Day 3: Wastewater Collections

Wastewater Lagoon Certification

Outline for Today

1. Conveyance facilities
2. Materials of construction
3. Appurtenances
4. Lift stations
5. Operation and maintenance (O&M) activities
6. Industrial pretreatment
7. Safety
8. Regulatory compliance
9. Half-day field trip

Pre-Quiz – write down your answers

1. What are 3 types of collection systems?
2. Why do we need manholes?
3. What is a drop manhole?
4. What is a lift station?
5. What's the difference between preventive maintenance and corrective maintenance?
6. What does I&I stand for?
7. What are the 2 types of leak testing?

1. CONVEYANCE FACILITIES

The Collection System

- A collection system consists of a means of collecting and transporting human waste, stormwater, and industrial waste from their sources to a treatment facility, receiving body of water, or disposal site
- Collection systems date back to 3750 BC (India)
- Oldest collection system in use is the arched sewer built in Rome around the first century

Privies and Cesspools

1884: National Toilet Day

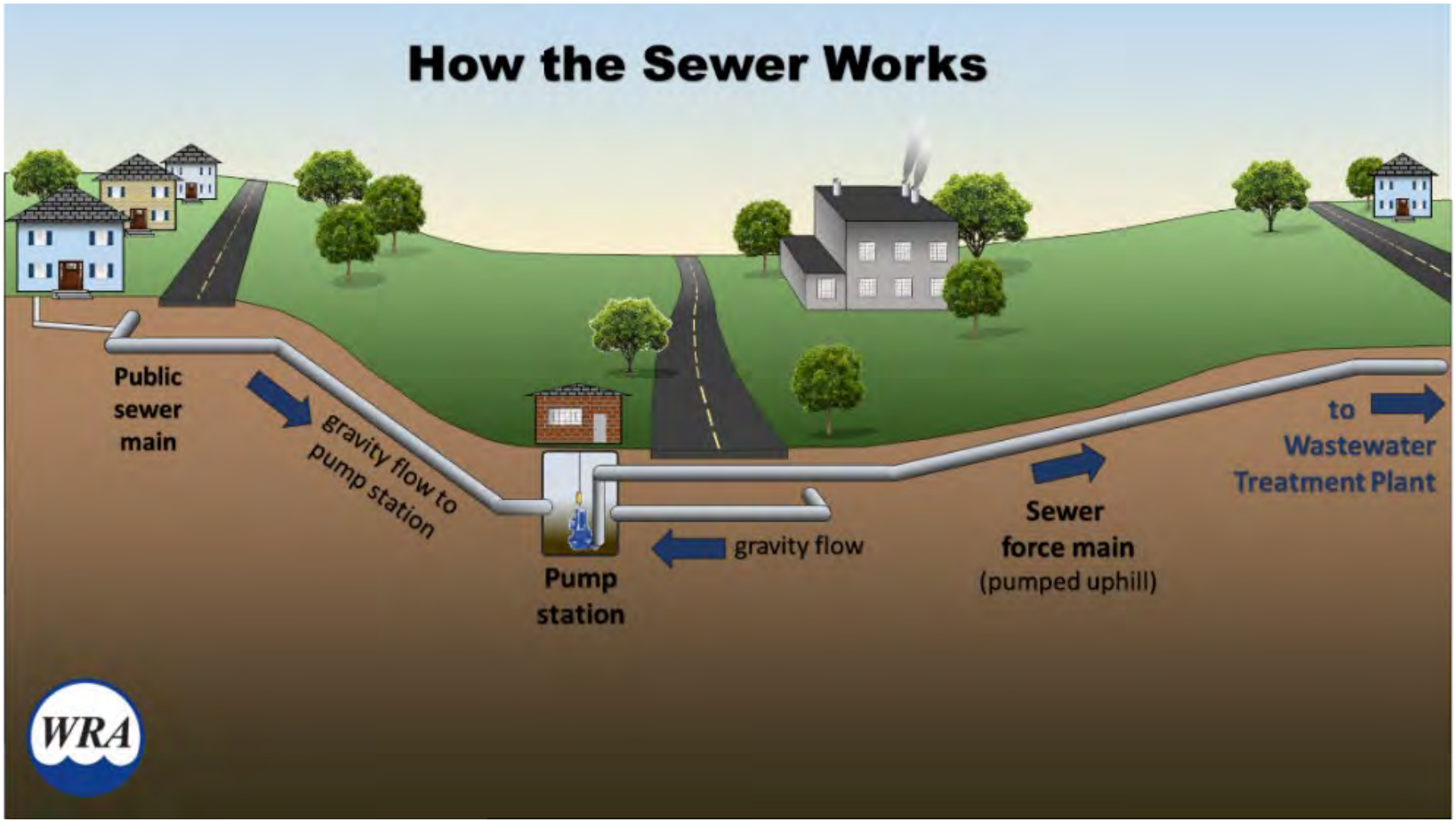
1854: Rhode Island suffered its second cholera epidemic outbreak in 5 years

We've Come Along Way

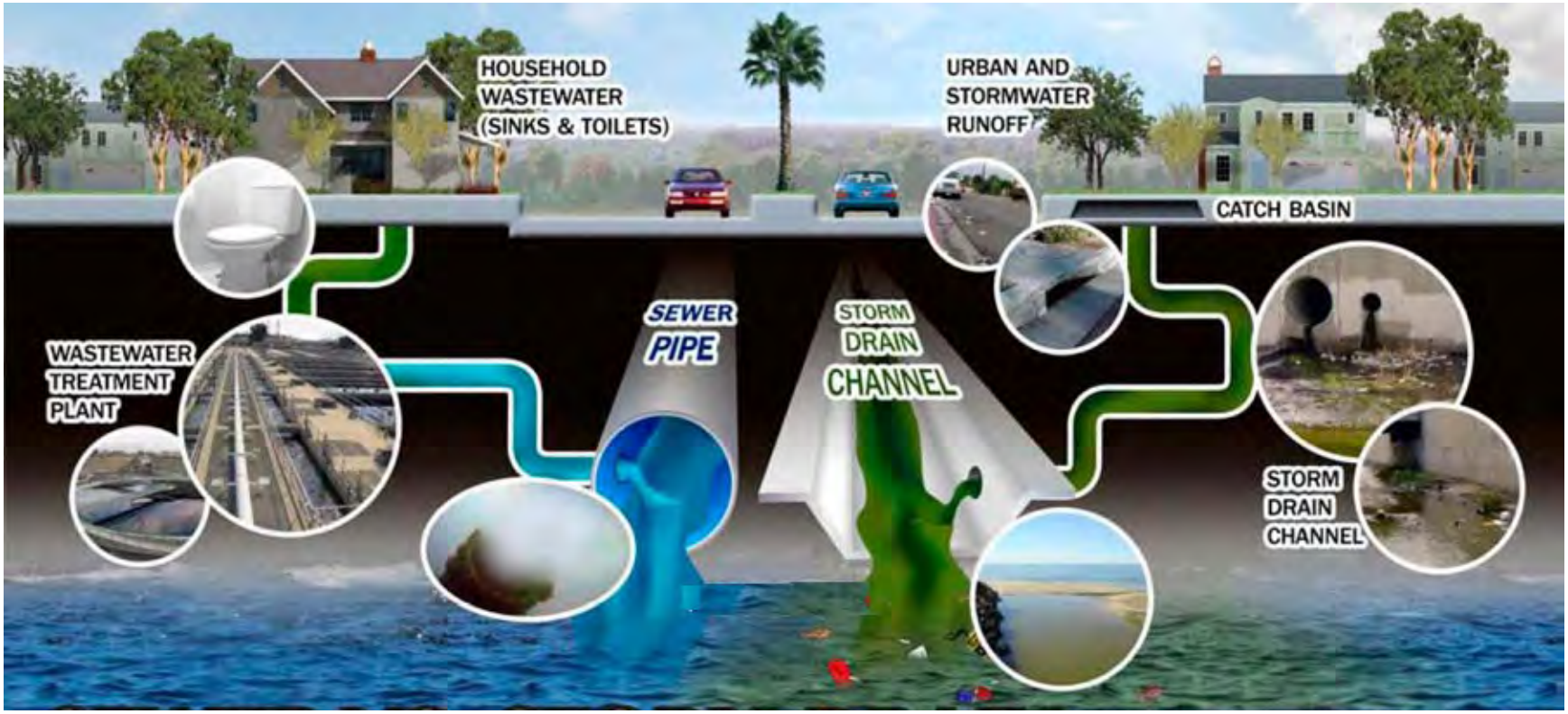
Collection System Types

- Sanitary sewer: Conveys wastewater from residences and businesses to wastewater treatment location
- Storm sewer: Handles influx of water into the collection system from surface runoff as a result of rain storms or snowmelt
- Combined sewage system: Carries both sanitary and stormwater flows
- Pressure, gravity, and vacuum: Collection systems may use all three, but pressure and gravity are most common

