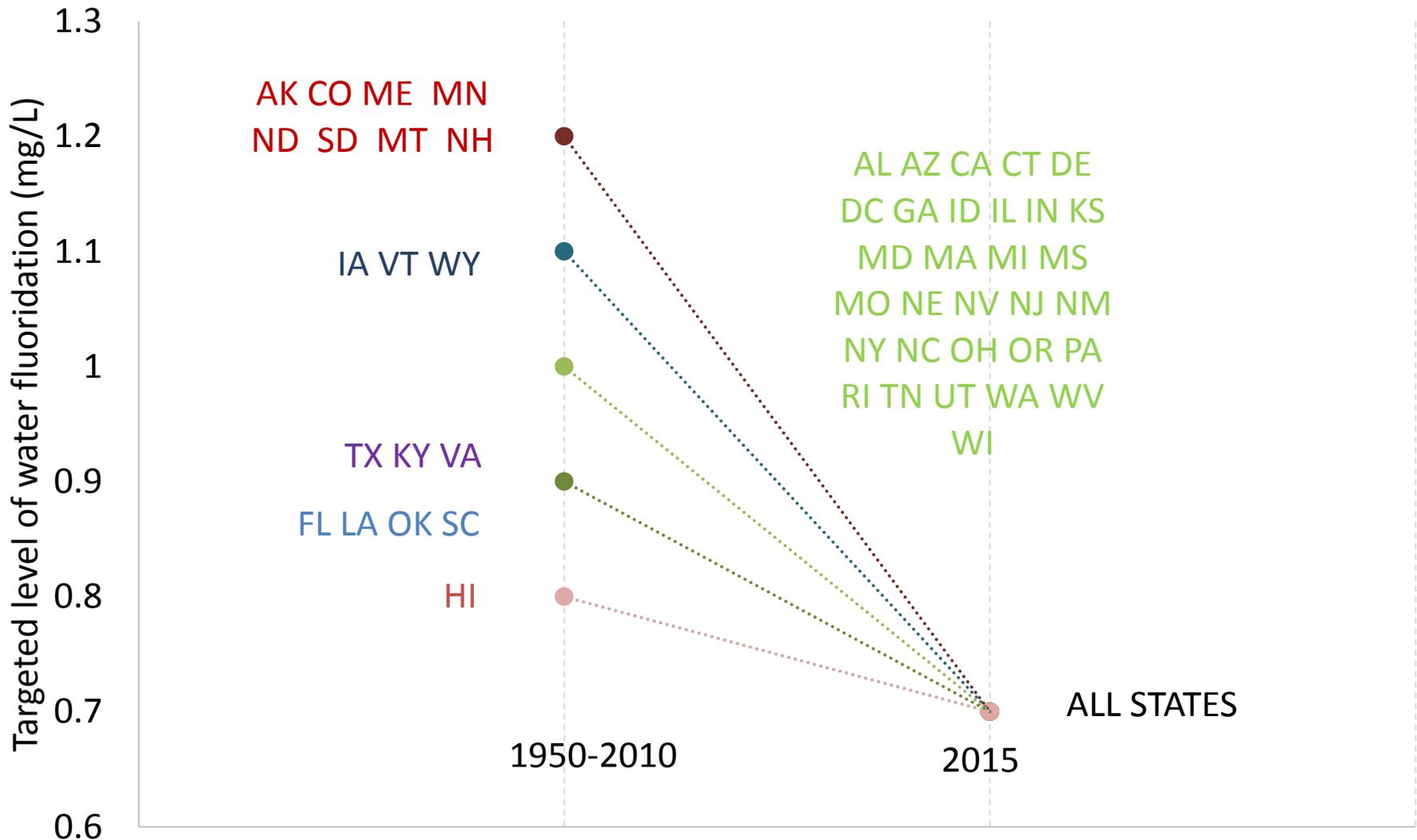
In April, 2015 the Centers for Disease Control (CDC) and Environmental Protection Agency (EPA) tightened the standard for fluoride (F) allowed in US drinking water.

- This implies valid concerns that the 1950 F standards were too high.
- New standard was not based on new, large scale US controlled trials, but on reevaluation of existing studies.
- Supports the need for new studies and approaches.
- The CDC/EPA standard in April 2015 mandated F limits was preceded by changes in CDC/EPA recommended F in January 2011.

# Conjecture #1

- Health in the US has gotten better since 2011

# State Fluoridation Targets Before and After 2015



Source: CDC 1992; U.S. Public Health Service Recommendation for Fluoride Concentration in Drinking Water for the Prevention of Dental Caries

# Conjecture #2

- Health in the US States with larger initial levels of F have improved more since 2011 than those with lower initial levels of F

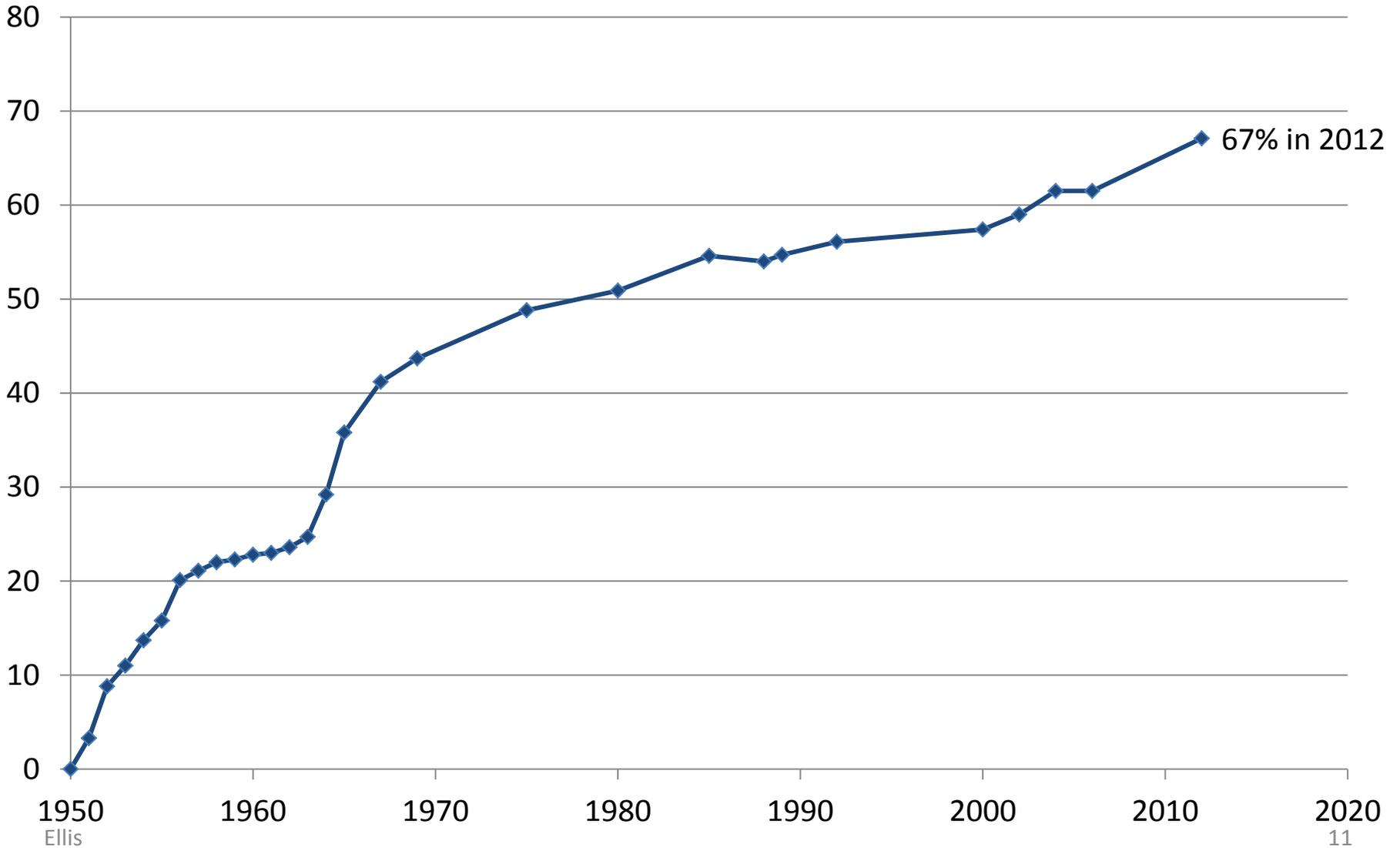
# Fact #2

Previous US fluoridation standards for drinking water were set in 1950 before fluoridated toothpaste and many other sources of fluoride were known.

- Fluoridated toothpaste (1955) and dental rinses
- Fluoride-containing drugs
- Fluoride in foods, workplace, pesticides
- Other trends affect water and hence F consumption
  - air conditioning, home insulation, GatorAid, dialysis, antidiuretics, HIV/AIDS, (plastic) bottled water, long showers, sports, jogging ...

# Percentage of U.S. population receiving fluoridated water as of April 21, 2016

<http://www.cdc.gov/fluoridation/statistics/fsgrowth.htm>



# Conjecture #3

- Health in the US States with higher percentages of their population with of F water have improved more since 2011 than those with lower initial levels of F penetration
- *Call the fraction of the population with F in a region  $\theta$*

# Fact #3

Most of the rest of the world does not artificially fluoridate their drinking water.

