Wastewater

Sewage overflow occurring in Roswell, Georgia, just alongside the Chattahoochee River
Courtesy USGS

Objectives

- Explain the Environmental Health role in wastewater issues
- Describe onsite (septic) and public sewer wastewater systems
- Discuss system vulnerabilities, failures, and recovery considerations
- Identify alternative means of treating wastewater
- Explain assessment and response to wastewater spills
- Identify areas to improve wastewater preparedness

Role of Environmental Health

- Ensure proper wastewater treatment and disposal is provided
- Prevent diseases caused by wastewater
- Prevent contamination of water
- Provide emergency information on wastewater treatment and handling
- Conduct interventions needed to protect the public from wastewater in food service and other industries

Role of Environmental Health

- Why Wastewater

Wastewater pathogens

- **Bacteria** – E. Coli, Salmonella, Typhoid fever, and Cholera
- **Viruses** – Hepatitis A
- **Fungi** – Aspergillus
- **Parasites** – Roundworms, Cryptosporidium, Giardia

Role of Environmental Health

- Disease transmission

- Spills are a point source for disease transmission
- Pathogens can be transported far away from the point source
- Transported by flies, roaches, people, and animals
- Pathogens introduced into living and food service areas
- Spills may not have recognizable odor or appearance

Role of Environmental Health

- Reasons for Concern

- Aging infrastructure
- Population growth
- Frequency of natural disasters
- Reduced funding
- Exceeded safety designs
- Raw sewage releases
- Climate change possibly facilitating disease agent migrations

Role of Environmental Health

- Responders, New York

Wastewater spill following Hurricane Katrina
Courtesy FEMA

E. Coli 157:H7
Courtesy CDC

Wastewater spill following Hurricane Katrina
Courtesy FEMA
Role of Environmental Health

Safety Is Job #1

- Personal Safety – buddy system
- Personal protective equipment: use it!
- Hand washing in the field
- Physical Injury from damaged systems
- Demeanor of the public
- Confined spaces: must be trained
- Decontamination of footwear

Response Nexus

- Assessment
- Consultation
- Monitoring environment
- Public information
- Preparing Planning
- Leadership
- Support activities
- Liaison activities

Key Partners – Introduce yourself before a disaster

- State and local departments
- Portable sanitation industry
- Septage and sewage haulers
- Industry
- Media
- Emergency management agency
- Volunteer and community organizations
- Public works and wastewater utilities
- Emergency Support Functions (ESF)

System Overview - Public Sewer Systems

- Wastewater treated on a large scale
- Treated/reclaimed water discharged back into the environment
- Plants require onsite manpower to operate
- Power dependent systems

Sewage Lift Stations and the Collection System

- Series/chain of hundreds of manholes and lift stations
- Collection systems run for miles
- Engineered safety holding capacity (free air space)
- Redundant and alternating pumps
- Back up power supplies
- Power dependent systems
System Overview – Onsite Systems

Basic components:
- The tank
- Connected by D-box, pump tank or header pipe to...
- The Drainfield

System Overview – Onsite Systems

Alternative systems
- Mounded drainfield
- Aerobic treatment tanks
- Drip or spray irrigation
- Time or volume dosed drainfield
- Artificial media filters
- Chlorinated effluent
- Sand filters
- Combination of advanced system components

* Power Dependent systems

System Vulnerabilities, Failures and Considerations

Natural disasters
- Physical damage
  - Treatment plants
  - Collection pipes
  - Onsite systems; septic tanks
- Loss-of-power effects
- Workforce affected

System Vulnerabilities, Failures and Considerations

Acts of terrorism – man made events
- Fires – treatment plant targets
- Explosions – critical infrastructure disrupted
- Cyber attacks – intentional black outs
- Biological attacks -loss of utility staff
- Damage affects similar to natural disasters
- Need for increase in wastewater system resiliency–
  - Preparedness, Response, Recovery, Mitigation

