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May 27th, 2025

PHO Rounds

Drinking water safety

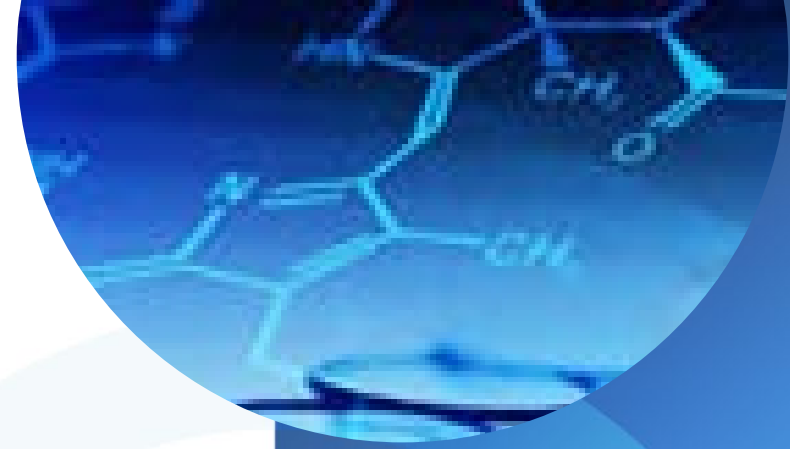
25 years after Walkerton:

Risk & regulatory perspectives

Ian Douglas, P.Eng.

Water Quality Engineer

Ontario Drinking Water Advisory Council



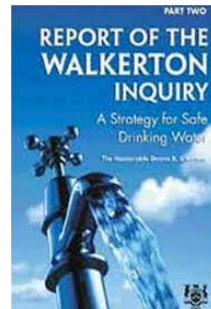
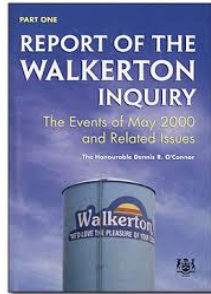
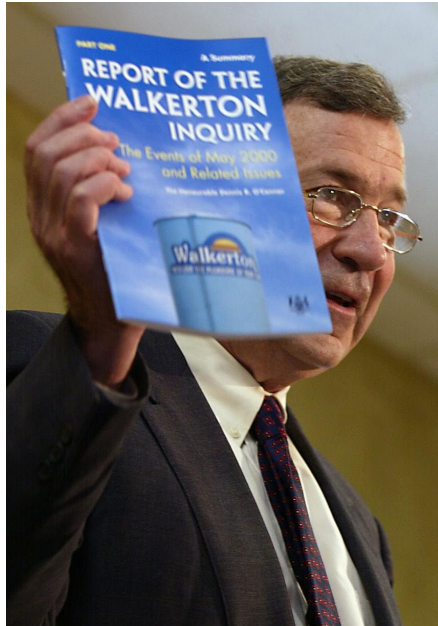
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Walkerton, Ontario: waterborne outbreak

May, 2000 2,300 illnesses & 7 deaths

E.Coli O157:H7 & Campylobacter jejuni



How did Walkerton change the water industry?

Regulations...

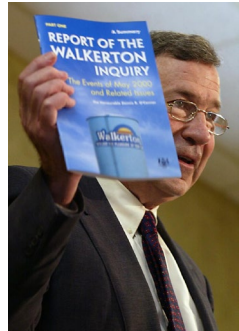
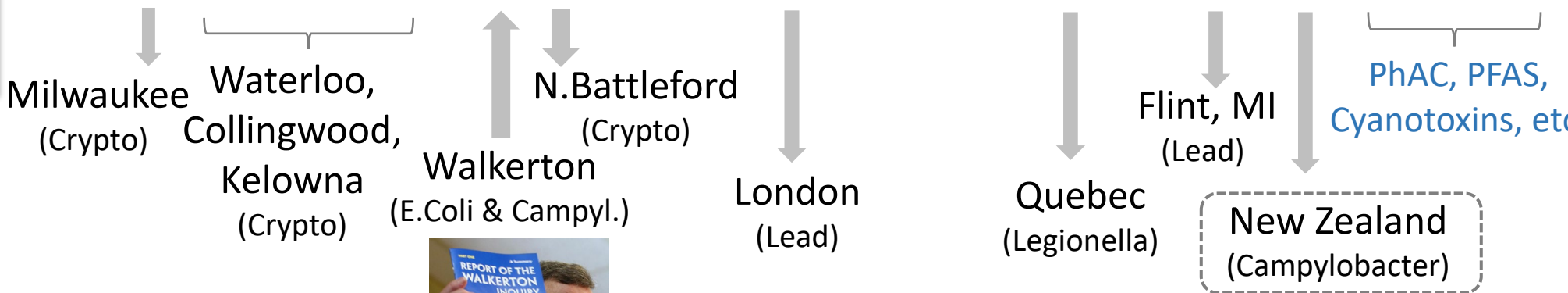
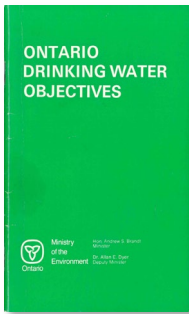


Operators

Lead Reg
Sch.15(1)

Well drilling
Lab Testing
DW Systems
Small Systems
DWQMS
Source water protection

Asset Management



Ontario's drinking water protection framework



SDWA, 2002



DWQMS



Reports



Permits &
Licences



Inspections



Technical
Bulletins

21 Elements: Ontario DWQMS

(Drinking Water Quality Management System, 2007)

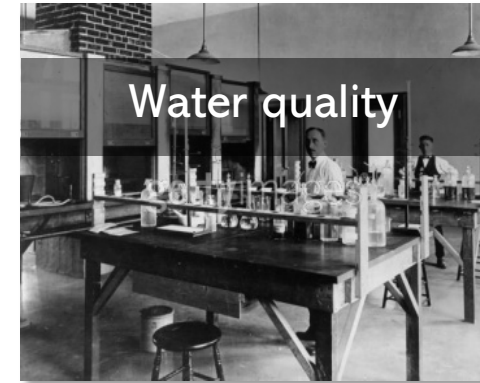


“Heart” of the DWQMS:

- Risk assessment
- Critical control points
- Monthly incident review
- Management review
- Annual reports

Five Elements of a Safe Drinking Water System

Walkerton Report Part II, 2002



Are there any “gaps” in Ontario’s DW framework?

