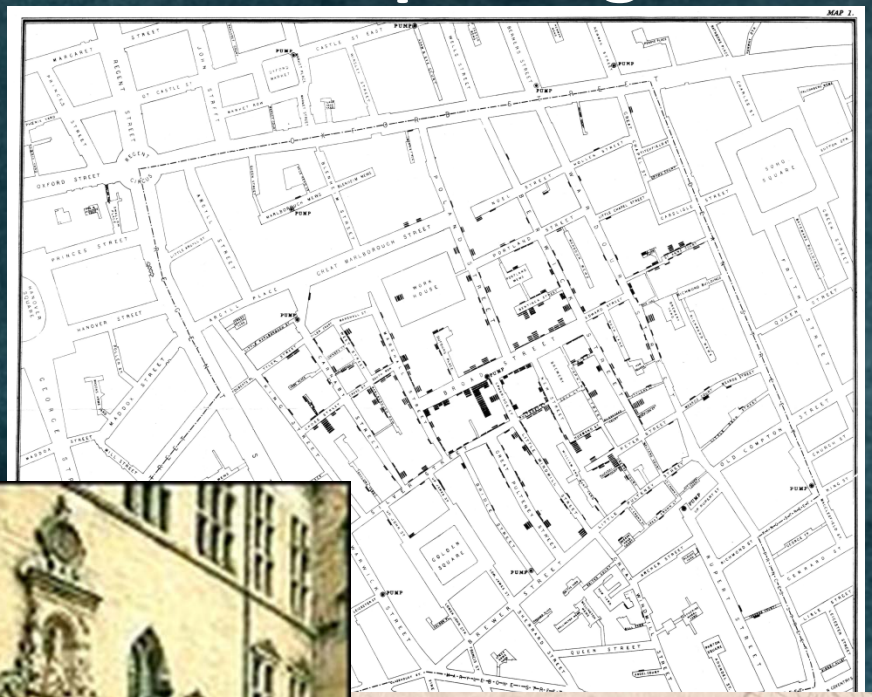
We can find anything ANYWHERE at any level. *What does it mean???*

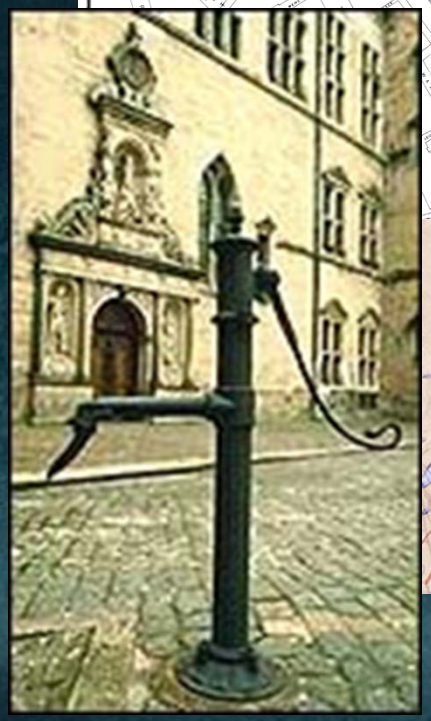
Water Quality Monitoring and Regulations: Is my water safe to drink?

Theresa Slifko, Ph.D.
Water Quality Manager: Chemistry
Metropolitan Water District of Southern California

Presented for the Los Angeles Chapter of the WateReuse Association Quarterly Meeting, Dec. 6, 2016

Early recognition of waterborne pathogens



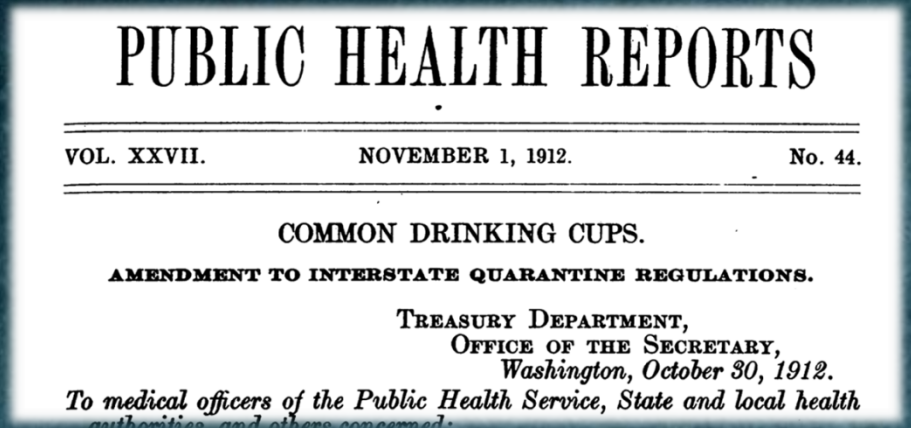


"Monster Soup commonly called Thames Water": Colored engraving by William Heath (1828), published by T. McLean. In the nineteenth century, sewage and waste contaminated the River Thames in London, making it a prime source of waterborne diseases such as cholera and typhoid.
Photo credit: www.wikigallery.org

Broad Street Pump: In Soho, London during a cholera outbreak in 1854, Dr. John Snow traced the illness source to a popular well on Broad Street. He removed the pump handle and the outbreak ceased.
Photo credit: www.ph.ucla.edu; www.theguardian.com

