

Science and Technology to Ensure the Safety of the Nation's Drinking Water



**President's Council of Advisors on
Science and Technology**

November 18, 2016

State of Emergency Declared Over Man-Made Water Disaster in Michigan City – The New York Times



Toxic algae threatens Lake Erie drinking water - Cleveland.com



The New York Times

Legionella bacteria found in some Flint homes – The Detroit News



Detroit Free Press



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“There is no more basic element sustaining human life than water. It’s not too much to expect for all Americans that their water is going to be safe.”

– President Barack Obama



PCAST was asked to consider:

1. What is the current state of scientific understanding of the risks associated with contaminants in drinking water?
2. What can be said about the comparative risks from different contaminants?
3. Is improvement needed in monitoring, data collection, and/or data analysis on contamination in drinking water and the factors that may contribute to it?
4. What can currently available technology contribute to risk assessment, risk mitigation, and risk communication in this domain?
5. What could additional research and development contribute to understanding and minimizing the risks from contaminants in the Nation's drinking water?



Science and Technology for Safe Drinking Water Study

PCAST Members

- Rosina Bierbaum, University of Michigan
- Christine Cassel, Kaiser Permanente
- John Holdren, PCAST Co-Chair
- Maxine Savitz, Honeywell (retired)
- Daniel Schrag, Harvard University
- Ed Penhoet, Alta Partners

Working Group Members

- Matt Davis, Ann & Robert H. Lurie Children's Hospital of Chicago
- Bob Perciasepe, Center for Climate and Energy Solutions
- Joan Rose, Michigan State University
- Orren Schneider, American Water
- Chad Seidel, University of Colorado Boulder
- Nancy Sutley, Los Angeles Department of Water and Power
- Paul Westerhoff, Arizona State University

Staff

- Diana Pankevich, PCAST Staff
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PCAST Stakeholder Exploration

- Conducted deep-dive conversations with stakeholders
- Reviewed relevant reports and peer-reviewed papers
- Hosted a workshop with 36 experts including:
 - ✓ Water, energy, environment, and public health sectors
 - ✓ Federal agencies including EPA, CDC, and NIEHS
 - ✓ Non-governmental organizations representing both public and private sectors including water utilities



Experts Consulted

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Rhodes Trussell, Trussell Technologies, Inc.

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Christopher Weis, National Institute of Health