Five Elements of a Safe Drinking Water System

Walkerton Report Part II, 2002



- ❖ Crypto & Giardia
- ❖ Viruses in well water



- ❖ Filter turbidity <0.1 NTU
- ❖ CT Disinfection: tracer



- ❖ Depressurization
- ❖ Animal intrusion
- ❖ Biofilm pathogens
- ❖ Lead in tap water



- ❖ Bacteriological testing
- ❖ 10 ODWS: no testing



- ❖ QA/QC cross-checks
- ❖ Coagulation “map”
- ❖ Critical Control Limits

Source water pathogen levels: *Cryptosporidium* & *Giardia*

A tale of three cities...



Treatment
Regulations

3.0 log

3.0 log

3.0 log



Treatment
Source Risk

4.5 log

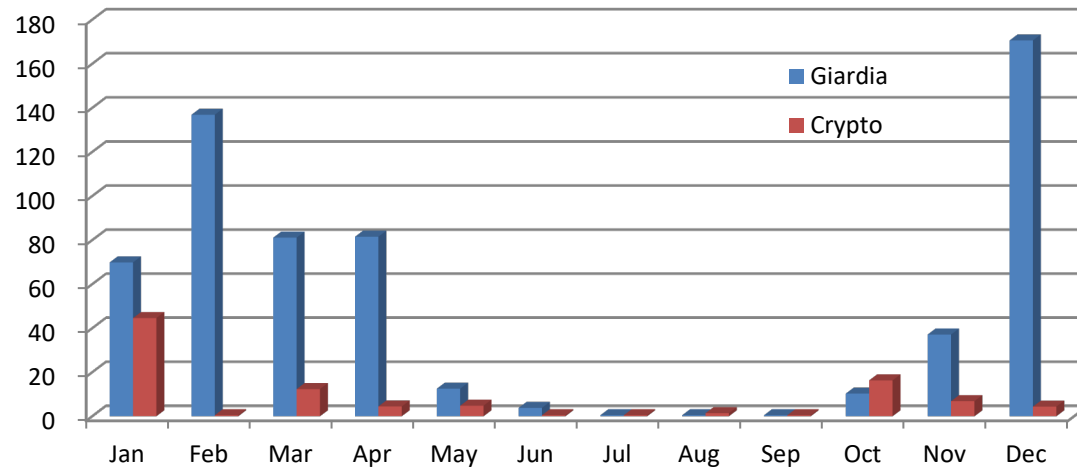
5.5 log

4.5 log

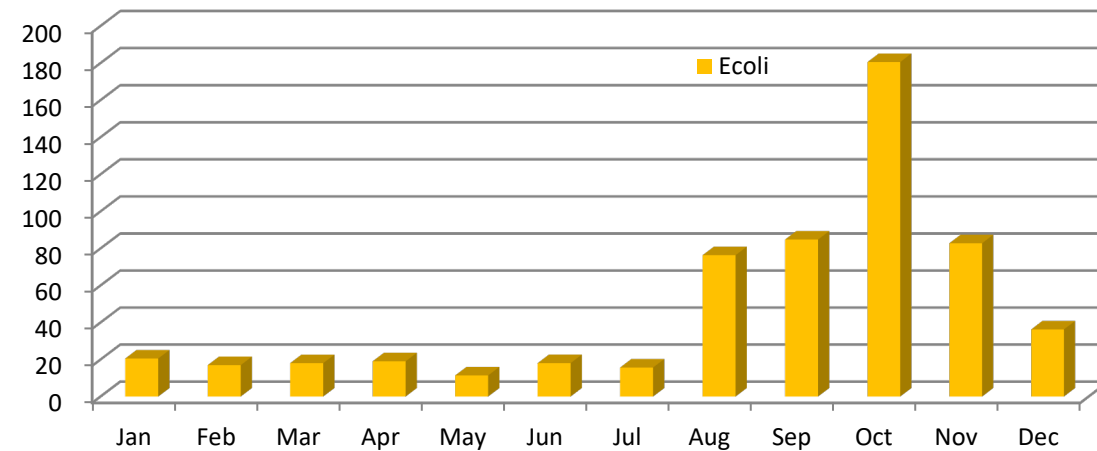


Ottawa River: source water protozoa concentrations

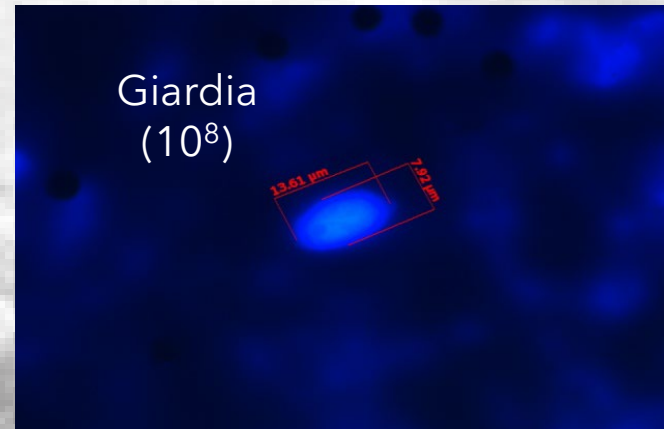
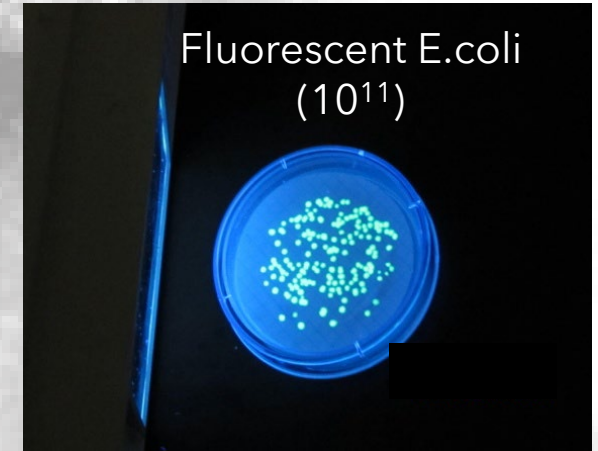
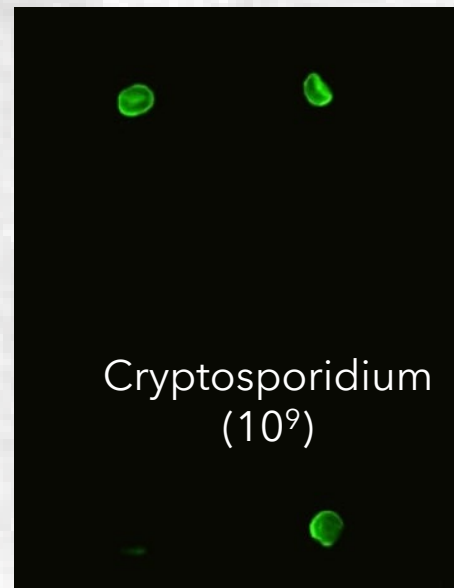
Crypto & Giardia (#/100L)



E.coli (cfu/100mL)

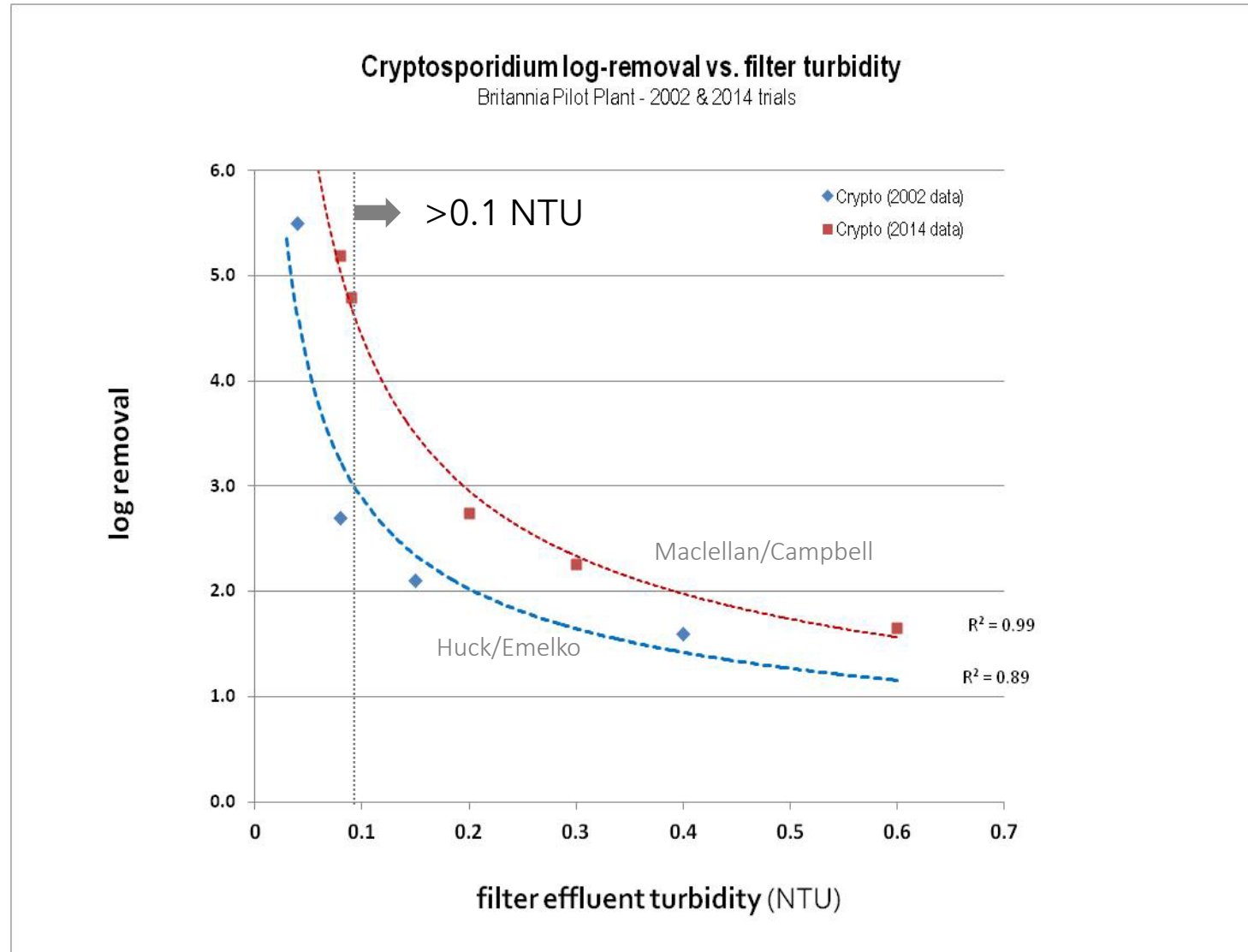


Pathogen challenge experiments:



Filtration: pathogen log-removal vs. turbidity

eg. Cryptosporidium



Higher risk of pathogen release even at slight increase > 0.1 NTU turbidity:
5.0-log (± 0.4) \rightarrow 2.5-log (Ottawa)
3.0-log (± 0.7) \rightarrow 1.0-log (California)

Current regulations allow 0.3 NTU up to 1 NTU in filter performance

Coagulation road “map” for plant operators

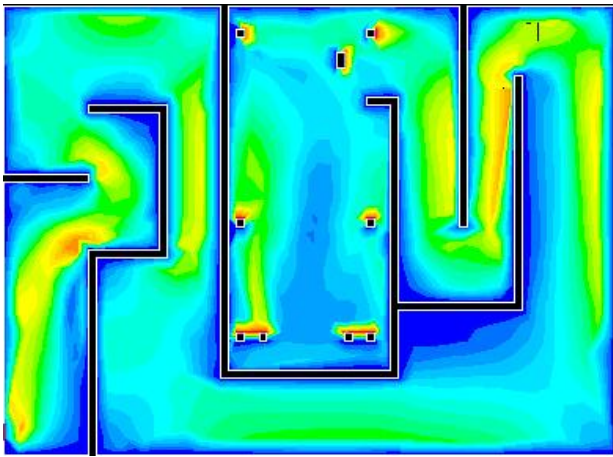
Optimize for seasonal variations in source water



Tracer tests to validate primary disinfection

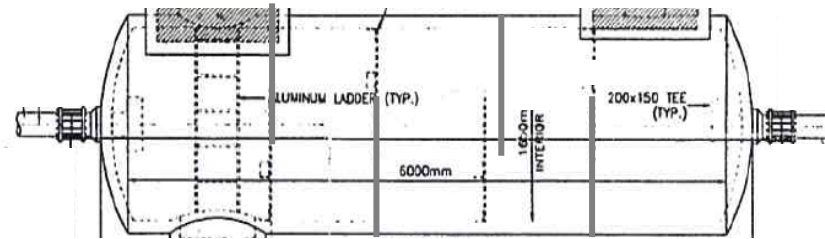
Full-scale WTP:

Primary disinfection chlorine chamber:
tracer test to improve hydraulic efficiency
0.25 → 0.79



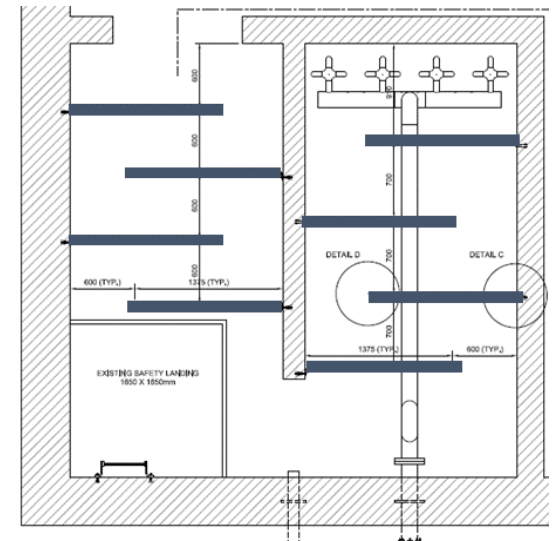
Municipal Well System

Chlorine disinfection contact chamber with
design efficiency of 0.9
tracer: **actual** → 0.5



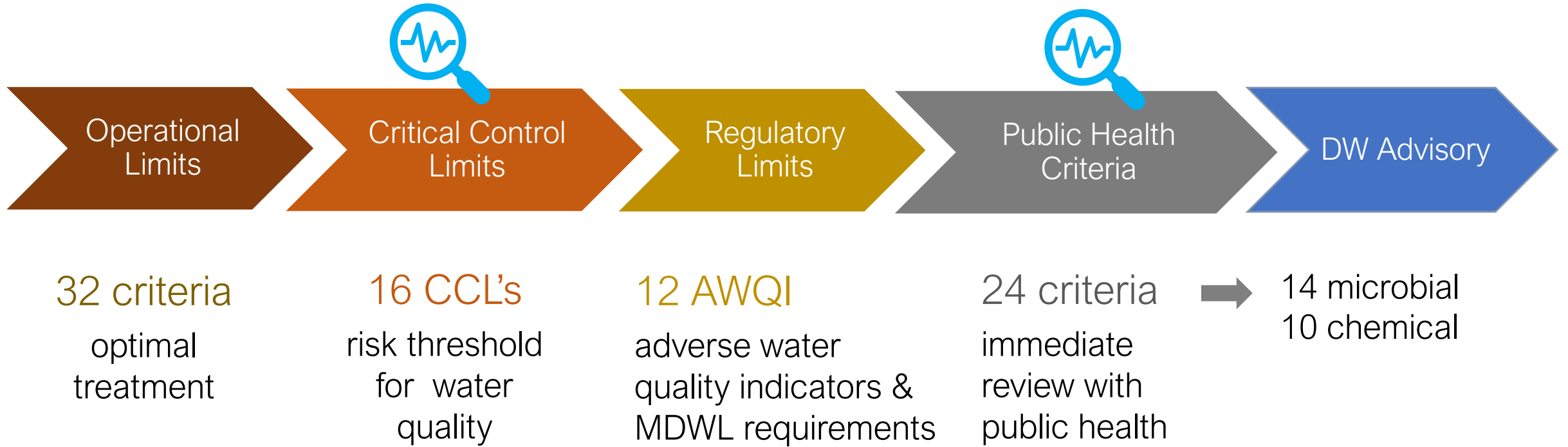
NEW Municipal Well System

Disinfection chamber **design** stated 0.50 efficiency; tracer test: **actual** → 0.25 baffles