- Their review of scientific studies has convinced them that fluoride is dangerous to put in drinking water.
- Remarkable division according to whether English is the primary language spoken.

# Remarkable International Division

## Fluoridation added to drinking water in:

- US (75% of community water systems, 67% of population) Canada (45%)
- Ireland (71%), UK (10%)
- Singapore (100%), Hong Kong (100%)
- Australia (70%), New Zealand (~50%)
- Brazil (60% of cities), Chile (71%)

## Fluoridation not added in:

- Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Italy, Luxembourg, Netherlands, Northern Ireland, Norway, Scotland, Sweden, and Switzerland,
- Most other countries not listed.
- Many countries, including China (Guangzhou) have briefly fluoridated water

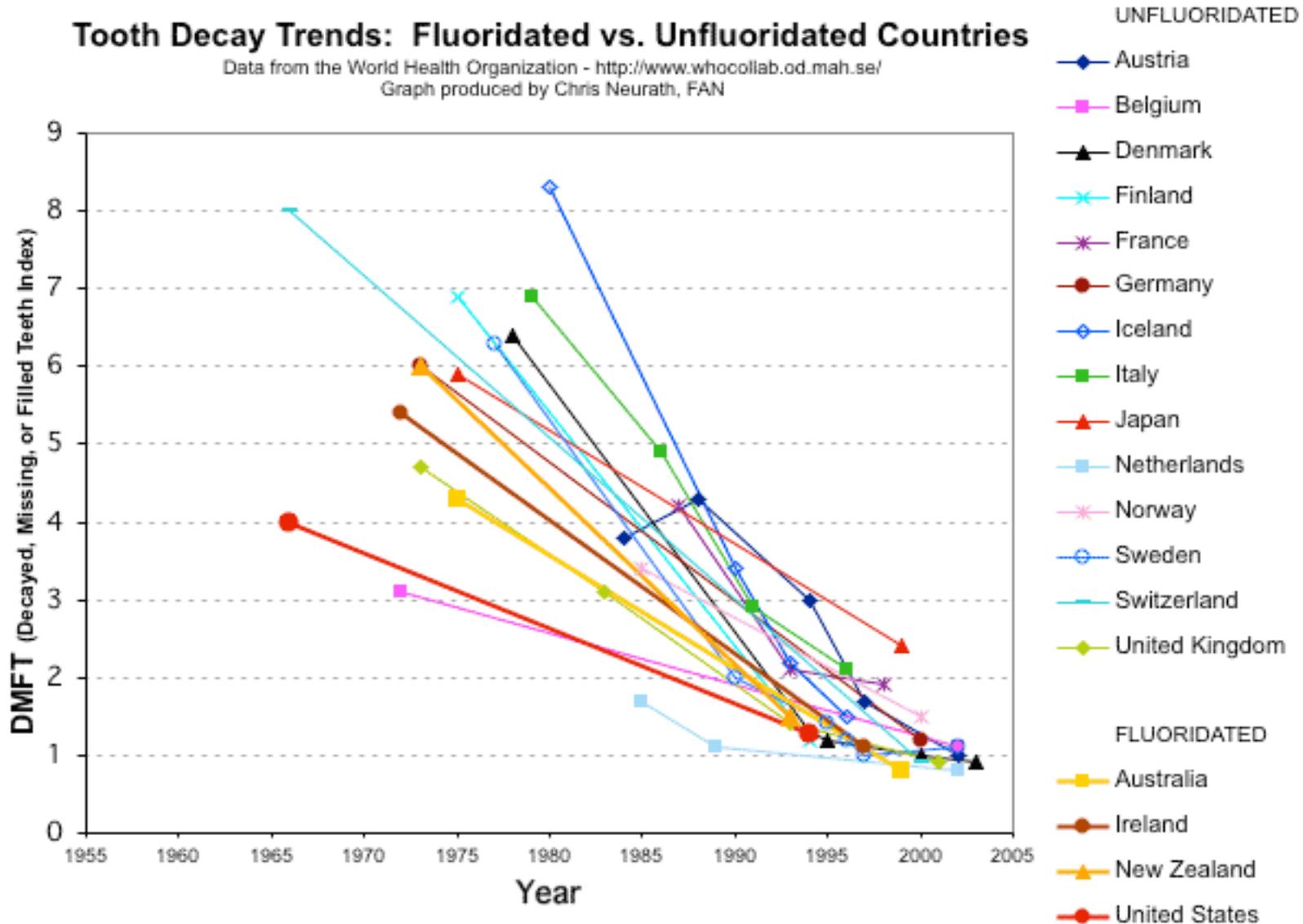
# Conjecture #4

- If we look at the diseases believed to be caused by F in Europe, we will find that they are caused by F in the US.

# Consensus view in Europe

- Even low levels of F associated with health risks.
- Fluoridation of public water supplies is banned.
- Levels of dental cavities have been decreasing independently of water fluoridation.

# World Health Organization Data (2004) – Tooth Decay Trends (12 year olds) in Fluoridated vs. Unfluoridated Countries:



# Conjecture #5

- There is no longer any benefit of F levels in the US from fluoridated water

# Fact #4

Most (> 90 %?) of the fluoridated water systems in the US use chemicals that were never subject to any randomized clinical trials to determine their health effects.

- Sodium fluoride (NaF) was used in all clinical trials
- More commonly used in practice in the US are:
  - Hexafluorosilicic acid ( $\text{H}_2\text{SiF}_6$ )
  - Sodium fluorosilicate ( $\text{Na}_2\text{SiF}_6$ )
- No other drug is allowed to be used without careful clinical trials

# Key quote from NRC (2006 )report

“ As reported in Chapter 2, exposure to fluorosilicates could occur under some conditions. **There are reports that such chemicals enhance the uptake of lead into the body and brain, whereas NaF does not.** Further research is needed to elucidate how fluorosilicates might have different biological effects from fluoride salts.”

National Academy of Sciences, National Research Council (2006)  
“Fluoride in Drinking Water: A scientific Review of the EPA’s Standards” p. 221 in chapter 7 on “Neurotoxicity and Neurobehavioral Effects”

# More on NaF substitutes

“In the studies by physicians treating patients who reported problems after fluoridation was initiated, **there were several reports of skin irritation (Waldbott 1956; Grimbergen 1974; Petraborg 1977).**

Although blinded experiments suggested that the symptoms were the result of chemicals in the water supply, various anecdotal reports from patients complaining, for example, of oral ulcers, colitis, urticaria, skin rashes, nasal congestion, and epigastric distress, do not represent type I (anaphylactic), II (cytotoxic), III (toxic complex), or IV (delayed type reactivity) hypersensitivity, according to the American Academy of Allergy (Austen et al. 1971). **These patients might be sensitive to the effects of silicofluorides and not the fluoride ion itself.** In a recent study, Machalinski et al. (2003) reported that the four different human leukemic cell lines **were more susceptible to the effects of sodium hexafluorosilicate, the compound most often used in fluoridation, than to NaF.”** NRC (2006, p. 93)

# This is the evidence on the CDC web site arguing that fluorosilicates are safe

- **Fluoride Additives Are Not Different From Natural Fluoride**
- Some consumers have questioned whether fluoride from natural groundwater sources, such as calcium fluoride, is better than fluorides added "artificially," such as FSA or sodium fluoride. Two recent scientific studies, listed below, demonstrate that the same fluoride ion is present in naturally occurring fluoride or in fluoride drinking water additives and that no intermediates or other products were observed at pH levels as low as 3.5. In addition, the metabolism of fluoride does not differ depending on the chemical compound used or whether the fluoride is present naturally or added to the water supply.
- Finney WF, Wilson E, Callender A, Morris MD, Beck LW. [Re-examination of hexafluorosilicate hydrolysis by fluoride NMR and pH measurement](#). *Environ Sci Technol* 2006; 40:8:2572.
- (A study of test tube solutions, not a study of people.)
- G.M. Whitford, F.C. Sampaio, C.S. Pinto, A.G. Maria, V.E.S. Cardoso, M.A.R. Buzalaf. [Pharmacokinetics of ingested fluoride: Lack of effect of chemical compound](#)., *Archives of Oral Biology*, 53 (2008) 1037–1041. (A study of ten people measuring chemicals, not health.)