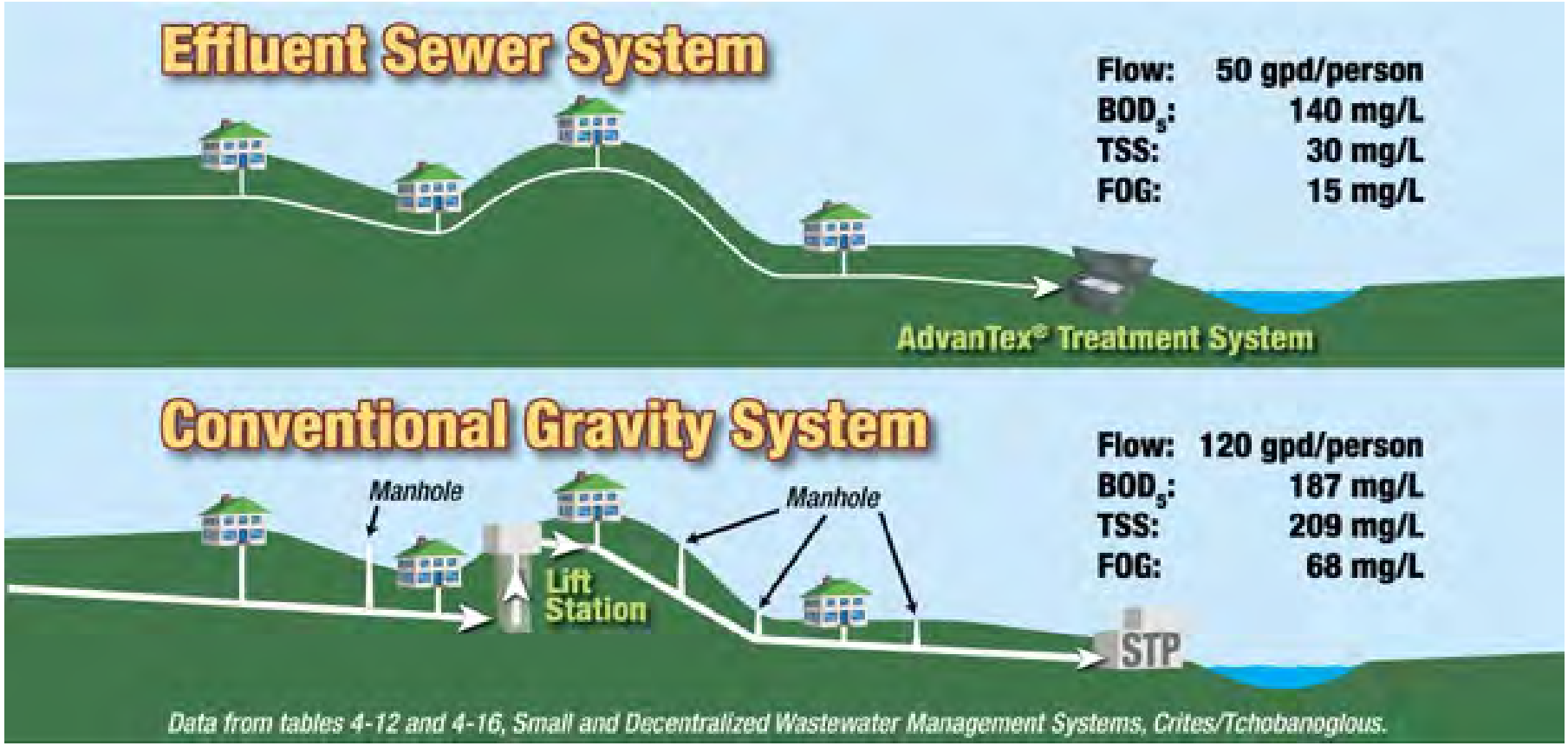
Collection System



Collection System



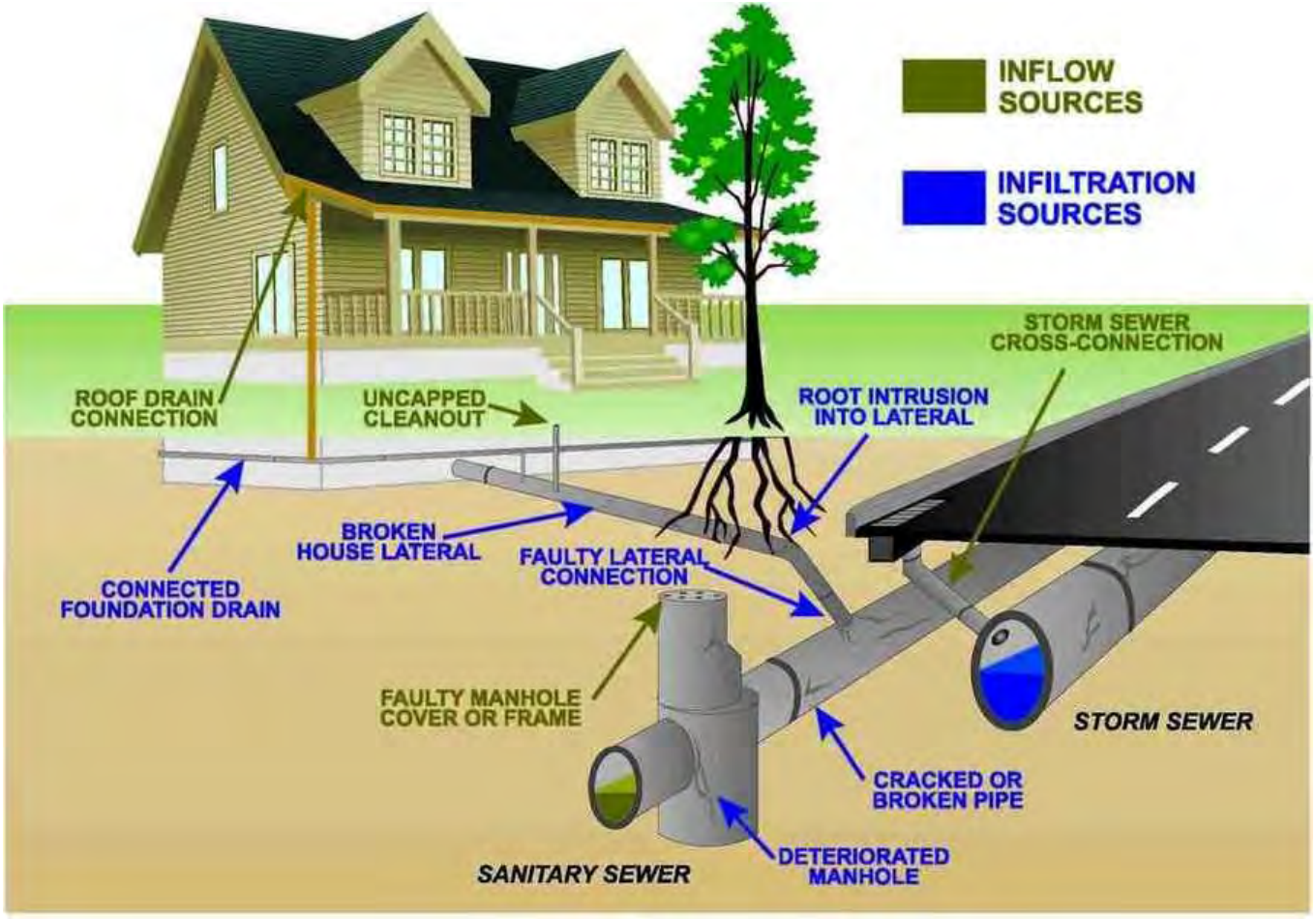
Collection System Profile



Collection System Components

- Laterals
- Branch sewer
- Sewer main
- Collectors or subcollectors
- Trunk lines
- Interceptors
- Wastewater treatment location
- Lift stations
- Manholes
- Vents
- Junction boxes
- Cleanout points

Infiltration and Inflow



Gravity Collection System

- Used for collection systems when slope is available
- No pumps needed
- Can be combined with lift stations and force mains if needed
- Minimum design slopes for various pipe sizes

Gravity Collection System

- Building sewers: Laterals/main sewer, trunk sewer
- Lateral or branch sewer: Upper ends of the street components
- Building sewers: Collect from laterals and branch sewers
- Trunk sewers: Main arteries
- Interceptors: Receive wastewater (WW) from trunk sewers and convey to wastewater treatment plant (WWTP)
- Lift stations: Gravity collection system to lift (pump) to a higher elevation when the slope is inefficient

Gravity Collection System

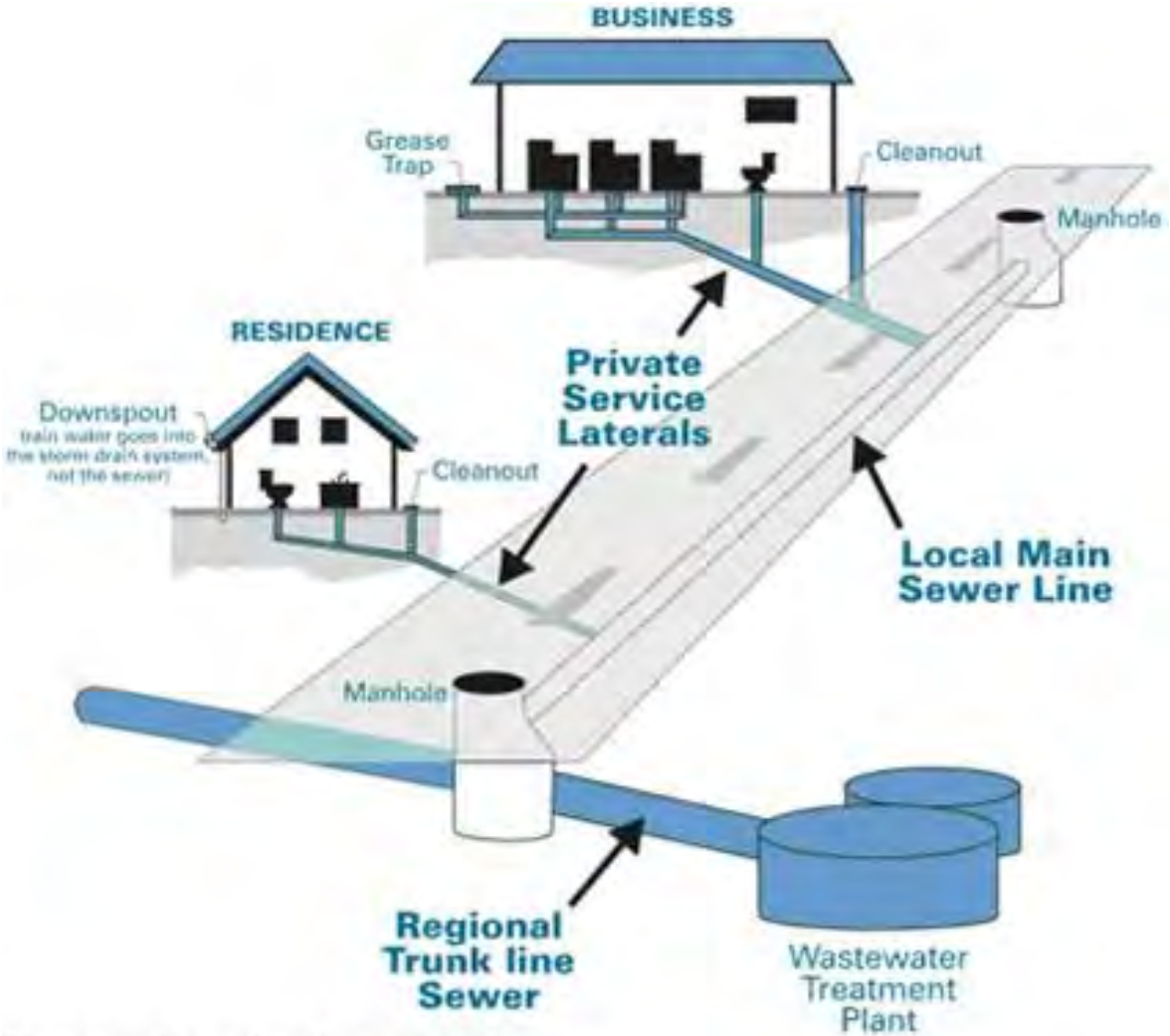


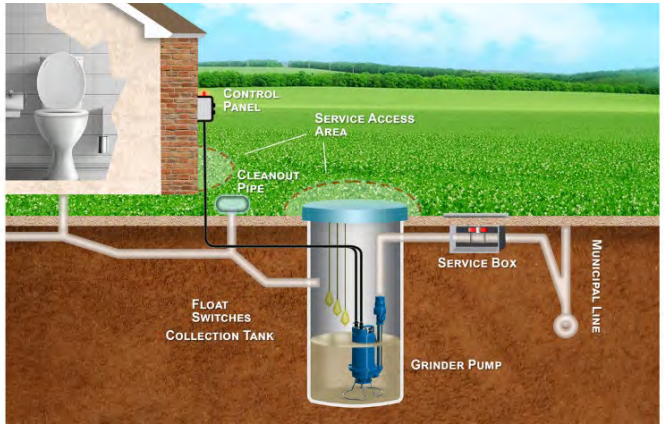
Diagram of a sanitary sewer system

Low-Pressure Collection System

- Force mains
- Topography and ground conditions are not suitable for a gravity system
- Flat terrain
- O&M considerations:
  - Greater pumping costs
  - Fewer stoppages
  - No root intrusion
  - No deep trenches
  - Holding tanks
  - Grinder pumps