Celebrating >100 Years

Since The First Drinking Water Regulation



PUBLIC HEALTH REPORTS

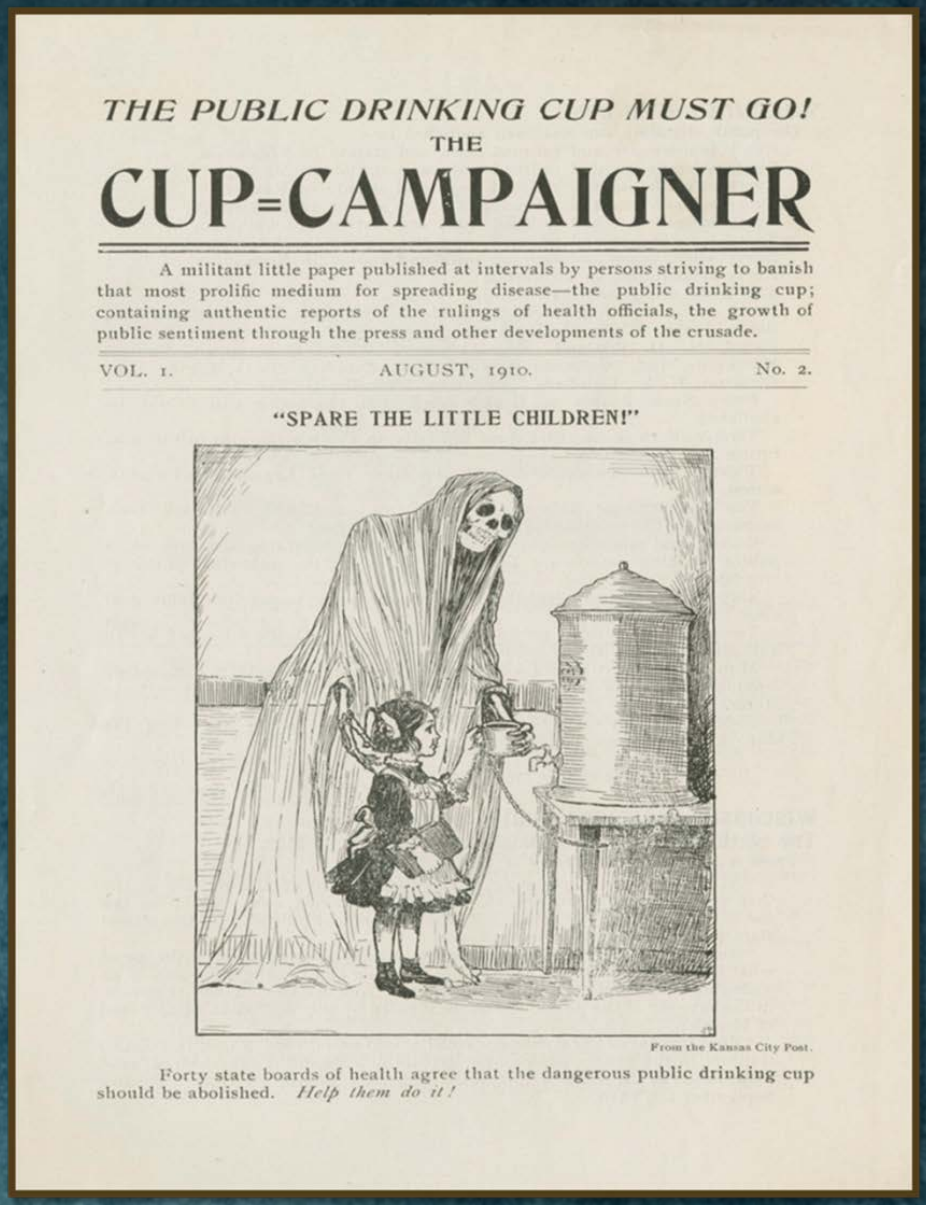
VOL. XXVII. NOVEMBER 1, 1912. No. 44.

COMMON DRINKING CUPS.

AMENDMENT TO INTERSTATE QUARANTINE REGULATIONS.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
Washington, October 30, 1912.

To medical officers of the Public Health Service, State and local health



THE PUBLIC DRINKING CUP MUST GO!

THE

CUP=CAMPAIGNER

A militant little paper published at intervals by persons striving to banish that most prolific medium for spreading disease—the public drinking cup; containing authentic reports of the rulings of health officials, the growth of public sentiment through the press and other developments of the crusade.

VOL. 1. AUGUST, 1910. No. 2.

"SPARE THE LITTLE CHILDREN!"

From the Kansas City Post.

Forty state boards of health agree that the dangerous public drinking cup should be abolished. *Help them do it!*

Image credit: Courtesy of Hugh Moore Dixie Cup Company Collection, Special Collections & College Archives, Skillman Library, Lafayette College

FIGURE 1. Crude death rate* for infectious diseases — United States, 1900–1996†

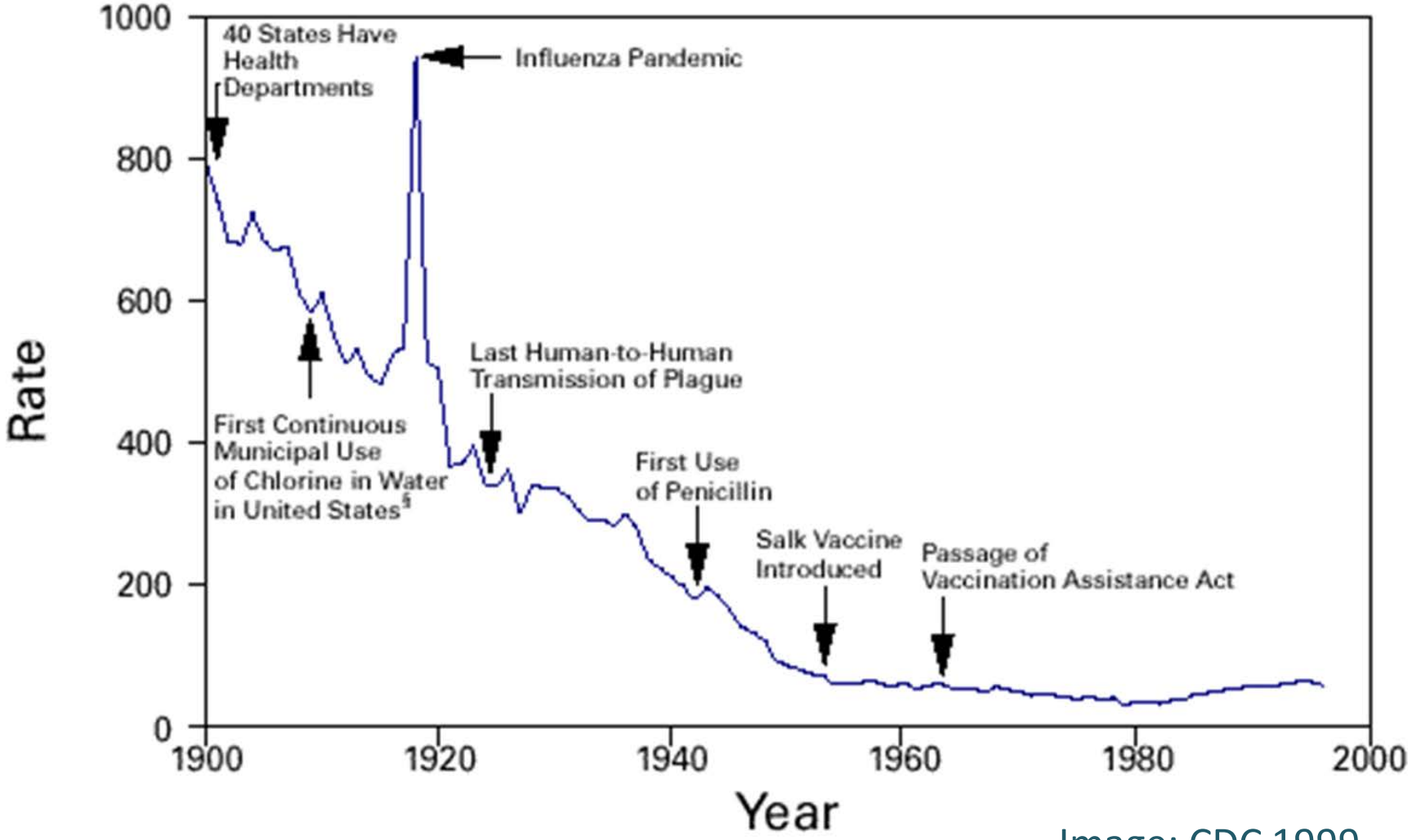


Image: CDC 1999

*Per 100,000 population per year.