# Conjecture #6

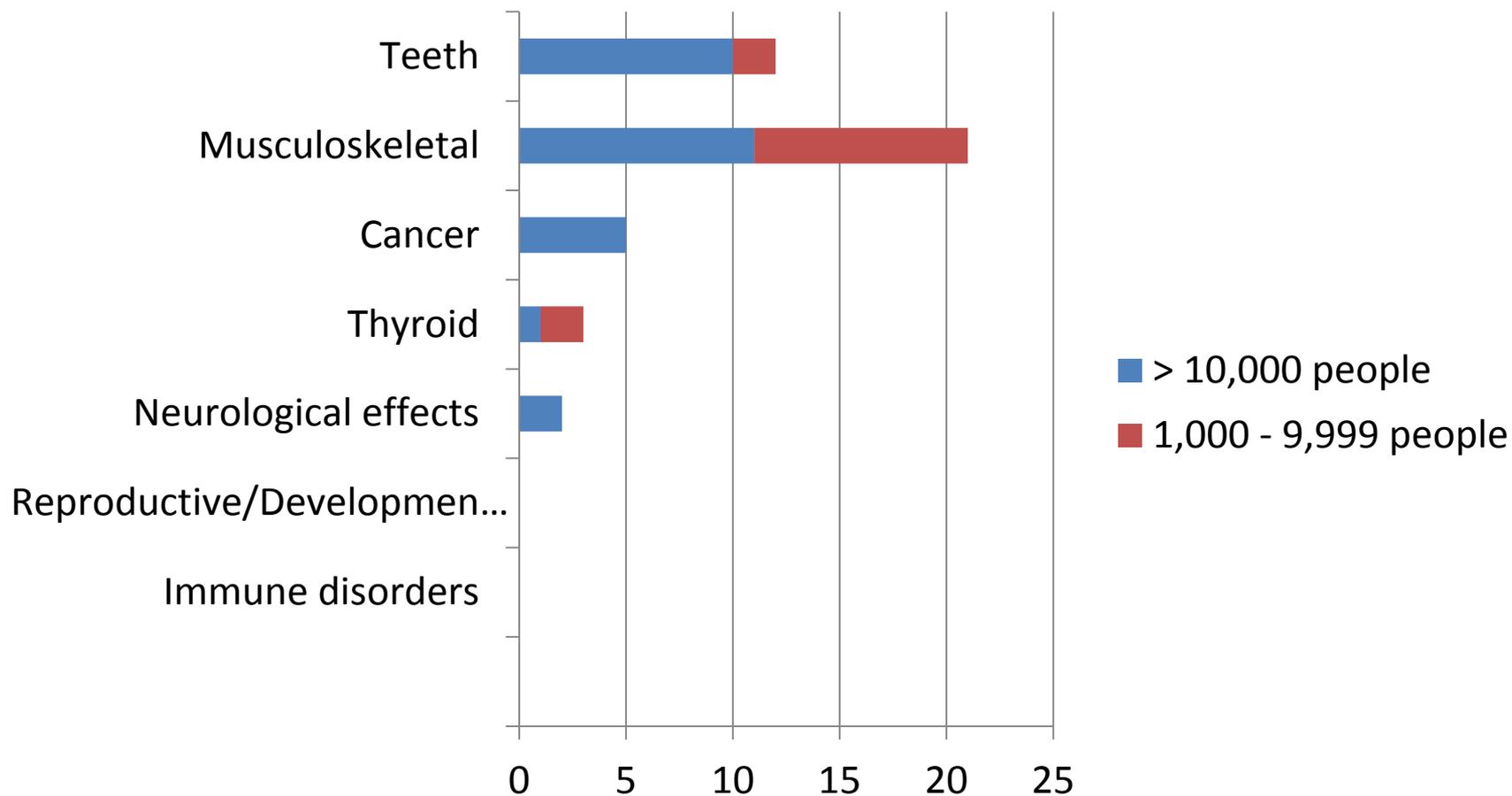
- Fluorosilicates are more dangerous to your health than NaF

# Fact #5

Early clinical randomized controlled trials on the health effects of fluoridated water focused on concerns that it might cause bone disorders or cancer.

- They did not test for changes in metabolism associated with toxic fluoride poisoning.
- Sample sizes only had the power to detect large effects on common conditions, not small to moderate effects on less common conditions

# Large sample studies discussed in the NRC (2006)report



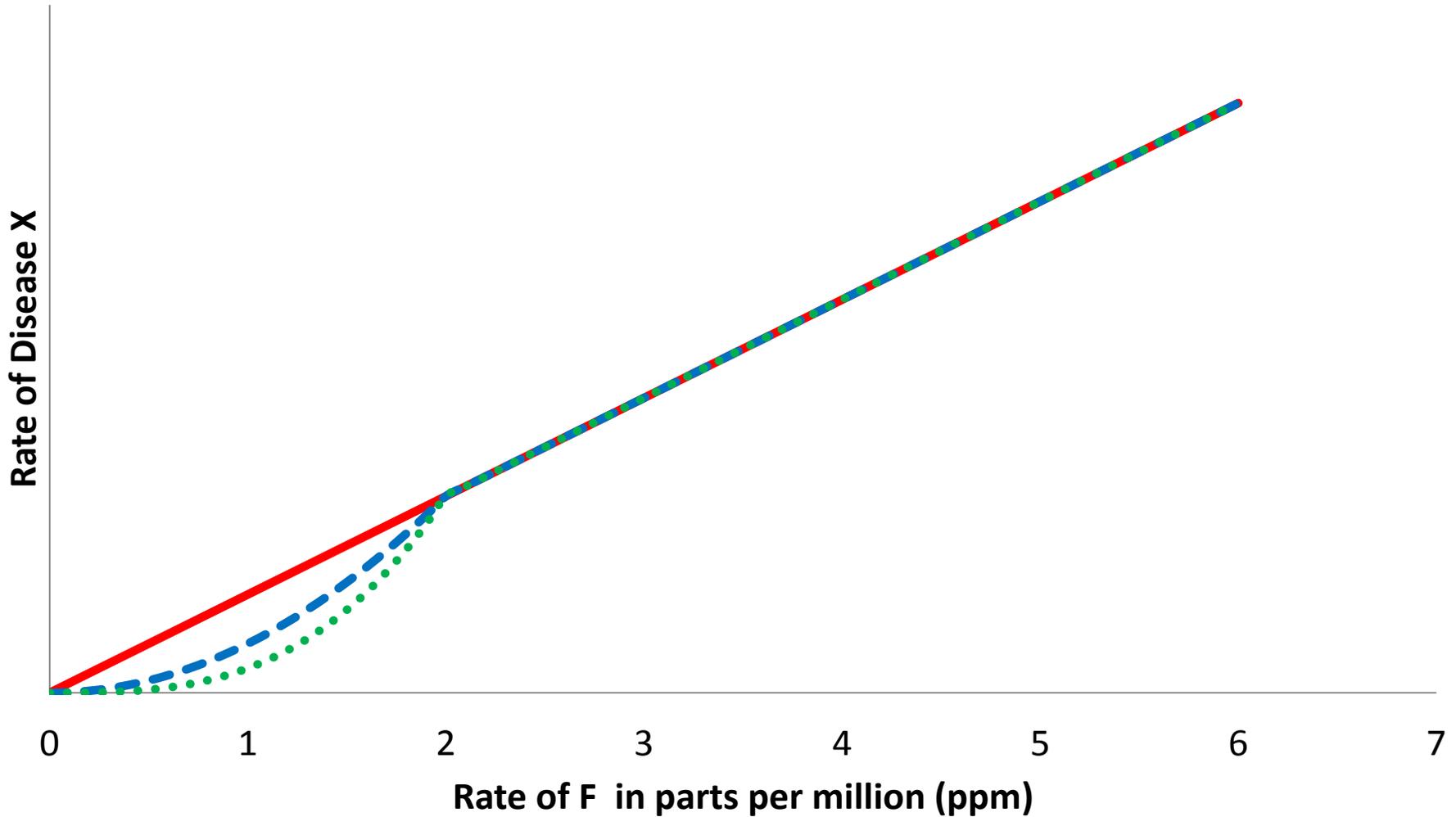
Need to do more precisely, which requires looking at underlying studies. These are inferences from tables and text discussion.

## NRC (2006), p. 295

- **“There is no question that fluoride can affect the cells involved in providing immune responses. The question is what proportion, if any, of the population consuming drinking water containing fluoride at 4.0 mg/L on a regular basis will have their immune systems compromised? Not a single epidemiologic study has investigated whether fluoride in the drinking water at 4 mg/L is associated with changes in immune function.”**

# US Water Fluoridation Policy Rests on the ASSUMPTION that the Relationships between F and Diseases is Nonlinear

— linear    - - quadratic    ···· cubic



# Conjecture #7

- F is not associated with most bone and cancers, but is associated with other metabolic disorders, and in particular immune disorders

# Fact #6

The acute toxic health effects of poisoning from excessive ingestion of fluoride are well understood and include gastrointestinal, metabolic, neurological, and cardiovascular effects.

- Based on studies of
  - Naturally occurring extremes of fluoride in water
  - Industrial accidents
  - Eating a tube of toothpaste
  - Accidental ingestion of fluoride rinses or chemicals
  - Eating plants that concentrate fluoride in their leaves

# Fluoride Toxicity Clinical Presentation

## Gastrointestinal signs

- Hypersalivation
- Nausea
- Vomiting
- Diarrhea
- Abdominal pain
- Dysphagia
- Mucosal injury

## Electrolyte abnormalities

- Hypocalcemia
- Hypomagnesemia
- Hyperkalemia
- Hypoglycemia

## Neurologic effects

- Headache
- Tremors
- Muscular spasm
- Tetanic contractions
- Hyperactive reflexes
- Seizures
- Muscle weakness

## Cardiovascular

- Widening of QRS waves in ECG
- Various arrhythmias
- Shock
- Cardiac arrest

Downloaded from <http://emedicine.medscape.com/article/814774-clinical#a0217> on 3/14/2012

# Conjecture #8

- F is associated with these Acute Effects of Fluoride (AEF) even at low doses
- AEF effects should show up quickly when exposed to F, while Chronic Effects of Fluoride (CEF) will not change, since they require long exposures

# Fact #7

Fluorine is a solid, and does not evaporate easily. Any evaporation process will tend to concentrate it.

