Water Research Foundation®

Celebrating 50 Years
1966–2016

Cost of Compliance for Safe Drinking Water Act Regulations

NARUC Conference 2017

Beate M. Wright, PE
Executive Director, DC Office
Water Research Foundation

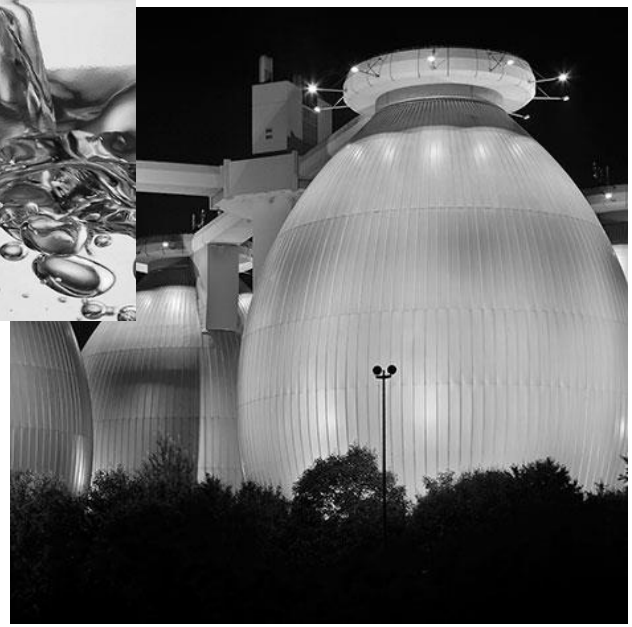
advancing the science of water

Presentation Overview

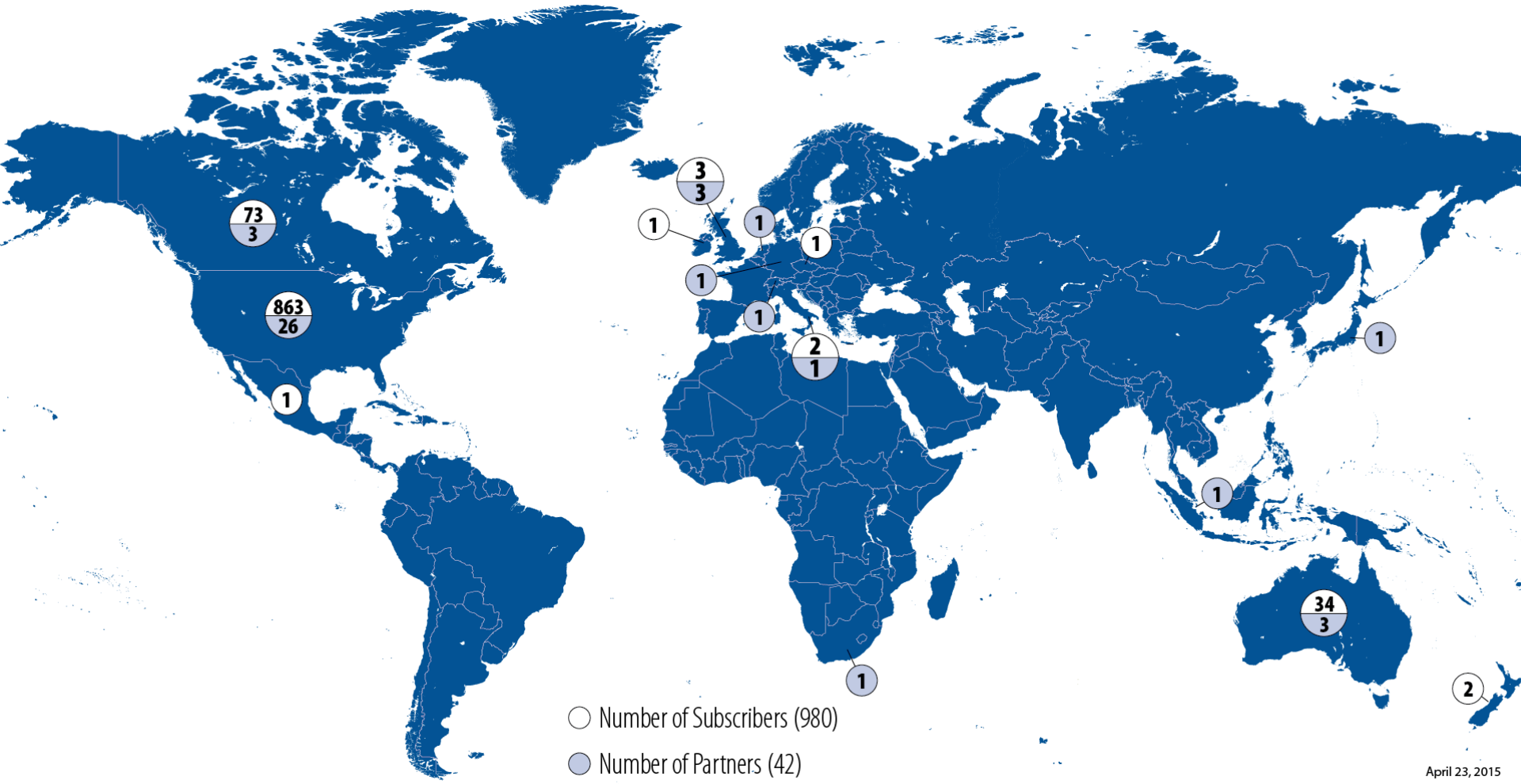
- About the Foundation
-  Regulatory History and Horizon
-  Cost Impact of Regulation: Focus on LCR & Research
-  Summary

Water Research Foundation

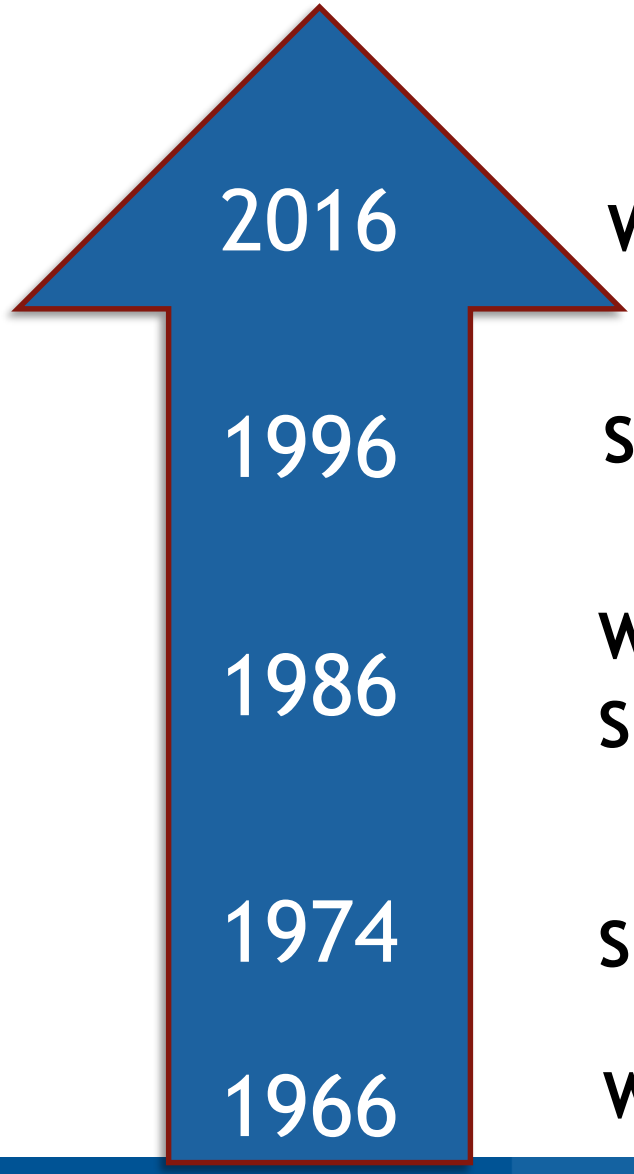
Advancing the science of water to improve the quality of life



WRF Subscribers and Partners



Water Research Foundation Launch



2016	WRF turns 50
1996	SDWA amendments
1986	WRF Subscription Program SDWA amendments
1974	SDWA established
1966	WRF Founded

One Water is an integrated planning and implementation approach to managing finite water resources for long-term resiliency and reliability, meeting both community and ecosystem needs.