†Adapted from Armstrong GL, Conn LA, Pinner RW. Trends in infectious disease mortality in the United States during the 20th century. JAMA 1999:281;61–6.

§American Water Works Association. Water chlorination principles and practices: AWWA manual M20. Denver, Colorado: American Water Works Association, 1973.

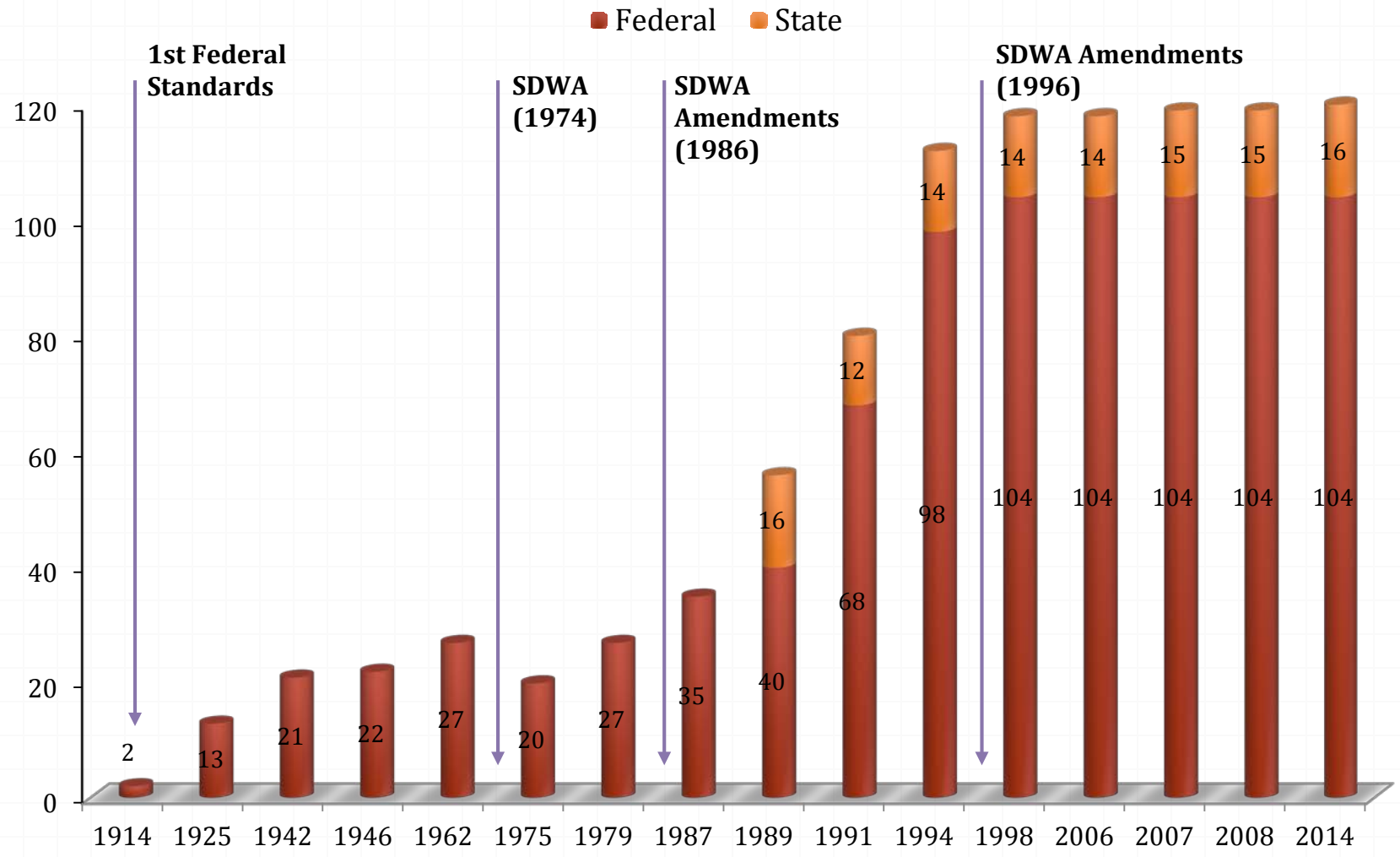
..and 42 Years

Of the Safe Drinking Water Act (SDWA)

1974 to 2016

Photo credit: Eugene Zimmerman. 1919. http://oldadstore.ecrater.com

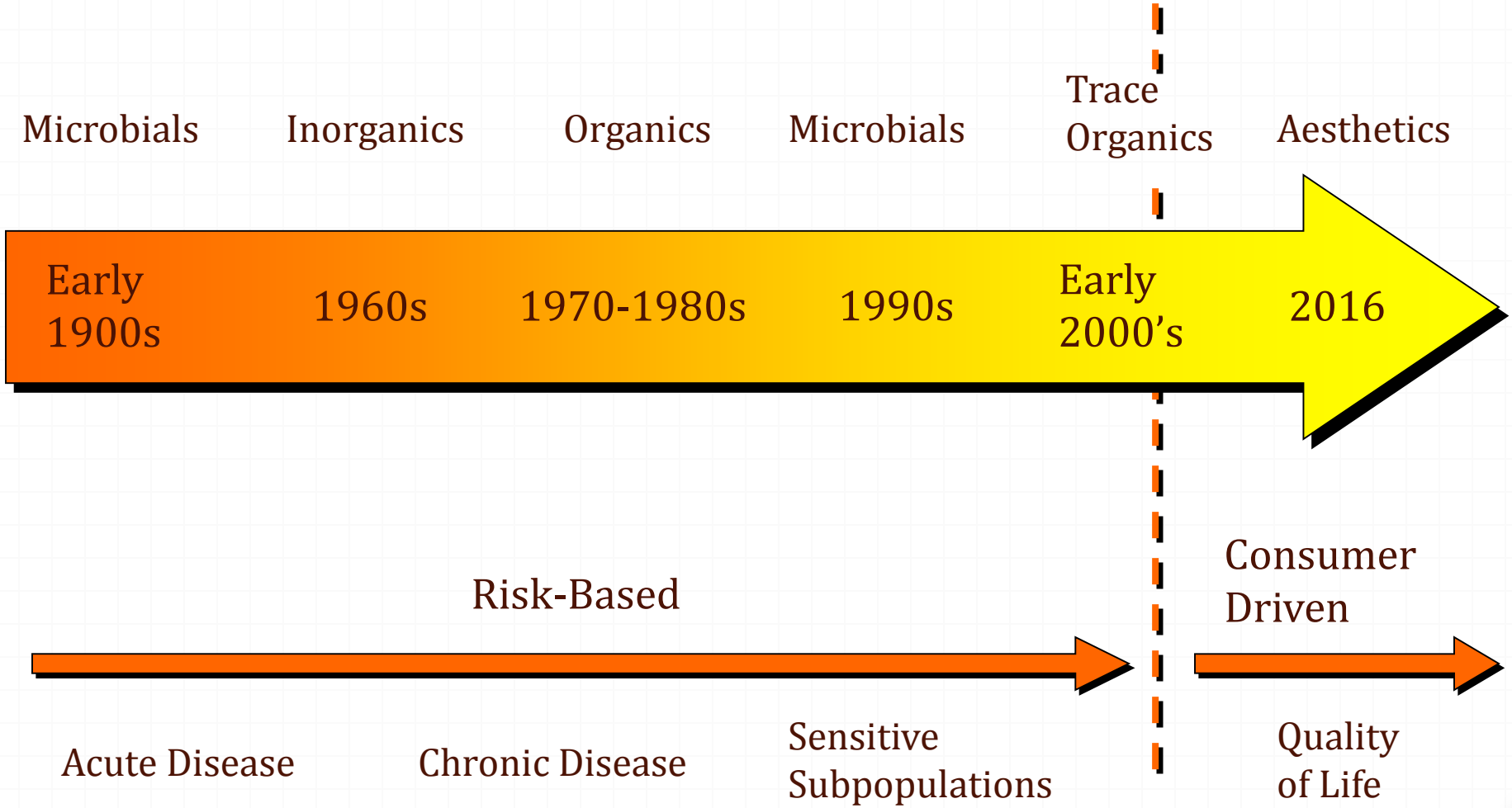
Timeline of Regulated Contaminants (1914 to 2016)