LIMITS: *Operational, CCLs, Regulatory, & Public Health*

eg. City of Ottawa





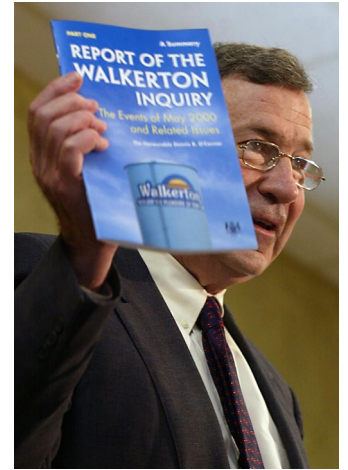
Research !

bench / pilot plant / full-scale



Final thoughts...

- 1) 25 years → excellent progress!
- 2) Ontario: DWQMS + Reg's → safety net, but some potential “gaps”
- 3) Engineering & critical thinking, research, peer & expert review;
- 4) Collaboration: public health & water operations!





Thank you!

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Drinking Water Safety: 25 years after Walkerton

Michele Grenier, P.Eng.

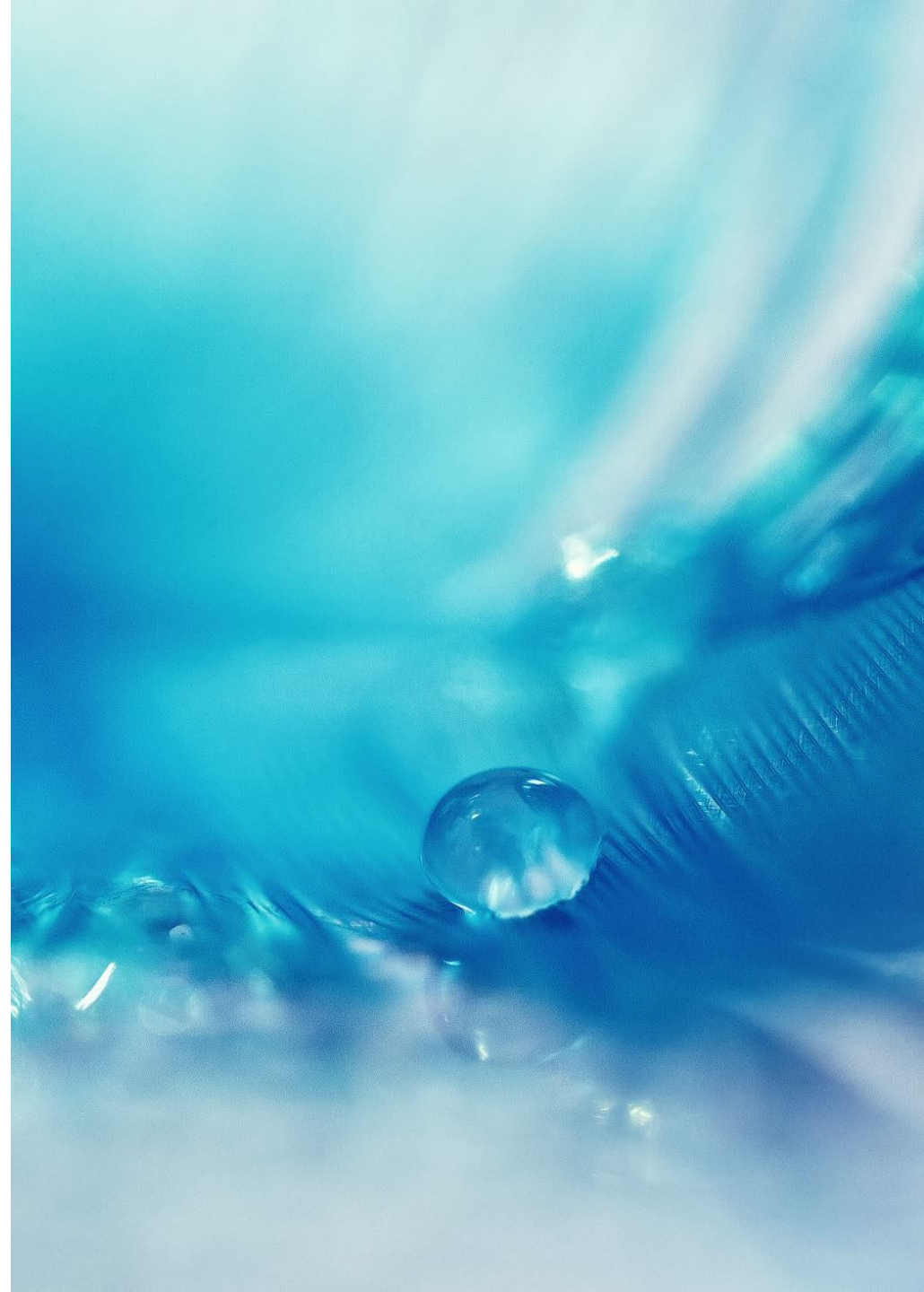
Chair – Ontario Drinking Water
Advisory Council (ODWAC)

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The Role of Water Professionals in Ontario

- Ontario's drinking water system involves multiple professionals, sectors, and regulations
- Safety is ensured at every step — from watershed protection to the glass
- Public health officials play a critical role in this integrated framework



