Does Pathogen Monitoring Ensure Safe Drinking Water?

病原性微生物のモニタリングは飲料水の安全確保に有効か？

Martin J. Allen, Awwa Research Foundation, US

米国水道協会研究財団　マルティン・アレン

Awwa Research Foundation

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Awwa Research Foundation

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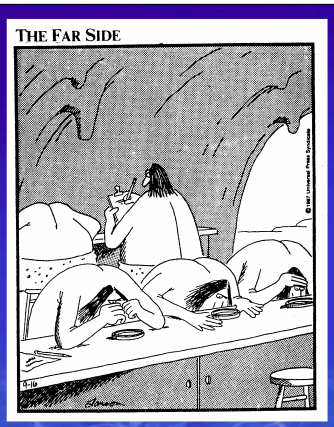
Two types of problems caused by microorganisms in drinking water.

Waterborne Pathogens: *Cryptosporidium*, *Giardia*, *Legionella*, *etc.*

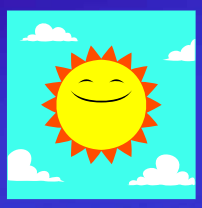
Aesthetic Effects - Taste & Odor, Color, Iron and Sulfur Bacteria, Algae,



Early Microbiologists- looking for pathogens.

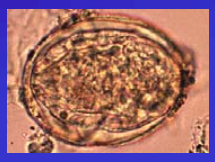
The Perfect Method

- Simple
- Quick
- Cheap
- Specific
- Sensitive
- Reproducible



Pathogen "Short List"

- *Giardia*
- *Cryptosporidium*
- *Vibrio*
- *Salmonella*
- *Shigella*
- *Legionella*
- *Campylobacter*
- *Mycobacterium*
- Cultivatable viruses



Reasons for Pathogen Monitoring

- Directed
- Expected
- Belief in concept
- Public image
- Self-serving

Advocates of Pathogen Monitoring

- Regulatory/health agencies
- Elected officials
- Utility personnel
- Consumers
- Special interest groups
- Researchers
- Commercial laboratories

Barriers to Pathogen Monitoring

- Technical issues
- Administrative issues
- Demographics
- Quality of data
- Representativeness of data

Technical Issues

- Low numbers of pathogens
- Pathogens difficult to detect
- Cannot determine viability
- Require large sample volumes
- Few labs equipped or staffed
- Days to weeks for results

Modern microbiologists- looking for pathogens

Demographics

- In U.S.— >93 percent of public water systems serve populations <10,000
- In Canada— >75 percent of public water systems serve populations <10,000

What Makes Microbial Data Credible?

- Sensitivity
- Specificity
- Reproducibility

No Pathogen Method Has Acceptable Sensitivity, Specificity, or Reproducibility to Make Timely Public Health Decisions!

Time for a Reality Check

Protozoa Monitoring Practices

Utility	Water Production Data	Monitoring Program – *Cryptosporidium/Giardia*			
	L/Month	Volume of Sample (Treated Water)	Number of Samples/ Month	Total Volume Sampled/ Month	Percent Water Analyzed/ Month*
Milwaukee, Wis. (2 plants)	1.44×10^{10}	500L	4	2000L	0.000014
Ottawa-Carleton, Ontario (2 plants)	1.05×10^{10}	1000L	2	2000L	0.000019
Calgary, Alberta (2 plants)	1.28×10^{10}	1000L	2	2000L	0.000016
Denver, Colo. (3 plants)	1.83×10^{11}	88L avg.	4	351L	0.00000019
EPCOR, Alberta (Edmonton) (2 plants)	9.84×10^{9}	1000L	2	2000L	0.000002
Windsor, Ont.	5.1×10^{9}	1000L	1	1000L	0.000019
Fort Collins, Colo.	2.9×10^{9}	3800L avg.	3 avg.	11,400L	0.00039

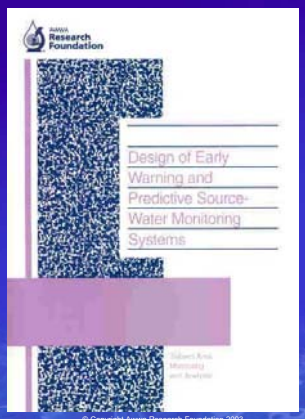
*Based on L/Month Production Data

A Better Way to Protect Public Health

- NOT by pathogen monitoring
- Source water protection and monitoring
- Treatment process optimization and enhancements
- Storage and distribution system integrity

Source Water Monitoring

- Turbidity
- Temperature
- Alkalinity
- Precipitation events
- pH
- *Escherichia coli*
- Conductivity

