Clean & Safe Drinking Water Workshop

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Gander, Newfoundland

March 27, 2001

THM Potential and Newfoundland Water Supplies - Implementing Best Management Practices

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

WHY IS THIS A CONCERN?

- Disinfection versus THM production.
- Humic and fulvic acids in local water.
- The “Walkerton Disaster”.
- Oh no - a carcinogen in my water!
- Where is Erin Brokovich (THM v. Cr^{+6})?

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LIFETIME CANCER RISK:

(Jorgenson, 1985 – 70 kg body weight, 1.5L/day water)

Lifetime Risk	THMs (åg/L)
10^{-5}	56 – 300
10^{-6}	5.6 – 30
10^{-7}	0.56 - 30

BE PREPARED NOT CRAZY:

We have all seen what has happened in Europe, where facts were absent and panic was extreme. Be cautious, but be reasonable in your decisions. Get the facts, evaluate the options, and only then take action.

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LESSONS FROM BEFORE:
(no need to repeat that here)

- Why do we need disinfection?
- DBPs (Disinfection By-Products).
- Health effects of DBPs and THMs.
- How THMs and formed?
- How are THMs reduced or removed?

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HEALTH CANADA WEB SITE:

Health Canada's evidence indicates that the benefits of chlorinating our drinking water – which yields a reduced incidence of water borne diseases such as cholera and typhoid – are much greater than the risks of health effects of THMs. So, yes, people should continue to chlorinate their drinking water.

THE 100 åg/L LIMIT:

Health Canada reports that the length of time in an area with elevated levels is important, however the 100 åg/L limit is based on an annual average. High levels on a particular day are not of concern unless they are consistently high. Expect higher levels in the summer.

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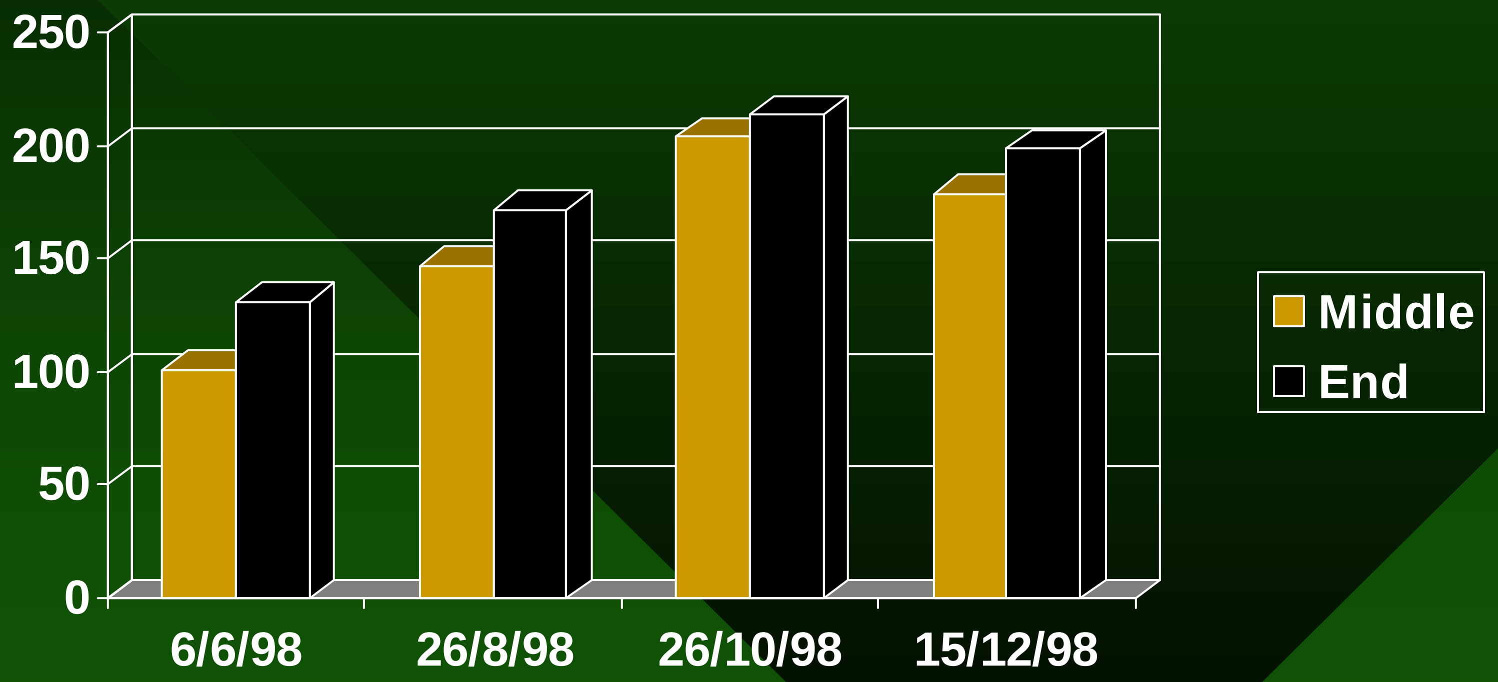
A TYPICAL COMMUNITY:

- Most supplies are well below 100 **å**g/L
- Many supplies are even less than 50 **å**g/L
- Some supplies peak in the summer period
- Surface water supplies yield more THMs
- Heavy chlorination yields higher THMs

THM (åg/L) IN DISTRIBUTION:

(TESTING BY POLLLUTECH IN NEWFOUNDLAND)



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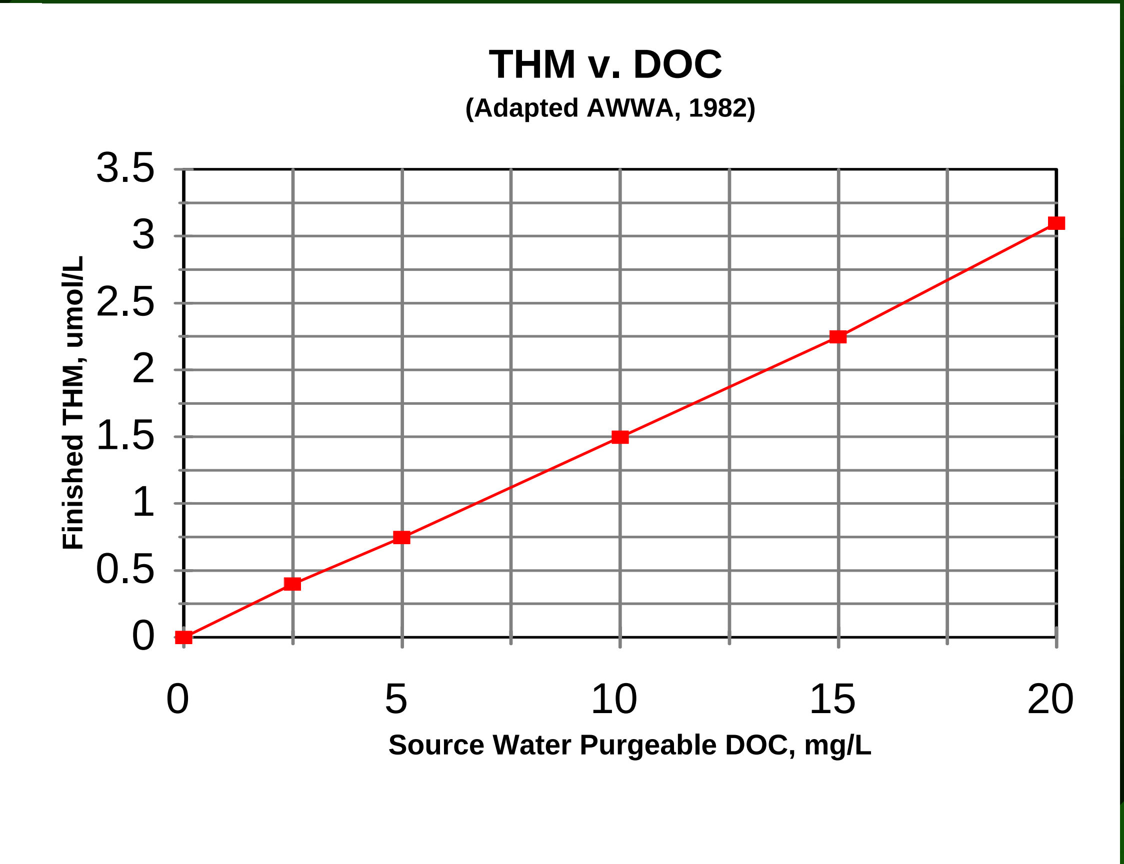
PROBLEM WATERS:

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

THM FROM PRE-CURSORS:



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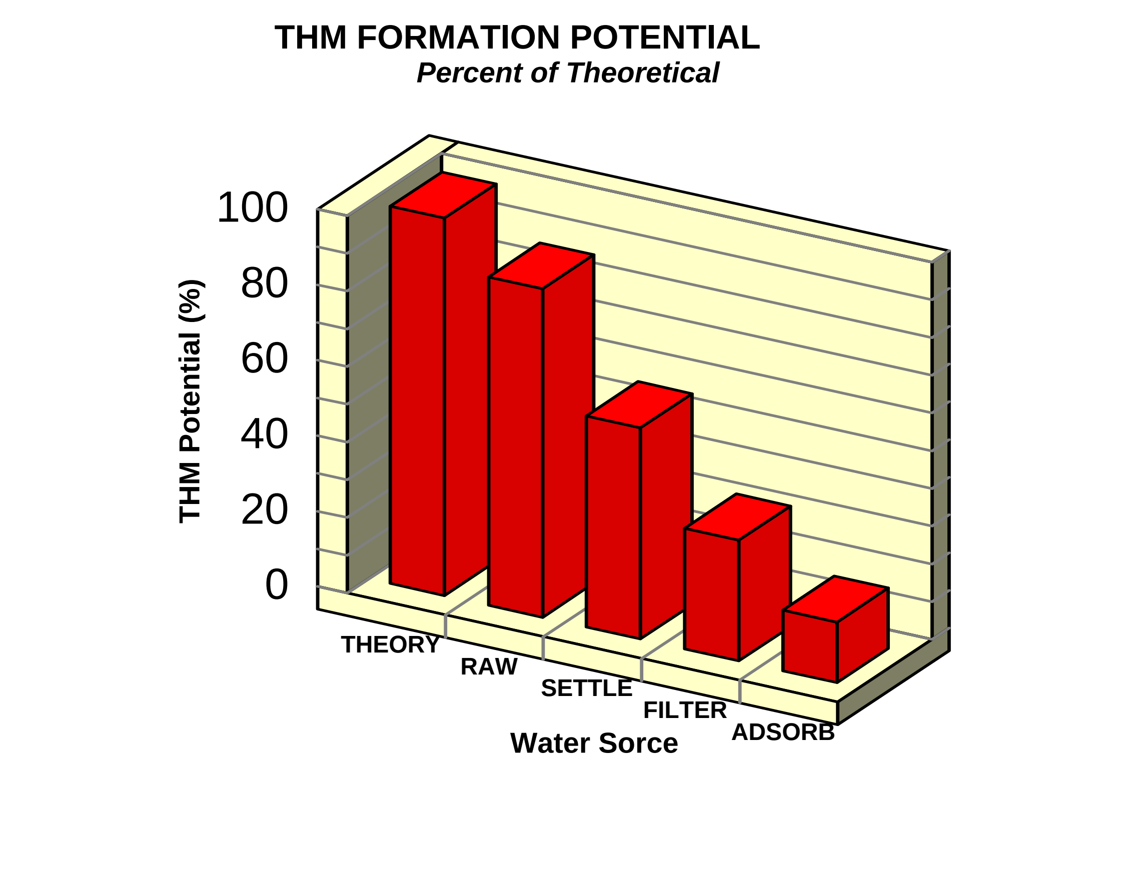
THM POTENTIAL:



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

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HISTORIC CORROSION:
(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