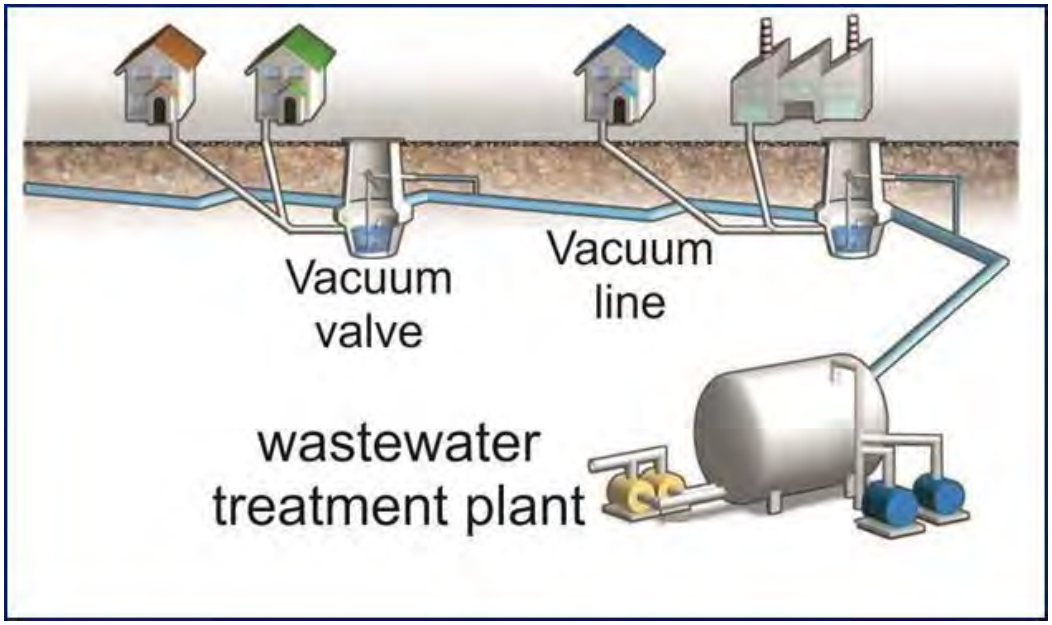
Pressure

- Septic tank effluent pumping (STEP) systems:
  - Individual grinder pumps; pump to pressurized main
- Pump into gravity mains or pressurized to WWTP



Vacuum Collection System

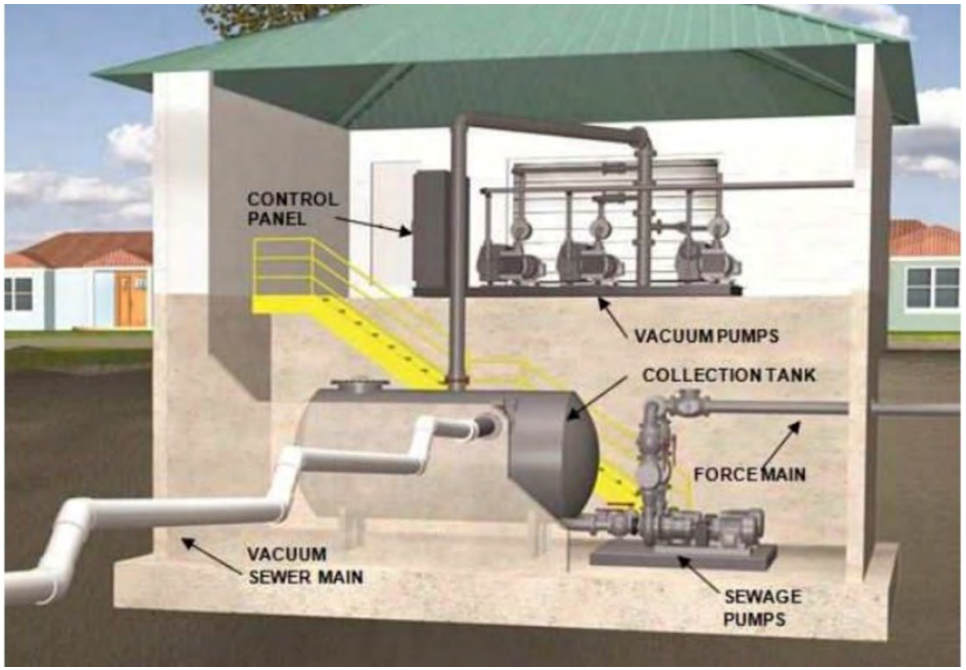
- Used as an alternative to gravity systems
- Similar application as low-pressure systems
- A vacuum is created to convey wastewater to central location



Vacuum Collection System

Vacuum Collection System

- Transferred to holding tank
- Sewer mains under vacuum and isolated using valves
- Wastewater pulled towards main station with suction force
- Pumped to force main




QUIZ

Quiz

1. What are the three types of collection systems?

   - ✓ Sanitary sewer
   - ✓ Storm
   - ✓ Combined

Quiz

2. When are pressure or vacuum systems needed?

   When no slope is available

2. MATERIALS OF CONSTRUCTION

Materials of Construction

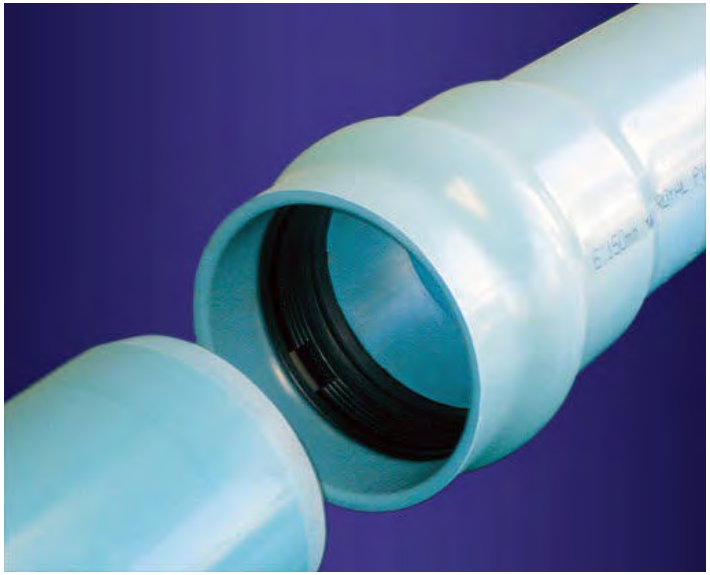
- Plastic pipe
- Vitrified clay
- Reinforced concrete
- Ductile iron
- Cast iron
- Asbestos cement
- Joints and couplings

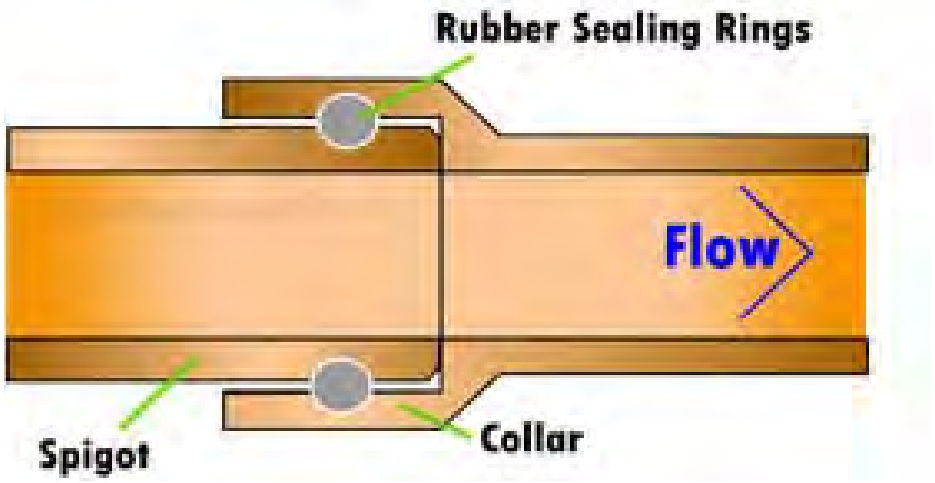
Collection System Piping

- Vitrified clay (VCP)
- Concrete (CP)
- Ductile iron (DI)
- Asbestos cement (AC)
- Polyvinyl chloride (PVC)
- High density polyethylene (HDPE)

PVC Pipe

- Most common
- Bell and spigot
- Wall thickness varies for strength





HDPE Pipe

- Flexible
- Trenchless installations
- Corrosion resistant
- Fusible connections

DI Pipe

- DI fittings
- Culverts
- Sewer mains

VCP Pipe

- Mix of clay and shale
- Used for over 6,000 years

AC Pipe

- Asbestos cement
- Popular in 1930s and 1940s
- Not manufactured since the 1960’s
- hazardous material – special disposal needed

Joints and Fittings

- PVC
- DI
- Mechanical joints (MJ)

