

Safe Drinking Water – Lessons from Outbreaks

Northern Ontario First Nations
Environmental Conference

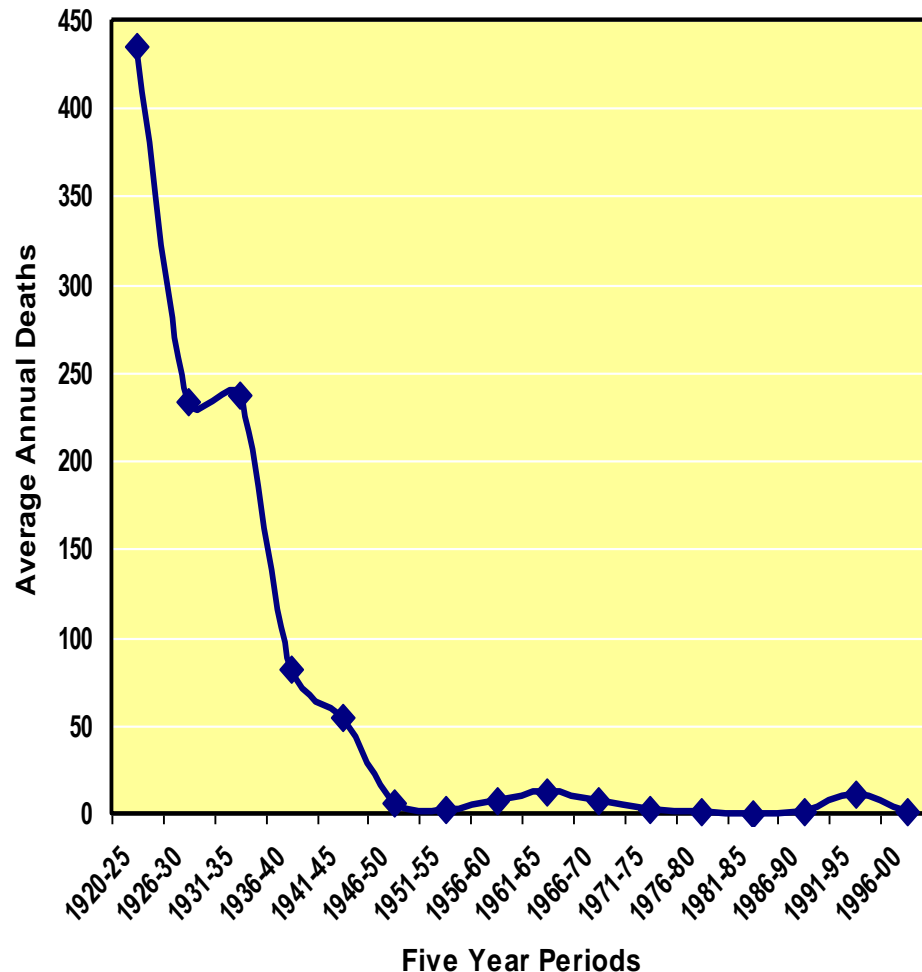
October 3, 2012

Introduction

- “The people of Ontario are entitled to safe, high-quality drinking water.”
- Safe drinking water is vital to public health
- Decision-makers have an important role in ensuring safe, high quality drinking water



Converting Hindsight into Foresight



- Major progress in reducing risks from waterborne disease over the past 150 years
- Society has come to take clean, safe water for granted

(Deaths from Waterborne Outbreaks – US)