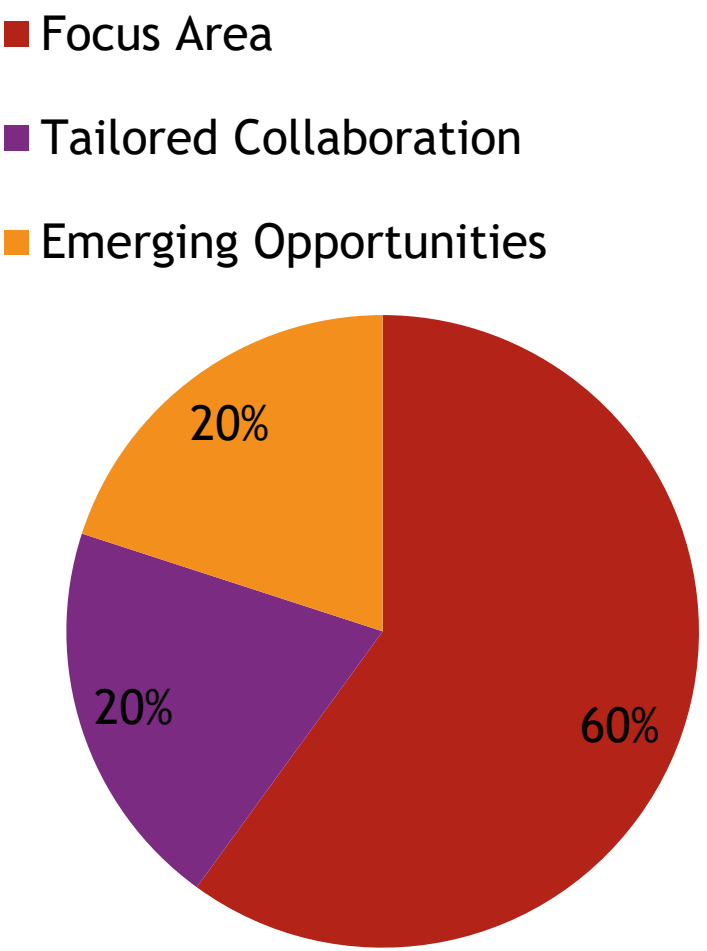
—Blueprint for One Water (project #4660)

WRF Research Programs

Focus Area Program (60% of WRF research budget) identifies a limited number of broadly relevant subscriber issues and solves them with a targeted, multi-year research response.

The Emerging Opportunities Program (20% of WRF research budget) enables the Foundation to respond quickly to emergent subscriber challenges and research ideas identified throughout the year.

The Tailored Collaboration Program (20% of WRF research budget) enables the Foundation to partner with utility subscribers on research that may be more limited or regional in impact.



2017 Focus Areas

Focus Area Title	Year Launched	# of Projects Funded
Source Separated Organic Feedstock Pre-Treatment and Management Practices	New in 2017!	2
Non-Regulated Disinfection By-Products in Drinking, Recycled, and Desalinated Water: Occurrence, Toxicological Relevance, and Control Strategies	New in 2017!	1
Lead and Copper Rule (LCR) Compliance	New in 2017!	1
Cyanobacterial Blooms and Cyanotoxins: Monitoring, Control, and Communication Strategies	2016	2
Waterborne Pathogens in Distribution and Plumbing Systems	2015	3
Defining Attributes and Demonstrating Benefits of Intelligent Water Networks	2015	4
Integrated Water Management: Planning for Future Water Supplies	2014	4
Water Demand: Improving the Effectiveness of Forecasts and Management	2012	9
Biofiltration: Defining Benefits and Developing Utility Guidance	2012	6
Developing Tools and Strategies for Improved Energy Efficiency and Integrated Water-Energy Planning	2012	8
Applying Risk Management Principles and Innovative Technologies to Effectively Manage Deteriorating Infrastructure	2011	9

2016 EO and TC New Research Projects

- Emerging Opportunities (EO) Program
  - 15 projects addressing wide variety of time-critical projects on lead corrosion, microbiomes, water affordability, cyanotoxins, land conservancy, green infrastructure
- Tailored Collaboration (TC) Program
  - 8 projects addressing regional needs on sensors detecting nitrification, T&O causing compounds, direct potable-reuse and intelligent control, ergonomics for w/ww workers, cyanotoxins, effects of pH on disinfection efficiency, and chloramine photalysis in UV advanced treatment

Most Popular Reports from 2016

Residential End Uses of Water, Version 2 (#4309)
Treatment Mitigation Strategies for Poly- and Perfluorinated Chemicals (#4322)
A Methodology for Locating and Managing Dynamic Potential Source Water Contaminant Data (#4581)
Energy Recovery from Pressure Reducing Valve Stations Using Hydrokinetic Turbines (#4447)
Planning and Implementing CIS and AMR/AMI Projects (#4583)
Smart Irrigation Controller Demonstration and Evaluation in Orange County, FL (#4227)
Metals Accumulation and Release Within the Distribution System: Evaluation of Mechanism and Mitigation (#4509)
Capital Funding Imperatives: Best Practices for Capital Improvement Programs (#4493)
Rate Approval Process Communication Strategy and Toolkit (#4455)
Managing Cyanotoxins in Drinking Water: A Technical Guidance Manual for Drinking Water Professionals (#4548)

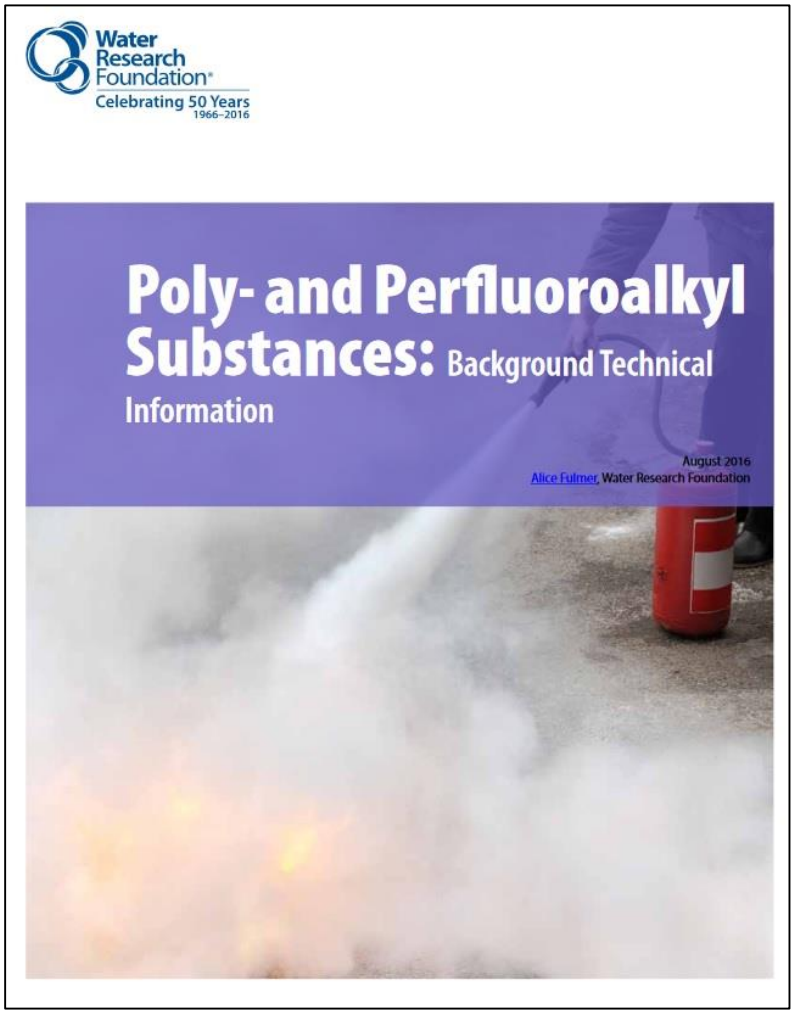
Hot Topic: Cyanotoxins

- Published two guidance manuals in 2015–16, for managers and utility staff, with AWWA (#4548)
- State of the Science includes overview and related WRF research
- Launched Focus Area in 2016 on Monitoring, Control, and Communication Strategies. Two ongoing projects.