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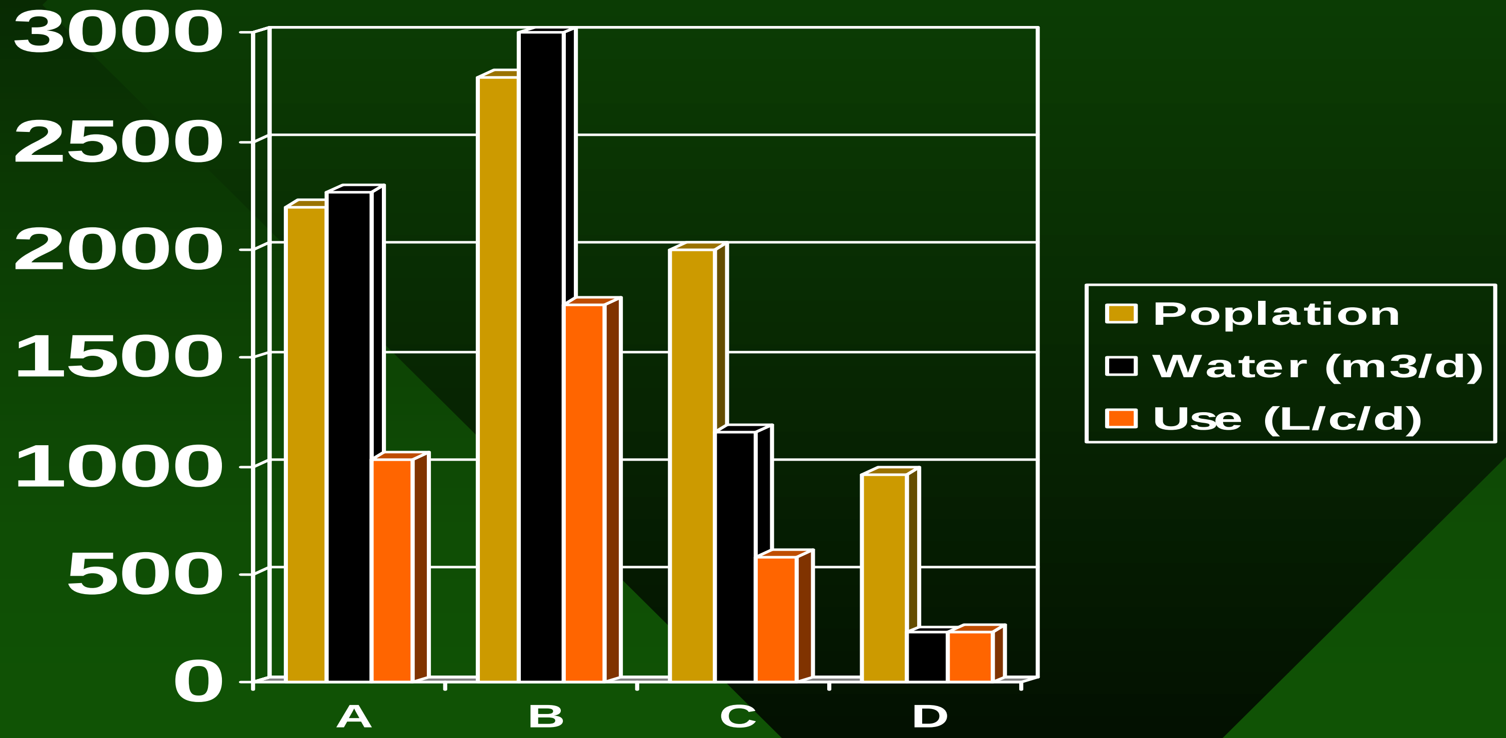
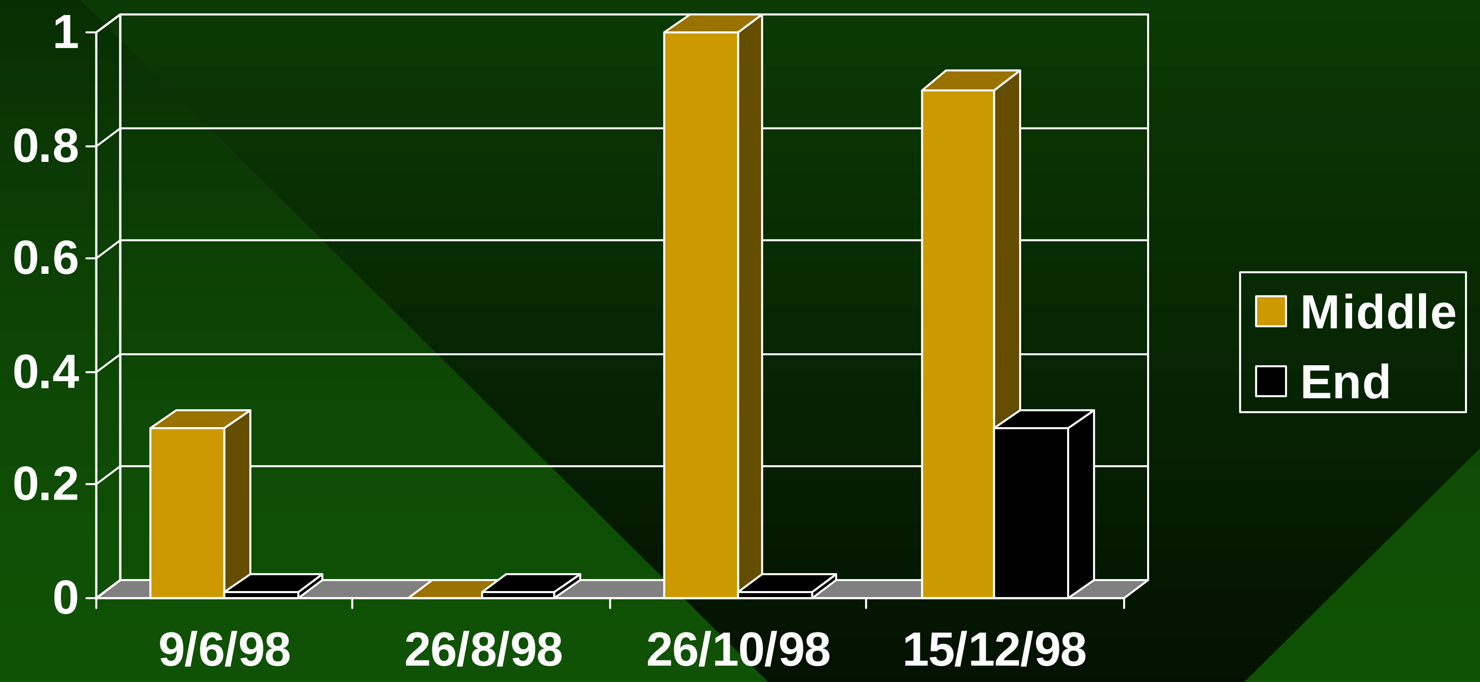
DISTRIBUTION PROBLEMS:



CHLORINE IN DISTRIBUTION:



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IMPLICATIONS OF STUDY:

- 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

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ALTERNATIVE DISINFECTANTS:

(Fleming et al, January 2001)

Process	Bacteria Virus	Cysts	Residual	Organic	Inorganic
NaOCl	Very Good	Fair	Good	High	Medium
$Cl_2 + NH_4^+$	Fair	Very Poor	Excellent	Medium	No
ClO_2	Very Good	Very Good	Fair	Low	High
Ozone	Excellent	Excellent	No	Low	Medium
UV	Good	Under Study	No	No	No

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EUROPEAN STANDARDS:

(Hydes, January 1999)

COUNTRY	TTHM (åg/L)	Chlorine (mg/L)
Austria	30	0.3 – 0.5
Belgium	100	0.2
Denmark	10 – 15	-
Germany	10	n/a
Ireland	100	0.2 – 0.5
Italy	30	-
Luxembourg	50	<0.25
Sweden	50	-
United Kingdom	100	-

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NORTH AMERICAN STANDARDS:

COUNTRY	TTHM (åg/L)	Free Chlorine (mg/L)
United States	**80**	**0.2**
Canada	**100**	**0.2**

Disinfection is not to be compromised in an effort to eliminate THM production, but all reasonable care is being taken to reduce the THM levels now and in the future.

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DO YOU HAVE A PLAN?

Don’t let the water get the best of you!

THE MANAGEMENT PLAN:
(STEP 1)

- Define the current system (physical and chemical).
- Establish the THM and chlorine levels.
- Identify the interaction of THM and Cl_2.
- Test the water and system for chlorine decay rates.

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THE MANAGEMENT PLAN:
(STEP 2)

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- Evaluate pre-cursor treatment alternatives.
- Consider alternate disinfectants.
- Complete a “Value Engineering” study.
- Make a “reasonable” decision.

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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IT IS YOUR CHOICE:

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.

SAMPLING AND ANALYSIS:

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

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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.

PILOT SCALE TESTING:

- 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.

FULL SCALE OPTIMIZATION:

- 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.

ONLY IN NEWFOUNDLAND?

- Northern Ontario
- New Brunswick
- Northern Quebec
- Central Europe
- Central USA
- Almost anywhere!

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WHAT TOMORROW WILL BRING:

- New technologies
- Better risk studies
- Improved distribution
- Scientific research
- Communication (Web)
- Community Understanding

WORKING AS A TEAM:

- International
- Federal
- Provincial
- Municipal
- Private
- Research Facilities

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FURTHER INFORMATION:

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Thank you!