Safety Through the Multi-Barrier Approach

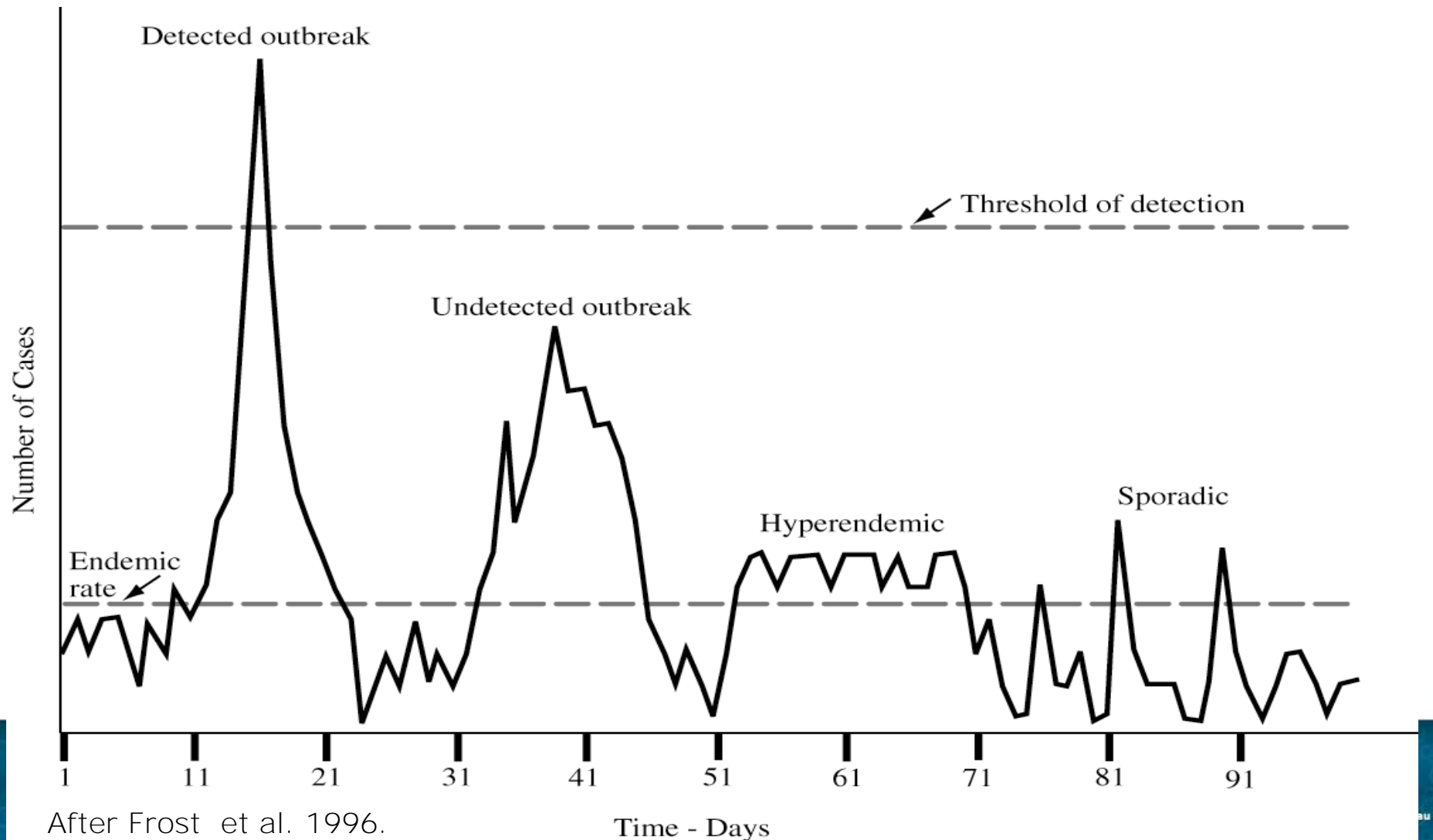
1. Source water protection
 2. Effective treatment
 3. Secure distribution
 4. Effective monitoring
 5. Effective management
- Developed for use across Canada by the Canadian Council of Ministers of Environment
 - Failure in one barrier alone may not lead to an outbreak - Ontario's Drinking Water Safety Net

Discussion Question

Has the drinking water in my community ever made anyone sick?

- Yes
- No
- Don't know
- Discuss

Waterborne Disease Outbreaks must be Large or Unusual to be Detected



Discussion Question

Are there pathogens in the untreated source water for my drinking water system?