Reinforced Concrete

- Manholes
- Valve vaults
- Lift stations


QUIZ

Quiz

1. List the materials used for piping.

   PVC, VCP, AC, DI, HDPE

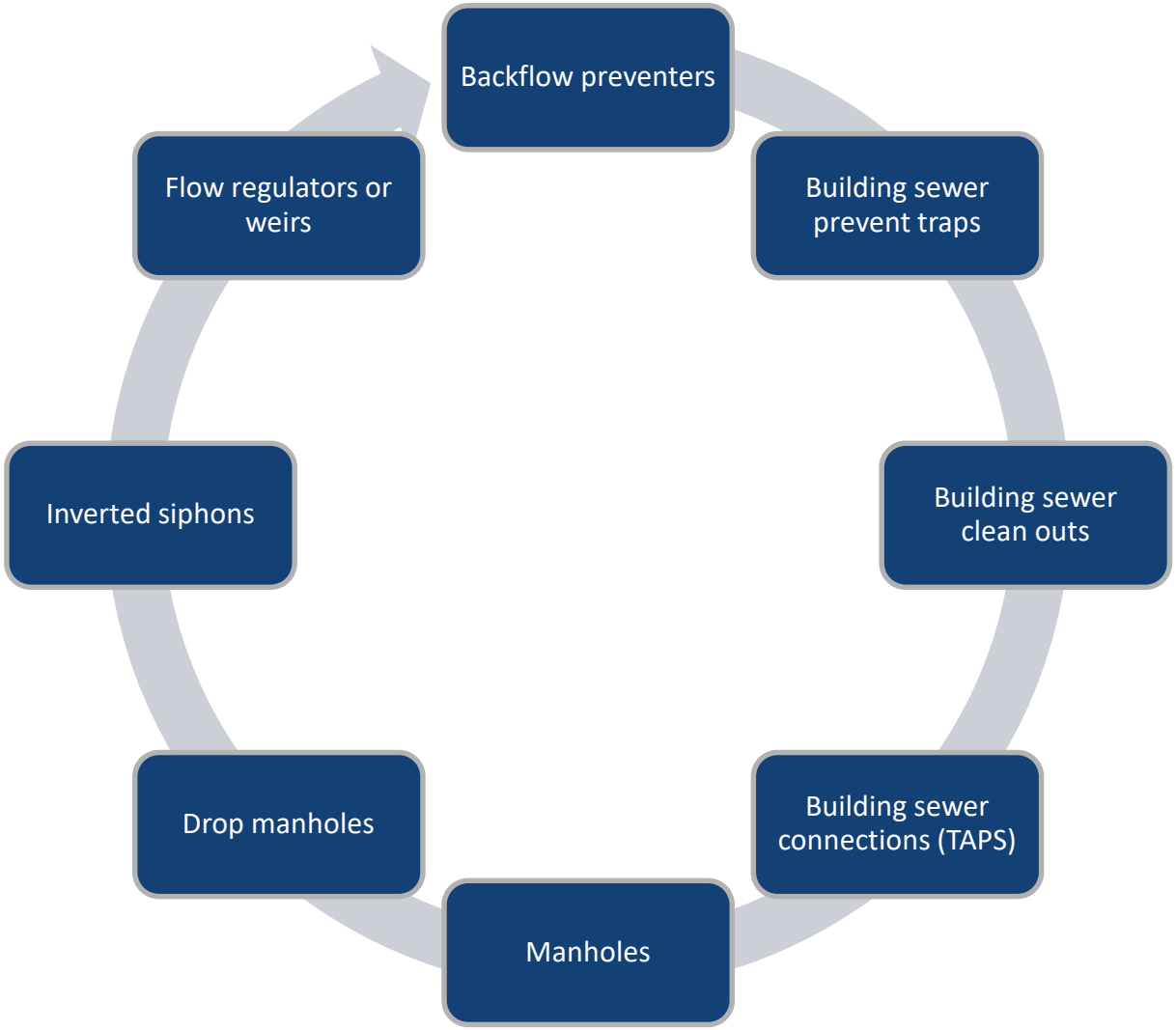
Quiz

2. How are pipe sections connected for the following materials?
   a) PVC
   b) DI
   c) HDPE

   a) Bell and spigot
   b) DI fittings and MJs
   c) Fusion

3. APPURTENANCES

Appurtenances

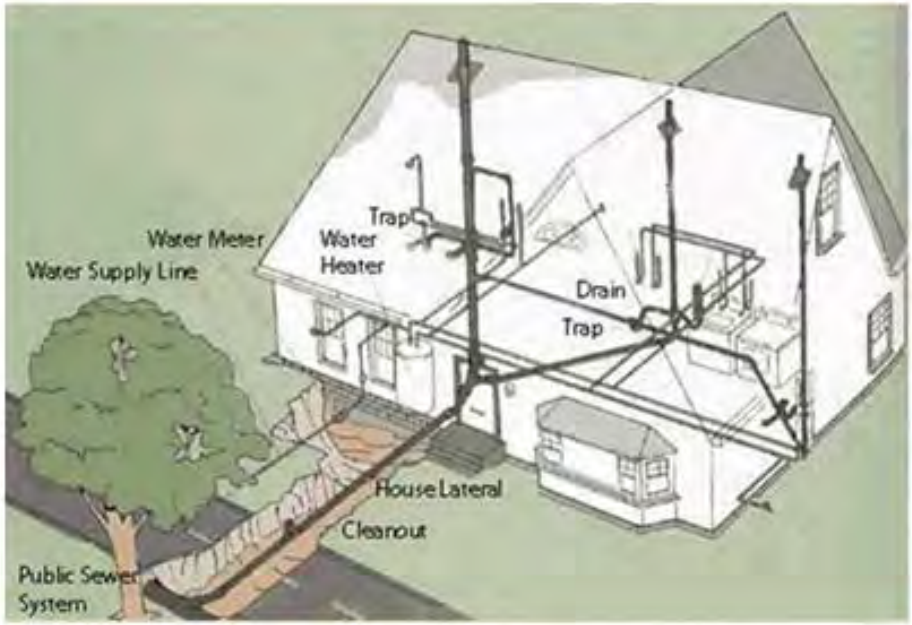


Backflow Preventer

- Designed to only allow flow in one direction
- Prevent water backing up into homes

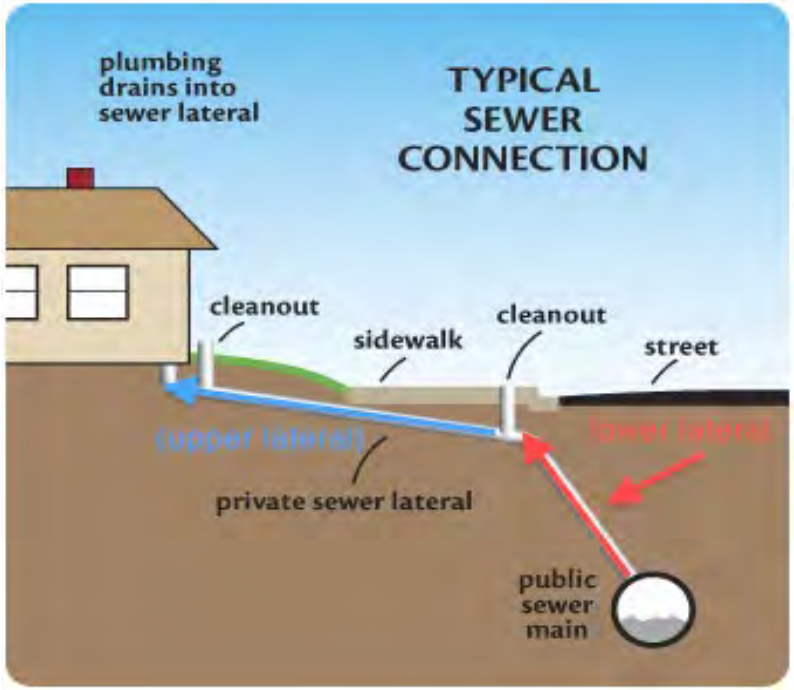
House/Building Connections

- Typically 4-inch diameter for service laterals
- Cleanouts for each connection
- Tie directly into the main



Cleanouts

- Cleanouts are installed at buildings to allow access for inspection and cleaning
- Double wye cleanouts allow access to each side of the pipe

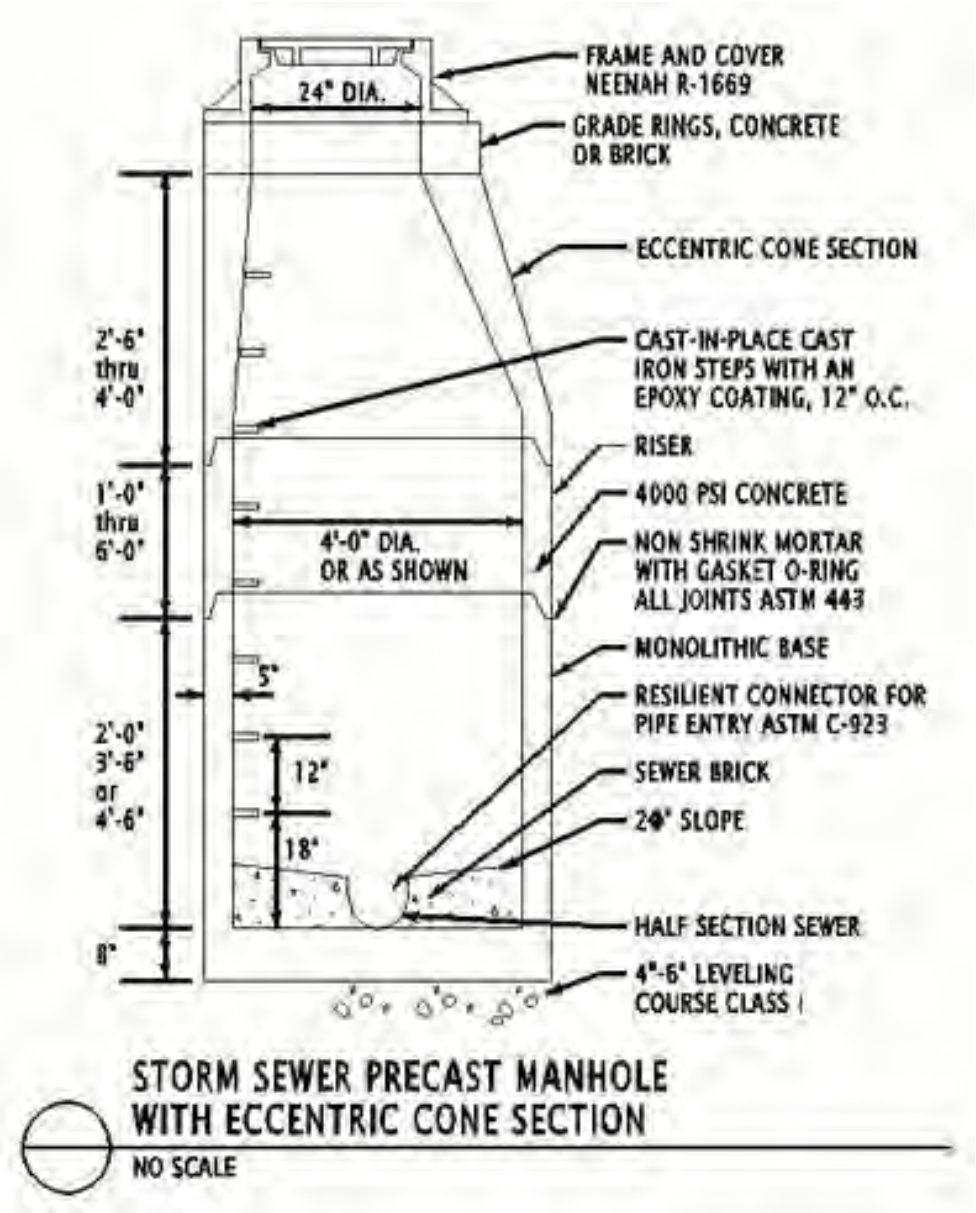


Manholes

- Manholes allow the connection of a lateral that is at much higher elevation than the main
- Provide access for line maintenance and inspection
- Allow for change in direction and grade
- Manholes are usually located every 400 to 500 feet