Video on “Understanding Cyanobacteria and Cyanotoxins available on youtube. Most watched WRF video ever.

Hot Topic: PFOA/PFOS

- Published report in February 2016 on *Treatment Mitigation Strategies for Poly- and Perfluorinated Chemicals* (PFASs) (#4322)
- Two key PFASs are PFOS (Perfluorooctyl Sulfonate) and PFOA (Perfluorooctanoic Acid)
- State of the Science created by WRF staff
- Held Webcast on #4322 in June 2016



Water Research Foundation®
Celebrating 50 Years
1966–2016

Regulatory History

advancing the science of water

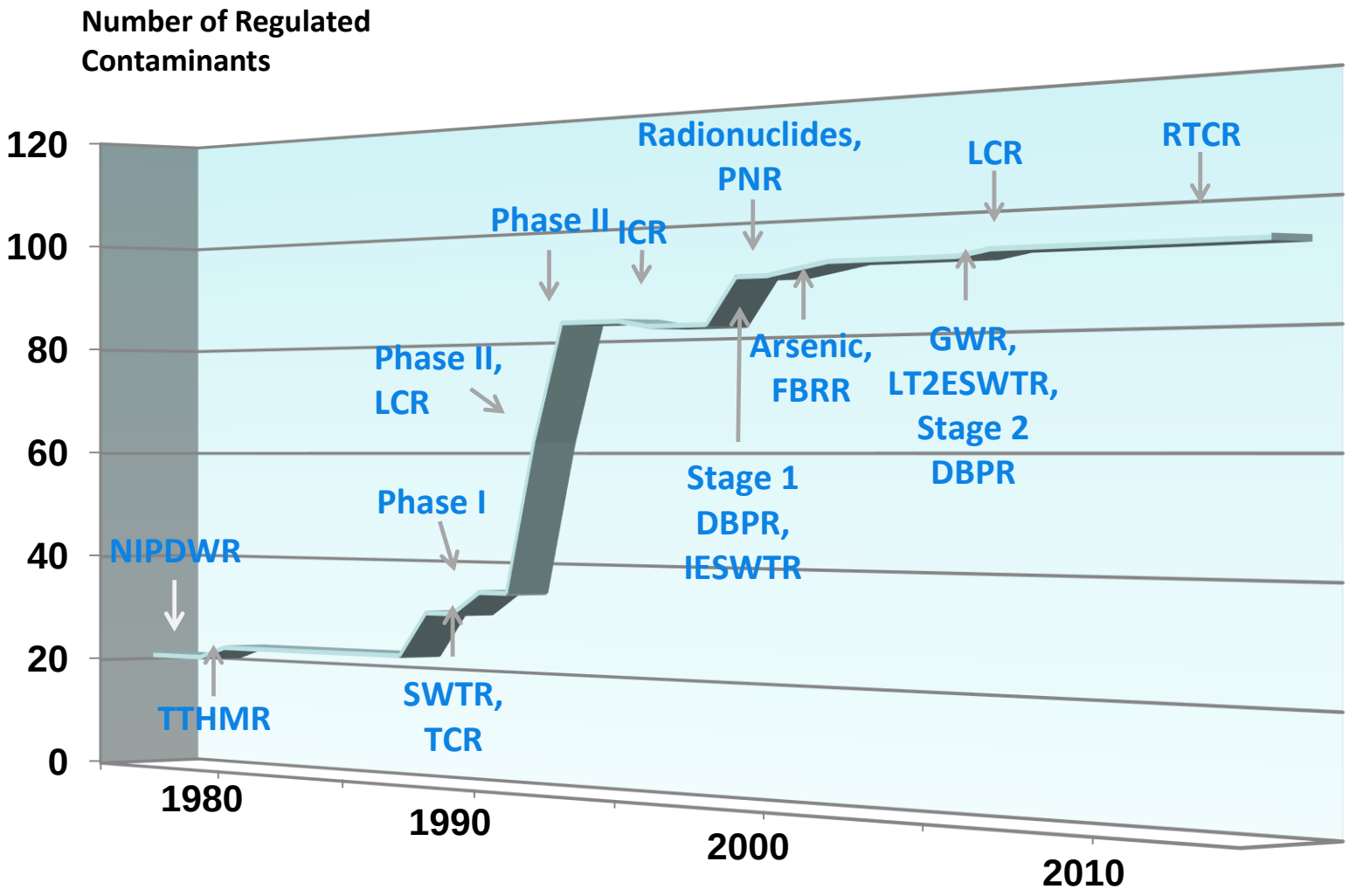
Safe Drinking Water Act (SDWA)

- 1974 SDWA established federal standard-setting process
- 1986 SDWA – created “regulatory treadmill”
- 1996 SDWA refined contaminant identification and risk management
- The three iterations of the SDWA have revised and refined USEPA’s regulatory development process, as well as the benefit-cost analysis that is a component of National Primary Drinking Water Regulations

Regulatory History

	Year	Rule	Reference
Pre 1996 SDWA Amendment	1975	National Interim Primary Drinking Water Regulations	40 FR 59566
	1979	Total Trihalomethanes (TTHMs)	44 FR 68624
	1986	Fluoride	51FR 11396
	1987	Phase I Volatile Organic Chemicals (VOCs)	52 FR 25690
	1989	Surface Water Treatment Rule (SWTR)	54 FR 27486
	1989	Total Coliform Rule (TCR)	54 FR 27544
	1991	Phase II Synthetic Organic Chemicals (SOCs) and Inorganic Chemicals (IOCs)	56 FR 3526
	1991	Lead and Copper Rule (LCR)	56 FR 26460
	1992	Phase V SOCs and IOCs	57 FR 31776
Post 1996 SDWA Amendment	1998	Stage 1 Disinfection By-Products Rule (DBPR)	63 FR 69389
	1998	Interim Enhanced Surface Water Treatment Rule (IESWTR)	63 FR 69477
	2000	Radionuclides	65 FR 76707
	2001	Arsenic	66 FR 6975
	2001	Filter Backwash Recycling Rule (FBRR)	66 FR 31085
	2002	Long-Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR)	67 FR 1844
	2006	Stage 2 Disinfection By-Products Rule (DBPR)	71 FR 387
	2006	Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)	71 FR 653
	2006	Groundwater Rule (GWR)	71 FR 65573
	2013	Revised Total Coliform Rule (RTCR)	78 FR 10269

Regulations



AWWA

The Good News about the Regs

- Most of the major risks that we know about in drinking water have already been addressed
  - 91 contaminants are regulated
  - Initial disinfection requirements in 1989 to address bacteria, viruses, and *Giardia*
    - Strengthened in 2006 to address *Cryptosporidium*
  - Arsenic standard lowered from 50 ppb to 10 ppb in 2001
  - 1991 Lead and Copper Rule lowered lead levels in water
  - Disinfection by-products (DBPs) regulations are tighter and apply to all system sizes
  - Lot of other common chemicals are already regulated

- National compliance is 92%-93%

Water Research Foundation®
Celebrating 50 Years
1966–2016

Regulatory and Non-Regulatory Actions on Horizon

advancing the science of water

Drinking Water Action Plan (DWAP)

- Six priority areas
  1. Promote equity & build capacity for infrastructure financing and mgmt. for disadvantaged, small, and environmental justice communities
  2. Next generation oversight for SDWA
  3. Strengthen source water protection & resilience of drinking water supplies
  4. Proactive strategy to address unregulated contaminants
  5. Improve transparency, public education, and risk communication on drinking water safety
  6. Reduce lead risk through Lead & Copper Rule (LCR)

Regulatory Actions on Horizon

- Lead and Copper Rule – Long Term Revisions
  - Will be published in 2017
    - Final rule will likely stretch out to 2019 or 2020
- Perchlorate
  - on EPA's "radar screen" since the 1996 SDWA Amendments
  - 2011: EPA positive regulatory determination
  - Peer review ongoing
  - EPA's court deadlines
    - Proposal in October 2018
    - Final in December 2019

Regulatory Actions & Regs.