- Yes
- No
- Don't know
- Discuss

Case Study 1

Walkerton, May 2000



Scope of Outbreak

Walkerton, 2000

- A shallow groundwater well was heavily contaminated by bacteria from cattle manure from a local farm
- More than 2300 individuals were estimated to have illness, caused by the bacteria *E. coli* O157:H7 (60%) and *Campylobacter* spp. (40%)
- 65 were hospitalized, 27 developed hemolytic uremic syndrome (HUS) and 7 died
- A \$9 million public inquiry led by Justice Dennis O'Connor was called to determine the causes and recommend actions

Saugeen River, Walkerton before & during storm



Summary Analysis of Failures

Walkerton, 2000

1. Source Water Protection

- Well 5 was known to be contaminated 22 years before the outbreak

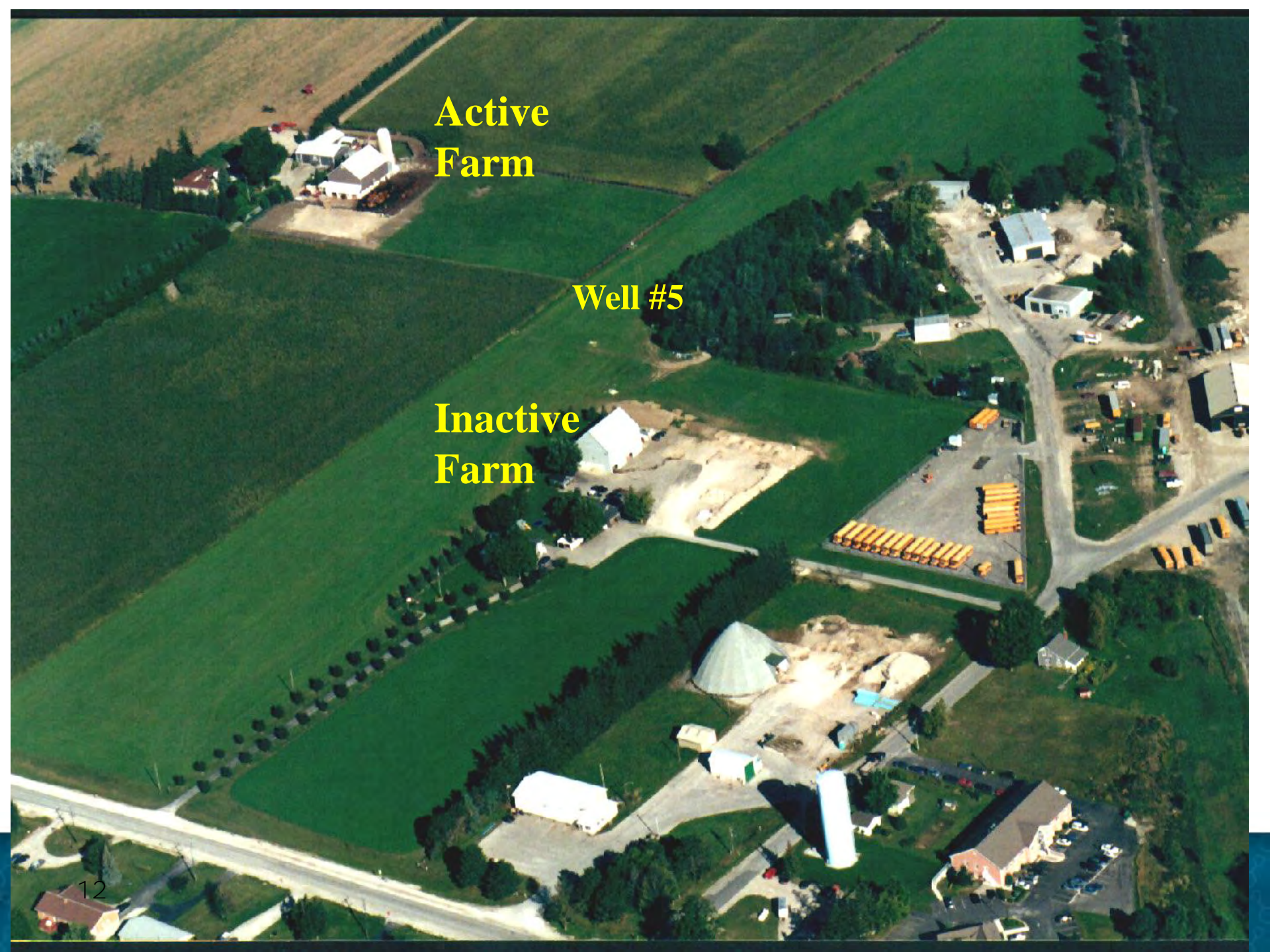
2. Treatment

- Chlorine is needed for disinfection – only treatment step for this system
- Operators did not measure chlorine residual properly
- Chlorine dosing was inconsistent and less than required