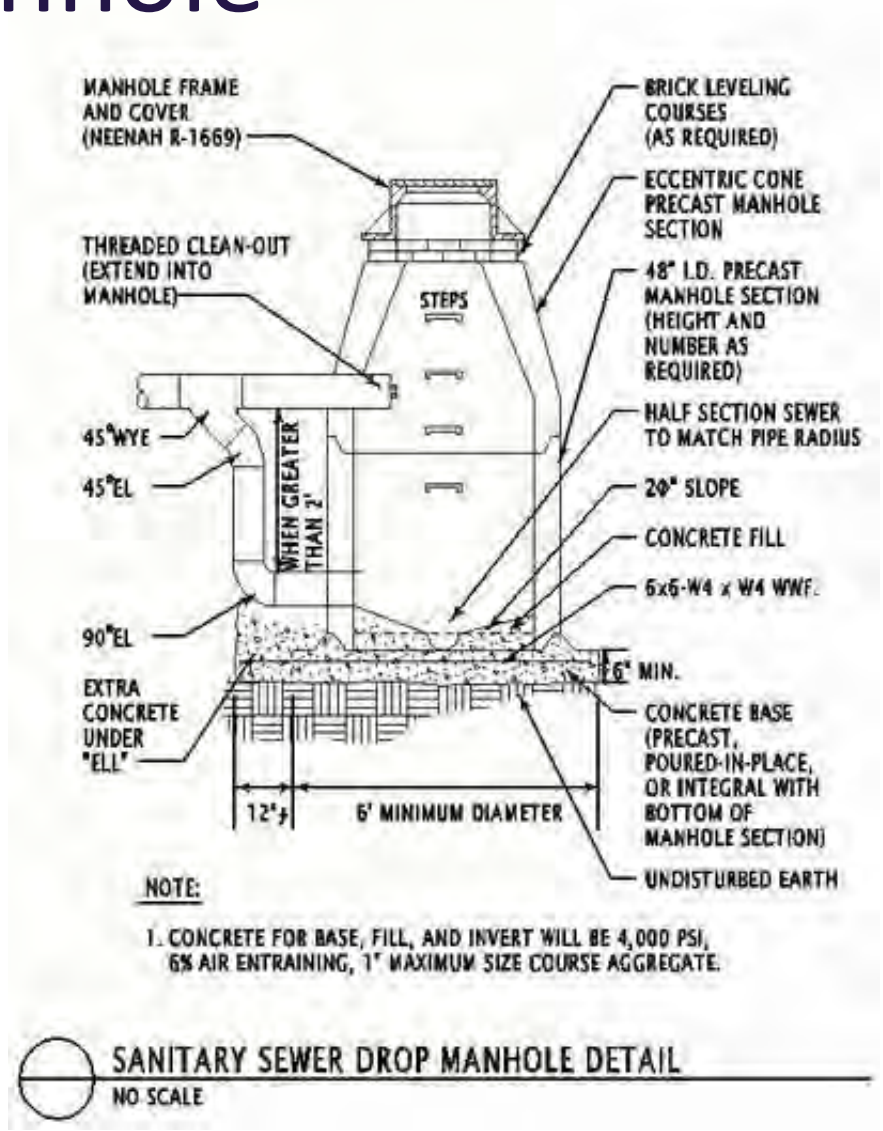
Manholes

- Manholes are placed at changes in direction, elevation, pipe sizes, and junctions



Vertical Drop Manhole

- Base
- Flow channel
- Barrel sections
- Top section
- Lid ring
- Lid
- Rings
- Steps



Collection System Nomenclature

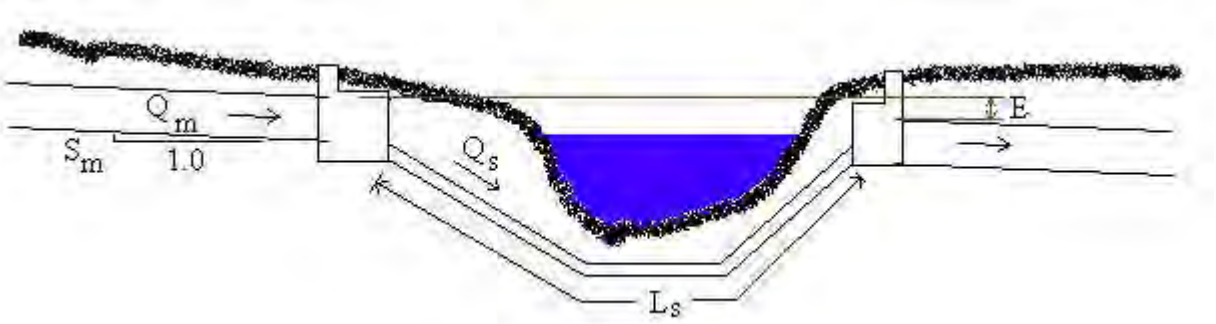
- Tap: A sewer tap is a means of connecting to an existing sewer line
- Saddle tap: A saddle is a pliable device placed over the newly cut hole in the sewer line and held in place with clamps
- Calder coupling: Flexible coupling used to connect two pipes together
- Inverted siphon: Section of sewer line used to carry wastewater under a depression
  - Stream
  - Storm sewer
  - Large water line

Appurtenances

Tap and Saddle Tap

Calder Coupling

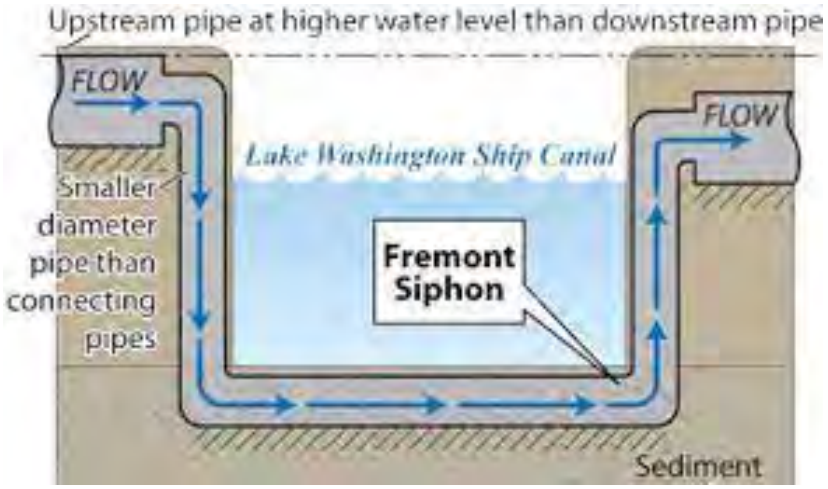
Inverted Siphon



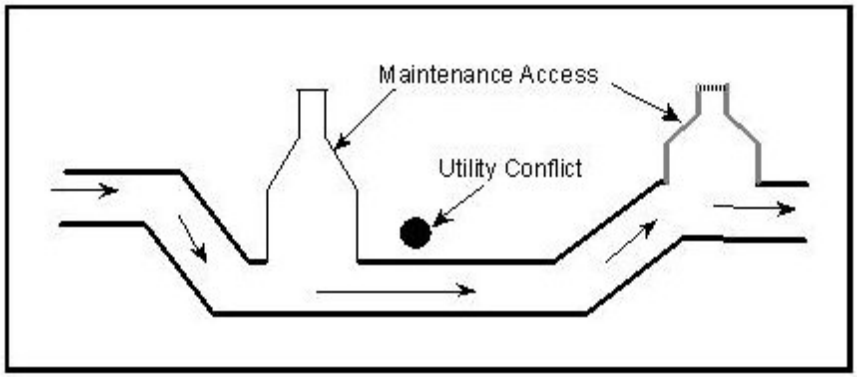
Saddles

Siphons

- Water is pulled by suction by the downstream end
- Atmospheric pressure on the higher end (upstream) will cause flow to continue
- Cracks in the pipe may interrupt flow if air enters the system
- Used in place of force main



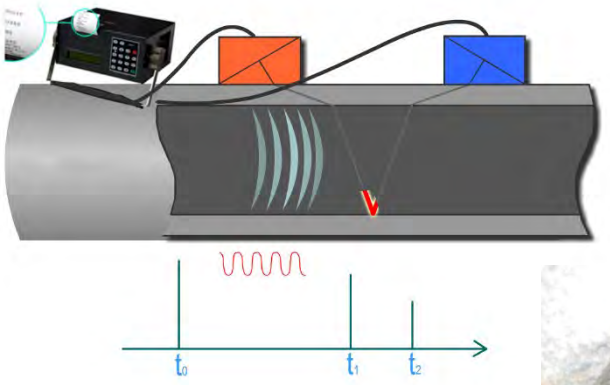
Inverted Siphon



Flow Metering

1. Weir or flume: Measures water levels
2. Area velocity meters: Measure velocity and depth
3. Staff Gauge: Sonic device that sends and receives a signal to an electronic recorder
4. Measurements should be taken during low and high flow conditions

Flow Meters



Odor Control

Under anaerobic (septic) wastewater conditions, sulfides cannot be oxidized. Therefore, they combine with hydrogen to produce hydrogen sulfide gas, creating the "rotten egg" odor associated with septic wastewater.

Vapor-Phase Technology

Vapor-phase technologies ventilate the point sources of odor problems (wet wells, headworks, etc.). For air treatment, the ventilation system is designed to maintain a negative pressure on the area at all times. This prevents the "leakage" of odorous air from vents, manways, access hatches, or other areas.

Liquid Redox Technology

Liquid redox units use a chelated metal dissolved in a water solution to remove hydrogen sulfide from a gas stream and catalytically convert it to solid, elemental sulfur. The metal held in solution by organic chelating agents acts as a catalyst, speeding up the naturally occurring reaction.