- Ocean water has an F concentration of 1 ppm
- Plants that lose a lot of water through evaporation
- Plants irrigated with water containing F
- Athletes, bicyclists, or outdoor workers who perspire a lot
- Deep fat frying seafood or other foods with high F
- Surface water in reservoirs

# Conjecture #9-14

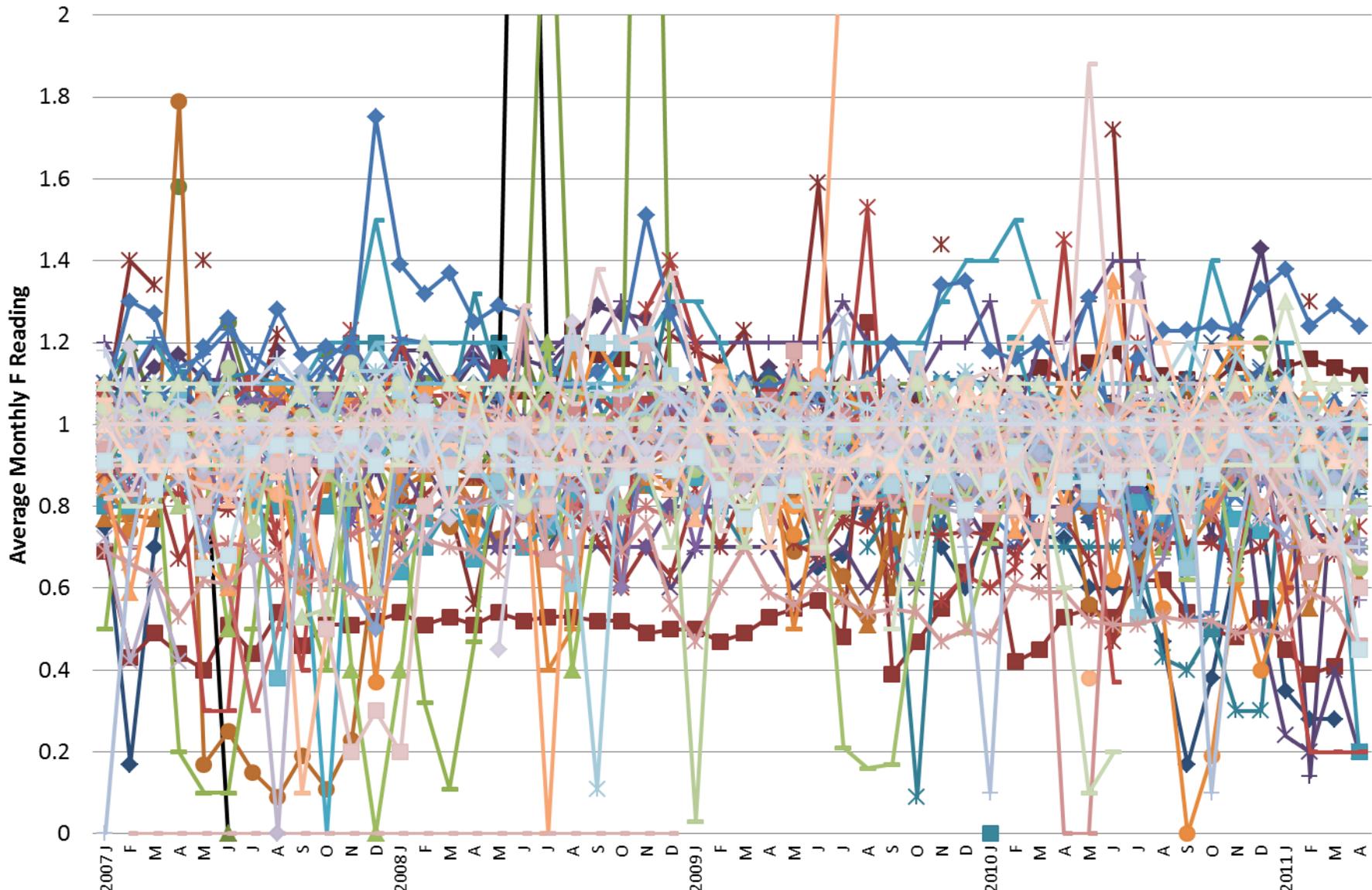
- Foods irrigated with water containing F will have more F in them than those irrigated with non F water.
- Seafoods will consistently have higher F than fresh water fish
- Deep fat fried foods will have higher rates of F than steamed or boiled foods, particularly if seafood
- People who perspire a lot are at greater risk of AEF
- Surface water F levels will be higher during droughts than during high rainfall periods, as should AEF.
- People living closer to fishing seaports will have higher exposure to F through eating seafood than those living further away from ports, and should have higher AEF and CEF.

# Fact #8

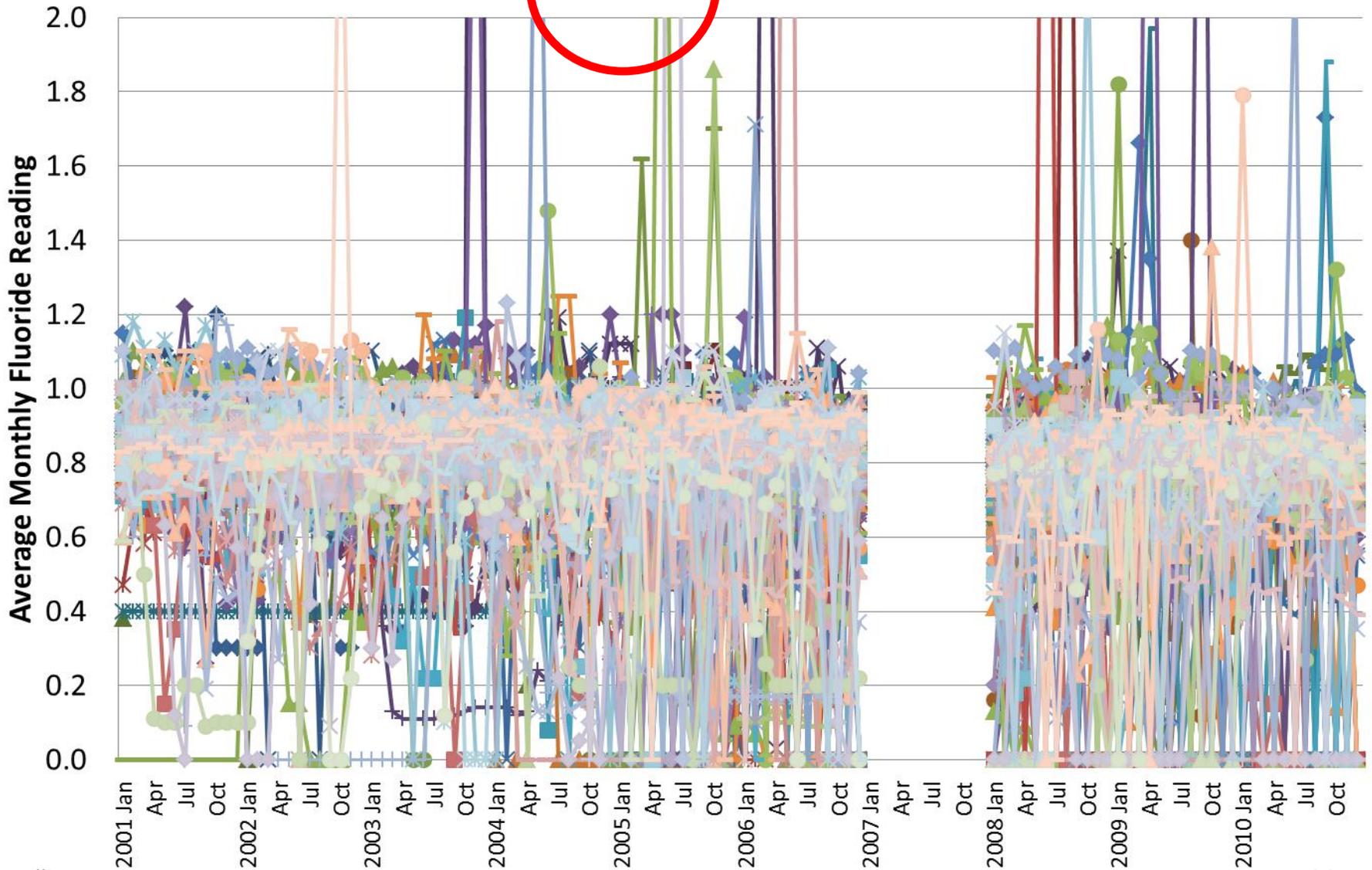
Actual rates of water fluoridation vary substantially around the targeted rates of “optimal F”

- Variation by day, month, season, and water testing site
- Reports on daily fluctuations are routinely collected but not reported publicly in the US.
- Much more on this later