- Third Six-Year Review
  - Published January 11th, 2017
- Fourth Unregulated Contaminant Rule (UCMR4)
  - Published December 20th, 2016
  - Monitoring 2018-2020
    - Occurrence data on algal toxins and brominated DBPs
- Fourth Regulatory Determination in Jan. 2021
  - Algal toxins and/or PFOA & PFOS??

Non- Regulatory Actions on Horizon

- Infrastructure $$
- Health Advisories
  - Cyanotoxins
  - PFOA and PFOS
- Disinfectant Residual
- Disinfection by-products
- Bromide discharges from coal power plants
- Spills and “incidents”
- Increased consumer expectations
- Others?? Hexavalent chromium? *Legionella*?

Source: “A Retrospective Analysis of the 19 Federal Drinking Water Regulations” (to be published in 2015)

Challenges & Uncertainties

- Regulatory delays
- Other threats/issues besides regulations
- Limited resources at all levels
  - Federal, state and local
- Big infrastructure needs
  - Water & wastewater are buried compared to roads, bridges, airports, etc.
- Increased consumer expectations

Water Research Foundation®
Celebrating 50 Years
1966–2016

Cost Impact of Regulation

advancing the science of water

Research on Costs of Regulations

- Retrospective Analysis of Benefits & Costs of the 19 drinking water regulations

- Develop an understanding of "meaningful opportunity for health risk reduction" – from 1996 SDWA Amendments

Source: "A Retrospective Analysis of the 19 Federal Drinking Water Regulations" (to be published near future)

Research Methodology

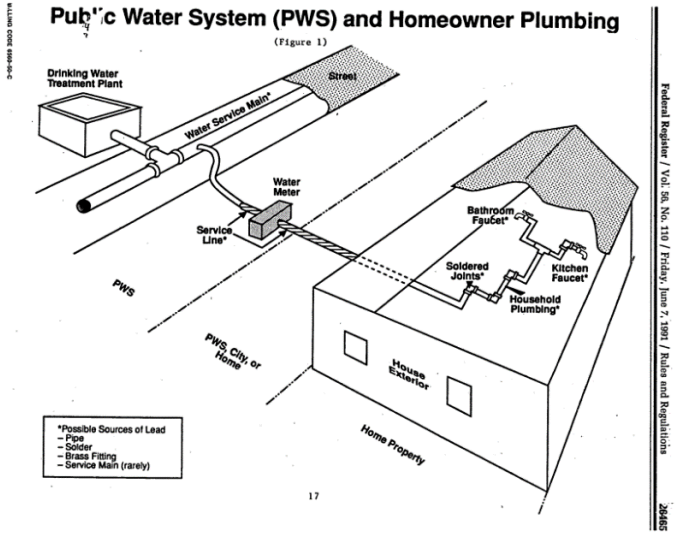
- Data Collection – Quantified Costs & Benefits
  - Economic Analysis (EA)/Regulatory Impact Assessments (RIA)
  - *Federal Register* notices

- Quantified Data
  - Net Present Value (NPV) $2014

Source: "A Retrospective Analysis of the 19 Federal Drinking Water Regulations" (to be published near future)

Research Methodology

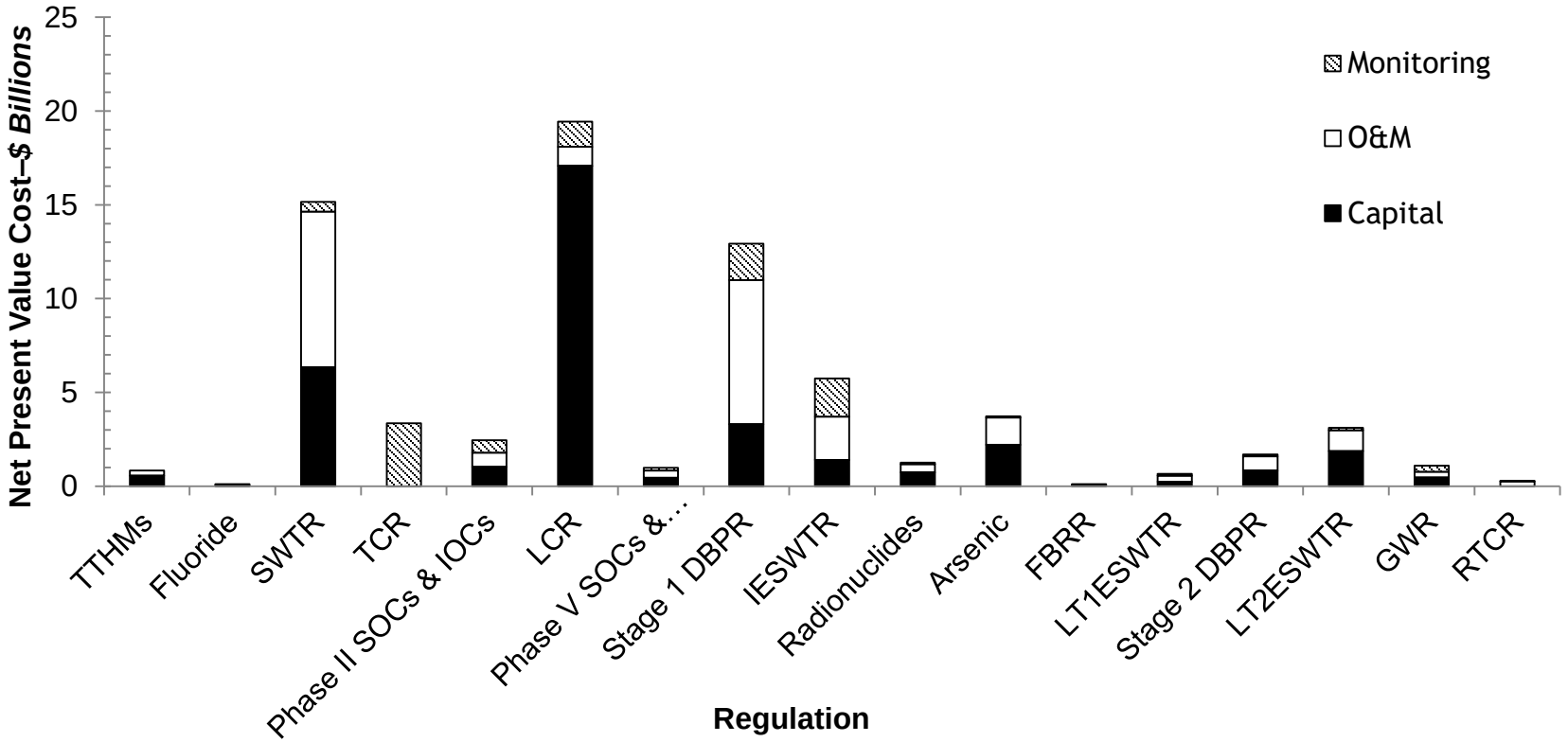
- Quantified Costs
  - Capital
  - O&M
  - Monitoring
- Example – Lead & Copper Rule:



	National Costs ($M)		
	No.of systems affected	Total capital	Total annual
Source water [1]	880	450	90
Corrosion control	40,000	990	220
Lead line [2] replacement	8,300	1,500-6,250	80-370
Public education [3]	40,000		30
State implementation		50 (initial)	40
Monitoring [4]			
—Source water	40,000		<1
—Corrosion control	79,000		27
—Lead line replacement	8,300		12

Source: "A Retrospective Analysis of the 19 Federal Drinking Water Regulations" (to be published near future)

Data Analysis - Cost



Capital, operation and maintenance (O&M) and monitoring costs of the 19 drinking water regulations graphed in order of year promulgated

Source: "A Retrospective Analysis of the 19 Federal Drinking Water Regulations" (to be published near future)

