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## Clean & Safe Drinking Water Workshop

Gander  
Newfoundland & Labrador  
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## Water Quality in the Distribution System: *Starting Clean & Staying Clean*



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## The Government Theme:



<http://www.gov.nf.ca/env/>

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## What are the water concerns?

- Starting with a good water supply
- Ensuring adequate treatment, as needed
- Maintaining disinfectant during distribution
- Limiting metals and corrosion in the distribution system
- *Starting clean & staying clean*

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## What are the water issues?

- Source water protection – *multi barrier*
- Treatment for pH, iron, and manganese
- Ensuring adequate disinfection while minimizing THM production (see 2001)
- Limiting water loss in the system
- *Starting clean & staying clean*

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## Be prepared, not crazy:

There are events out there that you need to consider and can plan for (floods & sand bags), however there are others that have potential but you as individuals can not control (sarin nerve gas & duct tape). The early months of 2003 have made these issues clear!



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## 3 P<sub>s</sub> – Plan, Produce & Protect

System operation and maintenance is key to the provision of clean safe drinking water. A lot of effort goes into the planning the source and treatment, the production quantity and quality, and the protection of the water and the system. Don't underestimate the need for planning to ensure these goals are met.

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## Drinking Water Safety Report

Multi-Barrier Approach

- Source Protection
- Treatment
- O & M
- Monitoring / Reporting
- Inspection & Abatement
- Education & Training



**Water Supplies: Source to Tap**

- 85% are chlorinated
- 2.2% unprotected
- 13 WTPs, 28% pop'n
- 59 > 100ug/L THM
- New initiatives for reporting, inspection, planning & training



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**A typical community:**


- Small community (200 to 5,000 people)
- Fe, Mn, Colour issues
- Very aggressive water
- Difficult to maintain disinfectant levels
- THM concerns



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**Historic problem waters:**

- Humic and fulvic acids
- Organic metal complexes
- Low pH in raw water
- Limited coagulation-filtration
- High chlorine dose
- Long residence times
- Chlorine booster stations



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**How to deal with the issues:**

- Determine the “real” quantity needs
- Adequately test the supply source
- Determine “realistic” treatment options
- Implement “cost effective” treatment
- Then when you are all done ....

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**Sometimes things just fail !**



**Plan for the worst!**

**The Historic Issues:**

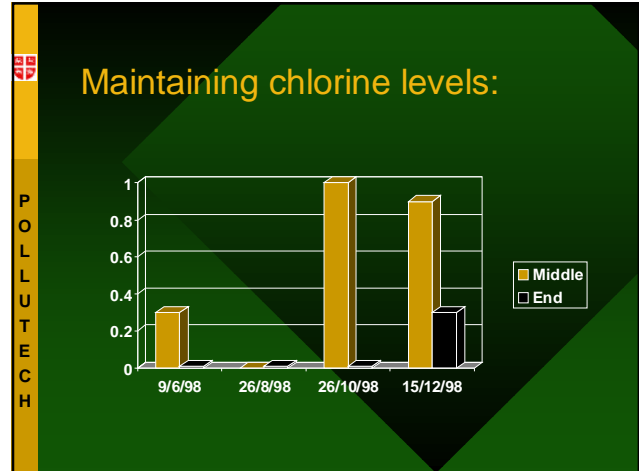
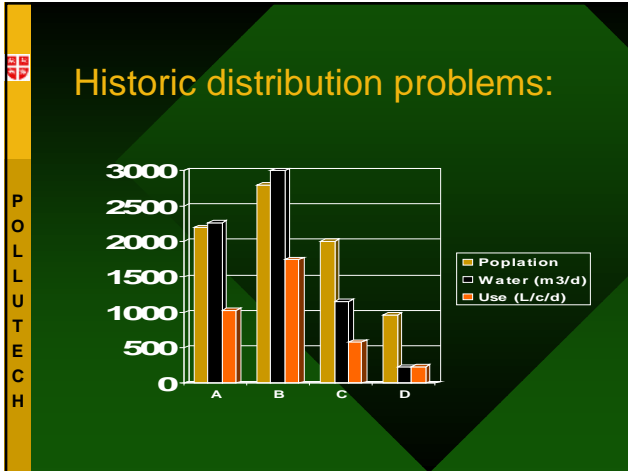
- water quality
- system corrosion
- distribution problems
- disinfectant residuals & THMs

**Historic water quality:**  
(TESTING COMPLETED BY POLLUTECH)

TOWN	pH	Colour	Fe (mg/L)	Mn (mg/L)
Community A	5.0	52	0.36	0.02
Community B	4.2	-	0.39	0.005
Community C	5.2	40	0.14	0.005
Community D	6.5	21	0.01	0.01
Community E	5.7	46	0.01	0.02
Standard	6.5 - 8.5	15	0.30	0.05

**Historic corrosion issues:**  
(TESTING COMPLETED BY POLLUTECH)

Location	pH	Fe (mg/L)	Cu (mg/L)
Intake	6.6	0.21	0.01
Hydrant	5.9	2.50	0.03
Cold Water	4.2	0.39	1.15
Hot Water	4.7	0.30	2.40



- ### Lessons learned from history:
- THMs are forming in the system
  - Rapid loss of chlorine in system
  - Chlorine residual is depleted at end
  - Water quality guidelines not met for either THMs or Chlorine Residual

- ### Planning for the future:
- what do you have now ?
  - what can be done better ?
  - what not to do !