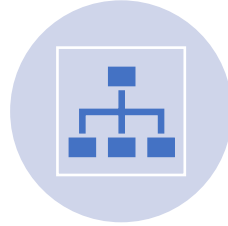
A Shared Responsibility



SOURCE PROTECTION



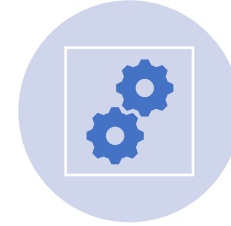
GOVERNANCE &
FUNDING



QUALITY
MANAGEMENT &
PLANNING



INFRASTRUCTURE &
ENGINEERING



OPERATIONS



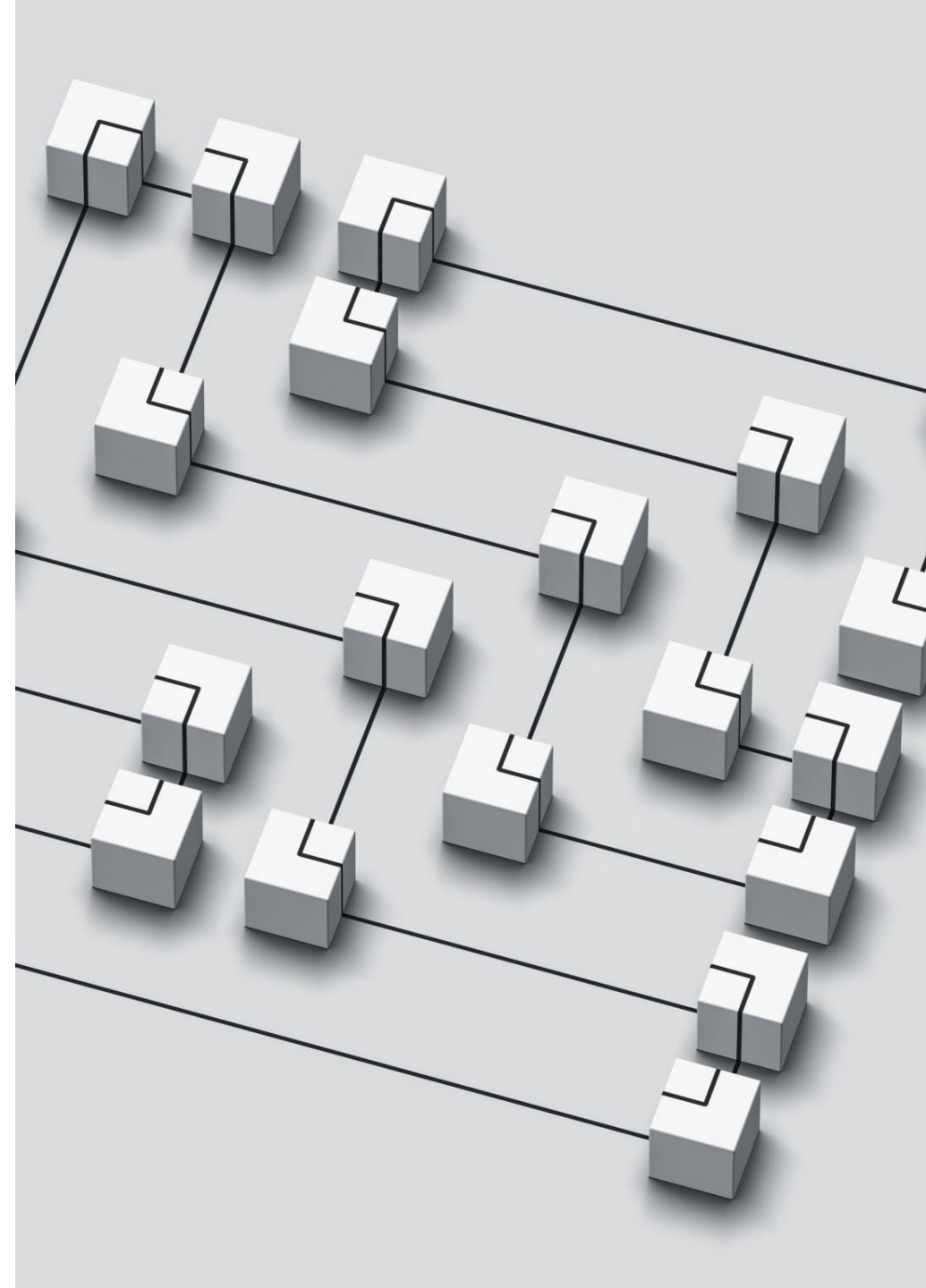
REGULATION &
COMPLIANCE



PUBLIC ENGAGEMENT
AND EDUCATION

Regulatory Framework for Small Systems

- The transfer of small, non-municipal systems from MECP to MOH:
 - Recognized the need for proportional regulation
 - Reduced administrative burden while maintaining public health protection
 - Relocated oversight to PHUs under **O. Reg. 319/08**, allowing for **risk-based inspections, simplified compliance, and local accountability**
- This change allowed Ontario to maintain the integrity of its drinking water safety net while **accommodating the practical realities** of small system operations