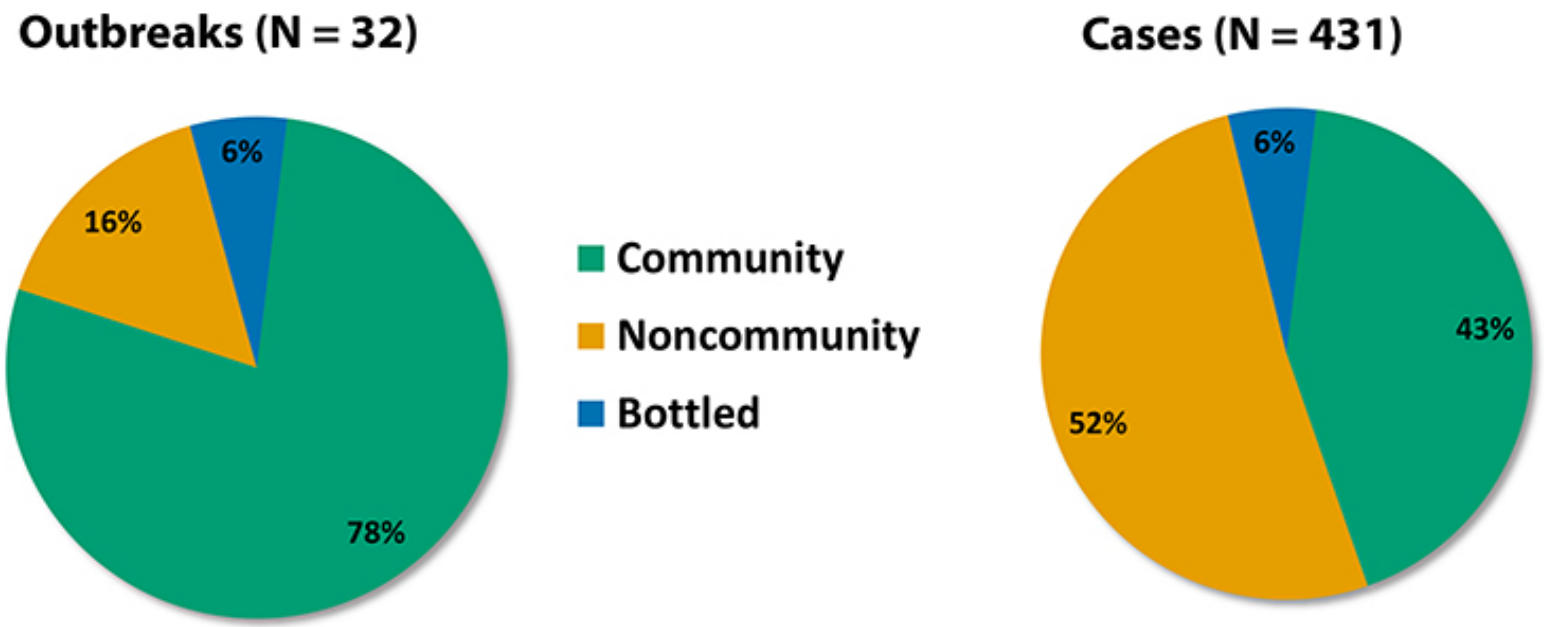
There are 97 chemicals or chemical groups and 12 microbial contaminants under consideration for future regulation under CCL-4

From Health Driven to Consumer Driven

Historical Water Quality Emphasis

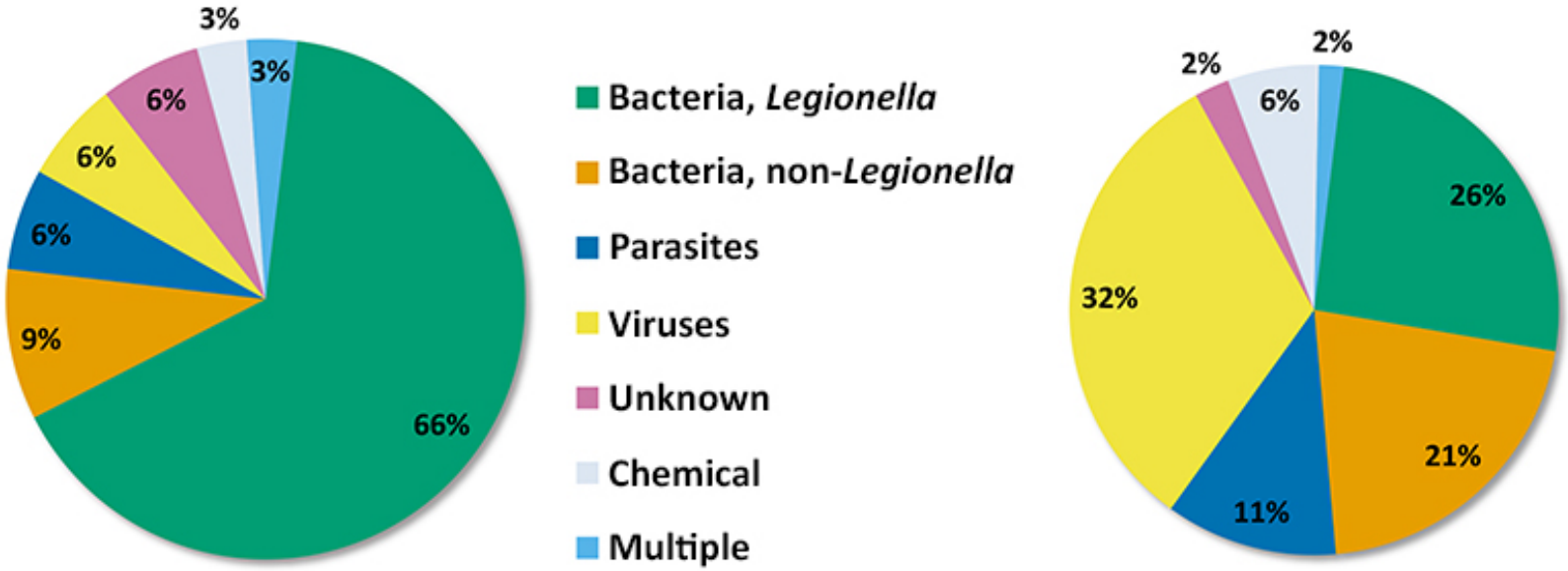


Water Systems Associated with Drinking Water Outbreaks* and Outbreak-related Cases†, Waterborne Disease and Outbreak Surveillance System, 2011–2012