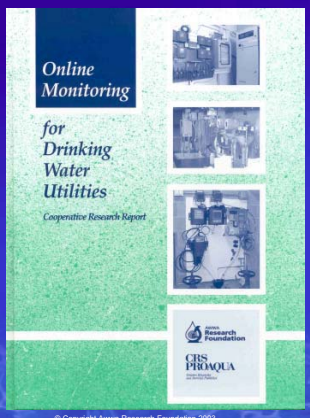


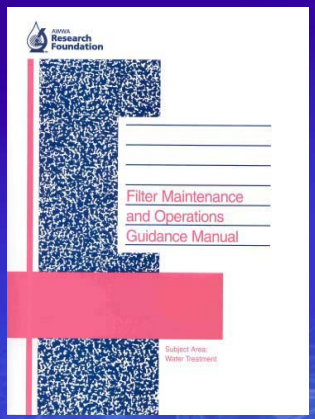
Emerging Drinking Water Treatment Technologies

- Suitable for large and small communities
- Validated by AwwaRF research
- Being widely applied

Process Optimization

- Improved instrumentation (on-line turbidimeters/disinfectant residual monitors, particle counters)
- Improved treatment operations & management
- Emerging affordable technologies (membranes, ultraviolet irradiation, ozone)





Experience from 42 water utilities

Future Directions

- Away from contaminant-by-contaminant approach—model other industries
- International efforts to explore alternatives to ensure public health
- The Bonn Workshops - 2001 & 2004

21st CENTURY QUALITY ASSURANCE WHERE ARE WE AT PRESENT

Divergent approaches

The science

The same base of knowledge

- •Are the differences justifiable ?
- •Are they based on historical accident or design ?
- •How much should geography or constitution influence the outcome ?

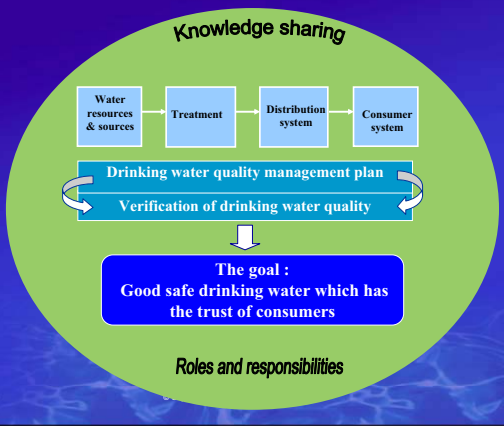
Different constitutional and legislative systems

WHAT DO CONSUMERS WANT FROM THEIR WATER SUPPLY ?

- Must be "safe"
  - free from " harmful bugs"
  - free from "chemicals"
- Taste and look good
- Continuously available at the right pressure
- Affordable

We are all in the vital business of public health protection

THE PROVISIONAL BONN FRAMEWORK



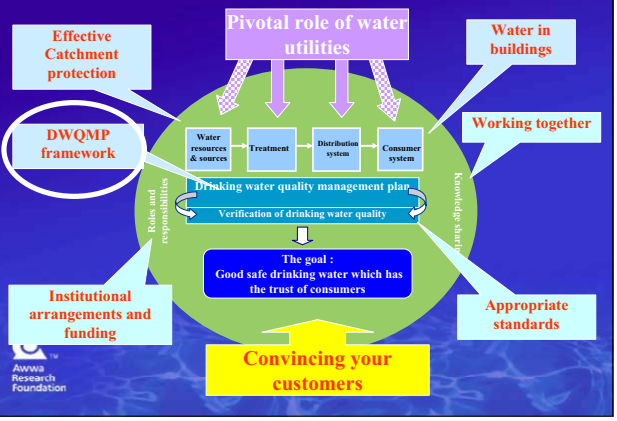
APPLIES TO ALL TYPES OF SYSTEM

- Small systems – Simplified generic approach
- Large/complex systems – Tailored approach but based on common framework

APPLIES TO ALL QUALITY ISSUES

1. Microbiological – absolute safety
   - System wide appraisal of risks and effective controls
2. Customer acceptability – appearance/taste
   - If customers do not like to drink our water how can they trust the things that they cannot detect
3. Chemical – whether real or perceived, e.g.
   - Algal toxins – effective controls without the need for lots of ineffective and complex monitoring
   - Endocrine disrupters – EU has accepted benefit of risk based approach

THE BIG PICTURE



New WHO Direction

- Water Safety Plans
- Now in development
- Aligned with Bonn workshops

ありがどございます

THANK YOU