**Active
Farm**

Well #5

**Inactive
Farm**



Summary Analysis of Failures

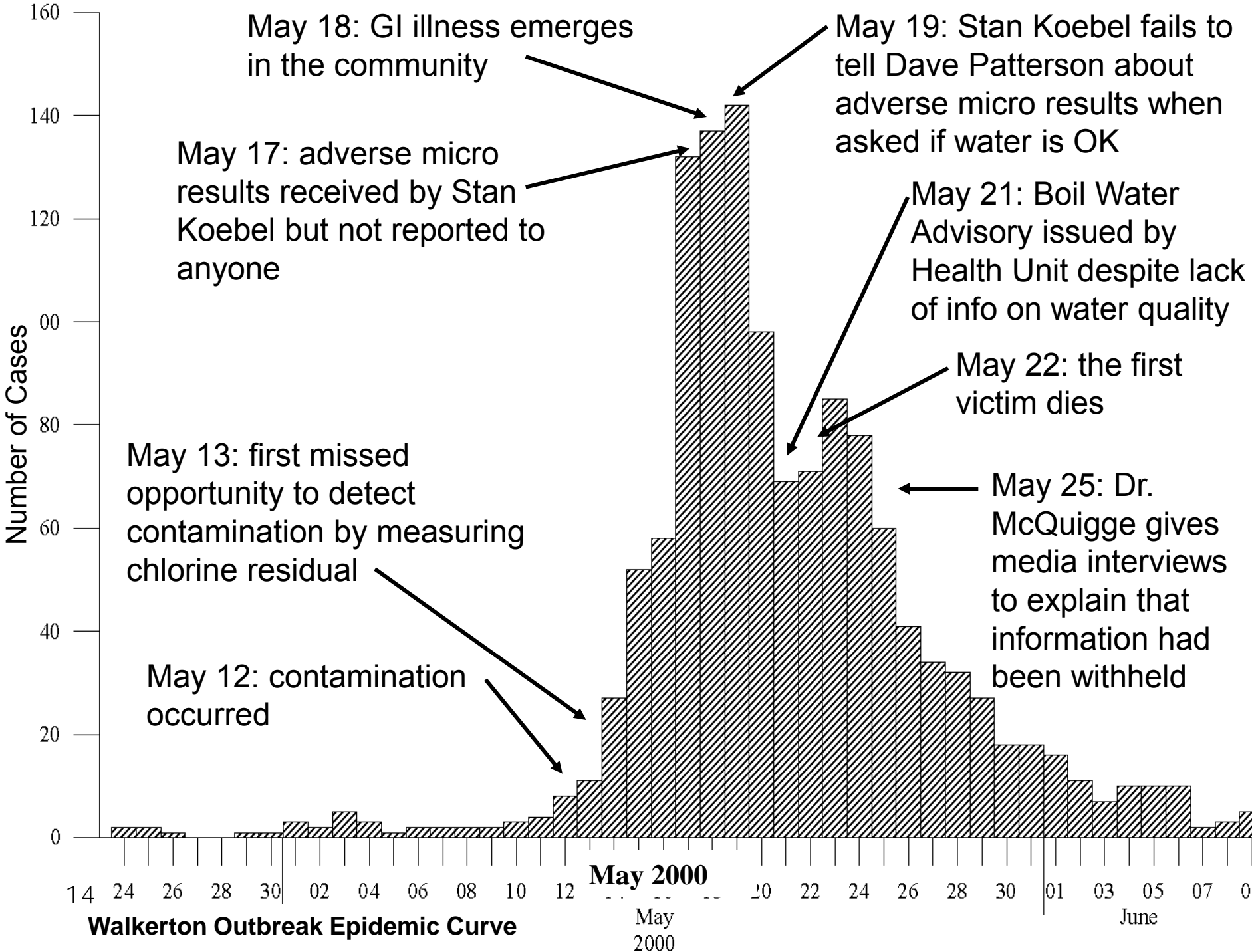
Walkerton, 2000

3. Distribution & Storage

- Many distribution and storage vulnerabilities found but none were significant contributors to outbreak

4. Monitoring

- Daily chlorine residual was not done or was done improperly (always 0.5 or 0.75 mg/L)
- Monthly samples were often intentionally mislabelled
- Laboratory reported microbiological contamination to GM only (not to the Health Unit)



Summary Analysis of Failures

Walkerton, 2000

5. Management

- Owner (Council/PUC) did not provide sufficient oversight
- Falsified data and lack of staff training
- Regulator failed in oversight role in terms of Inspections/approval of Well 5 and not following up on identified problems

Concluding Thoughts

Walkerton, 2000

- O'Connor Inquiry - “failure at all levels”
- Complacency was evident at most levels
- Multiple factors came together to cause disaster
- Well 5 had been vulnerable for 22 years
- Outbreak could have been reduced or prevented by measuring chlorine residual and responding appropriately

Case Study 2

North Battleford, March/April 2001



Scope of Outbreak

North Battleford, 2001

- In spring 2001, the raw water serving the City of North Battleford (pop. ~15,000) was contaminated by the protozoan parasite *Cryptosporidium*
- *Cryptosporidium* originated in the City's sewage outfall ~3.5 km upstream of the intake
- An estimated 5,800 to 7,100 in the region experienced illness
- A public inquiry by the Honourable Robert Laing was called to investigate the causes of this outbreak



sewage outfall

North Saskatchewan River

drinking water intake

Summary Analysis of Failures

North Battleford, 2001

1. Source Water Protection

- No watershed protection program
- Long history of poor sewage treatment practice (warnings dating back to 1963)
- No action taken on past problems