*N=32
†N=431

Etiology of Drinking Water Outbreaks* and Outbreak-related Cases†, Waterborne Disease and Outbreak Surveillance System, 2011–2012



*N=32
†N=431

Projected Number of Synthesized Chemicals by 2050

6 billion chemicals!

Chemicals Registered (millions)

7,000
6,000
5,000
4,000
3,000
2,000
1,000
0

1960 1970 1980 1990 2000 2010 2020 2030 2040 2050 2060

Year

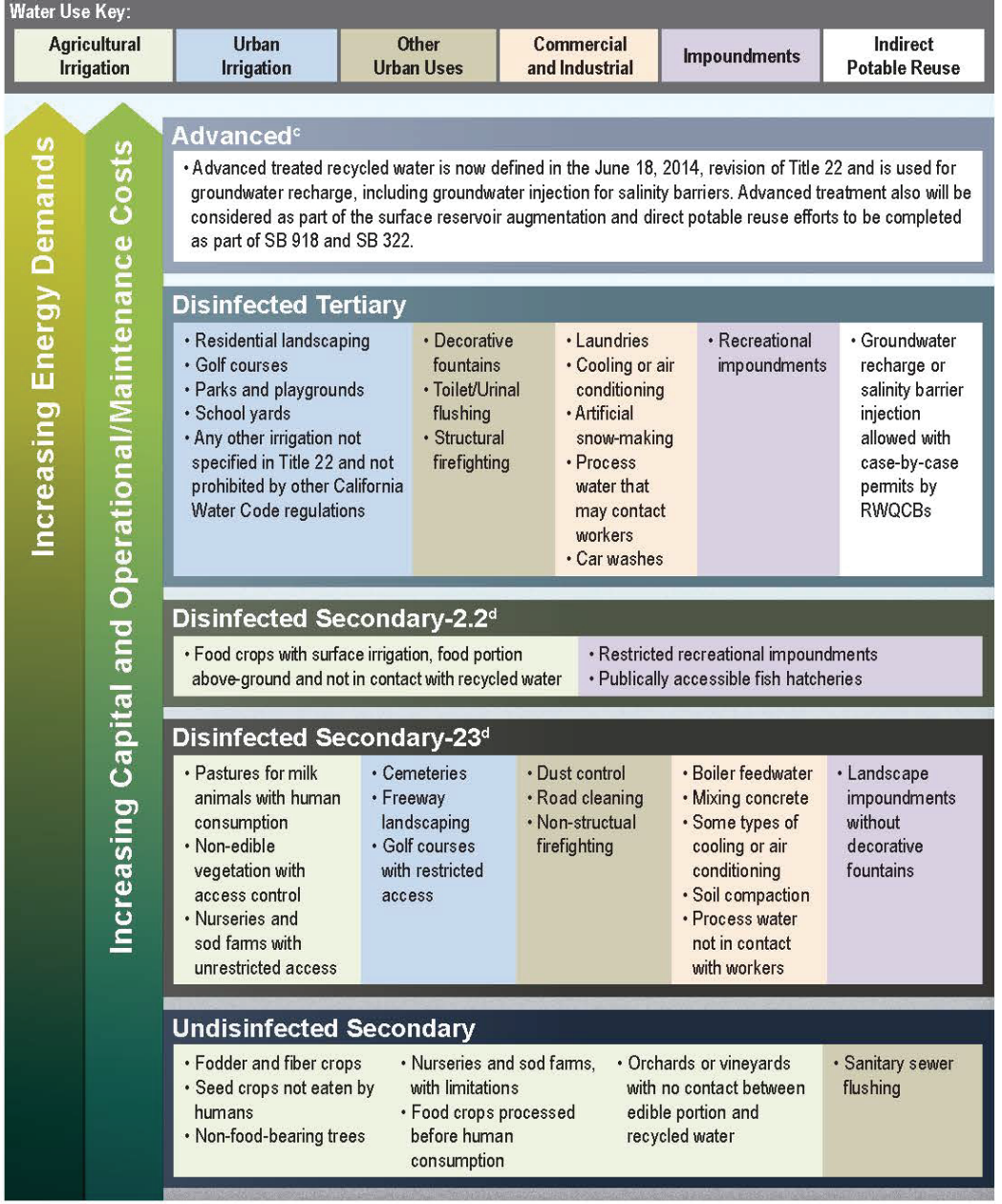
Original slide by Dr. Mic Stewart (MWD).

Drinking water community must protect public health

We can find anything ANYWHERE at any level.

What does it mean???

Title 22 Water Uses and Treatment Issues



a: Based on California Code of Regulations Title 22, Section 60001 et seq.

b: Uses for increasing levels of treatment also include all uses for lower treatment levels.