Liquid Redox Technology

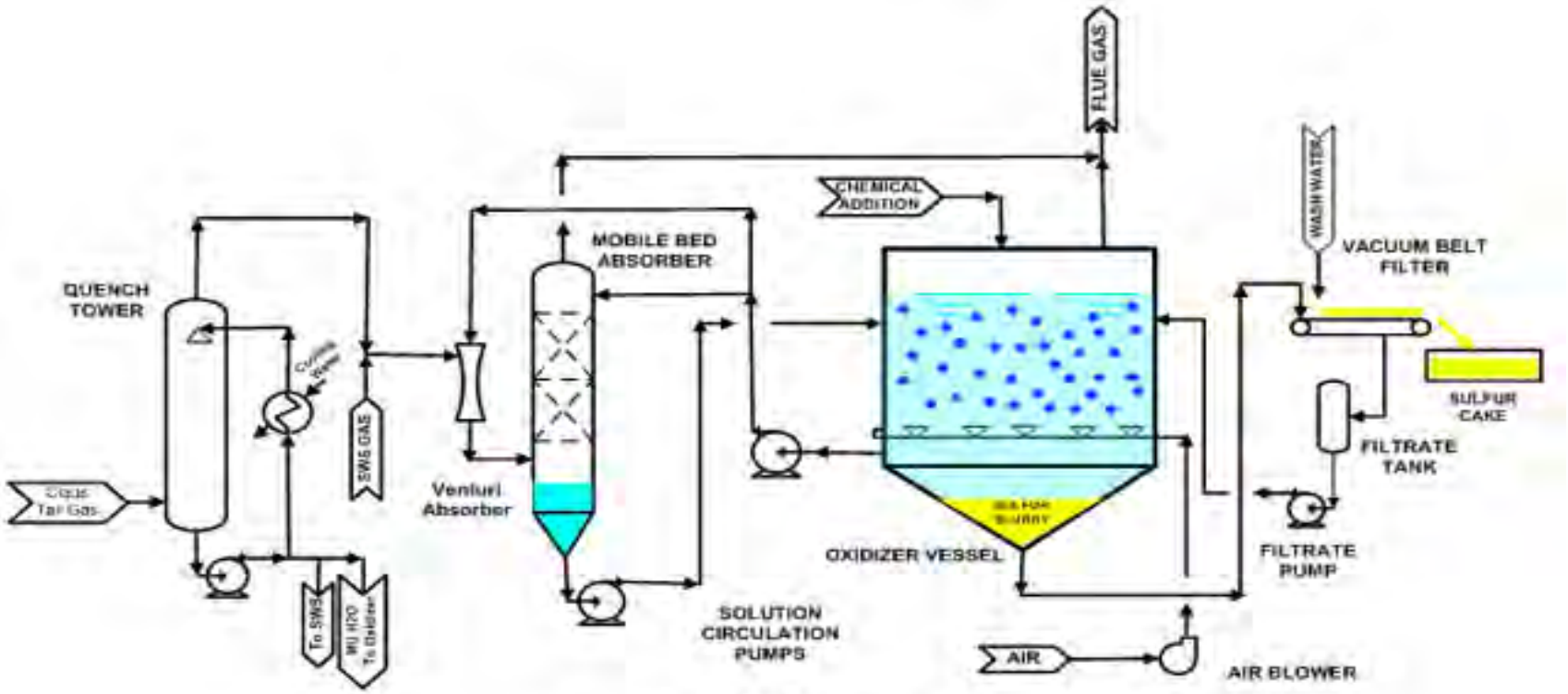


FIGURE 2
DIRECT TREAT OF CLAUS TAIL GAS

Biofiltration

- Biofiltration technology can be used to treat a variety of biodegradable, water soluble contaminants. In a biofilter, the odor contaminants are solubilized from the vapor phase into aqueous phase on the surface of an organic medium such as compost, mulch, or peat. The compounds are then degraded by the bacteriological population on this media.

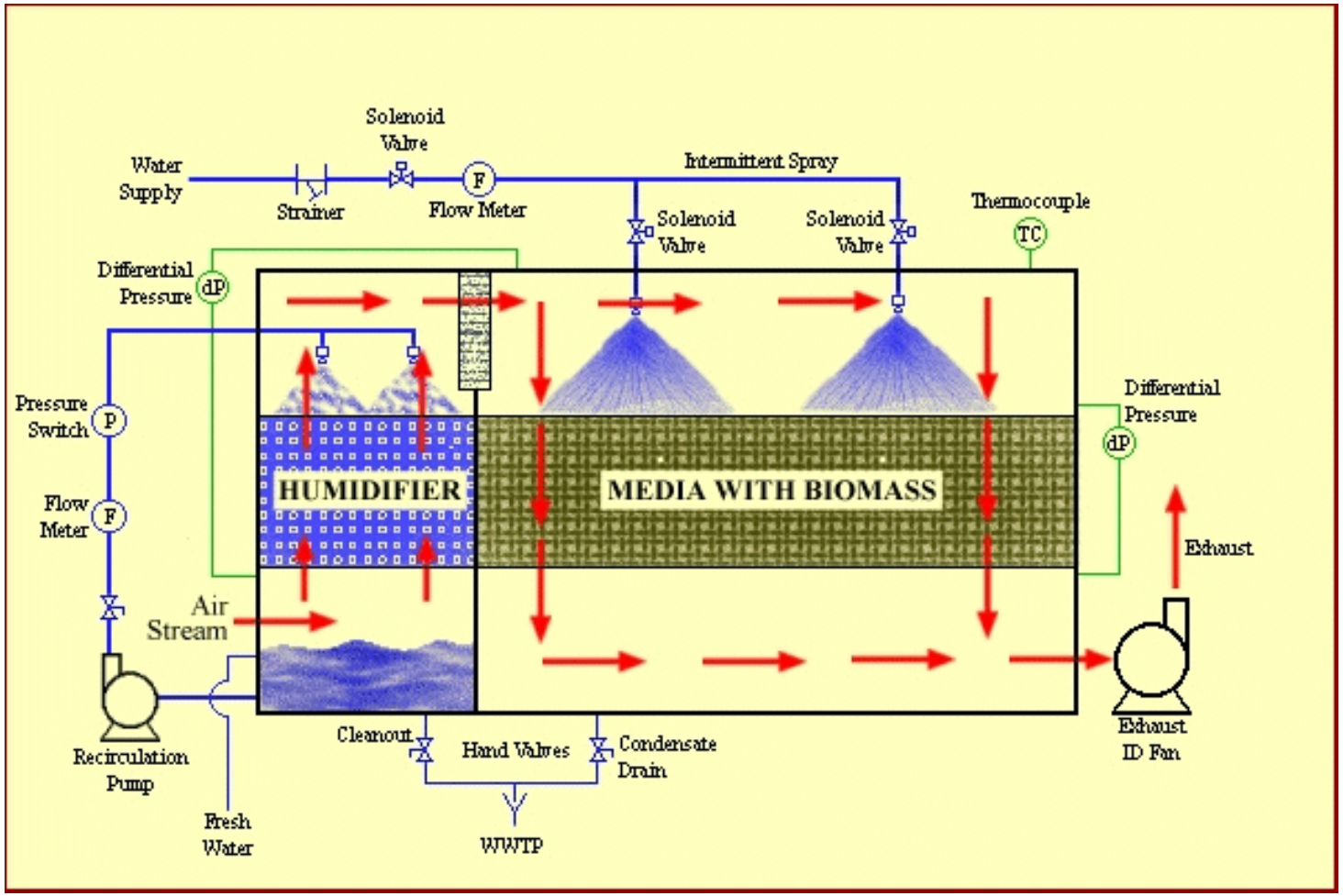
- Biofilters are very effective at removing sulfur-based odor compounds such as hydrogen sulfide, organic sulfides, and mercaptans. Biofilters generally are not effective at removing nitrogen-based compounds such as ammonia and amines.

Biofiltration

- Two major challenges in biofiltration systems are stability of the media and control of the biofiltration process. The media used in biofilters can be prone to breakdown. When this occurs, the bed settles and compacts, increasing headloss through the filter. This causes a decrease in airflow and fugitive odor emissions typically result from the air source.

- Control of the biofiltration process also is an important concern. The biological population within the filter is subject to upsets, as are any organisms. If the media are exposed to wide swings in environmental conditions, upset of the bacteria population may result, and breakthrough odors will occur.

Biofiltration



Odor Control

- Solid scavengers: Gas sweeteners (iron sponge)
- Carbon adsorption: Bed of adsorbent carbon
- Liquid-phase technologies: Chemical added to waste stream
- Iron salts: Oxidize and/or precipitate dissolved sulfide (ferric chloride)
- Bioxide process: Application of nitrate solution

Odor Control

- Oxidizing agents: Application of strong oxidizing agents
- Anthraquinone: Chemical compound that interrupts the sulfate reduction process carried out by sulfate-reducing bacteria (SRB) in wastewater under anaerobic conditions
- Wet-air scrubbers: Odor contaminants are solubilized from the vapor phase into an aqueous chemical solution
- Probiotic scrubber: Advanced bacterial solution


QUIZ

Quiz

1. Where are cleanouts installed?

   At buildings and on service lines

Quiz

2. Why are manholes needed?

   Change in pipe size; pipe deflection, direction, elevation

Quiz

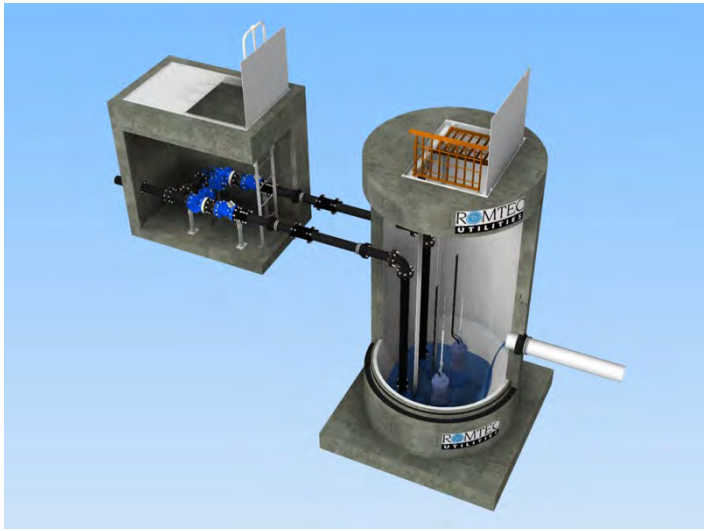
3. Where are siphons used?

   Stream crossings and other pipes

4. LIFT STATIONS

Purpose

- Pump stations that pump wastewater from low elevations to higher elevations
- Designed at low spots in the collection system to pump wastewater through force mains (pressurized pipes)
- Pump to the next gravity main or WWTP



Components of a Lift Station

- Wet well
- Flow distribution
- Operating levels
- Wet well access
- Wet well inlet channel
- Wet well safety
- Wet well hardware
- Wet well electrical systems
- Bar racks
- Dry wells
- Radio communication
- Backup generator
- Check valves

