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

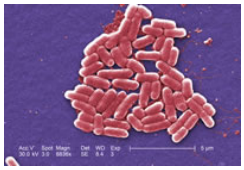
- Ensure proper wastewater treatment and disposal is provided
- Prevent diseases caused by wastewater
- Prevent contamination of water
- Provide emergency information on wastewater treatment and handling
- Conduct interventions needed to protect the public from wastewater in food service and other industries

Responders, New York
Courtesy FEMA

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



E. Coli 157:H7
Courtesy CDC

Role of Environmental Health
Disease transmission

Wastewater spill following Hurricane Katrina
Courtesy FEMA

- 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

Flooded sewer, Tennessee
Courtesy FEMA

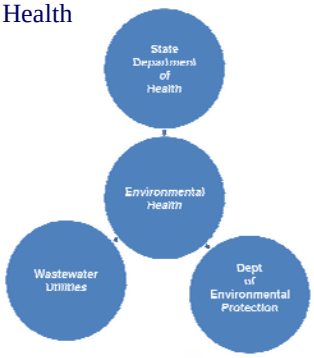
Role of Environmental Health
Safety Is Job #1

Responders in the field, New Orleans
Courtesy FEMA

- 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

Role of Environmental Health
Response Nexus

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



Role of Environmental Health
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)

Partner meeting, Alabama
Courtesy FEMA

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

Wastewater treatment facility, Mississippi
Courtesy EPA

Treated effluent outfall, Hawaii
Courtesy USGS

System Overview - Public Sewer Systems
Treatment plant video

System Overview - Public Sewer Systems
Sewage Lift Stations and the Collection System

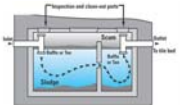
Lift station cross section
Courtesy Romtec Utilities

- 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

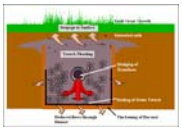
System Overview – Onsite Systems

Basic components:

- The tank



- Connected by D-box, pump tank or header pipe to…
- The Drainfield



System Overview – Onsite Systems

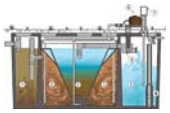
Alternative systems

- 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

Advanced components:

- Aerobic tank



- Effluent sand filters

System Vulnerabilities, Failures and Considerations

Natural disasters

Power crews, Maryland

Snow storm, Texas

Mudslide, California

Pictures courtesy FEMA

- 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

CDP training, Alabama
Courtesy FEMA

- 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

Pictures courtesy FEMA

- 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

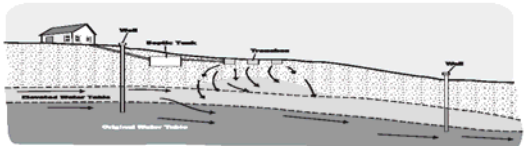
System Vulnerabilities, Failures and Considerations

Collection Systems (continued)

Pumping due to power loss at main lift station, Connecticut
Courtesy FEMA

- 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.

System Vulnerabilities, Failures and Considerations

Flood water diversion, North Dakota
Courtesy FEMA

Flooded yard, Memphis TN
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

System Vulnerabilities, Failures and Considerations

- 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

Bank erosion, Snohomish River, Washington
Courtesy FEMA

Erosion/surge bladders, North Carolina
Courtesy FEMA

System Vulnerabilities, Failures and Considerations

Septic Tank
Courtesy EPA

- 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

Video Presentation

Onsite System Damage

System Vulnerabilities, Failures and Considerations

- 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

Tornado-damaged tree, Oklahoma
Courtesy FEMA

Tree uprooted by ice, Arkansas
Courtesy FEMA

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

Pictures 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

Improvised Wastewater Systems

Wastewater discharge, MI
Courtesy Wayne County

Mobile kitchen waste
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

Portable waste tote
Courtesy 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

Bucket lined with bag, Florida
Courtesy CDC

Alternative means of treating Wastewater
Exercise

A school gymnasium is to be used as a shelter for 1000 people. After review of the floor plan. Determine the number of additional portable toilets and hand washing stations that would be needed for the facility.

