Environmental Health Disparities and Drinking Water Infrastructure

Jim VanDerslice, PhD
Associate Research Professor
Division of Public Health
University of Utah

**Strengthening Environmental Justice and Decision Making:
A Symposium on the Science of Disproportionate
Environmental Health Impacts,
Washington DC, March 18, 2010**

In conclusion .....

1. Despite the sparseness and limitations of the data, the existing data suggest that environmental inequities exist.

2. While the existing data do not support any broad nationwide pattern of inequity, there are, however, clear situations where certain populations are exposed to higher levels of contaminants in water.

In conclusion .....

“Despite the sparseness and limitations of the data, the existing data suggest that environmental inequities exist.

While the existing data do not support any broad nationwide pattern of inequity, there are, however, clear situations where certain populations are exposed to higher levels of contaminants in water.**”**

(Calderon et al., 1993)

Calderon RL, Johnson CC, Craun GF, Dufour AP, Karlin RJ, Sinks T, and Valentine JL, 1993. Health risks from contaminated water: do class and race matter? *Toxicology and Industrial Health,* **9(5):**879-900

Two worlds

Public water systems

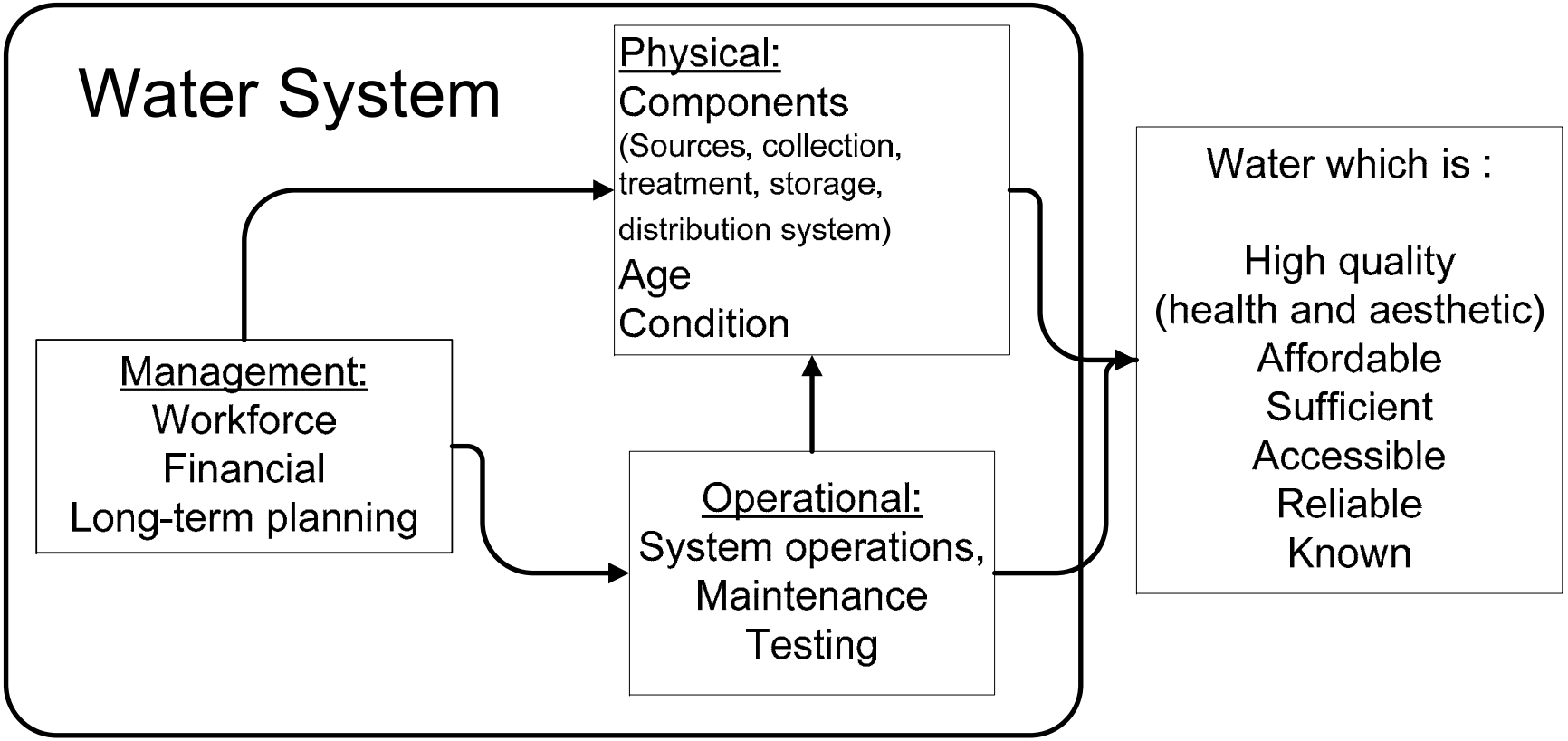
- **Regulated by the Safe Drinking Water Act**
  - Water quality standards
  - Monitoring requirements
  - Treatment requirements
  - Public notification
  - Consumer Confidence Reports
  - Operator certification
  - Plan review
  - Capacity development
  - Source water protection
- **Administered by states***
- **Oversight and support from US EPA**
- **Serve approx. 85% pop.***
  - 8% CWS (4,132) serve 82% pop.

