

# Case Studies in Pathogenic Contamination and Prevention

Presented by  
The Groundwater Foundation

## Two major outbreaks in recent history

- Washington County Fair, New York (1999)
  - Primarily *E. coli* infections, some *Campylobacter*
    - 781 confirmed or suspected ill, 71 hospitalized, 14 cases of hemolytic uremic syndrome, 2 deaths
- South Bass Island, Lake Erie, Ohio (2004)
  - *Campylobacter*, Noroviruses, *Giardia*, *Salmonella*
    - 1450 cases of gastrointestinal illness

## Washington County Fair: Greenwich, New York



## Washington County Fair: The Set-up for Disaster

- Contaminated well was #6- a shallow (20 ft.) well, 83 ft. from cattle shed
- Manure was piled outside of shed where about 100 cattle were kept during the fair
- Previously dry summer, but heavy rains fell on August 26, washing away manure from shed
- After water tests and genetic testing, it was determined that *E. coli* from one cow's waste was washed into Well #6

## Washington County Fair: Disaster Strikes

- Well #6 provided water to several vendors, including those who served water
- 781 people were confirmed or suspected to have become ill, with 71 of them being hospitalized (many in intensive care)
- First signs of illness began within 48 hours of exposure, with the first hospitalizations within 6 days

## Washington County Fair: Two Victims

- Rachel Aldrich
  - 3 years old
  - Ate and drank water from a vendor served by Well #6
  - Developed HUS, survived dialysis but was eventually taken off of life support when infection caused severe brain damage
  - Initially misdiagnosed by pediatrician
- Ernest Wester
  - 79 years old
  - Ate and drank coffee and soda from same vendor as Aldrich
  - Severe brain damage

## Washington County Fair: The Survivors

- Aldrich's sister, Kaylea, continued to experience anemia related to severe blood loss during infection, and developed a heart murmur that doctors believe is related to the infection
- 10 other children developed HUS
- Long-term effects of HUS unknown, but believed to include high blood pressure and/or eventual kidney malfunction requiring dialysis or transplant

## Washington County Fair: What's been done to prevent disaster?

- 2 new wells installed – all water is filtered and disinfected with chlorine
- All eight wells used at time of outbreak now permanently disconnected from fair's water system
- Entire system flushed and disinfected
- State-certified water system operator now regularly monitors system during Fair's entire run

## Washington County Fair:

What could have been done to prevent *this* disaster?

- Well location: up-gradient from barns
- Waste handling: containment of waste in leak-proof manner, not stored outside in piles
- Well construction: banked sides and sealed casing would prevent waste from washing in
- Continuous disinfection on all wells on site

## South Bass Island, Lake Erie, Ohio

Image source: [http://upload.wikimedia.org/wikipedia/commons/thumb/a/a3/Bass\\_Islands\\_map.png/300px-Bass\\_Islands\\_map.png](http://upload.wikimedia.org/wikipedia/commons/thumb/a/a3/Bass_Islands_map.png/300px-Bass_Islands_map.png)



## South Bass Island: The Set-up for Disaster

- Water systems on island utilize both groundwater and surface water
- Groundwater is primarily in karst systems, many “deep” wells have no casing below 25 feet (open boreholes)
- Karst aquifers connected to Lake Erie
- Soils are thin to absent, and not suited to septic system development (many existing septics developed in areas with thin/absent soil and others discharge into Lake Erie)

## South Bass Island: The Set-up for Disaster

- Open borehole wells have allowed shallow contaminated water to mix with deeper water over long period of time
- Openings and cracks in karst systems also allow direct contamination
- Combination of hydrogeologic setting and heavy rains during this time period lead to contamination

## South Bass Island: A Word About Karst Aquifers

- "Karst" refers to limestone rock systems where dissolution (chemical reactions of rock with water) has occurred, forming fissures, joints (openings) and caves



Lost Valley (National Park area), Arkansas

## South Bass Island: Disaster Strikes

- Early August of 2004, county health dept. notified Ohio Dept. of Health of increase in gastrointestinal illness on South Bass Island that had been occurring over previous 2 ½ months
- No deaths reported
- From July 23 to Sept. 12, 1450 cases of gastrointestinal illness in residents and visitors to South Bass Island were identified:
  - 16: *Campylobacter*
  - 9: Norovirus
  - 3: *Giardia*
  - 1: *Salmonella typhimurium*

## South Bass Island: What's been done to prevent disaster?

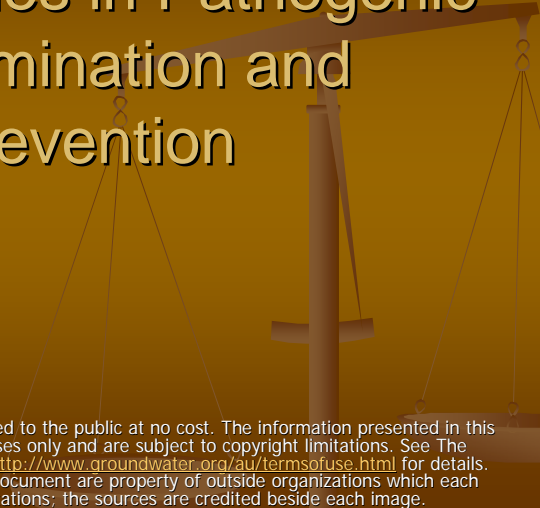
- Ohio Dept. of Health suggestions/requirements:
  - Public water systems issued orders for increased monitoring and restricting water use
  - Private well owners encouraged to have well evaluated by registered contractors to ensure construction compliance with current standards (no longer standard to allow open boreholes)
  - Businesses outside municipal systems required to add additional treatment (disinfection and UV) and provide bottled water for drinking during advisory, install hauled water from compliant system or connect to municipal systems prior to 2005 tourist season

## South Bass Island:

What could have been done to prevent *this* disaster?

- Stringent requirements for updating well construction to current codes (expensive!)
- Proper placement of septic systems (in soils that support system operation)
- Continuous disinfection of all public water supply wells (including transient, non-community systems)
- Unfortunately, hydrogeology is main problem here: alternative waste handling and continuous well disinfection would be top options

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