- Number of toilets
- Number of showers
- Number of hand wash stations

Shelter, North Dakota
Courtesy FEMA

Note: For this exercise, use California Manual ratios -1 toilet per 20 people, 1 shower per 15 people and 1 hand sink per 15 people

Responding to Wastewater Spills
Outdoor spills

Flooded drain
Courtesy EPA

- 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

…Outdoor spills continued next slide

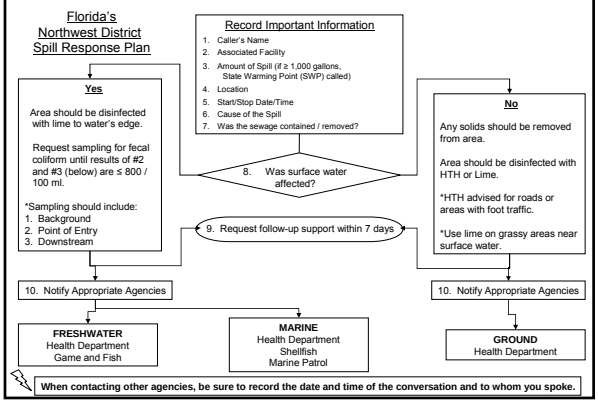
Responding to Wastewater Spills
Outdoor spills (continued)

- 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

Flooding manhole
Courtesy USGS

Flooded area, Wisconsin
Courtesy FEMA

Sewage Spill Protocol



Responding to Wastewater Spills
Recommended treatment procedures

Responders distribute lime to residents, Virginia
Courtesy FEMA

- 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

Clean up, Puerto Rico
Courtesy FEMA

From Kingcounty.gov, Washington State Department of Health

CDC FEMA

Responding to Wastewater Spills
Indoor cleanup of Sewage spill

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 drainfield dries out.

Main Message
The County Health Department is concerned about your health and the spread of disease, keeping pets, children and others out of areas that are contaminated with sewage, will help prevent disease from spreading.

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 to 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 you 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)

Posted Swimming area, Mississippi
Courtesy FEMA

CDC FEMA

Responding to Wastewater Spills
Recreational Surface Water Sampling (continued)

Surface water sample, Florida
Courtesy USGS

- Determine spill volume
- Volume of spill that entered the surface water body
- Consider 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

CDC FEMA

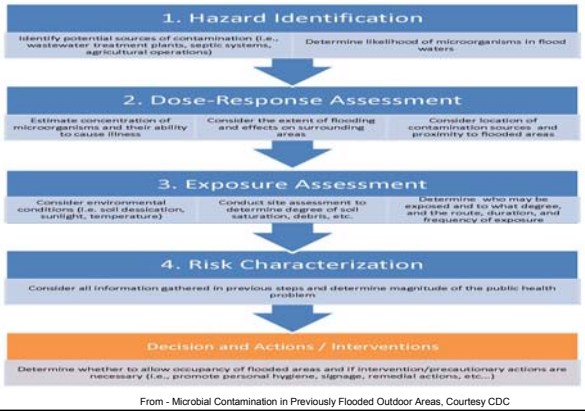
Responding to Wastewater Spills
Flooded Outdoor areas

- 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

Residents in flood water, Iowa
Courtesy FEMA

CDC FEMA

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



From - Microbial Contamination in Previously Flooded Outdoor Areas, Courtesy CDC

Responding to Wastewater Spills
Assessment Process

Survey of damage
Courtesy FEMA

- 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

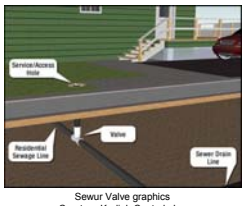
Responding to Wastewater Spills
Exercise

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.

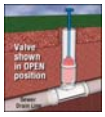
It is a Saturday evening and a call comes into ESF-8. A major lift station shut down and has overflowed approxiamately14,500 gallons of sewage. The sewage has flowed over a Elementary school yard(grass and asphalt areas). Two(2) drains have been affected. Both drains are storm drains and flow directly into Swimmy Lake. The School Superintendant has announced that all schools in the county will be open Monday morning.

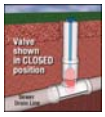
- In your group, discuss and list the steps of a comprehensive Environmental Health Response to this spill and situation.

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



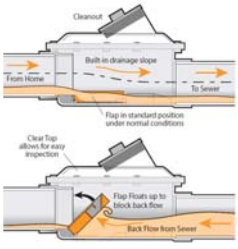
Sewur Valve graphics
Courtesy Kodiak Controls Inc





- 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

Backwater Valve graphics, samples and picture
Courtesy Mainline Backflow Products Inc

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

Generator powers a sewer lift station, Florida
Courtesy FEMA

Utility Map with delineated drainage areas
Courtesy City of West Lafayette, IN

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

FEMA helping homeowners, Montana
Courtesy FEMA

Sewer ejector pump, 30 gallon basin
Courtesy Pentair/Flotec

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

Septic effluent filter
Courtesy EPA

Septic System, Hawaii
Courtesy EPA

CDC FEMA

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

FEMA Specialist assists homeowner, New Jersey
Courtesy FEMA

Call center, Florida
Courtesy FEMA

CDC FEMA

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

Flooded treatment plant, Atlanta
Courtesy FEMA

CDC FEMA

Wastewater Preparedness
Lessons Learned (continued)

Temporary housing being plumbed, Louisiana
Courtesy FEMA

- 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

CDC FEMA

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

CDC FEMA