Summary of Regulatory Costs

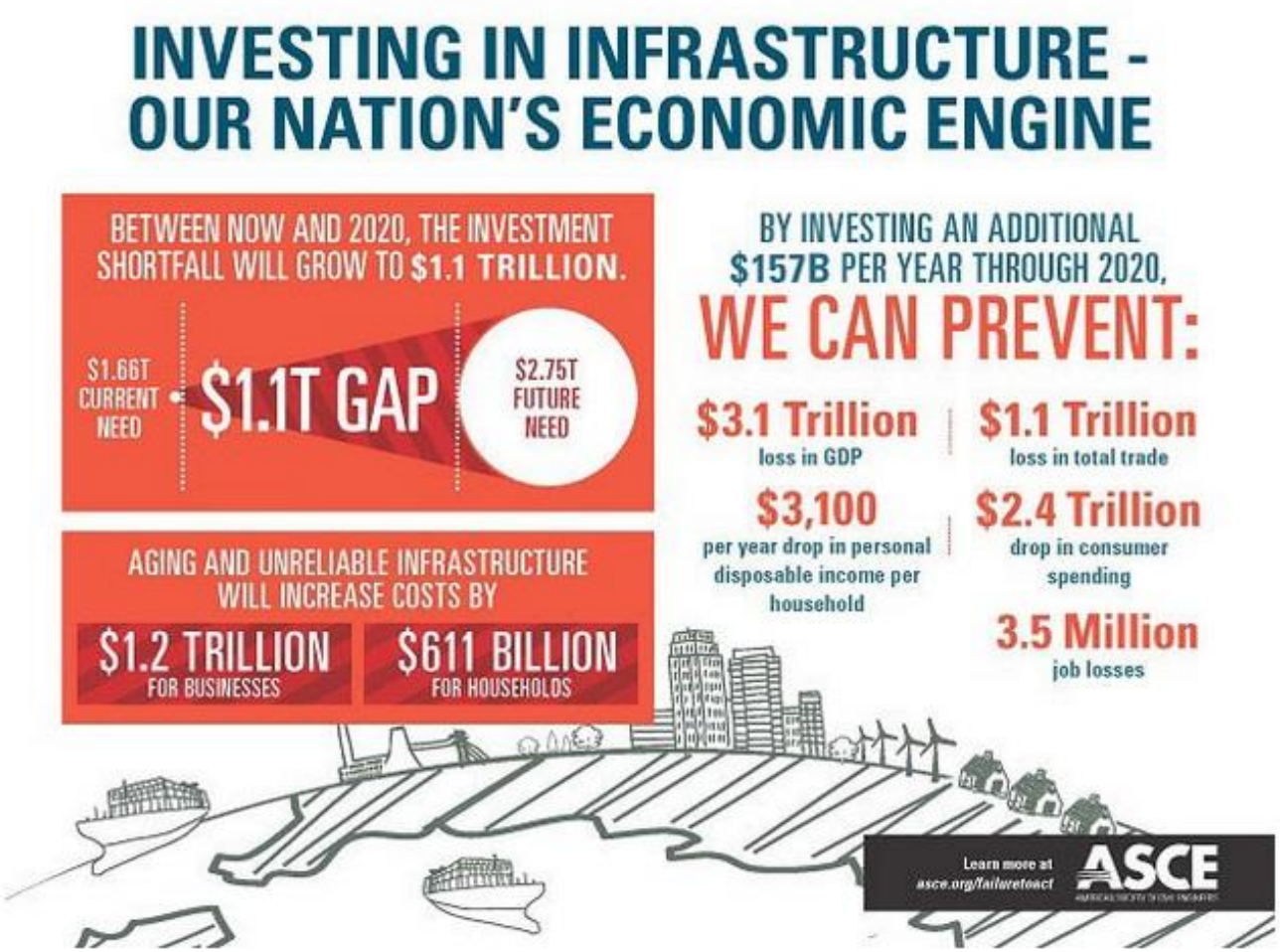
- Total national costs of the 19 regulations is $5.1 billion per year
  - Small compared to infrastructure requirements
- Three most expensive regulations
  - LCR, SWTR and Stage 1 DBPR
    - 67% of costs
    - Impacted almost all systems

Source: "A Retrospective Analysis of the 19 Federal Drinking Water Regulations" (to be published near future)

Infrastructure Funding Gap (IFG)

- EPA estimate: $384 billion over 20 years
- AWWA's *Buried No Longer* estimate: >$1 trillion over next 25 years
- 2014 AWWA SOTWI Report: $846 billion over next 25 years

Infrastructure Costs



Failure to Act: The Impact of Current Infrastructure Investment on America's Economic Future3 (ASCE, 2013) **was released as the culminating report on the economic impact of poor infrastructure in the U.S.**

Innovative Financing and Infrastructure Projects

2016

- New and Emerging Capital Providers for Infrastructure Funding (#4617)
- Challenges and Practical Approaches to Water Reuse Pricing (#4662)
- Practical Condition Assessment and Failure Probability Analysis of Small Diameter Ductile Iron Pipe (#4661)

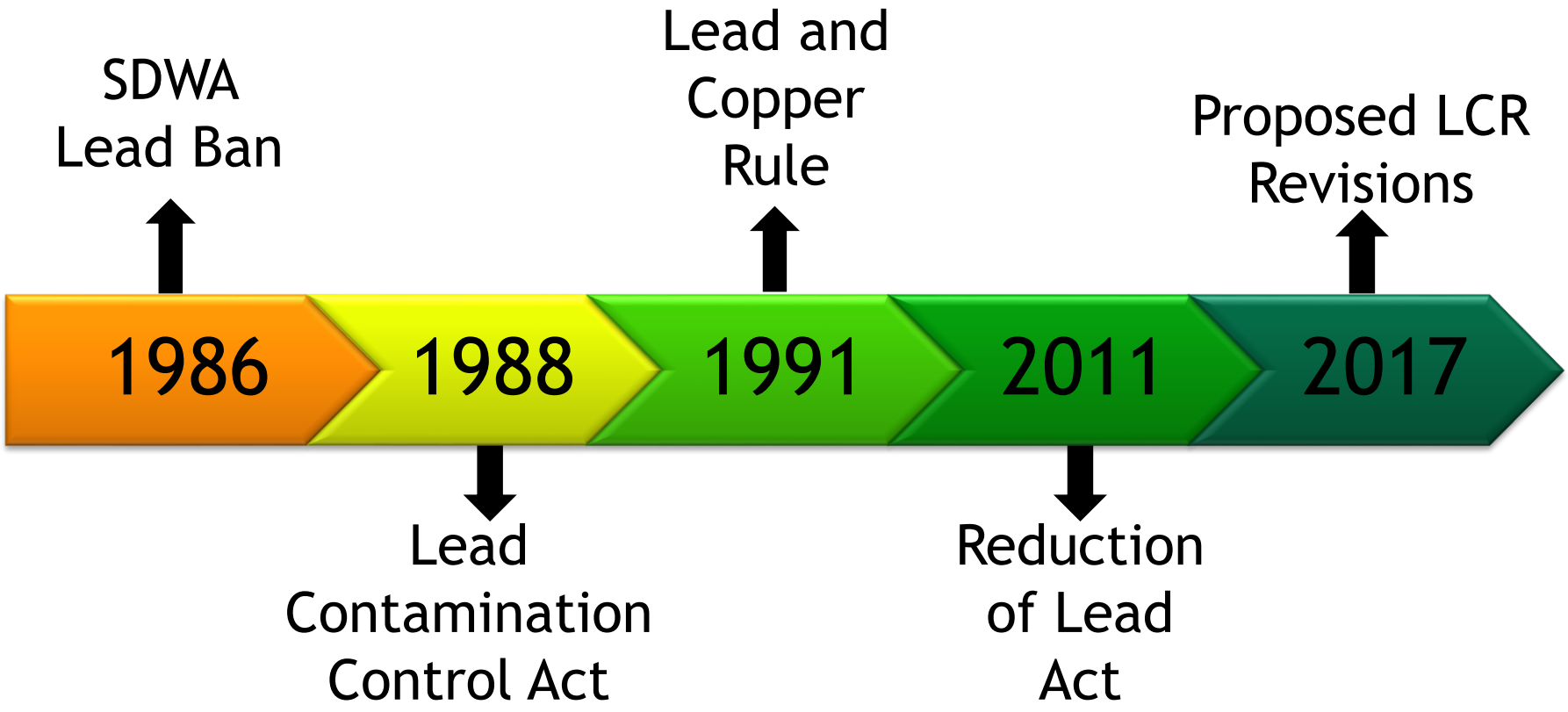
2017

- Innovative Technologies to Effectively Manage Deteriorating Infrastructure
- Intelligent Water Networks Summit