- The city continued to dispute the sewage theory even after it was essentially proven

Summary Analysis of Failures

North Battleford, 2001

2. Treatment

- Chlorination alone not adequate for a raw water contaminated by *Cryptosporidium*
- Timing of equipment repair was poor
- Poor particle removal (for weeks) should not have been tolerated

3. Distribution and Storage

- No deficiencies noted

Summary Analysis of Failures

North Battleford, 2001

4. Monitoring

- Operators did not perform tests required to optimize treatment processes
- Operating procedures were outdated

5. Management

- Owner failed to provide sufficient resources to run the system
- Regulatory neglect
- Poor communications between public health, the city and the province

Concluding Thoughts

North Battleford, 2001

- As with the Walkerton case study, the inquiry revealed failure at all levels
- Unlike the Walkerton case study, there was evidence that operators were trying to improve water safety but were frustrated by management and council
- There was little evidence that lessons had been learned from previous failures
- This case is a clear demonstration of the need for the multi-barrier approach

Summary - Case Studies

- Fecal contamination and pathogens are everywhere
- Some pathogens are difficult to treat - *Cryptosporidium* seemed like an obscure risk until the 1993 Milwaukee outbreak
- Complacency can arise because waterborne outbreaks are relatively rare
- Relaxation of vigilance can lead to disaster
- Multiple factors must usually align to cause an outbreak - Effective multiple barriers are critical

Discussion Question

If we have a modern drinking water plant do I have to worry about the safety of our drinking water?

- Yes
- No
- Don't know
- Discuss

Summary - What Should You Do?

- Eliminate Complacency
- Learn from Past Mistakes
- Promote Good Practice and Continuous Improvement
- Provide Sufficient Resources

Thank You!

Questions?