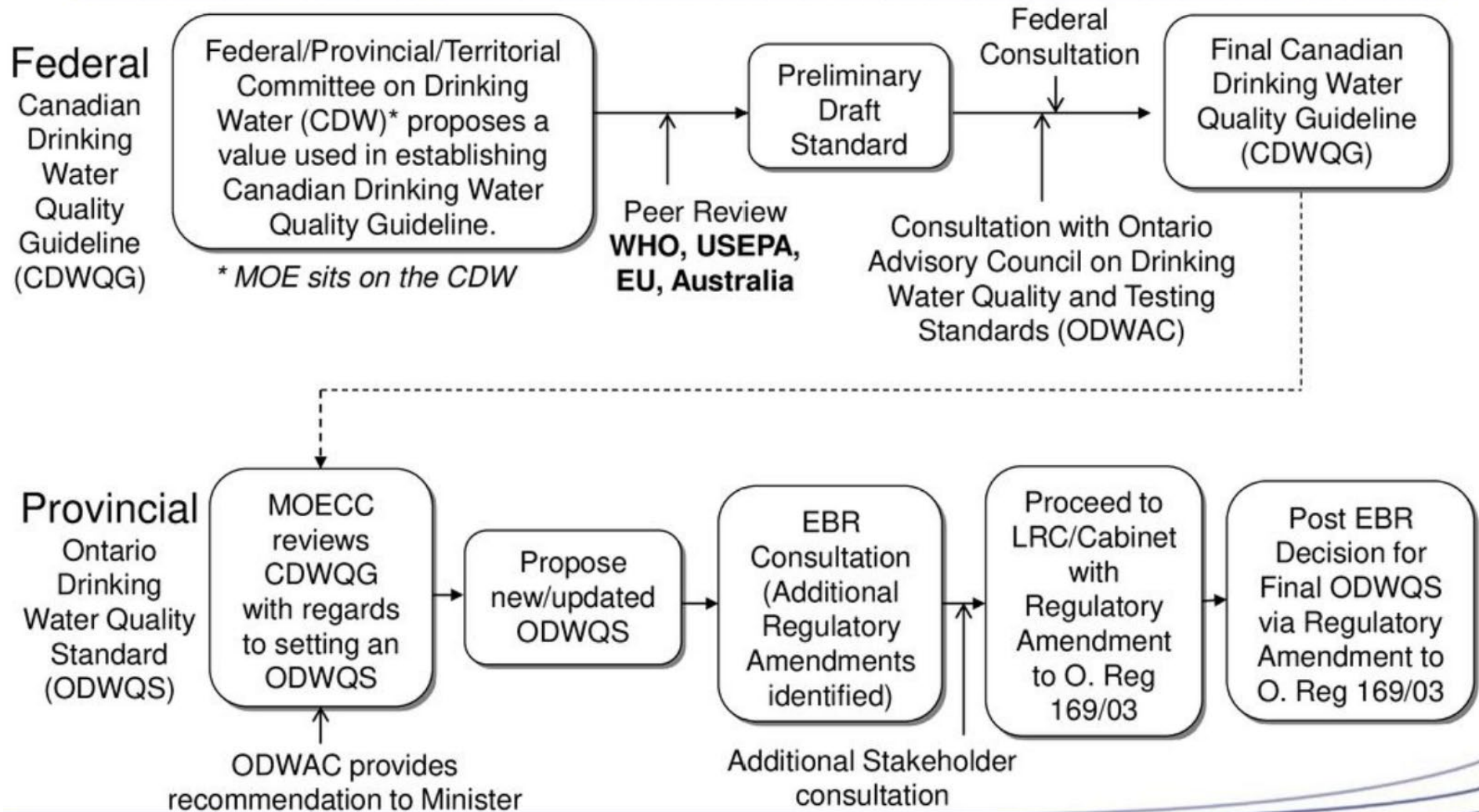


Advisory Council on Water Quality Standards and Testing

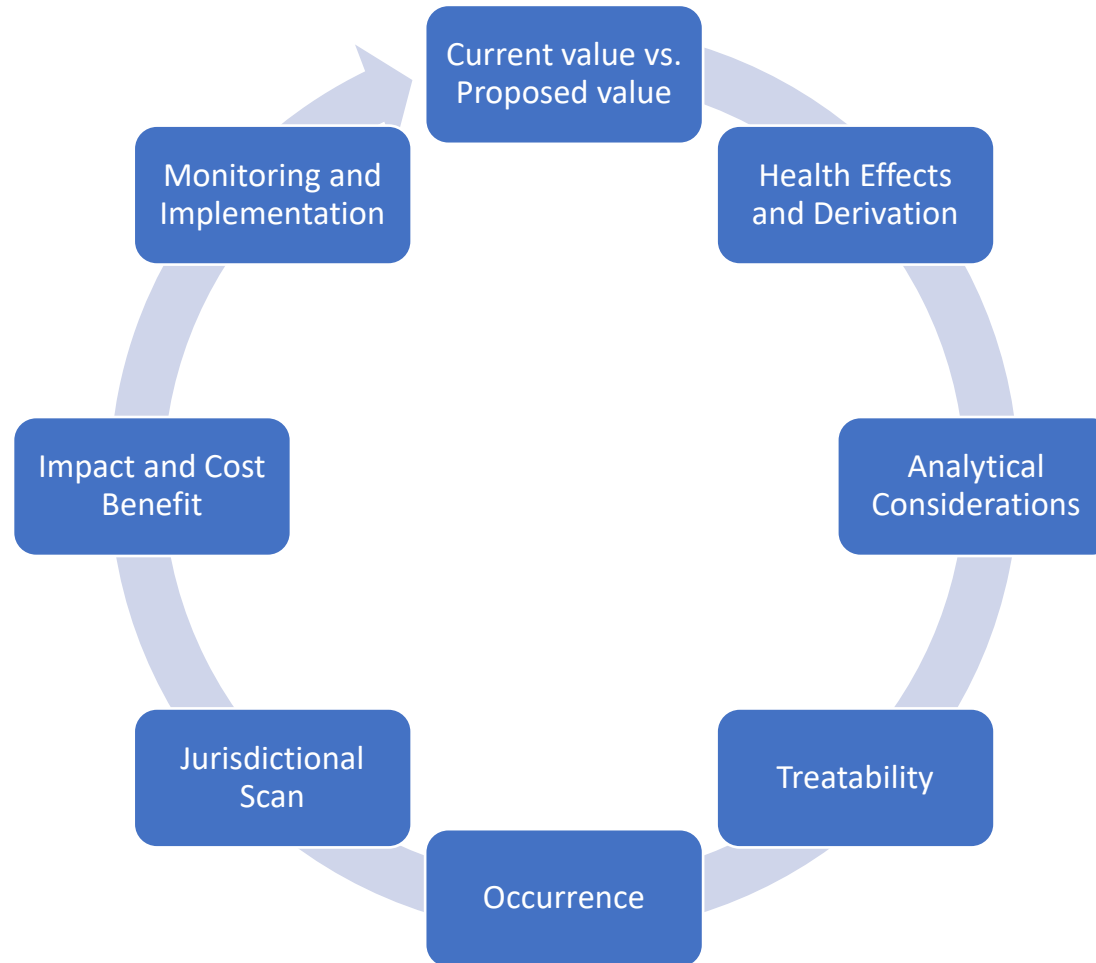
- ODWAC was created in response to one of Justice O'Connor's recommendations in the Part II Report of the Walkerton Inquiry
- The mandate of the council is to provide technical and scientific advice and make recommendations to the Minister of the Environment Conservation and Parks on matters related to standards for drinking-water quality and testing