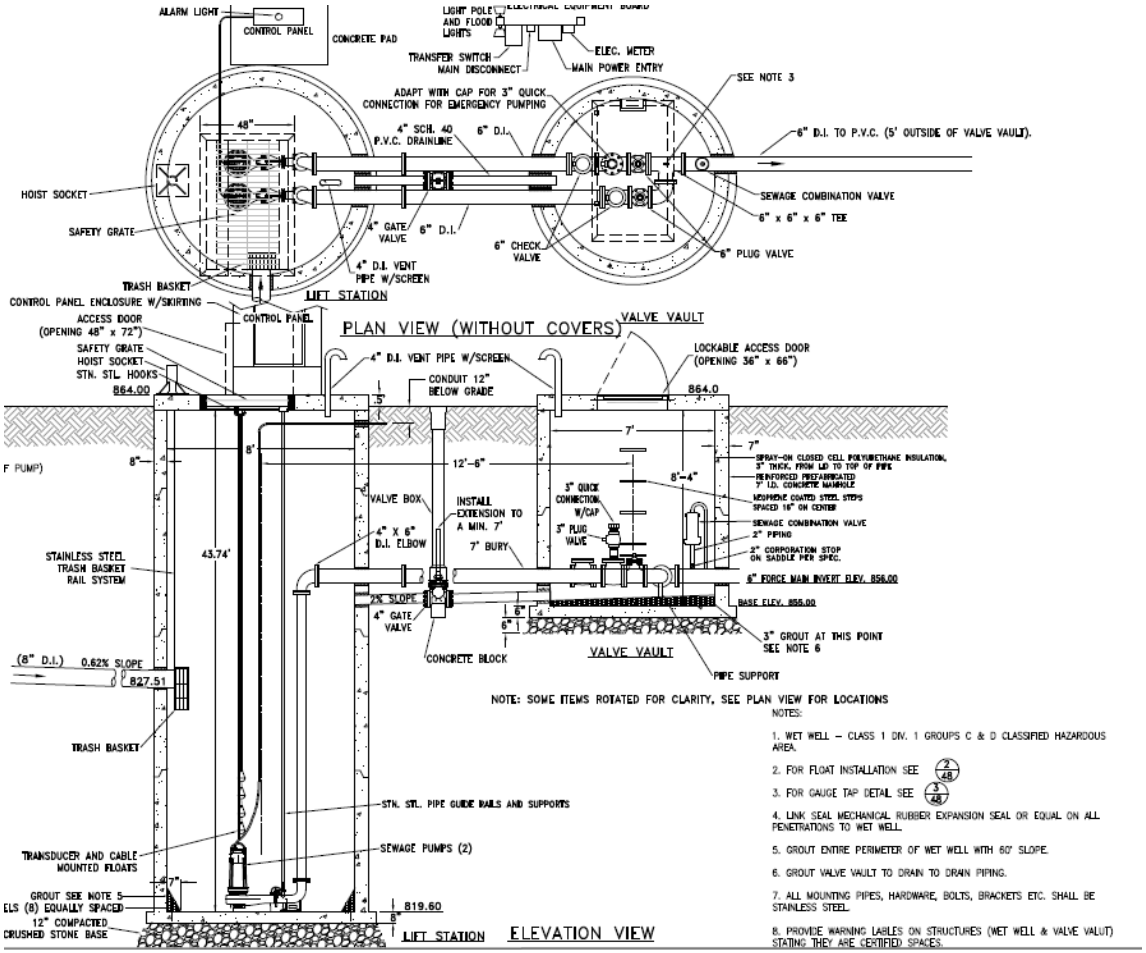
Wet Well/Submersible Pumps

- Wet wells are essentially holding tanks
- Wastewater flows into the wet well by gravity
- Wet well contains submersible pumps
- Level controls (floats) tell the pumps when to turn on/off
- Wastewater is pumped out of the wet well through a force main

Submersible Lift Station

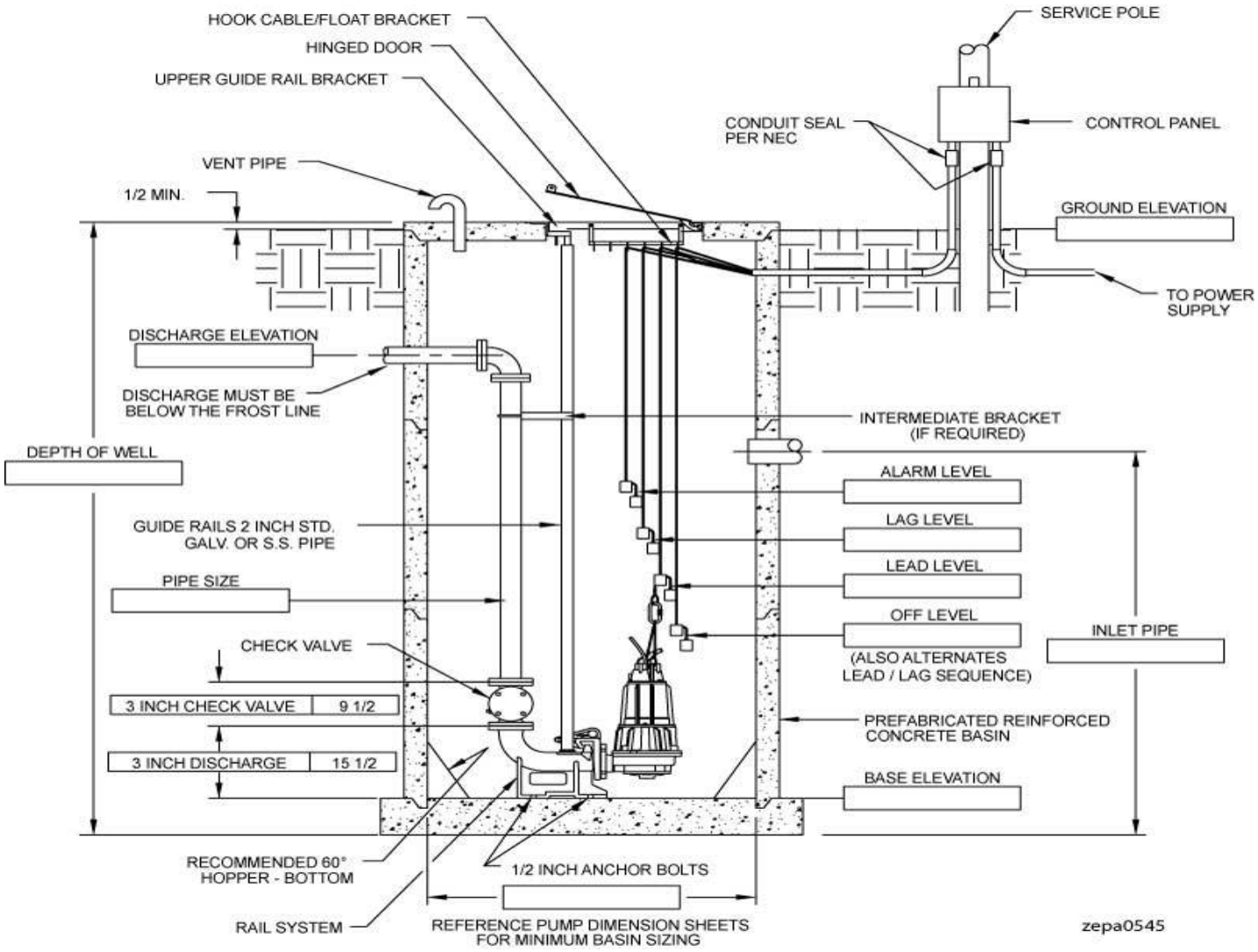
Submersible lift station with valve vault (courtesy of Bemidji Area IHS)

Submersible Lift Station



Submersible lift station with valve vault (courtesy of Bemidji Area IHS)

Submersible Lift Station



Appurtenances

- Pump rails:
  - Several different styles are available on the market; key is stainless steel fasteners and fittings for pumps

Lift Station; Courtesy of Tucson Area

Appurtenances

- Vents:
  - Required to equalize pressure in the wetwell during pump cycles
  - Can double as hoist socket stand; however, be aware of potential corrosion on hoist socket if you have a metal base
  - Can be below grade

t Station: Courtesy of Tucson Area

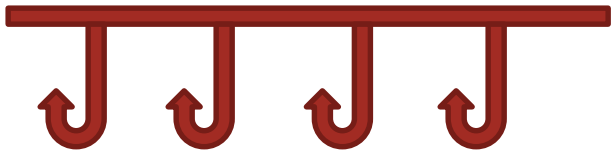
Appurtenances

- Hoists:
  - Design based on pump weight plus safety factors
    - Note that allowable weight may change based on hoist angle
  - Locate hoist socket in a location that will allow vertical removal of both pumps
  - Be cognizant that the socket may be a tripping hazard

Appurtenances

Appurtenances

- Hook rack:
  - Stainless steel
  - Hooks for floats and pump lift cables
  - Positioned for accessibility when access hatch is open



Appurtenances

- Access hatch:
  - Size:
    - Should be large enough to easily accommodate the installation or removal of both pumps
    - Can be a single door or double doors
      - Different types of releases and latches; may want the power-assist doors
    - Need to size the wetwell cover large enough to accommodate access hatch frame; may need an oversized lid

Appurtenances

Appurtenances

- Safety hatch:
  - Not mandatory, but can be useful to prevent falls when looking into the wet well and as a location to put a pulled pump

Appurtenances

Appurtenances

Lift Station; Courtesy of Tucson Area

Valve Vault

- In most locations, following the lift station will be a valve vault; in warm climates, this plumbing tree may be above grade
- Includes:
  - Check valves
  - Gate valves
  - Pressure gauges (or taps)
  - Air release valves *(dependent on fm design)*
  - Drain line with gate valve *(optional)*
  - Emergency pump connection *(optional)*
    - *Consider lift station depth; will not work for liquid levels >20 to 25 feet*