Lead

- Flint has made lead #1 on EPA's regulatory agenda
- 1991 Lead and Copper Rule (LCR) has substantially lowered lead levels through corrosion control
  - Most systems have learned about corrosion control
  - Have learned since then that partial lead service line replacements are not a good idea
  - EPA is planning to revise/update 1991 LCR
- Total replacement of lead service lines all the way to the building wall is now the way to go
  - "Shared responsibility" between water systems and property owners

History of SDWA Lead Regulation



Lead and Copper Rule Compliance Costs

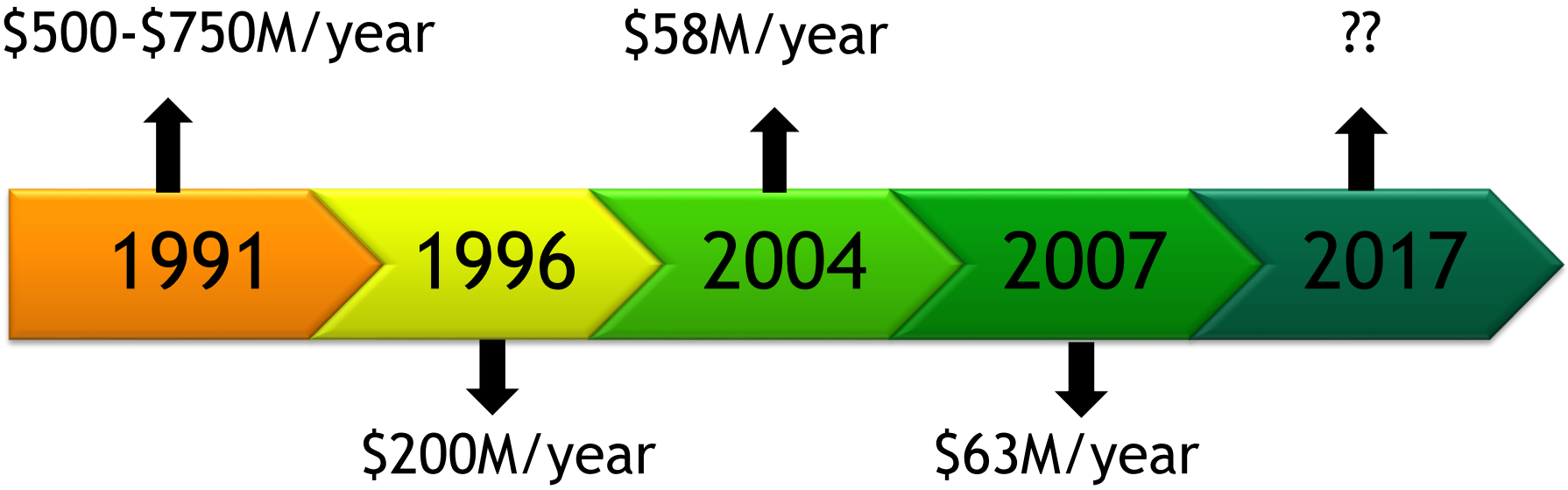
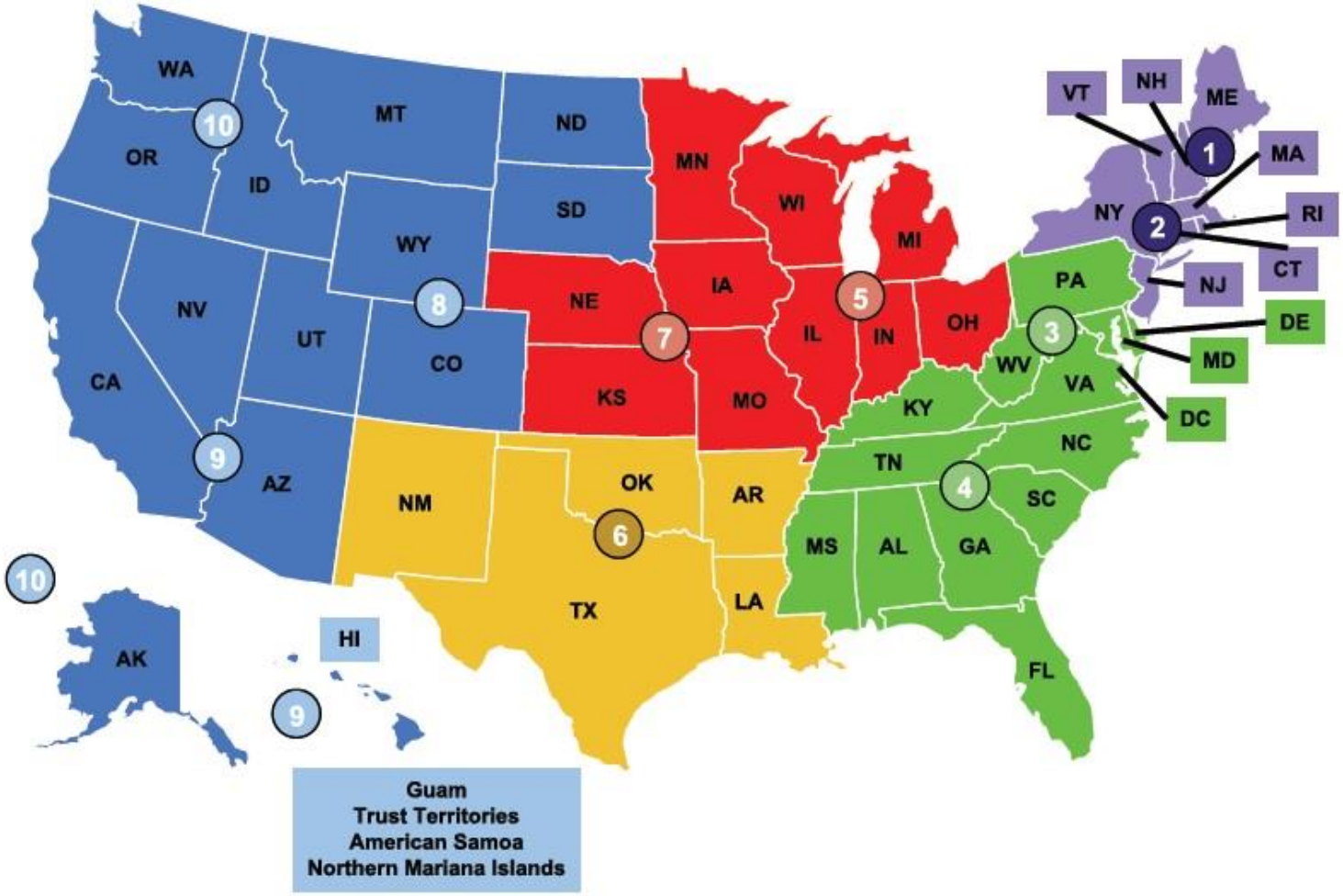