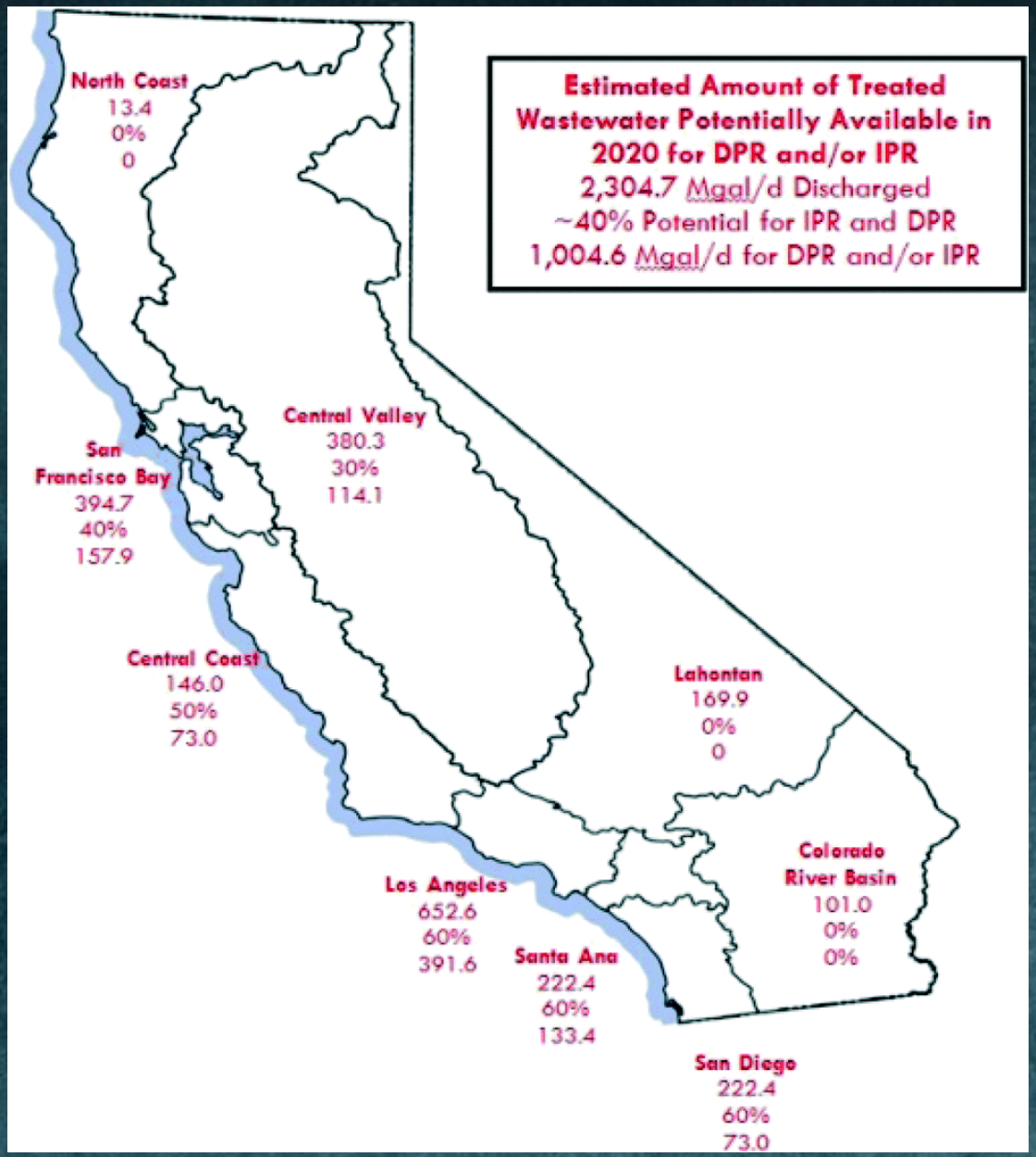
c: Wastewater treated with reverse osmosis and advanced oxidation processes.

d: Recycled water with a median concentration of total coliform bacteria not exceeding a most probable number of 2.2 or 23 per 100 milliliters (see California Code of Regulations, Title 22).

Source: CaDWR 2016. Municipal Recycled Water: A Resource Management Strategy of the California Water Plan.