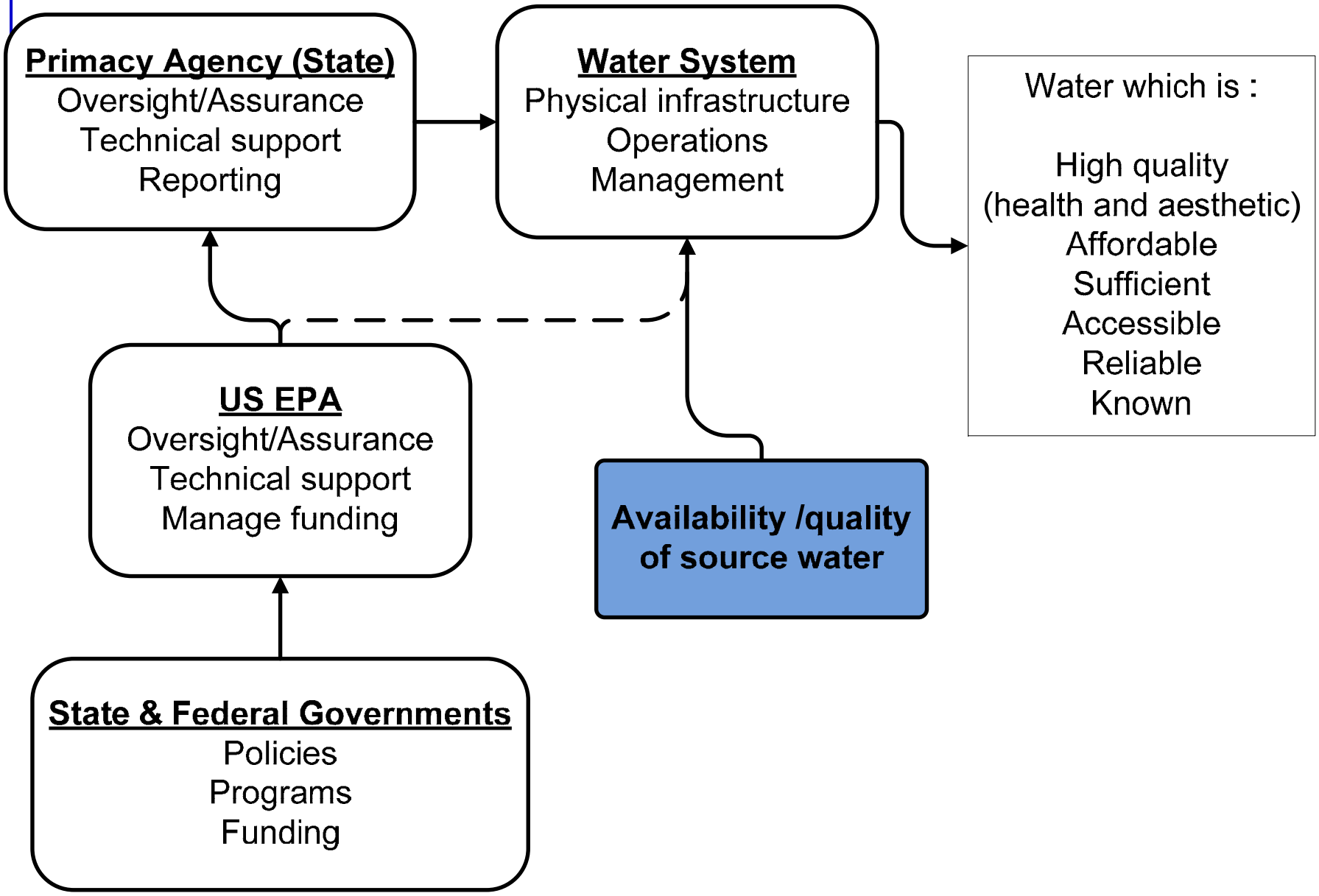
Private/shared water systems

- **Few state regulations**
  - Source adequacy
  - Water rights
  - Well drillers certified
- **Variable county regulations**
  - Water quality testing at completion of well, sale of property
  - bacteriological
  - nitrate
  - Arsenic
- **State and county education and technical assistance**
- **Serve approx. 15% of pop.**

http://www.epa.gov/ogwdw000/pws/factoids.html

Water system inputs and outputs




Primacy Agency (State)
Oversight/Assurance
Technical support
Reporting
Water System
Physical infrastructure
Operations
Management
Water which is :
High quality
(health and aesthetic)
Affordable
Sufficient
Accessible
Reliable
Known
US EPA
Oversight/Assurance
Technical support
Manage funding
Availability /quality of source water
State & Federal Governments
Policies
Programs
Funding