FIGURE 1 USEPA regions color-coded by grouping for data analysis

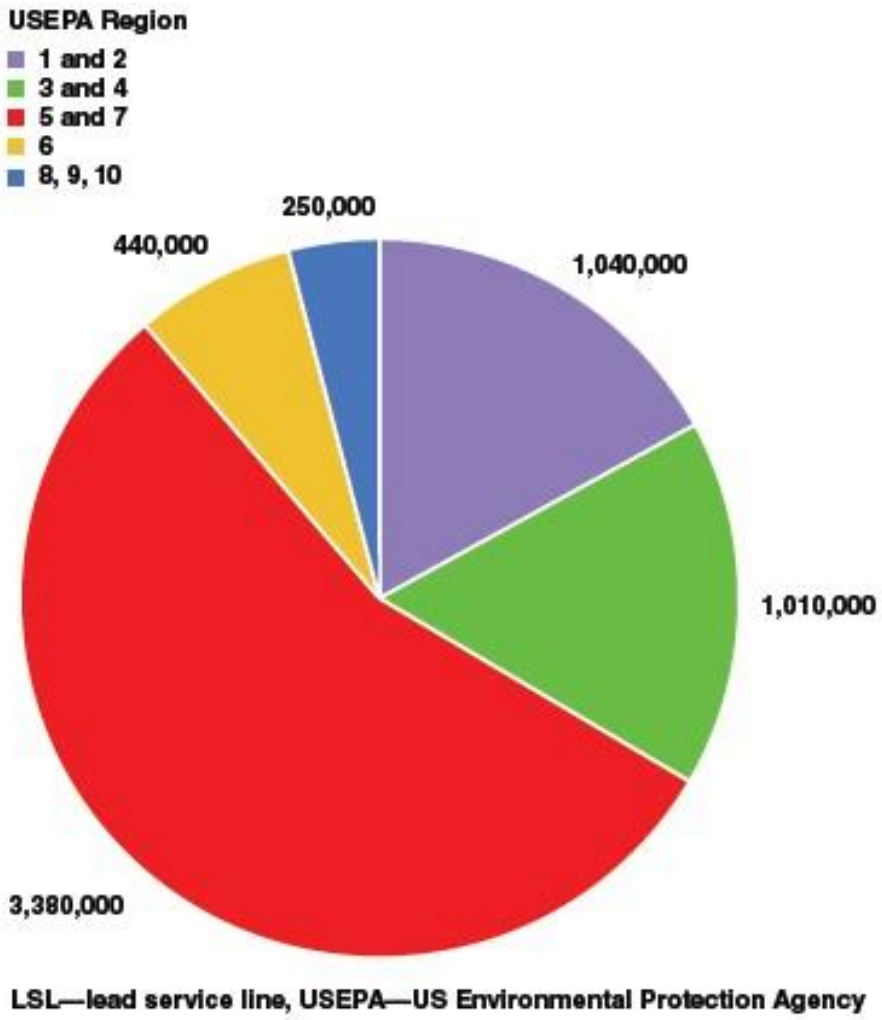


USEPA—US Environmental Protection Agency

Regional groups used in this study: Regions 1 and 2; 3 and 4; 5 and 7; 6; and 8, 9, and 10. Puerto Rico (Region 10) is not included in this map.

Cornwell et al. 2016 JAWWA

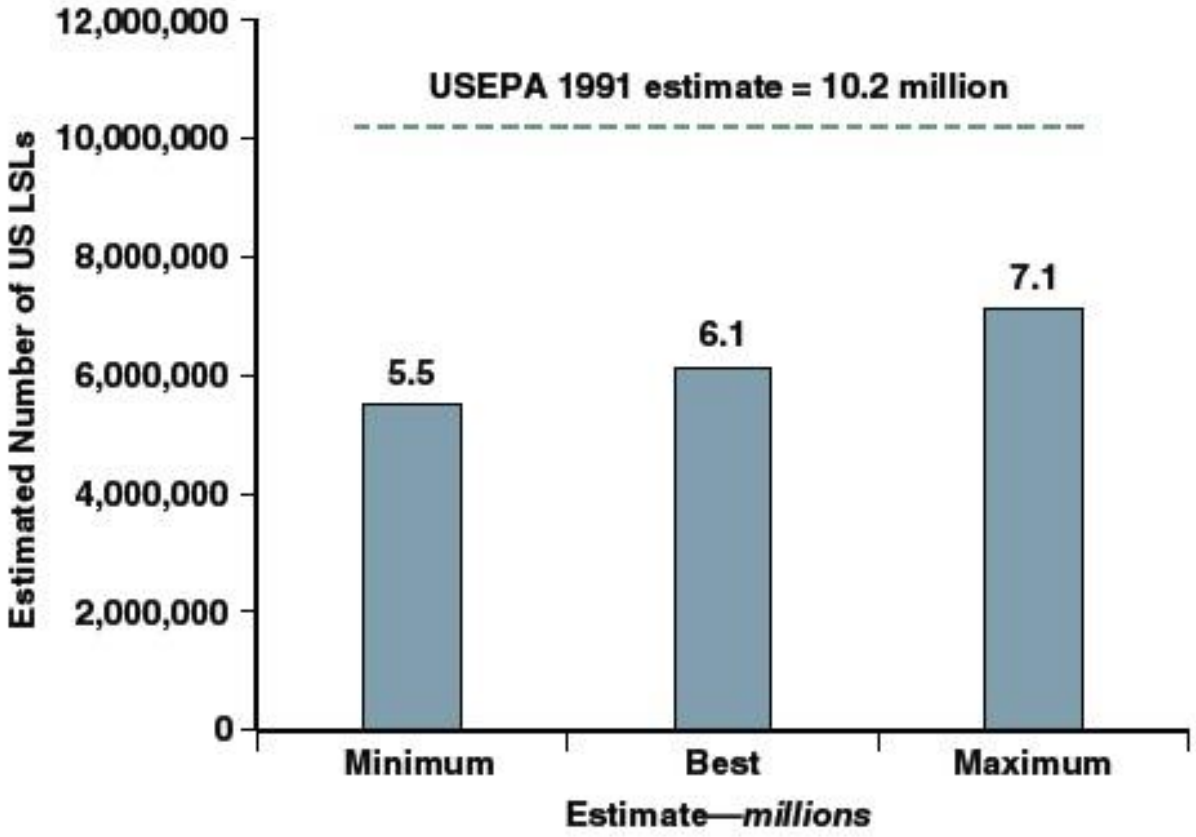
FIGURE 3 National LSL estimate by USEPA regional group



LSL—lead service line, USEPA—US Environmental Protection Agency

Cornwell et al. 2016 JAWWA

FIGURE 4 Range of national LSL total estimate



LSL—lead service line, USEPA—US Environmental Protection Agency

Cornwell et al. 2016 JAWWA

Lead Service Lines

- Replacement value of lead service lines is estimated at $1.0 Trillion ($5,000/house hold)
- Are they extensions of the public water supply????????
- Lead Service Line Collaborative
  - http://www.lslr-collaborative.org

Bertol Brecht & Marc Edwards, 2015

LCR-LTR Issues

LCR Long-Term Revisions will likely address:

- Partial Lead Service Line Replacement (LSLR)
- Optimized corrosion control and water quality parameters
- Sampling protocol issues

LCR-LTR Dialogue

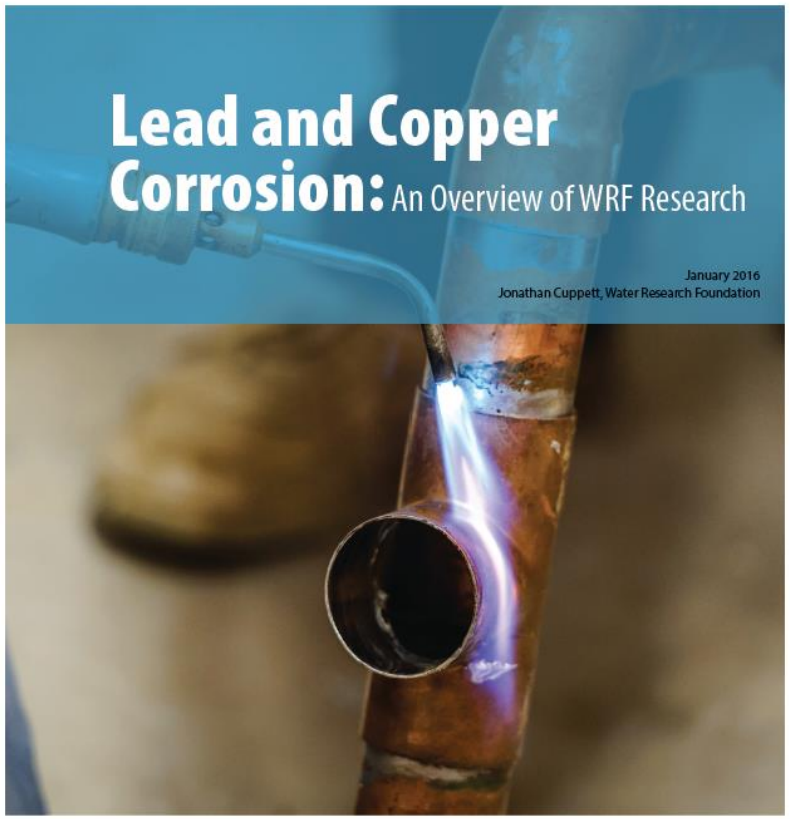
- With all of the issues, EPA completed a stakeholder approach to discuss potential recommendations
  - Broad range of issues were addressed
- Workgroup under the National Drinking Water Advisory Council (NDWAC)
  - Developed recommendations for EPA