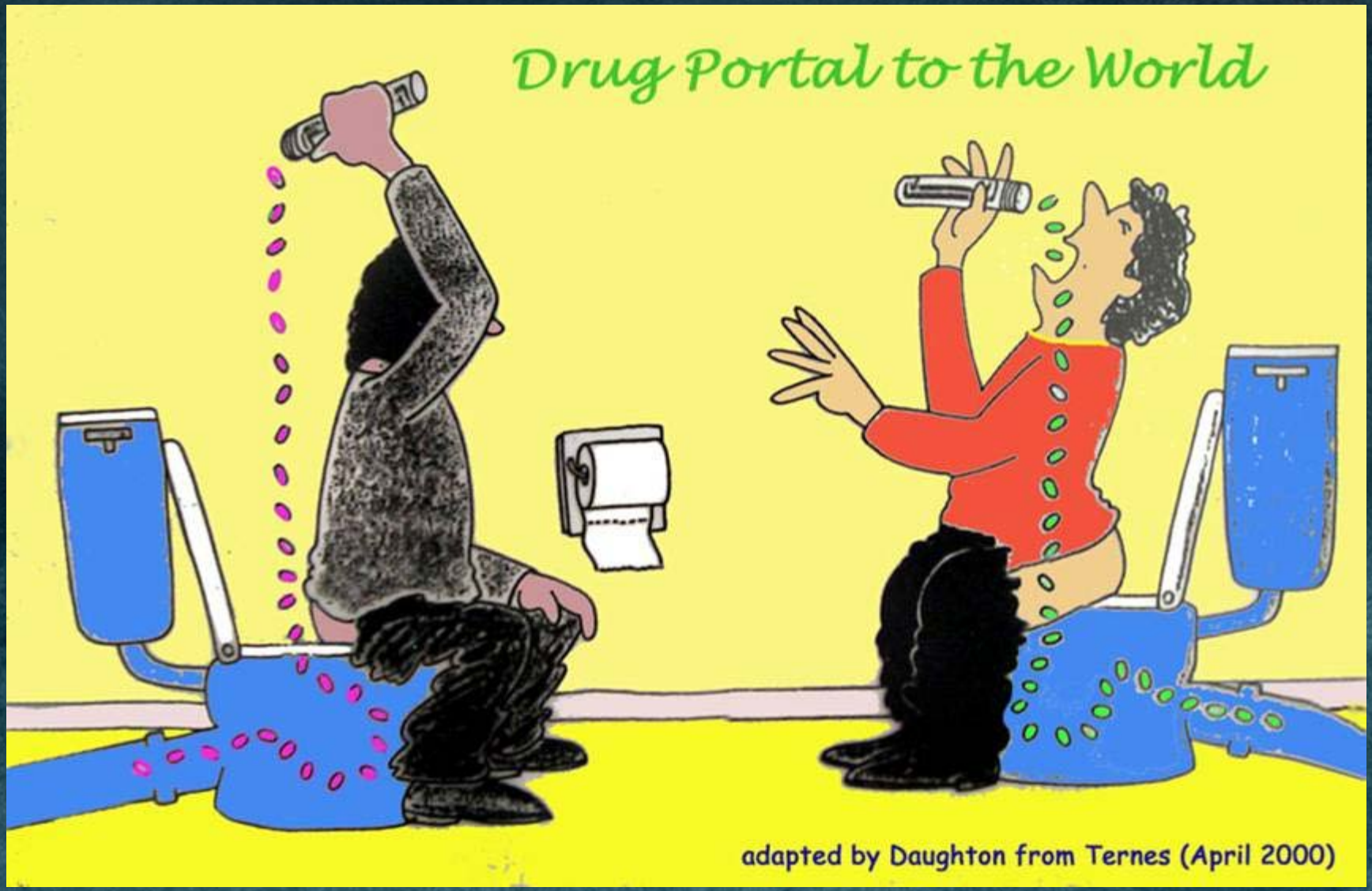
Water Quality Monitoring

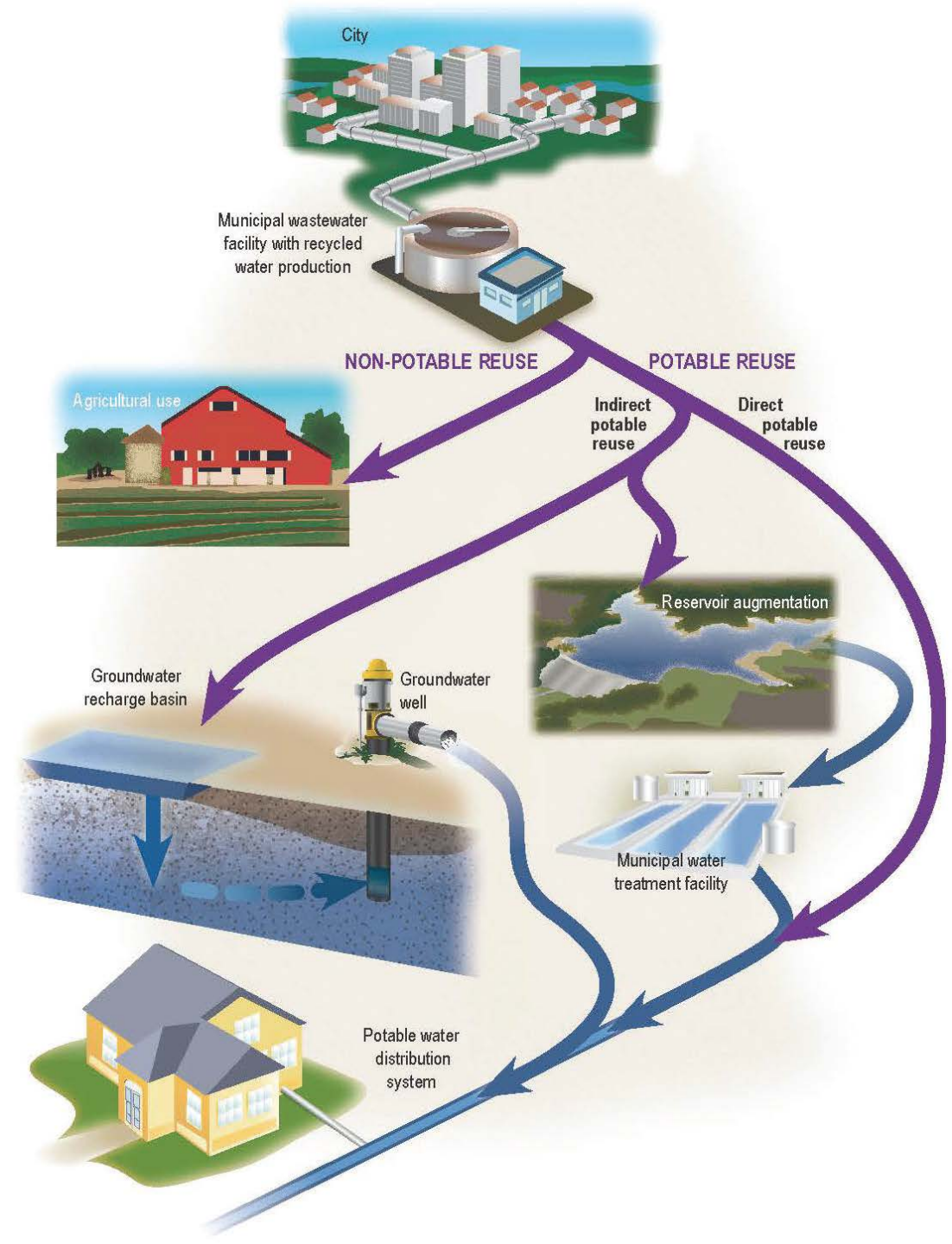
- **Recycled Water**
  - Pathogens (bacteria & viruses)
  - Salinity
  - Nitrogen compounds
  - Permit limits for organic and inorganic substances
  - Monitoring for PCPs, household chemicals and detergents, fertilizers, pesticides, fungicides, hormones, and sometimes other CECs
- **Drinking Water**
  - Source water protection
  - Pathogens (bacteria, viruses, protozoa)
  - Federal MCLs for 90 constituents
    - For health-related organic, inorganic, and radionuclide constituents
  - State MCLs for 13 additional constituents



Estimate >1,000 Mgal/day unrecycled treated municipal wastewater available

Figure source: Burgess et. al. 2015. International research agency perspectives on potable water reuse. *Environ. Sci.: Water Res. & Technol.* 1 (563-580).