Studies of Disparities in Water Infrastructure

Case studies

- Farmworkers
  - **Continuing field / camp water & sanitation**
- Colonias
  - **>400 colonias, 250,000 people w/out water systems or sanitation**
- American Indians
  - **30% Navajo w/out piped water; 12% other Tribes**
- Rural, agricultural areas
  - **Elevated groundwater nitrate, Yakima Valley, WA**

Commonalities

- Low income, racial or ethnic minority communities
- Unregulated ‘water systems’
- Case studies documented problems with
  - **Water quality**
  - **Accessibility/reliability**
  - **Cost**
- Implicit standard was a Public Water System
- Governmental response

Assessing disparities between PWS: Arsenic levels in Arizona

- Association of race, ethnicity and income with arsenic concentration from PWS – 'selective enforcement'
  - **Zip code unit of analysis – demographic data**
  - **For each zip code, calculated average arsenic level for all PWS serving that zip code**
  - **Compared zip codes with average > 10 mg/l As to zip codes with average As <=10 mg/l**
- Authors concluded no evidence of a disparity

Cory DC, and Rahman T, 2009. Environmental justice and enforcement of the safe drinking water act: The Arizona arsenic experience. *Ecological Economics,* **68:**1825-1837.

Assessing disparities between PWS: Nitrate in the San Joaquin Valley, CA

- Examined relationship between nitrate levels in CWS and ethnicity, income.
- Preliminary results:
  - **Race and home ownership associated with nitrate levels**
  - **1% increase in percent Latino associated with increase of 0.14 mg/l nitrate-nitrogen**
  - **1% decrease in homeownership associated with increase of 0.17 mg/l nitrate-nitrogen**

Balazs C, and Isha R, Just water? Environmental justice and drinking water quality in California's Central Valley. Presented at the annual meeting of the *American Public Health Association*, Philadelphia, PA, November 15, 2009.

Estimated proportion served by type of water system (self-reported), US, 2007

	CWS	Shared	Private
Overall	87.2	1.6	11.2
Lower income	90.6	1.9	7.6
Higher income	86.0	1.5	12.5
Hispanic	96.1	0.8	3.1
Non-hispanic	86.1	1.7	12.2
Asian only	97.4	0.4	2.1
African American only	95.6	0.8	3.6
American Indian/ Alaskan Native only	87.8	4.2	8.0
White only	85.4	1.8	12.8