Ontario's Standard Setting Process

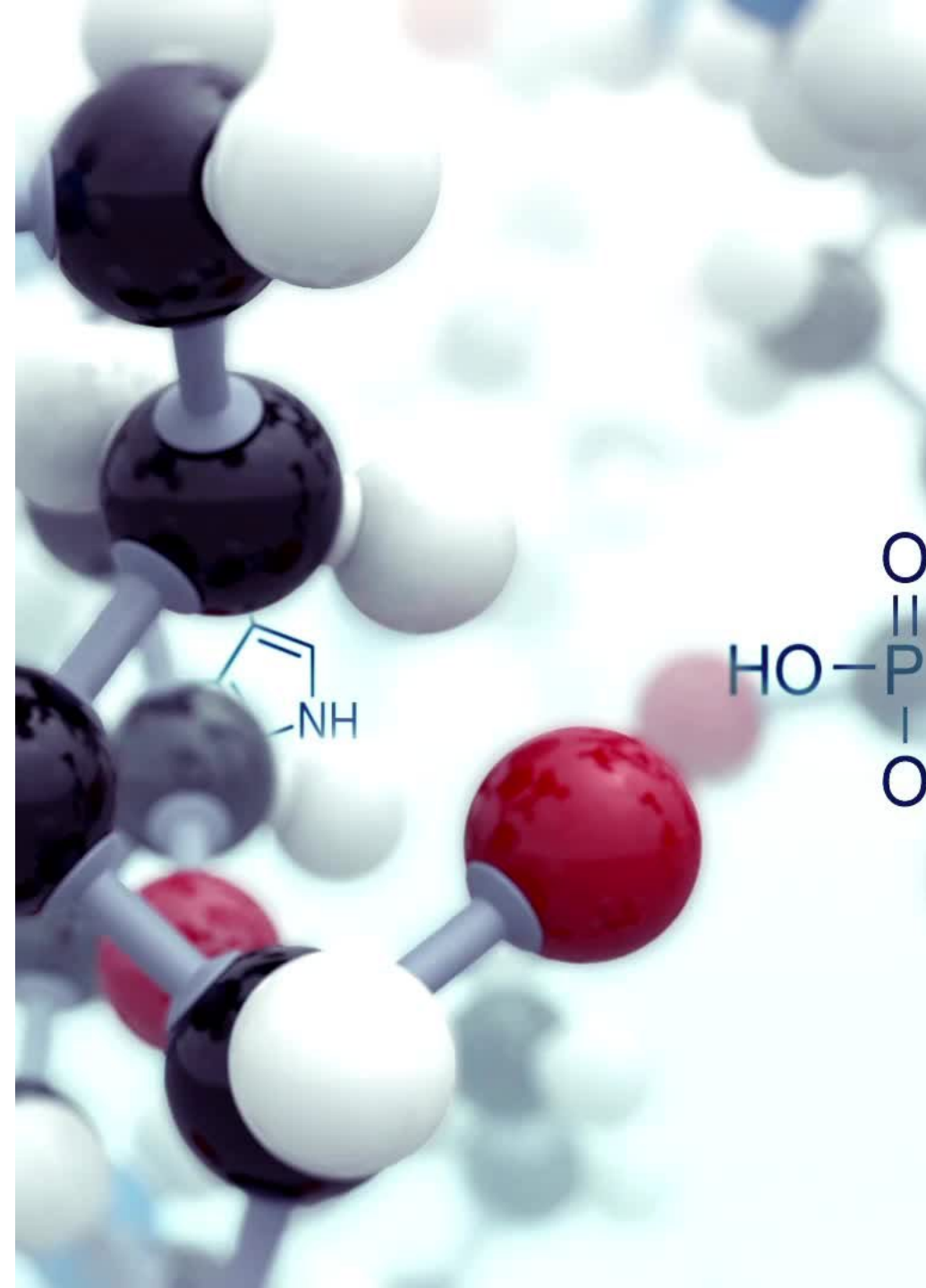


What does ODWAC consider in its review?



Recent Work

- Chromium
- pH
- Bromate
- Manganese
- Microcystins
- 1,2-dioxane
- Metribuzin
- Uranium
- Barium
- Boron
- Bromoxynil
- MCPA
- 2,4-D
- Strontium
- Cadmium
- Chloramines
- Pesticides



Current Issues and Future Trends

Lead

PFAS

Legionella

Iron

Copper

Aluminum

Antimony

Arsenic