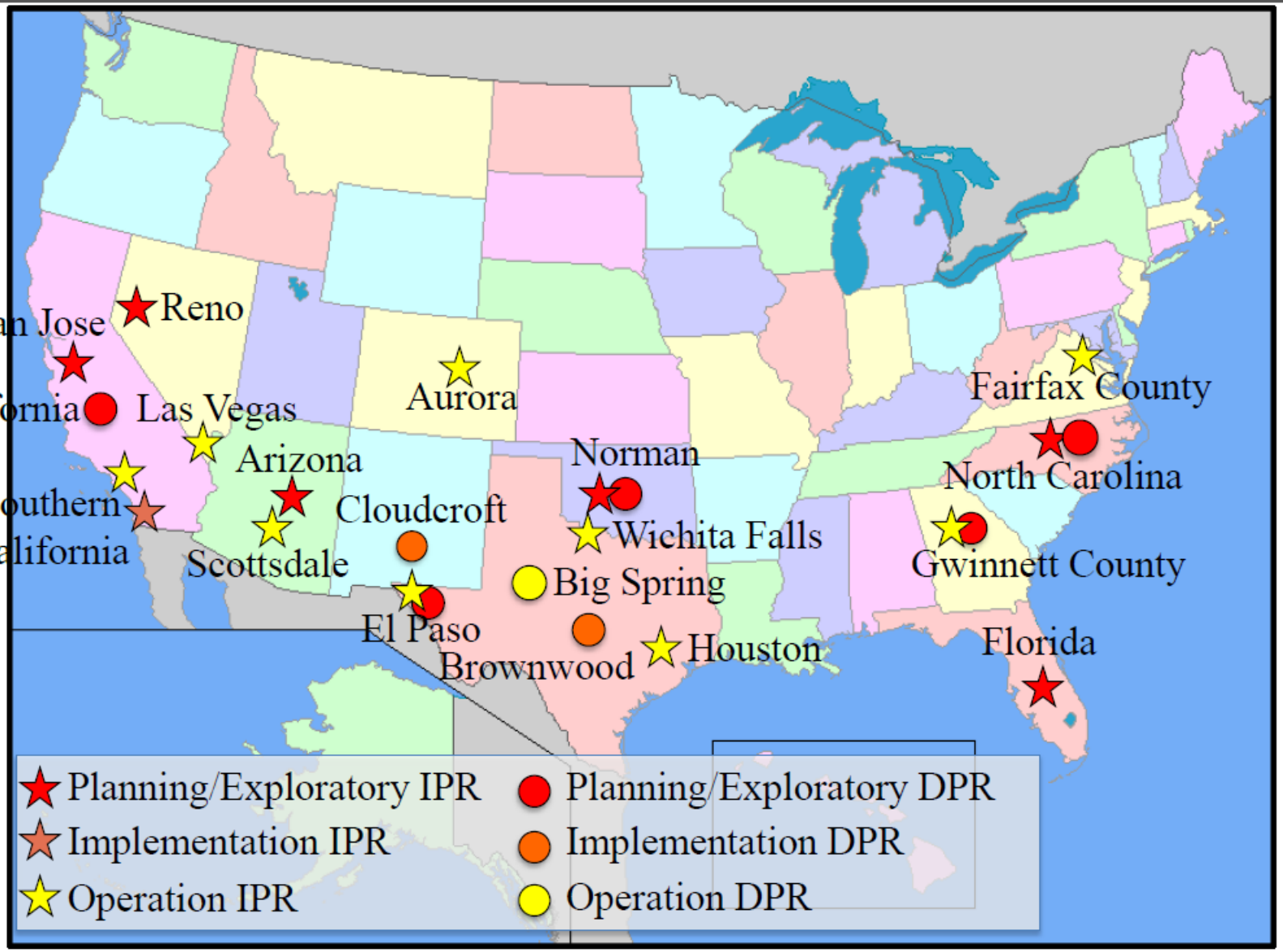

Drug Portal to the World
adapted by Daughton from Ternes (April 2000)



Potable and Non-Potable Municipal Recycled Water

Figure Source: CaDWR 2016. Municipal Recycled Water: A Resource Management Strategy of the California Water Plan.

Potable Reuse Systems in the U.S.



National Water Reuse Institute (NWRI), WateReuse Association, and WE&RF critical for the success of these projects

Slide source: Gerrity, Daniel. 2015. Early Career Award Presentation: Framework for Quantifying Microbial Risk and Sustainability of Potable Reuse Systems in the United States. UNLB

Rigorous Water Quality Monitoring Program

Revised August 11, 2016

changes to schedule are printed in reverse text

Bold are regulatory required samples; others are for process monitoring

	Q-1	MFF	MFE-	MFC	ROF	ROP-	ROC	UVF	UVP-	DPW	FPW	OC-44
EC	2WG/MC		**QG**		2WG	2WG			WG		**DG**	MG
TDS	WC				WG	WG	WG		WG		**WG**	MG
pH	2WG	2WG/**COL**	2WG		2WG	2WG	MG		2WG		2WG/**COL**	MG
Na	MC				MG	MG	MG		MG		**MG**	MG
K/Mg	MC				MG	MG	MG		MG		MG	MG
Ca	MC				MG	MG	MG		MG		WG	MG
Ca Hardness										2WG	WG	MG
Fe	MC				MG	MG	MG		MG		**AG**/QG	QG
Mn	MC				MG	MG	MG		MG		**AG**/QG[3]	MG[3]
Trace Elements[1]	MC				MG	MG	MG		MG		**QG**	QG[1]
Priority Pollutants[2]											**QG**	QG
NH_3-N / Org-N / TKN	WG				WG	WG				WG	**2WG**	MG
Total Alkalinity	MC				MG	MG			MG	2WG	WG	MG
OH/CO_3/HCO_3					MG	MG			MG	2WG	MG	MG
TH	MC				MG	MG	MG		MG		**MG**	MG
F	MC										**QG**	QG
Cl	MC				MG	MG		MG	MG		**MG**	MG
Br											MG	MG
NO_3-N	2WG				WG	WC			WC		**2WG/MG**	**MG**
NO_2-N	2WG				WG	WC			WC		**2WG/MG**	**MG**
NO_3+NO_2-N	2WG				WG	HWC			WG		**2WG**	**MG**
Total Nitrogen											**2WG**	MG
PO_4-P (ortho)	WC						WG				QG	QG
SO_4	MC				MG	MG	MG		MG		**MG**	MG
B	MC				WG	WG			MC		**QG**	MG
SiO_2	MC				MG	MG	MG		MG		QG	QG
BOD*	**QC**											
Inorganic DBPs											**QG**	QG
TOC	DC/WG	WG			DG	DG					DC/**WC**	MG
UV%T-254			MG			**DC**						QG
MBAS	MC				MC	MC					**AG**/QG	QG
Suspended Solids	DC/**QC**	WG	WG	WG								
Color	MC				MC	MC					**AG**/QG	MG
CN	MG				MG	MG					**QG**	QG
Residual Cl_2		2WG	2WG		2WG	2WG					QG	QG
Total Coliforms	2WG	2WG	2WG			2WG			2WG		**DG**	QG
E. coli	2WG	2WG	2WG			2WG			2WG		DG	QG
Turbidity	2WG	COL	2WG			**COL**			COL		**COL**	QG
Radioactivity											**QG**	QG
ClO_4											**QG**	QG
1,4-Dioxane/NDMA	WG					WG		WG	WG	WG	WG/**QG**	MG
Asbestos*											**QG**	QG
Oil and Grease*											**QG**	QG
Threshold Odor											**AG**/QG	QG
Corrosivity											**AG**/WG	**QG**
H_2O_2								WG	WG		WG	QG

[1] - Includes Ag,Al,As,Ba,Be,Cd,Co,Cr,Cr^{+6},Cu,Hg,Ni,Pb,Sb,Se,Tl,V,Zn

[2] - Includes Ag,As,Be,Cd,Cr^{+3},Cr^{+6},Cu,Hg,Ni,Pb,Sb,Se,Tl,Zn, and parameters in Tables I and II of the GWRS permit

[3] - Mn, Mn-DIS

* - Analysis outsourced

A = "Annual" tests--currently analyzed quarterly

C = Composite Sample

COL = Continuous On-Line measurement

D = Daily (7-day/wk.)

G = Grab Sample

HWC = Acid-preserved Composite, collected Wed.

M = Monthly (representative Wed.)

Q = Quarterly (representative Wed. of Jan., Apr., Jul., Oct.)

WG = Weekly Grab (Wed.); 1,4-Dioxane & NDMA are Fri.

WC = Weekly Composite (day of week rotates)

2WG = Twice/week grab collected on Mon. & Wed., except FPW is Mon. & Thu.

C:\Users\lr\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\PYZ

Critical for Success

- Change in mindset;
- Communication, transparency, education, and engaged public and water community;
- Operator training and certification;
- Rigorous water quality and operational monitoring and reporting;
- Remain vigilant.

Then, Now & Tomorrow

Drugs dropped off for proper disposal as part of the LA Sheriff's Department Safe Drug Drop Off program.

Photo credit: Terri Slifko

PFOA & PFOS

"Unknown unknowns"

CONSTITUENTS of EMERGING CONCERN

Cyanotoxins

1,2,3 TCP

Arsenic

Cr^{6+}

Lead

Nitrosamines

HOW SAFE IS SAFE?

Water, thou hast no taste, no color, no odor; canst not be defined, art relished while ever mysterious. Not necessary to life, but rather life itself, thou fillest us with a gratification that exceeds the delight of the senses.

(Antoine de Saint-Exupery)

izquotes.com