System Vulnerabilities, Failures and Considerations

Collection Systems
- Collection can be quickly overloaded by flood waters
- Flood waters enter through damaged collection system pipes and low manholes
- Flood waters sent directly to the treatment plant

System Vulnerabilities, Failures and Considerations

Collection Systems (continued)
- Flood water can lessen treatment plant capacity quickly
- Flood water can introduce saltwater into the treatment plant
- Intruding saltwater can corrode system components
- Damaged collection pipes can isolate service areas
- Power dependent components
System Vulnerabilities, Failures and Considerations

Out of site…out of mind

Damaged onsite systems can short circuit proper treatment and contaminate water supplies

- Damage caused by:
  - Saturated conditions (atypical ground water levels).
  - Physical damage from earthquakes, uprooted trees, and storm surge.

Flooded yard, Memphis TN
Courtesy FEMA

Flood water diversion, North Dakota
Courtesy FEMA

Onsite systems will not work when underwater
- May be able to occupy a structure but not have proper wastewater disposal
- Homeowners may try to divert water away from their home

Identify vulnerable areas
- Locate systems and components away from hazards
- Stabilize system areas with soil and vegetation, bulk heads or bladders
- Educate system owners on component location
- Facilitate the expansion of public sewer to vulnerable areas

Septic tanks can float
- Septic tanks can collapse
- Consider pumping tank half way
- Wait until saturated conditions subside
- Installation methodologies to prevent floating
- Products available to prevent floating - anchors

Educate owners on their system and component location
- Evaluate vulnerable power supply lines to system components
- Consider system and component damage from falling trees
- Proactively relocate systems or cut trees

System Vulnerabilities, Failures and Considerations

Onsite System Damage

Video Presentation

Bank erosion, Snohomish River, Washington
Courtesy FEMA

Tree uprooted by ice, Arkansas
Courtesy FEMA

Tornado-damaged tree, Oklahoma
Courtesy FEMA

Septic Tank
Courtesy EPA

Erosion/surge bladders, North Carolina
Courtesy FEMA

Greenhouse bladders, North Carolina
Courtesy FEMA

Back yard, Delaware River, Washington
Courtesy FDMA

Tornado-damaged tree, Oklahoma
Courtesy FDMA

Trees uprooted by ice, Missouri
Courtesy FDMA
System Vulnerabilities, Failures and Considerations

Rural Wastewater systems

Municipal Wastewater systems

Alternative means of treating Wastewater

When normal wastewater systems are out
- Estimate wastewater volume
- Determine number of fixtures needed
- Consider the population served
- Ensure adequate service frequency
- Coordinate location for holding device(s)

Chemical toilet in front of home, North Dakota
Courtesy FEMA

Alternative means of treating Wastewater

Holding Containers

Chemical toilet in front of home, North Dakota
Courtesy FEMA

Alternative means of treating Wastewater

Septage and Sewage Disposal Options
- Disposal in a sewage treatment plant
- Temporary storage in a tank (holding tank)
- Lime stabilization with land application
- Drying beds
- Composting
- Landfill burial
- Transporting out of disaster affected area

Service truck at Atlanta Sewer Plant
Courtesy FEMA

Alternative means of treating Wastewater

Emergency Facilities at Home - Options
- Modify an existing toilet:
  - Flush until the bowl has no water
  - Line with heavy-duty trash bags and disinfect with chlorine bleach after each use
  - When full, tie shut and remove to an outside location
  - Use campers/motor home holding tanks