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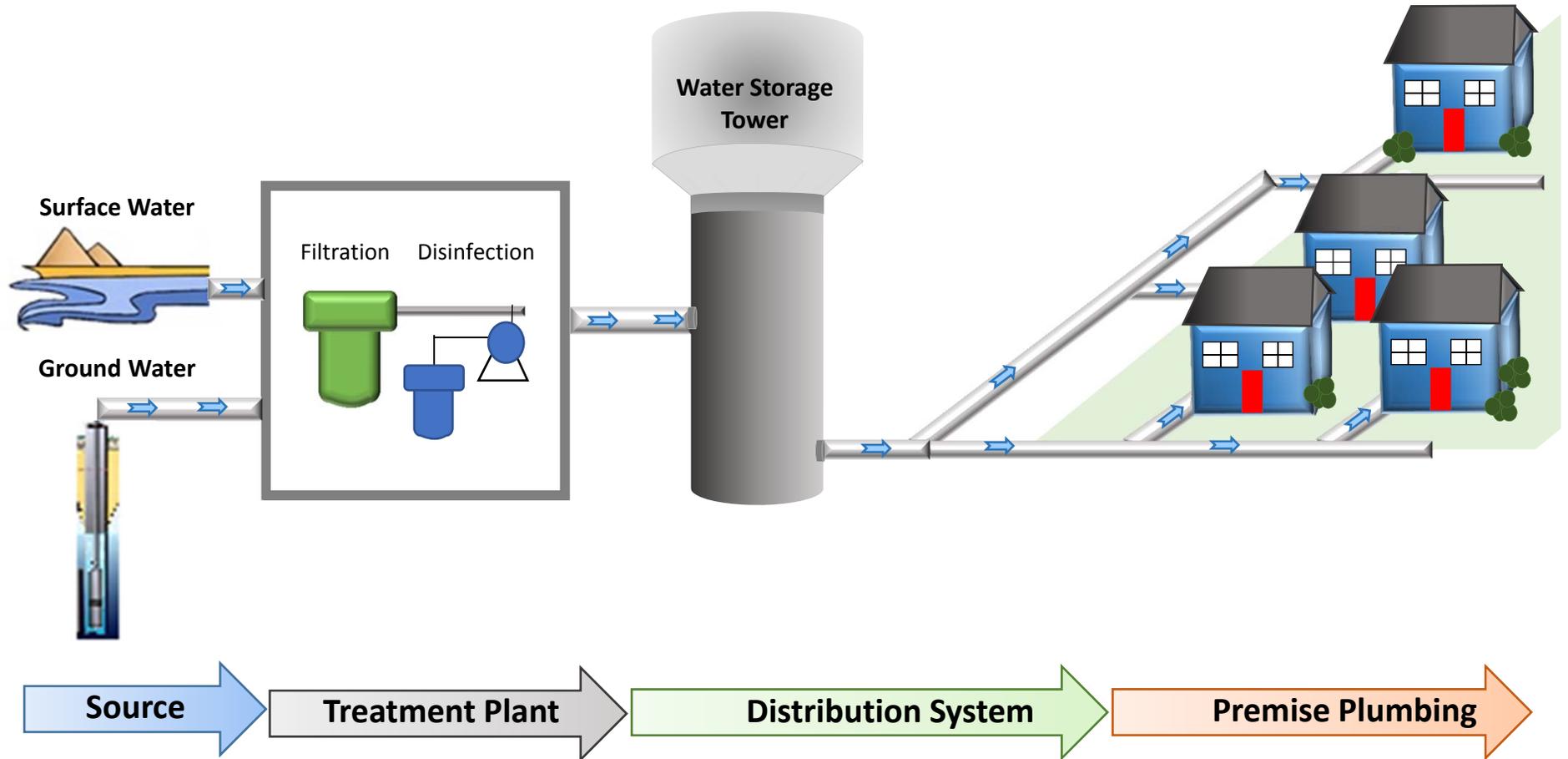
EPA's Drinking Water Action Plan

- The PCAST S&T recommendations are complementary to EPA's Plan, also due this year.
- The Plan's priority areas include:
 - promote equity and build capacity for water infrastructure financing and management in disadvantaged, small, and environmental justice communities;
 - advance next generation oversight of Safe Drinking Water Act;
 - strengthen source water protection and resilience in drinking water supplies;
 - address unregulated contaminants; improve transparency, public education, and risk communication on drinking water safety;
 - and reduce lead risks through the Lead and Copper Rule.

The Safe Drinking Water Act is EPA's primary authorizing legislation to protect public drinking water systems. EPA has additional authorities under the Clean Water Act and other legislation to protect against chemical releases and pollutant discharges.



Drinking Water Systems



Focuses of PCAST Recommendations

1. Increased Monitoring of Drinking-Water Contaminants, Especially for Vulnerable Populations
2. Big Data Analytics for Drinking-Water Systems
3. Developing the Drinking Water Treatment and Distribution System Workforce
4. Federal Coordination of Research and Development Focused on Safe Drinking Water
5. Developing the Next Generation of Technologies to Improve the Safety of Drinking Water
6. Developing Comparative Risk Assessment Methodologies and Capacity
7. Increased Data Collection and Sharing Through Citizen Science Efforts
8. Safe Drinking Water Demonstration Projects



Increased Monitoring of Drinking-Water Contaminants

Findings

- The use of existing drinking water monitoring technologies can be **expanded through innovative implementation and funding mechanisms.**
- Technologies have also advanced and can be adapted to provide **affordable, real-time, sensors and data** tailored to the needs of system managers, researchers, and customers for both public and private wells.
- There are particular monitoring opportunities that can **reduce the exposure of pregnant women, infants, and young children** to chronic, water-borne pollution, through targeted monitoring of those most at risk and remediation when appropriate.