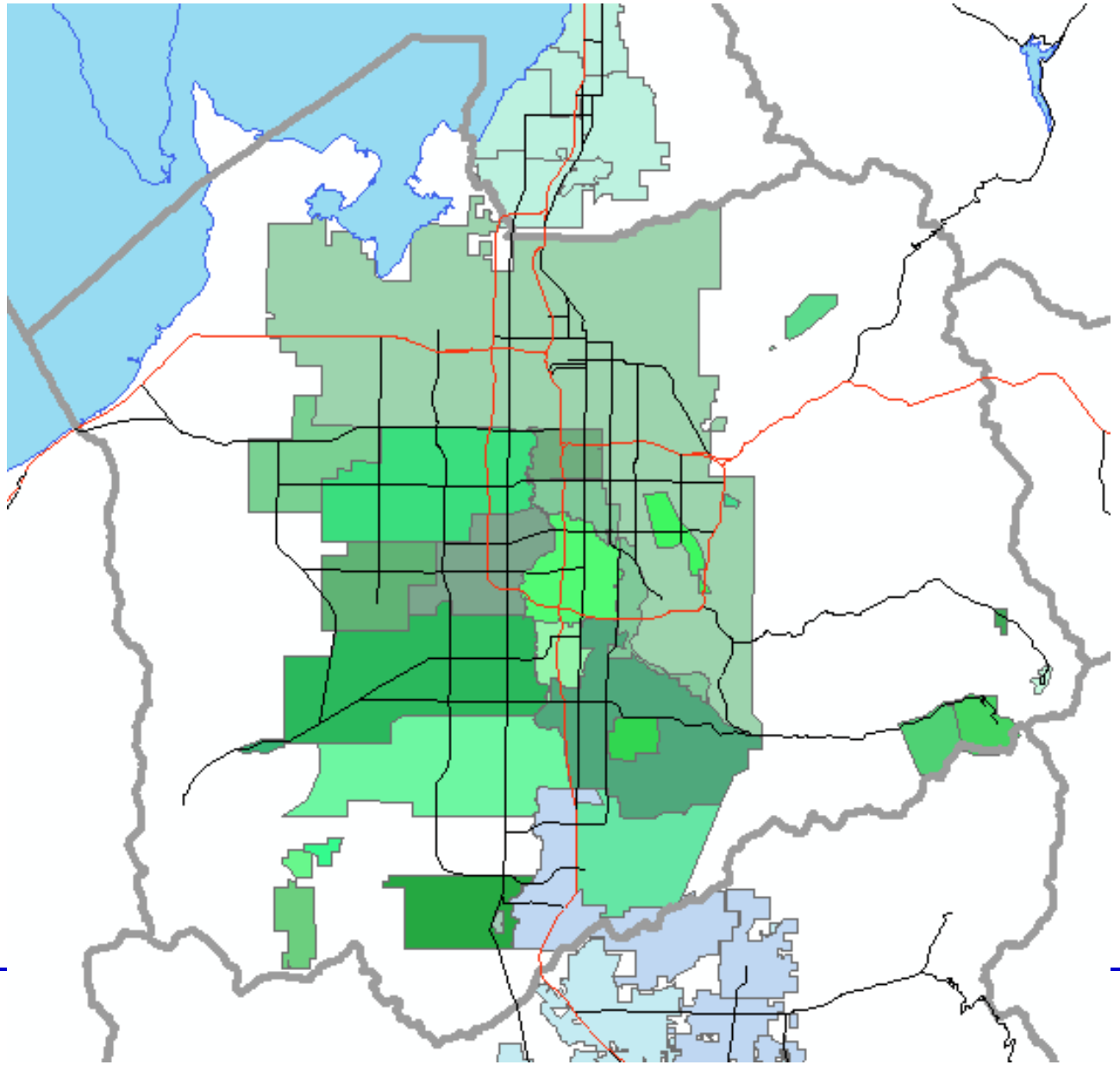
Data from American Housing Survey, 2007. Weighted proportions

Methodological Issues

Linking people to water system infrastructure

- No information about who a water system serves.
  - **Demographic data not collected**
- Little information about where they serve.
  - **County, zip code available**
  - **Few states have spatial data on service areas**
  - **Creating these data can be very time consuming**
- Individuals often know their water system

CWS service boundaries Salt Lake County



Assessing disparities within PWS

- Variable water quality within distributions systems of large utilities
  - **Multiple sources, treatment plants, distribution system entry points**
  - **Age of system**
- Water quality parameters
  - **Disinfection by-products**
  - **Lead/copper from service lines, plumbing and fixtures**
  - **Taste and odors**
  - **Intrusions, microbiological contamination**
- Spatial patterns of both water quality variation and demographic characteristics

Unit of analysis

- Individual-level – need to account for error associated with CWS
  - **Use administrative individual level data with geo-coding**

- Unit of aggregation depends on the question
  - **Water system level processes: CWS as unit of analysis**

    (water quality, cost, customer service, provision of information in appropriate language)
  - **State-level actions: state or regional office of primacy agency**

    (enforcement, technical assistance, information for consumers in appropriate languages, data access)

Geographic scope:
Who are we comparing?

- Hypothesis driven
  - **Based on CWS characteristic**
  - **Based on political boundary/data source**
- Data driven
  - **Detailed data only available from the State**

Assessing disparities for private or shared water systems

- What kinds of comparisons?
  - **Comparison to those served by CWS / SDWA regulations**
  - **To others also with private wells**
  - **To other benchmarks**
- Multiple objectives:
  - **Identify situations where disparities exists**
  - **identify any community where water quality poses a risk**

- Crucial to understand the process and recognize all determinants of the outcome
  - **What are the differences in source water quality or treatment techniques?**
  - **What are the procedures which might lead to an enforcement action?**
  - **How to act on observed disparities in water quality when all water quality standards are met?**

Recommendations

- Develop data to link people to their water systems
- Opportunities to ‘mine’ existing epi studies to evaluate disparities in water quality
- Examine underlying factors that can lead to improvements
  - **Infrastructure, age**
  - **Financial status**
  - **Operations**
- Evaluate as part of community assessment
- Assess with goal of improvement

In conclusion ….

“Despite the sparseness and limitations of the data, the existing data suggest that environmental inequities exist.

While the existing data do not support any broad nationwide pattern of inequity, there are, however, clear situations where certain populations are exposed to higher levels of contaminants in water.”

(Calderon et al., 1993)

Calderon RL, Johnson CC, Craun GF, Dufour AP, Karlin RJ, Sinks T, and Valentine JL, 1993. Health risks from contaminated water: do class and race matter? *Toxicology and Industrial Health,* **9(5):**879-900