Toilet lined with bag, Florida
Courtesy CDC

Pictures courtesy FEMA

Portable waste tote
Courtesty Barker Manufacturing

Alternative means of treating Wastewater

Improvised Wastewater Systems

Waste spill
Wastewater discharge, MI
Courtesy Wayne County

Mobile toilet, North Dakota
Courtesy FEMA

Mobile kitchen waste
Courtesy FEMA

Portable waste tote
Courtesty Barker Manufacturing
Alternative means of treating Wastewater
Emergency Facilities at Home – (continued)
Create a homemade port-a-john:
- Use 5-gallon buckets lined with heavy-duty plastic garbage bags
- Add deodorizer such as lime, household bleach or kitty litter
- Keep buckets in a cool, dark place, tight lid
- Do not throw human waste in regular trash
- Dispose of waste by flushing down the toilet when services are restored or bury
- Clean and disinfect buckets

Responding to Wastewater Spills
Outdoor spills
- Contain the spill – shut off the source(water supply)
- Determine the volume of the spill
- Determine the limits of the spill
- Determine if sewer drains are affected
- Are the drains combined sewer, storm sewer and/or sanitary sewer
- Block drains – parapets or sandbags
- Use PPE and mark affected area off with caution tape or other signage

Responding to Wastewater Spills
Outdoor spills (continued)
- Pump sewage off of the ground
- Spread powdered lime over the entire spill area and/or
- Treat hard surfaces with HTH or a bleach/water solution
- Remove material such as playground sand
- Allow a day to air dry
- Rake up excess and place in heavy garbage bags
- Revegetate / restabilize area

Sewage Spill Protocol
When contacting other agencies, be sure to record the date and time of the conversation and to whom you spoke.

Responding to Wastewater Spills
Recommended treatment procedures
- Hydrated lime for grassy areas – how does it work?
- Bleach/ HTH for hard surface areas – how does it work
- Confusing public health lingo ‘use lime’
- Lime – alkaline compound that raises pH to greater than 12
- High pH destroys pathogen cell membranes
Responding to Wastewater Spills

Indoor cleanup of Sewage spill

- Wear rubber boots and gloves
- Clean and disinfect contaminated surfaces
- Saturated wall-to-wall carpeting (and the pad) usually cannot be adequately cleaned
- Remove and discard porous materials
- Disinfect clean-up mops, brooms, and brushes with the bleach solution

Message Diagram: There is sewage in my home, what can the health department do about this?

1. **What should you do if there is sewage in your home?**
   - Limit access to the area.
   - Keep everyone, especially children and pets out of all wet areas in your home.
   - After the sewage is no longer backing up, clean all areas thoroughly. This includes but is not limited to carpets, sheetrock, drywall, and baseboards.
   - If your entire home has sewage in it, you may need to leave until all areas have been cleaned.

2. **If you have a septic tank:**
   - Limit the use of water in your home as much as possible.
   - The dosing tank will not operate without electricity.
   - Flood prone areas and areas filled with water will not allow the septic tank to operate properly until the water levels are appropriately regulated.

3. **What can you do to prevent illness?**
   - If you come in contact with the sewage, wash your hands thoroughly with soap and water.
   - Wash clothes that come in contact with sewage in hot water, and dry them on high heat. Discard them if they are heavily soiled.
   - If you become ill with symptoms such as diarrhea or vomiting, see your doctor.

4. **If you have city or municipal sewage:**
   - Contact your utility company to let them know you are having problems.
   - If you do not know who your utility company is, contact the citizen’s information line at (XXX) XXX-XXXX.

Responding to Wastewater Spills

Recreational Surface Water Sampling

- Determine applicable rules for your jurisdiction
- Common bacteriological indicators
- Fecal coliform
  - E. Coli
  - enterococci
- Bacteria sample density methodology
- Single sample
- Geometric mean (over 30 days)

Responding to Wastewater Spills

Flooded Outdoor areas

- Flood waters and standing waters pose various risks
  - Infectious diseases – diarrheal diseases
  - Chemical hazards – utilize DOT guidebook and NIOSH pocket guide
  - Physical injuries – drowning, animal and insect bites, electrical hazards and wounds

Responding to Wastewater Spills - Flooded Outdoor areas (cont.)