LCR-LTR Costs

- National costs implications too difficult to assess due to the breadth and depth of the issues being discussed
- Not sure of the ultimate resolution(s)
- Not sure what the proposed revisions are going to look like

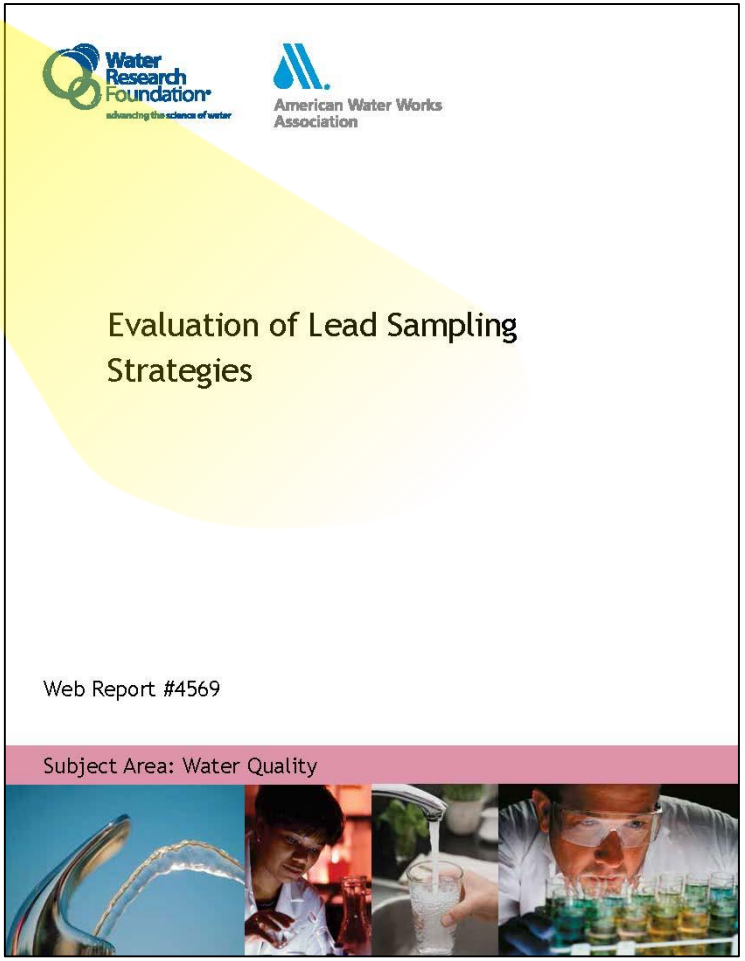
WRF Research: Lead

- Since late 1980s, WRF has funded over 45 projects on lead and copper
- Lead and Copper Corrosion Research Review
- April 2016 Webcast on “Lead and Copper Rule: Potential Regulatory Changes, Corrosion Chemistry, and Stakeholder Communication.” Largest ever audience for a WRF Webcast.
- Launched Focus Area in 2017 on Lead and Copper Rule (LCR) Compliance. First project is “Full Lead Service Line Replacement Guidance”



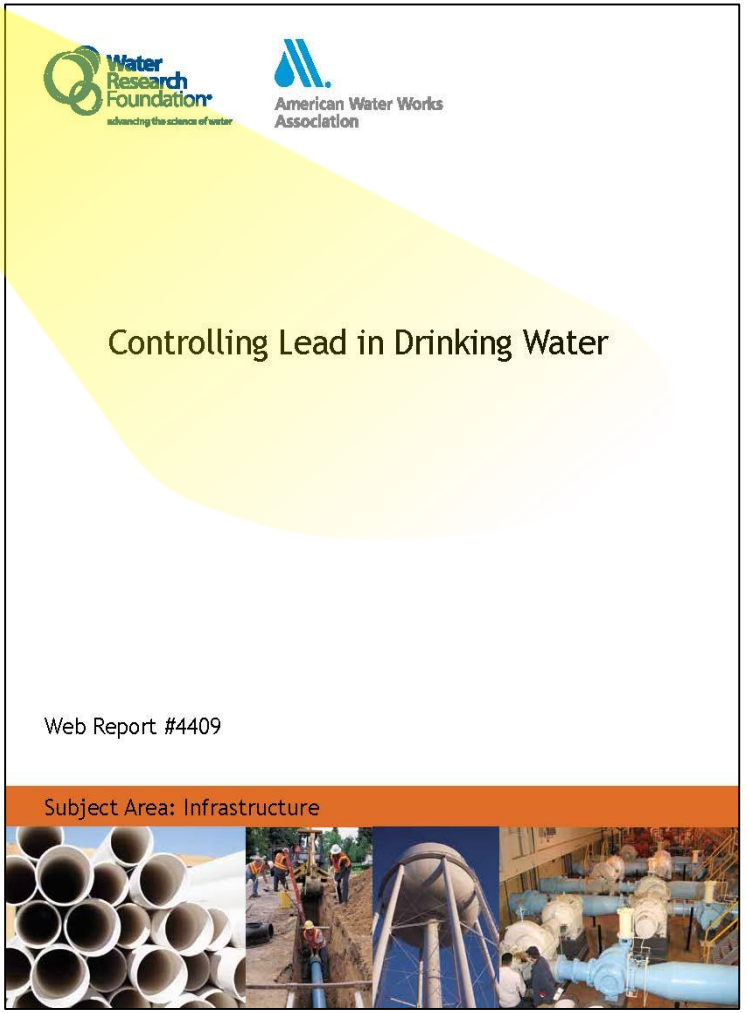
Project Spotlight

- 2015 publication (WRF P[illegible]t # 4569)
- Response to attention to profile sampling
- Highlighted challenges with customers performing profiles
- No sampling method was particularly proficient at finding the peak lead level compared to doing a full profile for each sampling event
- Webcast available



Project Spotlight

- Overview of Lead in drinking water and corrosion chemistry
- Lead service line replacement strategies
- 6 – Optimized corrosion control Case Studies
- Published in 2015 (WRF Project #4409)



Lead Projects

2015

- Evaluation of Lead Service Line Lining and Coating Technologies
- Evaluation of Flushing to Reduce Lead Levels
- Service Line Identification Techniques

2016

- Optimization of Phosphorus-Based Corrosion Control Chemicals and Flushing for Lead and Copper Control
- Corrosion of Nonleaded Pump Impeller Alloys in Chlorinated Potable Water
- Full Lead Service Line Replacement Guidance

2017

- Full Lead Service Line Replacement Guidance

Summary

- SDWA has had a major impact on protecting public health
- Cost of SDWA compliance is getting higher as regulations become more complicated
- Other major cost considerations — infrastructure, wastewater, stormwater, etc…….
- LCR- LTR yet unknown, but suspect to be high as replacement of LSLs are addressed
- Many challenges – non-regulatory
- Sound science through research supports utilities in their mission and helps inform policy and regulation

Alice Fulmer

Chemicals of Emerging Concern

Katie Henderson

Integrated Water Management

Dr. Djanette Khiari

Disinfection By-Products

Dr. Grace Jang

Microbials & Distribution System Integrity

Leanne Miller

Resource Recovery

Allison Witheridge

Stormwater

Dr. Jian Zhang

Asset Management
Distribution System Mgmt

Jonathan Cuppett

Utility Finance, LCR &
Distribution System Mgmt

Dr. Kenan Ozekin

Climate Change &
Advanced Treatment

Linda Reekie

Customer Service,
Energy Management,
& Source Water

Mary Smith

Distribution
System
Management

Maureen Hodgins

Water Efficiency

Water Research Foundation®

Celebrating 50 Years
1966–2016

Thank you!!

Beate Wright, PE
Executive Director, DC Office
bwright@waterRF.org
202.570.5320

advancing the science of water