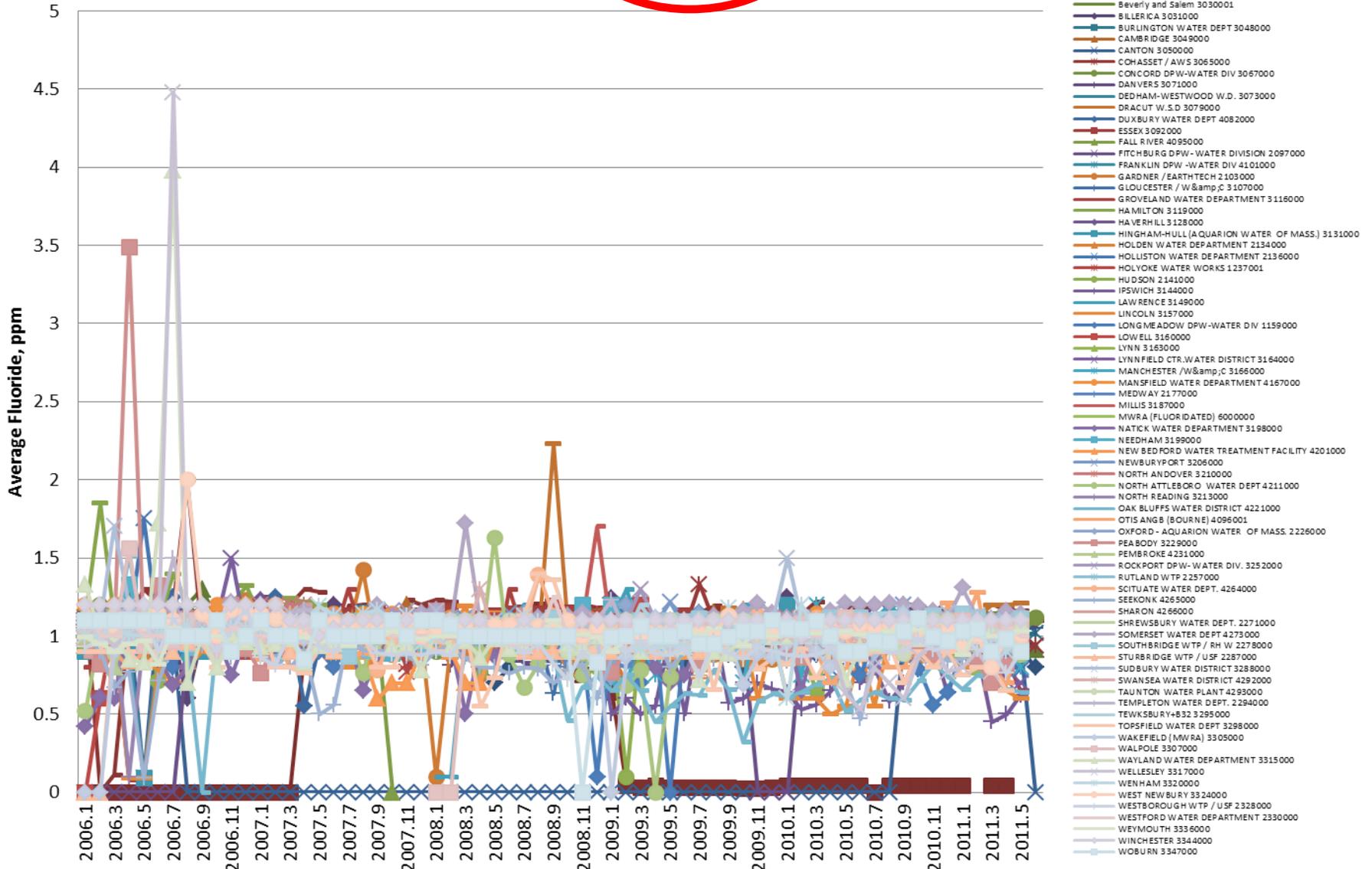
# Monthly Fluoride Readings at All 133 Fluoridated Water Sites in AL, 2007:1-2011:4



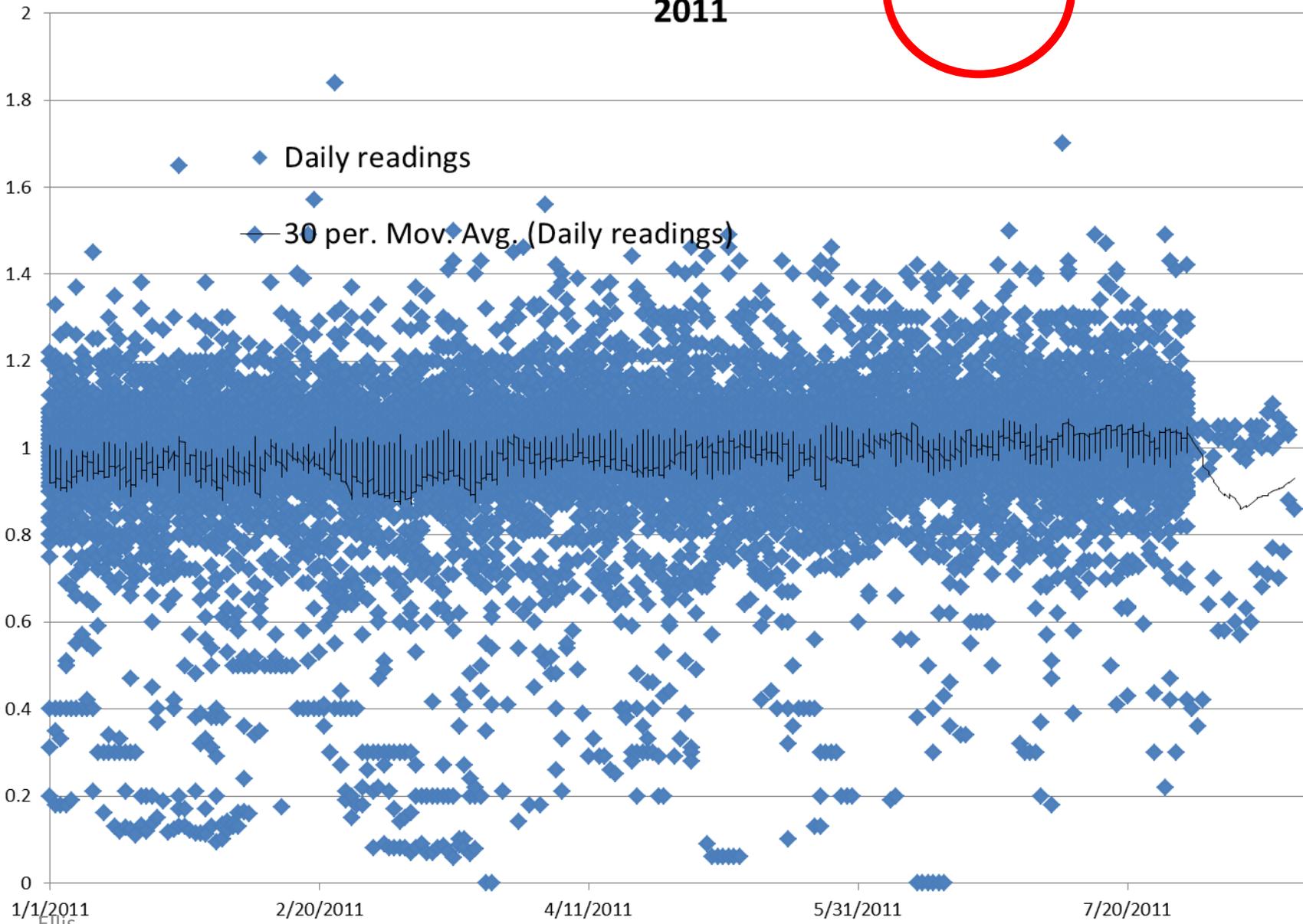
# Monthly Distribution of Fluoride Readings in 126 Fluoridated Water Systems in Florida, 2001:1-2010:12



# Average Monthly Fluoride Readings, Massachusetts, 82 Water Systems, 2006-2011



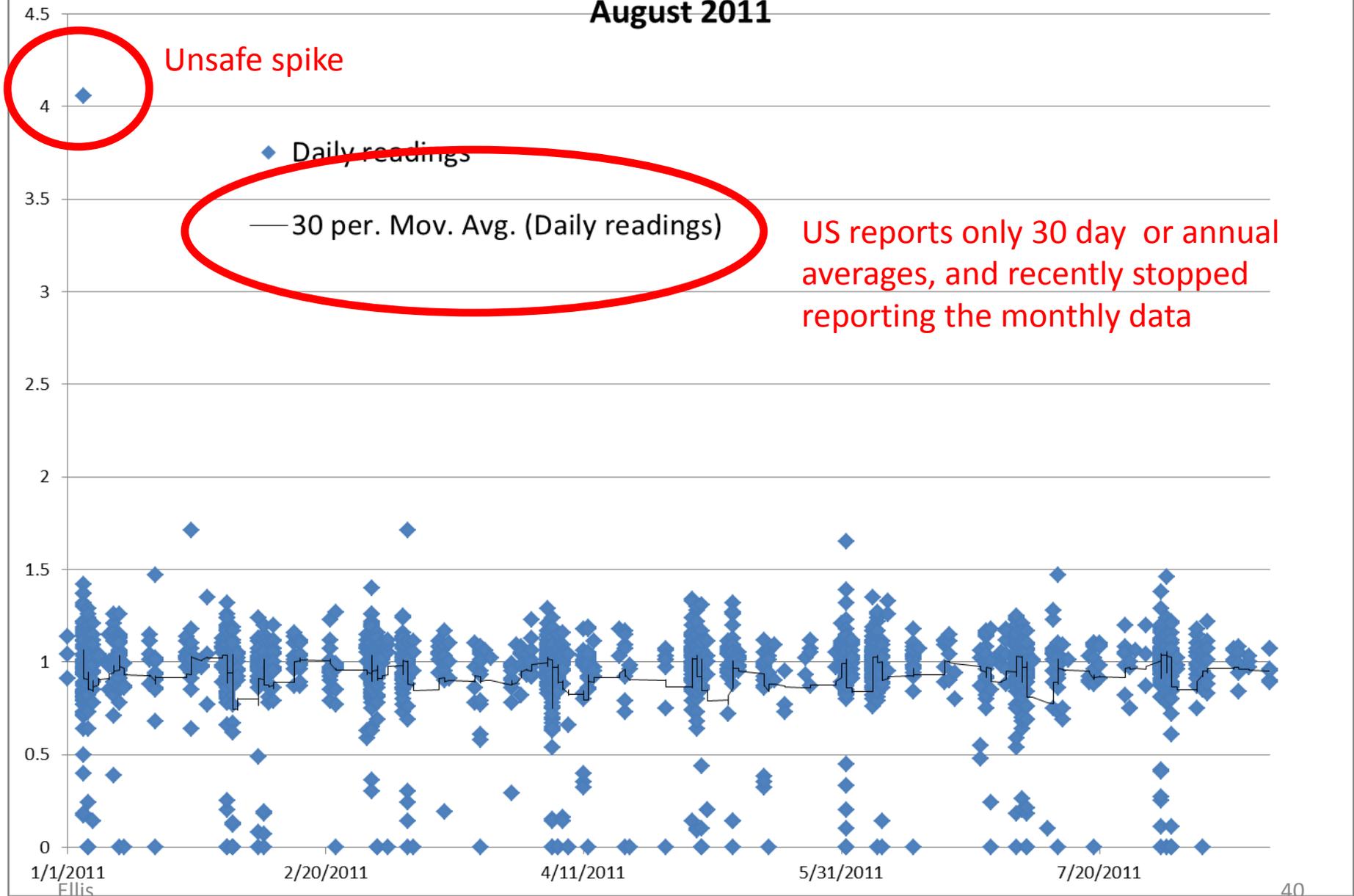
# Daily readings for Water Supply Authority, Sydney Australia, Jan-August 2011