1. **Hazard Identification**
   - Identify hazardous substances, conditions, or situations that can cause harm or damage.
2. **Dose-Response Assessment**
   - Determine the extent of exposure to hazardous substances, conditions, or situations.
3. **Exposure Assessment**
   - Assess the risk of exposure to hazardous substances, conditions, or situations.
4. **Risk Characterization**
   - Evaluate the likelihood and severity of potential health effects from exposure to hazardous substances, conditions, or situations.

**Note:**
- Evaluate current, wind, and tides for spill migration.
- Develop effective means to advise the public.
- Minimum three (3) sample points: point of entry, upstream and downstream.
Responding to Wastewater Spills
Assessment Process

- Community wide impact on systems
- Individual and municipal system assessment
- More detailed assessments as needed
- Identify a universal assessment form
- Cameras for documentation
- Determine how imminent health hazards will be prioritized

Responding to Wastewater Spills
Exercise
During a major blackout over 4 days, your county has lost power. The treatment plant is still operational however, lift station backup generators have begun to run out of diesel fuel and fuel suppliers have been affected by the blackout.

It is a Saturday evening and a call comes into ESF-8. A major lift station shut down and has overflowed approximately 14,500 gallons of sewage. The sewage has flowed over an Elementary school yard (grass and asphalt areas). Two (2) drains have been affected. Both drains are storm drains and flow directly into Swimmy Lake. The School Superintendent has announced that all schools in the county will be open Monday morning.

In your group, discuss and list the steps of a comprehensive Environmental Health Response to this spill and situation.

Wastewater Preparedness
Preventing Backup - Sewur Valve (original Elder Valve)

- Reduces possibility of backup
- Allows fluids to pass until the line sees solids
- After solids present, provides 100% shutoff
- Disconnection of the sewer line in low lying areas prone to flooding

Wastewater Preparedness
Preventing Backup - Full-Port Backwater Valve

- Prevents sewage backflow
- Removable cover for cleanout
- Transparent cover for inspection
- Installed inline with existing plumbing

Wastewater Preparedness
Resiliency for Power Dependent components

- Determine lift stations of priority
- Utility maps with lift station and drainage area identification
- Provide permanent back up generators
- Ensure mobile generators have a universal connection

Wastewater Preparedness
Helping Sewer connected Owners - Educate before the Disaster

- Know location of sewer service connection components
- Understanding the connection component responsibility – utility or homeowner
- Evaluate pump canister holding capacity
- Consider backup power for service connection pumps
- Evaluate need for backflow device in plumbing
Wastewater Preparedness
Helping Onsite System Owners - Educate before the Disaster

- Properly maintained onsite systems are more resilient
- Know location of septic system - as built sketches
- Understanding how the onsite system works
- Backup power for onsite components

Wastewater Preparedness
Helping Onsite and Sewer connected owners

- Provide information through
  - Department websites
  - Radio blurbs
  - Community centers
  - FEMA help stations
  - Information phone lines
- Provide lists of:
  - Portable toilet companies
  - Septic tank service companies

Wastewater Preparedness
Lessons Learned by Public Wastewater Utilities

- Smart utilities: join WARN
- Local utility agreements
- Utility personnel planning
- Identify areas of priority
- Provide permanent backup generators
- Establish contracts with private septage pumping /hauling companies

Wastewater Preparedness
Lessons Learned (continued)

- Listing of treatment plants
- List of RV parks with sewage dump stations
- Printed list of septage and portable toilet companies
- Maintained list of key contacts
- Knowledge of community wastewater operations

Wastewater Preparedness
Exercise

Your County Administration is working on a disaster preparedness campaign for the general public. She has asked that the Health Department develop key bullet points for a Public Service Announcement (PSA) on Wastewater issues. The PSA should include how to prevent and deal with wastewater issues.

- What items of information should you include in this PSA
  - Group A focus: Onsite Systems owners
  - Group B focus: Sewer System users