Recommendation 1: Increased Monitoring of Lead in Drinking-Water, Especially for Vulnerable Populations

All women who enroll in in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) **be referred to the appropriate agency for tap water testing for lead.** That agency should also provide point-of-use treatment, when appropriate. Testing for additional contaminants that have similar risk profiles to lead such as arsenic and nitrate, particularly in rural areas that rely on private wells, should also be provided.

EPA should consider modifying the Lead and Copper Rule, as well as additional contaminant rules, to **require follow-up testing when contaminant levels exceed a threshold level,** even if the frequency of these samples is below the number that would trigger remedial actions under current rules.



Data Collection, Analysis, and Sharing

Finding:

Data accessibility, utilization, and interoperability across time and space are **severely limited in public and private drinking water systems**, and across federal agencies.

- Tens to hundreds of millions of dollars are spent annually on data collection by multiple federal agencies and by cities or other local agencies and utilities.
- There is **no common data-analytics platform** to access this data across agencies and/or across states and local communities.
- Private industry is beginning to market a series of sensors, data analytics, control systems, and interfaces for utility operators but the **industry lacks standardization, security, and interoperability capabilities** in this emerging internet of things related to drinking-water systems.



Recommendation 2: Big Data Analytics for Drinking Water

The Executive Office of the President should **support the development of a Drinking Water Data Platform for collection, analysis, storage, and sharing of geospatially linked drinking water system contamination data.** This platform should be accessible to agencies, water utilities, researchers, and the public and include information related to water quality and contamination levels. The Drinking Water Data Platform should be informed by and could build off of the EPA's Safe Drinking Water Information System (SDWIS) and the Water Quality Portal managed by EPA, USGS, and the National Water Quality Monitoring Council.

Federal Actors: OSTP, CEQ, DPC, and OMB



Developing the Drinking Water Treatment and Distribution System Workforce

Finding:

Water operators are critically important to the delivery of safe drinking water.

Workers need ongoing training and new talent must be recruited as the existing workforce reaches retirement. The Nation needs to **develop a new technologically advanced drinking water workforce.**



Recommendation 3: Developing the Drinking Water Treatment and Distribution System Workforce

The Federal Government should increase investment in programs aimed in helping American workers get the skills and credentials needed to support the operation, maintenance, and improvement of drinking-water systems throughout the Nation.

Near-term Opportunity: NSF should increasing funding of meritorious drinking-water-related projects through the Advanced Technological Education (ATE) program.

Long-term Opportunity:
EPA, in coordination with NSF, ED, and DOL, should initiate a stakeholder process to develop a blueprint for the overall professional development of water treatment operators' programs.



Federal Coordination of Research and Development Focused on Safe Drinking Water

Finding:

Responsibilities for S&T research and development on **topics related to the safety of drinking water are spread across a number of Federal agencies**. No single Federal entity has responsibility for ensuring coordination across these efforts.

There are three interagency groups with mandates relating, in part, to the challenge of providing safe drinking water but **none has comprehensive visibility into or explicit responsibility for coordinating** the broad array of R&D needs germane to drinking-water safety from source to tap.

There is a need for a more coordinated and Federal strategy for science and technology research, development, and demonstration to remedy these shortfalls.



Recommendation 4: Federal Coordination of Research and Development Focused on Safe Drinking Water

The Executive Office of the President should oversee the development, and execution, of a Federal Strategy for the research, development, and deployment of drinking-water monitoring, treatment, and distribution technologies.