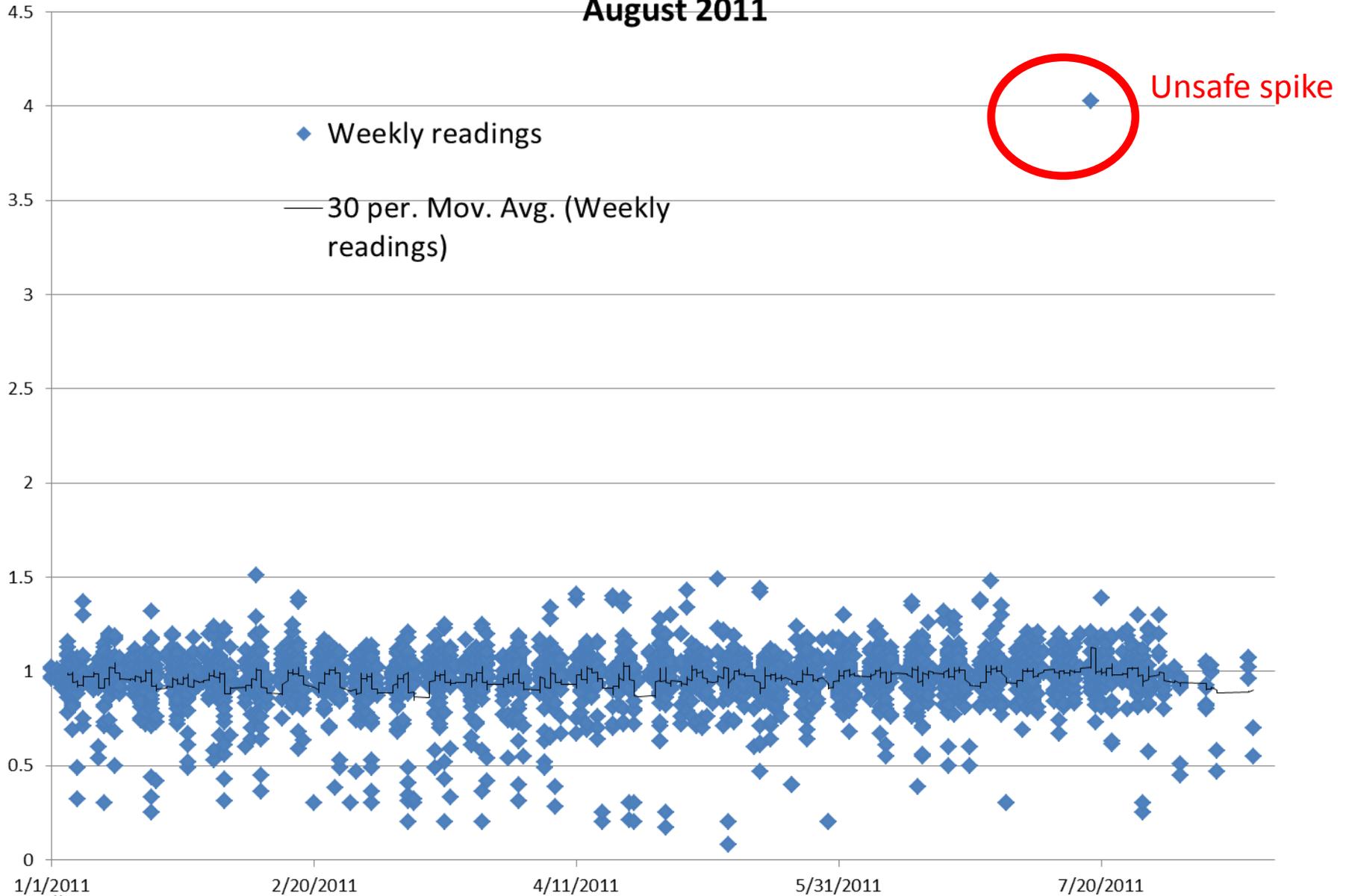
# Daily readings by Water Supply Authority, Sydney Australia, Jan-August 2011, one water reading site, AB01999



# Daily readings for non-Water Supply Authority, Sydney Australia, Jan-August 2011



# Weekly readings for Water Supply Authority, Sydney Australia, Jan-August 2011



# Conjectures #15-16

- Acute Effects of Fluoride (AEF) will increase in frequency during or after periods of elevated F
- Appointment lags, or levels lasting more than one day of moderately high F may mean that there is a lag of 1-3 months before AEF.

# Conjectures #17, 18

- Random spikes in water F rates should be associated with increased rates of diagnosis for AEF.
- Periods where F is turned off should have fewer people complaining about AEF than otherwise.

# Fact #9

Some people consume a lot more water (W) than the average.

- Athletes, joggers, bicyclists
- Physical laborers, particularly if outdoors
- People working or living in high temperature settings
- People with impaired renal function (kidney disorders)
- People on dialysis (many liters of blood are processed and cleaned weekly)
- People with certain metabolic disorders
- People on antidiuretics or certain other medicines

# Conjecture #9

- Weather temperature interacted with F should show increase in AEF.
- Injuries related to sports, bicycles, or strenuous labor, signaling a person with high water consumption should be associated with higher rates of AEF (or CEF).
- F levels interacted with certain Metabolic disorders should show higher rates of AEF

# Fact #10

Some people are more at risk of F effects than others.

- Grimbergen (1974) study of 60 **hypersensitive** patients receiving 1.0 mg/L F in a double-blind test in Haarlem Netherlands.
  - 50% of these subjects had stomach and intestinal symptoms; 30% had stomatitis.
  - Symptoms started and ended each time they were (randomly) assigned to fluoridated water.
- BU visitor with adult acne

# Children, mentally and physically impaired and people with dementia are at greater risk

- Children are more sensitive to F than adults
  - Tighter standards used for children age <2, including use of unfluoridated toothpaste
- People with mental or physical disabilities may not spit out F when brushing teeth.
- People with dementia may swallow too much toothpaste.

# Fact #11

There are many other sources of F besides artificially fluoridated water and toothpaste

- Food levels of F have been increasing
- Many of the best-selling drugs contain F
- Pesticides use F compounds, and are used to process grains, cocoa, and other seeds
- Commercial fertilizers contain F
- Seawater contains 1 ppm of F

# Maximum Recorded Fluoride Content (PPM), USDA National Fluoride Database of Selected Beverages and Foods, Release 2 (2005)