**Do you have a plan?**

- Supply options
- To treat or not to treat
- Distribution systems
- Maintaining quality
- Maintenance programs
- Monitoring & Reporting



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**The management plan:**  
(STEP 1)

- Define the current system (physical and chemical).
- Establish the water quality characteristics.
- Determine your end quality and quantity needs.

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**The management plan:**  
(STEP 2)

- Check for downstream issues – corrosion, disinfectant residuals, THMs.
- Complete a “Value Engineering” study.
- Make a “reasonable” decision.

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**The “Not To Do” List:**

- Don't panic, base your decision on good testing and reasonable decisions.
- Don't listen to “fear mongers”, read the “peer reviewed” literature.
- Don't run out and buy a treatment system until you know what you need.
- Remember “*What is the use of a treatment system that is affordable yet ineffective, or one that is effective and not affordable?*”

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**Are you a leader or follower ?**

Do you find sometimes that you are just "following the flock"? Now is the time to take the lead, so find out all the details and make a rationale decision.



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**Should you do testing?**

- sampling and analysis
- lab scale testing
- pilot scale testing
- full scale testing

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**Start with sampling & analysis:**

- **Chemical**
  - metals, ions, corrosive characteristics
- **Biological**
  - bacteria, cysts, viruses
- **Physical**
  - flow, corrosion potential, leakage, retention

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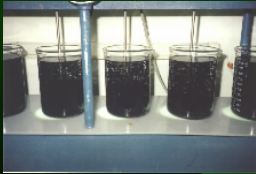
**Screen by bench scale testing:**

- Presence of organically bound metals
- Influence of pH on water chemistry
- Adjustment of alkalinity (corrosion control)
- Evaluation of alternative coagulants, filtration
- Consideration of alternative oxidants
- Interaction of all parameters on water quality

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**Evaluate chemical usage:**


- Use a simple jar test
- Determine what works
- Determine the correct dosage
- Estimate the costs of treatment



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**Sequestering as an alternative:**


- Does it work?
- How long will the metals remain sequestered?
- Are you aware of the problems (heat, chlorine, and time)



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**Evaluating oxidants:**


- Very source specific!
- Define your choices
- Which ones work?
- How complex is the system (i.e.  $\text{ClO}_2$ )
- What is the cost?



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**Modern membrane systems:**


- Have an open mind !
- Evaluate all alternatives
- Compare capital to operating costs for all systems (what is the ROI)
- Don't believe it works until you prove it works!



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**Testing in the system:**

- How large is the system (time)?
- Can you maintain the disinfectant?
- What will be picked up in the system?
- Are the pipes secure?



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**Pilot scale testing rewards:**

- Confirm bench scale test results
- Evaluate seasonal variation
- Decide on most appropriate process
- Demonstrate water quality achievable
- Train plant operations and maintenance
- Obtain public acceptance and confidence

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**Pilot testing at the wellhead:**

- The “exact” source
- Quality fluctuations
- Real time observations
- “Hands On” experience
- Detailed process design and costing achievable



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**Use available equipment:**




You can keep it simple!

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**Residue disposal evaluation:**

- Backwash volumes
- Residue concentration
- Settling characteristics
- Final sludge volumes
- Recycling or reuse options (i.e. P removal)



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**Seeing is believing!**



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**Full scale testing alternatives:**

- Investigate an existing system.
- Evaluate alternatives (corrosion, pre-cursors, disinfectants).
- Understand the “real chlorine decay”.
- Identify system “hot spots” or “upgrade needs”.
- Demonstrate what can be technically and financially achievable.

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**Full scale evaluation:**

- System malfunctioning
- Chemical optimization
- Alternative processes to consider
- Improved disinfection needed
- Operations start-up



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**Evaluate alternatives carefully:**

- Custom systems
- Package plants
- Household treatment
- Treat at the tap
- Bottled water



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**Field testing confirmation:**

- Did you get what you paid for?
- Do you need to do some fine tuning?
- Is the system still working over time?
- Can you do better?



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**Managing the system:**

- Keep the supply safe
- Adequate treatment
- Effective distribution
- Ongoing monitoring
- *Start clean, Stay clean*



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**Learn from others *worldwide*:**


- Region of Waterloo
- City of Moncton
- Region of Halton
- AWWA Research
- Equipment Suppliers



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**Working with the community:**

- New Fe / Mn system
- Residues in mains
- Flushing?
- Swabbing?
- Dealing with turbidities
- Community planning



The sign reads: THE REGIONAL MUNICIPALITY OF WATERLOO GREENBROOK WATER PUMPING STATION 20 GREENBROOK DR.

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**So in conclusion:**

- plan in advance
- evaluate all the alternatives
- apply continuous improvement

*and now ...*

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**That's it, I am out of here!**



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**FURTHER INFORMATION:**

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**Thank you!**

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