This could be through a new National Science and Technology Council (NSTC) subcommittee that absorbs the relevant parts of the existing interagency groups, or a free-standing interagency council similar to the Council on Climate Change Preparedness and Resilience.

Federal Actors: OSTP, CEQ, DPC, and OMB



Developing the Next Generation of Technologies to Improve Safety of Drinking Water

Finding:

The Nation's **innovation** ecosystem for development and deployment of innovative technologies to improve the safety of drinking water **is inadequate**.

A suite of complementary funding and management mechanisms for the development of innovative technologies (e.g., prizes, grand challenges, research hubs, water research centers) could be utilized.

PCAST recognizes the value of these mechanisms and encourages agencies with drinking water-related programs to coordinate such activities, perhaps with a new focused research entity.



Recommendation 5: Developing the Next Generation of Technologies to Improve Safety of Drinking Water

The Federal Government should launch a new research organization, focused specifically on developing transformational technologies aimed at improving the safety of drinking water.

Among topics for early attention by this entity are:

- Inexpensive multi-contaminant sensing, testing, and treatment technologies;
- New techniques for pipe and lead service line identification, mapping, and replacement;
- Understanding microbial contaminants across the water systems (from source to tap);
- Developing disinfection mechanisms beyond chlorine.

Potential placement could be EPA, DOI, DOE, or other agencies.



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Developing Comparative Risk Assessment Methodologies

Finding:

Comparison of different risks with each other is important part to developing an overall strategy for risk reduction.

Health endpoints of concern differ between different contaminants, as do methods for calculating ‘safe’ concentrations, making it challenging to select a common endpoint.

Methodologies for conducting quantitative risk comparisons across different drinking-water contaminants and different sources of exposure constitute an underdeveloped field of study.



Recommendation 6: Developing Comparative Risk Assessment Methodologies and Capacity

Initiate a coordinated research effort, in conjunction with state and other drinking water experts, to improve the methodologies and develop the data needed to support more comprehensive comparative-risk assessments of contaminants across the spectrum of chemical mixtures, sources, and treatment systems that provide drinking water to the Nation.

Federal Actors: CDC, EPA, NIEHS, and USDA



Citizen Science Efforts

Finding:

Under current EPA rules, monitoring requirements and sampling rates vary by state, water system size, and contaminant. Private wells are not covered and some utilities are granted waivers to sample less frequently.

Citizen science efforts can both help educate the public about water quality and help fill **geographic and temporal gaps in data about drinking-water contamination.**

There is a near-term opportunity to leverage the hundreds of citizen science efforts – both inside and outside of Federal agencies – to include water testing.



Recommendation 7: Increase Data Collection and Sharing through Citizen Science Efforts

Extend efforts to measure and monitor drinking water supplies in the U.S. by supporting citizen science activities such as home water testing, drinking water sources, small systems, and private wells.

Citizen Science Coordinators from agencies should begin to identify a series of near-term activities focused on collection of water contamination data. Longer-term activities for developing safe drinking water-related citizen science programs within states, should also be considered.

Federal Actors: EPA, NSF, CDC, NIEHS, and HUD



Safe Drinking Water Demonstration Projects

Finding:

American cities are facing significant effects from water shortages and crumbling drinking water infrastructure.

Some cities are beginning to take on these challenges through innovative approaches along with developing partnerships across water utilities, universities, and public companies.

There is **an opportunity and a need to pilot innovative ideas related to safe drinking water.**



Recommendation 8: Safe Drinking Water Demonstration Projects

Consider deploying city-based safe drinking water demonstration projects. The demonstration projects should be deployed in (1) an in-land arid city; (2) a groundwater dependent city; and (3) an industrial mid-western (or northeastern) city.

The interagency initiative should start three demonstration projects with new funding for each in the range of \$20-30 million a year for five years.

Federal Actors: EPA with HUD, USDA, CDC, DOE, and DOC



Thank you!

For more information about PCAST: www.whitehouse.gov/ostp/pcast