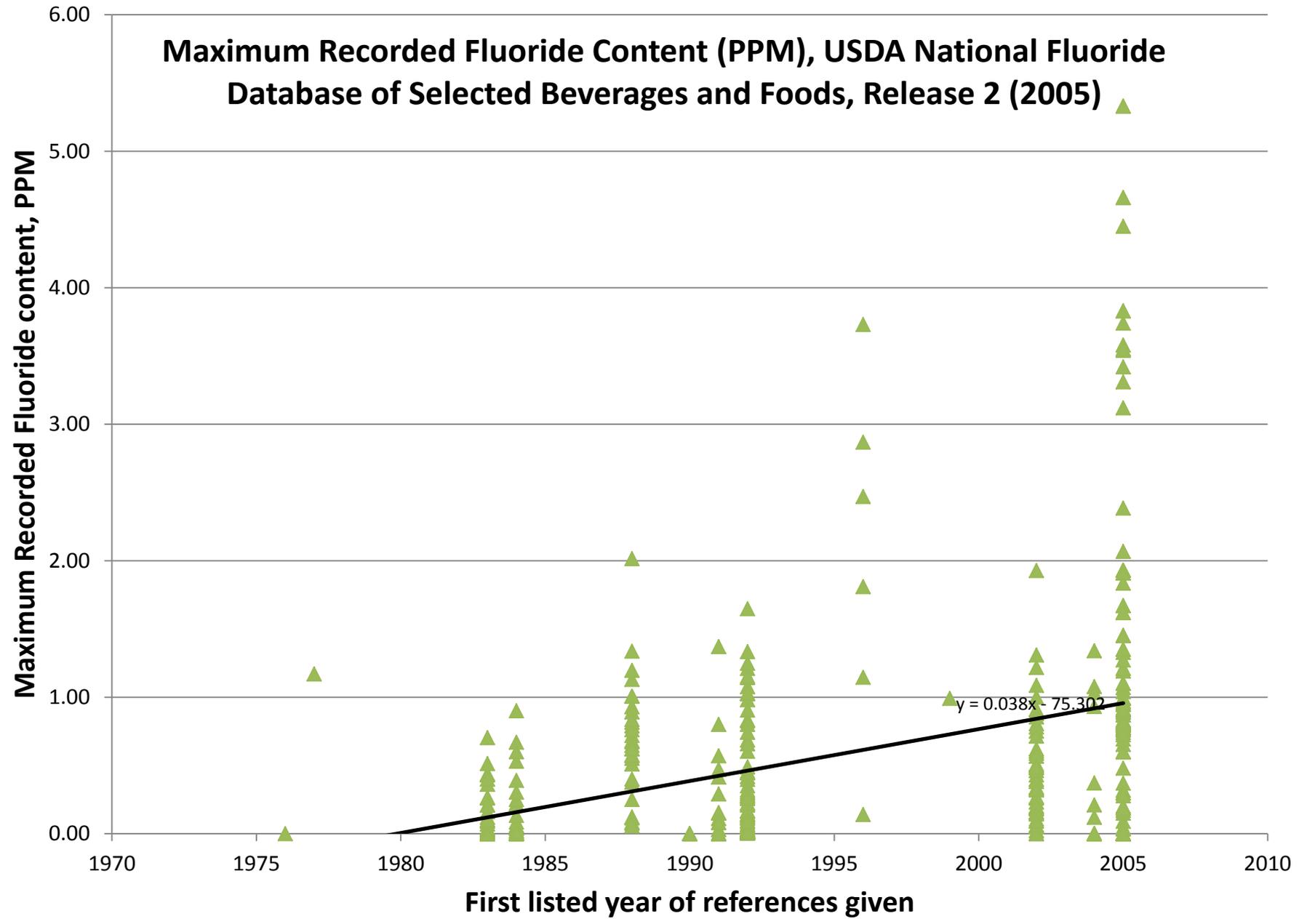


Table XXX Fluoride levels of selected US foods, various studies 1983-2005						
Item	Mean Fluoride, ppm	Number of datapoints	Min Fluoride, ppm	Max Fluoride, ppm		
Tea, black, brewed, regular, all	3.73	63	2.57	5.33		
Tea, black, brewed, microwave, all	3.22	36	2.60	3.83		
Juice, grape, white	2.13	12	1.39	2.87		
Alcoholic beverage, wine, white	2.02	17	0.15	2.39		
Shrimp, fried	1.66	9				
Fish sticks, baked	1.34	9				
Tea, iced, ARIZONA, ready-to-drink	1.23	21	0.84	1.91		
French fries, McDONALD'S	1.15	2	0.38	1.93		
Tea, green, brewed	1.15	23	0.34	2.47		
Cream substitute, powdered	1.12	9				
Juice blend (apple and grape), JUICY JUICE grape, ready-to-drink	1.07	27	0.53	1.84		
Potato chip, baked	1.06	4	0.60	1.31		
Carbonated, water, fruit-flavored	1.05	8	0.89	1.21		
Alcoholic beverage, wine, red	1.05	14	0.86	1.19		
Waters, tap, Mid-West, all (includes municipal and well)	0.88	68	0.04	1.67		
Waters, tap, South, all (includes municipal and well)	0.76	100	0.01	1.91		
Waters, tap, Northeast, all (includes municipal and well)	0.69	56	0.02	1.93		
Waters, tap, West, all (includes municipal and well)	0.47	64	0.03	1.35		
USDA National Fluoride Database of Selected Beverages and Foods, Release 2						
U.S. Department of Agriculture, December 2005.						
<a href="http://www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/Fluoride/F02.pdf">http://www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/Fluoride/F02.pdf</a>						
Downloaded on December 15, 2009						

# 55 Fluoride-containing drugs in 2012

Fluoride Ion

Sodium Fluoride

Stannous Fluoride

Fluoxymesterone

Enflurane

Isoflurane

Methoxyflurane

Flurazepam HCl

Triflupromazine HCl

Fluphenazine

Decanoate

Fluphenazine Enanthate

Fluphenazine HCl

Trifluoperazine HCl

Fluoxetine HCl

Diflunisal

Fenfluramine HCl

Flurandrenolide

Fluocinolone Acetonide

Fluorometholone

Flunisolide

Ellis

Bendroflumethiazide

Flurbiprofen

Trichloromonofluoromethane

Dichlorodifluoromethane

Dichlorotetrafluoroethane

Fluorouracil

Flutamide

Flucytosine

Trifluridine

Fluconazole

Fluticasone Propionate

Fludarabine Phosphate

Flumazenil

Fluvoxamine Maleate

Fluorometholone Acetate

Hydrogen Fluoride

Flurbiprofen Sodium

Desflurane

Dexfenfluramine HCl

Na M-Fluorophosphate

Difluprednate

Corticoreslin Ovine Triflutate

Leflunomide

Perflutren Protein-A

Microspher

Norflurane

Perflutren Lipid Microspheres

Fluocinolone Acetonide Oil

Fluvastatin Sodium

Fluoxetine

Fludrocortisone Acetate

Fluorescein Sodium

Hydroflumethiazide

Fluocinonide

# Fluoride Poisoning from toothpaste is fairly common in the US, but largely uncommented upon

## **United States**

- In 2009, the American Association of Poison Control Centers reported 24,547 exposures involving toothpaste with fluoride.<sup>[1]</sup>
- Only 378 cases were actually treated in the emergency department. Moderate effects were seen in 42 cases, and major effects were seen in 2 cases. No deaths were reported.<sup>[1]</sup>
- One death from ingestion of fluoride toothpaste was reported to the American Association of Poison Control Centers in 2002.

Downloaded 4/3/2012 from <http://emedicine.medscape.com/article/814774-overview#a0199>

# Fact #12

A woman's breast milk has nearly zero fluoride even when her diet contains significant fluoride.

- If F were beneficial, then animals would have evolved to retain and use it to strengthen teeth instead of trying hard to purge it from their system.
- Along with arsenic, lead, and mercury there are no organic chemicals in humans that contain F naturally.

# Conjecture #20, 21

- Babies fed breast milk should have lower rates of AEF than babies using formula that is made with F containing water.
- AEF in infants should become more common after age 9-12 month when most switch to other drink and food sources

# Fact #13

The US CDC (Centers for Disease Control) which responsible for setting standards and providing public information about F has instead been promoting F and intentionally providing deceptive information, i.e., it has been lying to the public.

- Distorting statistics to increase the apparent fraction of the population that uses F
- Gradually providing less and less information about levels and forms of F in our drinking water
- Concealing statistics about F in specific states to make it difficult for researchers to study the effects of F.

# Sample monthly operational Report from the CDC

Downloaded on March 30, 2012 from

[http://apps.nccd.cdc.gov/MWF/Reports/report\\_html\\_410.asp](http://apps.nccd.cdc.gov/MWF/Reports/report_html_410.asp)

Note that the population of MA is only 6.5 million!

## State Of Massachusetts

Reading Date: January, 2011

			% of Fluoridated		% of Total	
	Systems	Population	Systems	Population	Systems	Population
<b>All Water Systems</b>	510	10,854,377	—	—	100.00%	100.00%
<b>Fluoridated</b>						
Adjusted:	83	6,136,358	53.5%	75.4%	16.3%	56.5%
Natural:	5	905	3.2%	0%	1%	0%
Defluoridated:	0	0	0%	0%	0%	0%
Consecutive:	67	1,998,473	43.2%	24.6%	13.1%	18.4%
<b>Total:</b>	<b>155</b>	<b>8,135,736</b>	<b>99.9%</b>	<b>100%</b>	<b>30.4%</b>	<b>74.9%</b>
<b>Non-Fluoridated</b>						
Non-Adjusted:	304	2,166,988	—	—	59.6%	20%
Variable/Other:	0	0	—	—	0%	0%
Defluoridated:	0	0	—	—	0%	0%
Consecutive:	51	551,653	—	—	10%	5.1%
<b>Total:</b>	<b>355</b>	<b>2,718,641</b>	<b>—</b>	<b>—</b>	<b>69.6%</b>	<b>25.1%</b>

# CDC data systematically exaggerate the number of people with fluoridation

MA-4350000	WRENTHAM WATER DIVISION	Norfolk	9332	9332	9332	9332	9332
MA-4350001	WRENTHAM STATE SCHOOL	Norfolk	1475	1475	1475	1475	1475
MA-4350003	MOUNT ST MARY'S ABBEY	Norfolk	60	60	60	60	60
MA-4351000	YARMOUTH WATER DEPARTMENT	Barnstable	21277	21277	21277	21277	21277
MA-6000000	MWRA (FLUORIDATED)	Suffolk	2360000	2360000	2360000	2360000	1
MA-6000001	MWRA-NON-FLUORIDATED	Suffolk	200000	200000	200000	200000	200000

