Wastewater Pathogens

What’s In There?

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Afraid?

A little information goes a long way…
Complex Issue

- Pathogen: Organism that causes disease
  - Bacteria
  - Viruses
Bacteria

- Living single cell organisms
  - Spherical (cocci), Cylindrical (bacilli) and Helical (spirilli); the spiral forms may be 15 microns long.
- Some are pathogens
Bacteria

- Pathogen: Vibrio Cholera; Disease: Cholera; Transmission: Person to person;

- Pathogen: Salmonella Typhi; Disease: Typhoid fever; Transmission: Person (or animals) to person;
Bacteria

- Pathogen: Other types of Salmonellae; Disease: Various enteric fevers (often called paratyphoid), gastroenteritis, septicemia, (generalized infection in which organisms multiply in the blood stream); Transmission: Person (or animals) to person;

- Pathogen: Shigella Dysenteriae; Disease: Bacterial Dysentery; Transmission: Person to person
Bacteria

- Pathogen: Escherichia Coli;
- Disease: Diarrhea;
- Transmission: Person to person
Viruses

- **Pathogen:** Poliovirus; **Disease:** Poliomyelitis; **Transmission:** Person to person

- **Pathogen:** Coxsackievirus; **Disease:** Various cases including respiratory disease, fevers, rashes, paralysis, aseptic meningitis, myocarditis; **Transmission:** Person to person
Viruses

- H1N1 (Swine Flu) and H5N1 (Bird Flu)
  - May be present in raw wastewater. Readily inactivated by disinfection or digestion
  - Respiratory Illness, so ingestion is not a method of transmission.
  - Aerosolize as little as possible
Aerosols
Viruses

- H5N1, H1N1
  - Does not survive outside body for extended period of time
  - May survive through primary treatment, but time is on your side.
  - Irrigation at our site
    - 1980's study showed viruses did not survive to irrigation.
Viruses

- **Hepatitis A**
  - Can cause severe liver damage
  - Spread fecal to oral
  - More common in developing countries
  - No documented cases of wastewater workers contracting on the job.
Viruses

- Hepatitis B, C
  - Blood borne virus
  - Spread by direct contact with concentrated blood or body fluids
  - Potentially fatal
  - One case of a worker infected by a needle stick (bar screen)
Viruses

- **HIV**
  - Blood borne virus
  - Spread through direct contact with blood or concentrated body fluids
  - Known since the 1980’s
  - Does not survive outside the body
Chemical Exposures

- Gases
- Acids, bases
- Organic Chemicals
- Metals
Gases

- Hydrogen Sulfide
  - Toxic Gas!
  - Exposure limit 10 ppm (8 hr.), 15 ppm STEL
  - Detectable at less than 100 ppb
  - Sense of smell quickly deadened
  - Local Ventilation
Gases

- Flammable Gases
  - Accidental release from industry
  - Spills to sewer system
Organic Chemicals

- Vast variety of possibilities
- Protective equipment and Engineering Controls
- Regulation of discharges
- Know your customers
Acids / Bases

- Unlikely to be present in concentration at influent
- Release from industry to lift stations
- What you use around the plant is more dangerous
Metals

- Will complex and bind in sludge
- Mercury is volatile and may be released in aeration.
Exposure Routes

- Ingestion (yuck)
  - Aerosols in the mouth
  - Swallowing

- Absorption
  - Through skin
  - Through cuts

- Injection
  - Forced directly into bloodstream
Will I get sick?

- It’s possible, but unlikely
- Three things necessary for contracting a disease
  - Pathogen
  - Route of entry
  - Concentration
Concentration

- How many organisms in how much water?
- How many organisms are required for infection?
- Normal illness rates
- Pandemic rates
Is The Risk Really So Low?

- No significant increase in human disease appears to be attributable to aerosols from wastewater treatment plants, sludge application, or spray irrigation sites.¹

- Questions remain

- Workers develop immunity, young workers may have less resistance
How Can Exposure Be Reduced?

- **Engineering Controls**
  - Guards, baffles, covers
- **Thoughtful design (or modification)**
- **Personal Protective Equipment**
- **Industrial Pretreatment Program**
- **Hygiene!**
  - Momma told you to wash your hands
References

1: Health Hazard Manual: Wastewater Treatment Plant and Sewer Workers, Nellie J. Brown, Cornell University, 1997

2: Safety and Health in Wastewater Systems, Water Environment Federation, 1994

3: www.all-about-wastewater-treatment.com/

4: www.cdc.gov
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