CDC corrected overstatement of MA in the 2015 report. Causing a 10% drop in apparent rates. Water system population still exceeds census levels

Sum of populations shown	9,310,130	9,317,072	9,317,072	9,317,072	6,962,282
	2011	2012	2013	2014	2015
Fluoridated water systems from the	6,562,236	6,562,236	6,562,236	6,562,236	4,203,927
Non-fluoridated water systems	2,747,894	2,754,836	2,754,836	2,754,836	2,758,355
Official Population of Massachusetts	6.745 million (2014)				
Sum of populations in MWRA individual water systems				1,784,847	1,785,128
Population claimed by MWRA fluoridated water system	2,360,000	2,360,000	2,360,000	2,360,000	1
	2011	2012	2013	2014	2015
CDC calculated % of population with fluoridation	70.5%	70.4%	70.4%	70.4%	60.4%

# State Fluoridation Percentage Calculations and States Ranked by Fluoridation Percentage

State	Persons receiving fluoridated water	Persons served by CWS	%	Rank
United States	Footnote f . Population served by CWS exceeded the US Census state population estimate; number of people was reduced by the ratio of the population estimate to the CWS population estimate.			
Alabama <sup>f</sup>	On 26 states!			
Alaska	On 26 states!			
Arizona <sup>f</sup>	3,199,068	5,536,324	57.8%	38
Arkansas	1,986,099	2,809,741	70.7%	31
California <sup>f</sup>	24,699,693	38,802,500	63.7%	35
Colorado	3,963,053	5,355,866	74.0%	28
Connecticut <sup>f</sup>	2,409,333	2,691,768	89.5%	14

## States Participating in My Water's Fluoride website, according to the CDC

**Note:** MWF is a voluntary public disclosure web site.

States choose whether they will provide their water fluoridation information to MWF.

Some states choose to use other ways to notify the public about their water fluoridation program, such as a state web site. **Currently, the states listed above provide their information to this system**

### State/Territory

Alabama

Kentucky

Oklahoma

Alaska

Louisiana

Oregon

Arizona

Maine

Pennsylvania

Arkansas

Massachusetts

Rhode Island

Colorado

Michigan

South Carolina

Connecticut

Minnesota

Tennessee

Delaware

Mississippi

Texas

Florida

Missouri

Utah

Georgia

Nebraska

Vermont

Idaho

Nevada

Virginia

Illinois

New Hampshire

West Virginia

Indiana

New York

Wisconsin

Iowa

North Carolina

Kansas

North Dakota

All of the allegedly nonparticipating states actually have data for individual water systems. It is just hidden from consumers.

### **Non-participating States and Territories**

- California
- Hawaii
- Maryland
- Montana
- New Jersey
- New Mexico
- Ohio
- South Dakota
- Washington
- Wyoming

# CDC claims F information is only available for selected states, but it is present for all states on the CDC web site.

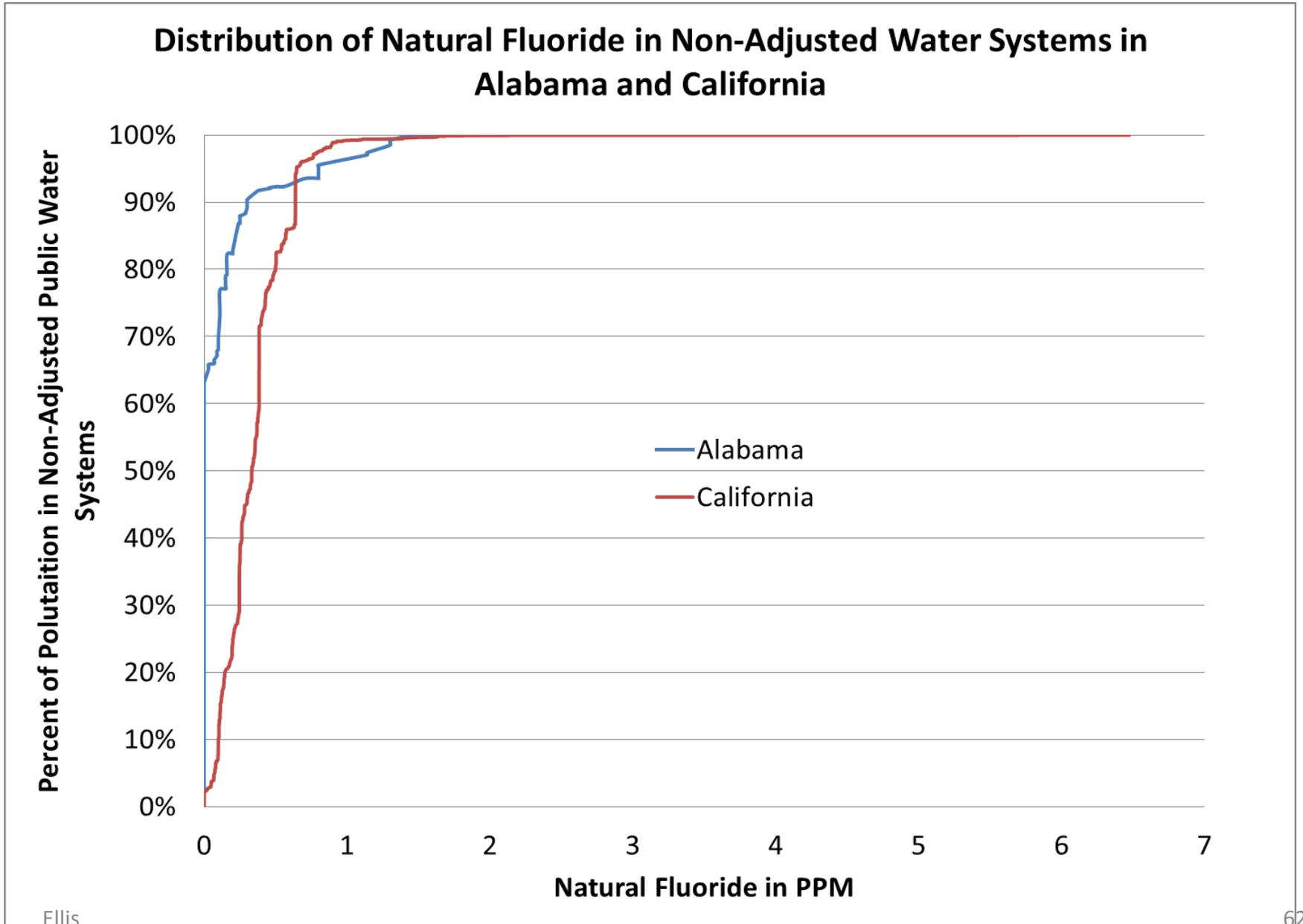
Compare:

- [https://nccd.cdc.gov/DOH\\_MWF/Default/Default.aspx](https://nccd.cdc.gov/DOH_MWF/Default/Default.aspx)

Try these links

- [https://nccd.cdc.gov/DOH\\_MWF/Default/CountyList.aspx?state=California&stateid=7&stateabbr=CA&reportLevel=2](https://nccd.cdc.gov/DOH_MWF/Default/CountyList.aspx?state=California&stateid=7&stateabbr=CA&reportLevel=2)
- [https://nccd.cdc.gov/DOH\\_MWF/Default/CountyList.aspx?state=Hawaii&stateid=15&stateabbr=HI&reportLevel=2](https://nccd.cdc.gov/DOH_MWF/Default/CountyList.aspx?state=Hawaii&stateid=15&stateabbr=HI&reportLevel=2)
- [https://nccd.cdc.gov/DOH\\_MWF/Default/CountyList.aspx?state=Maryland&stateid=24&stateabbr=MD&reportLevel=2](https://nccd.cdc.gov/DOH_MWF/Default/CountyList.aspx?state=Maryland&stateid=24&stateabbr=MD&reportLevel=2)
- [https://nccd.cdc.gov/DOH\\_MWF/Default/CountyList.aspx?state=Montana&stateid=30&stateabbr=MT&reportLevel=2](https://nccd.cdc.gov/DOH_MWF/Default/CountyList.aspx?state=Montana&stateid=30&stateabbr=MT&reportLevel=2)
- ...
- [https://nccd.cdc.gov/DOH\\_MWF/Default/CountyList.aspx?state=Wyoming&stateid=56&stateabbr=WY&reportLevel=2](https://nccd.cdc.gov/DOH_MWF/Default/CountyList.aspx?state=Wyoming&stateid=56&stateabbr=WY&reportLevel=2)

Some nonparticipating states have much higher levels of natural F than participating states.



# Summary of 10 Facts

1. Recently tightened drinking water standard
2. Previous standard was archaic
3. Most of the rest of the world bans use of F
4. Mostly F is untriated silicofluorides
5. Most large studies were focused on bones and cancer
6. Acute toxic effects well understood
7. Fluorine is a solid, hence easily concentrated
8. Variation in F rates around target level
9. Variations in consumption of F water
10. Variations in sensitivity to F
11. Many F sources besides drinking water
12. Breast milk contains no F
13. CDC is lying to us