Valve Vault

Gate Valves

Plug Valves

Check Valves


QUIZ

Quiz

1. Why are lift stations needed?

   To pump wastewater from a lower elevation to a higher elevation

Quiz

2. What is a wet well?

   A holding tank for wastewater and submersible pumps

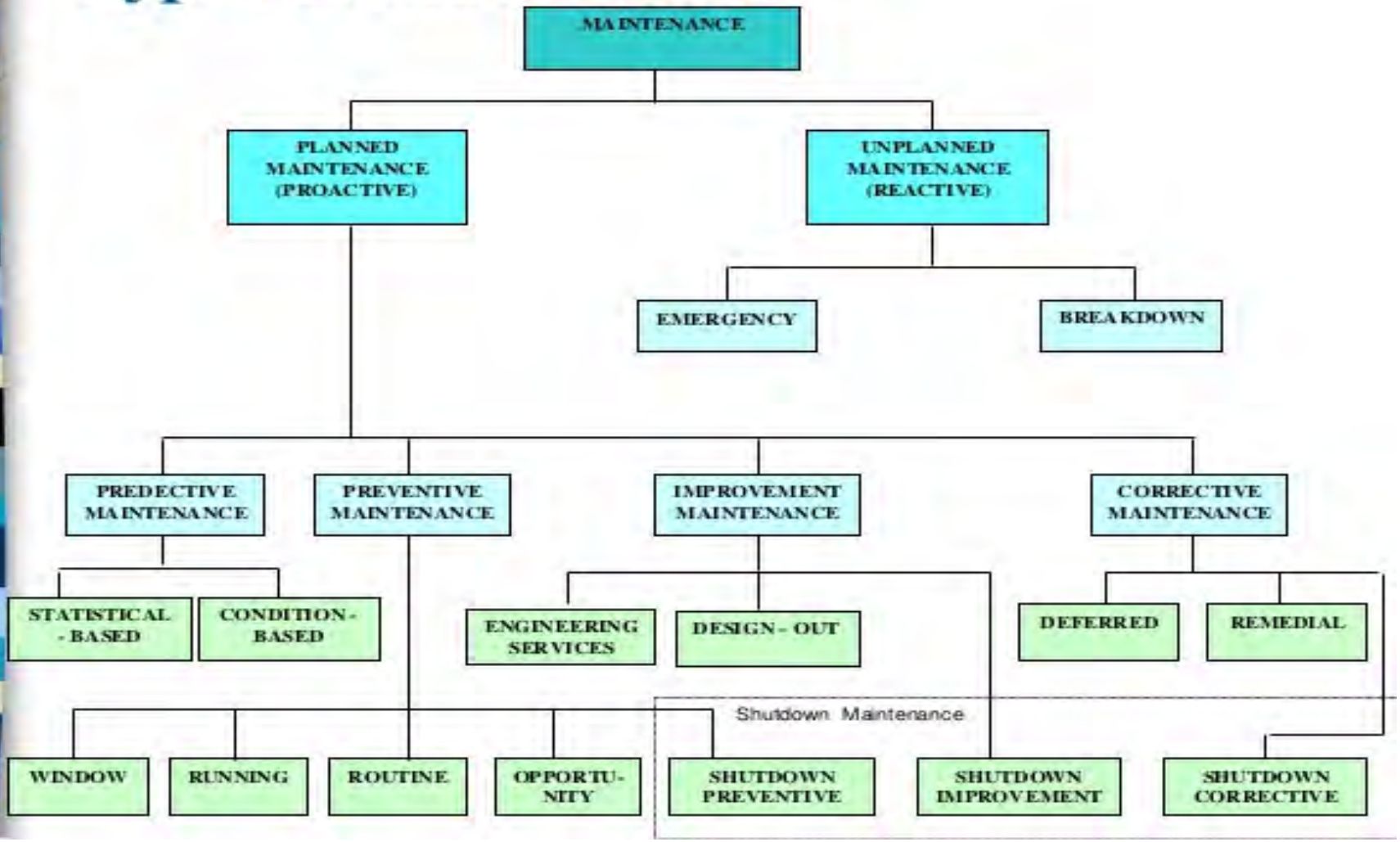
Quiz

3. What is a dry well?

   Valve vault downstream of the wet well containing valves, gauges, and meters

5. OPERATION AND MAINTENANCE (O&M) ACTIVITIES

Types of Maintenance



RED OR GREEN

Preventive Maintenance

- The care and servicing by personnel to maintain equipment in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures, either before they occur or before they develop into major defects
- Preventive maintenance tends to follow planned guidelines to prevent equipment and machinery breakdown
- The work carried out on equipment in order to avoid its breakdown or malfunction; it is a regular and routine action taken on equipment in order to prevent its breakdown[1]
- Maintenance, including tests, measurements, adjustments, parts replacement, and cleaning, performed specifically to prevent faults from occurring

Corrective Maintenance

Corrective maintenance is a maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or system can be restored to an operational condition within the tolerances or limits established for in-service operations.

- Leak check procedure
- Flow balance procedure
- Sample conditioning system
- Probe maintenance
- Troubleshooting the flow monitors
- Troubleshooting the gas analyzers
- Spare parts

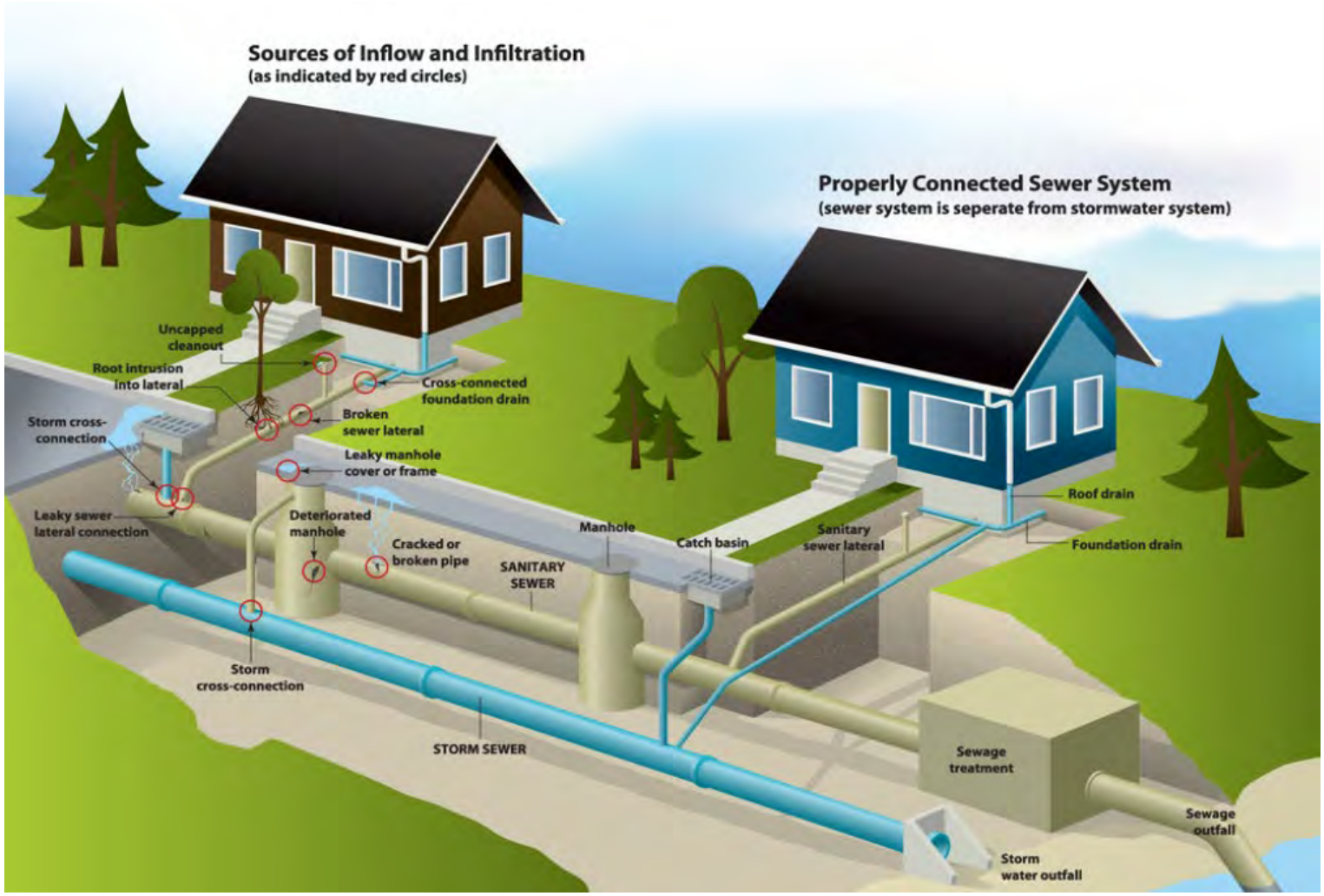
Identifying Problems

- Maintenance program
- Types of stoppages:
  - Root problem
  - Grease problem
  - Debris
  - Pipe damage
  - Line sag
  - Sewer laterals
  - Recent repairs
  - Settlement or sink holes

Infiltration and Inflow (I&I)

- Infiltration: Groundwater that enters the collection system through cracks or leaks
- Inflow: Stormwater, drains, and other connections to the collection system

Infiltration and Inflow (I&I)



Inspection

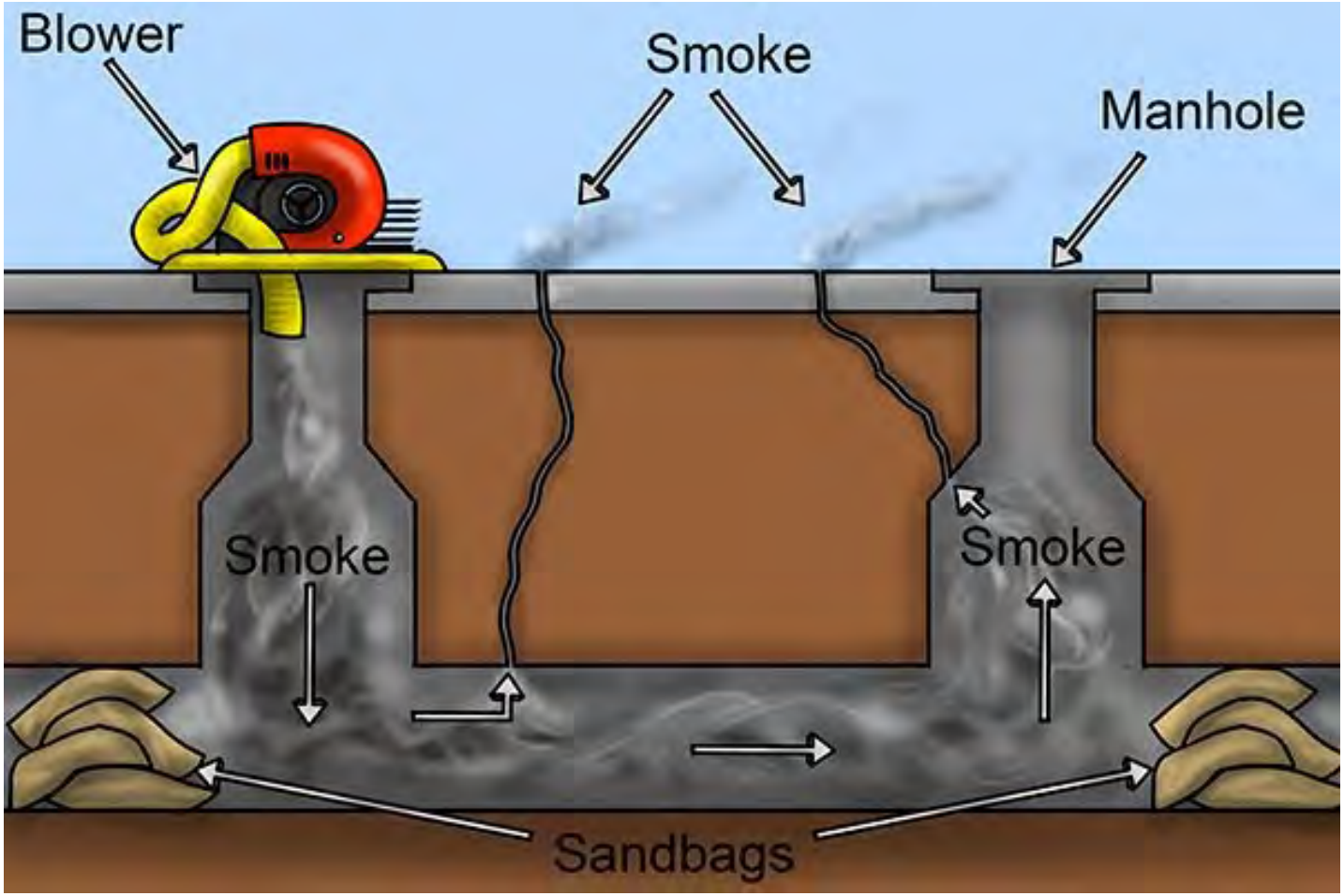
Collection System Testing

- Sewer system testing techniques are often used to identify leaks which allow unwanted infiltration into the sewer system and determine the location of illicit connections and other sources of stormwater flow.
- Two common types of testing:
  - Smoke testing
  - Dye water testing

Smoke Testing

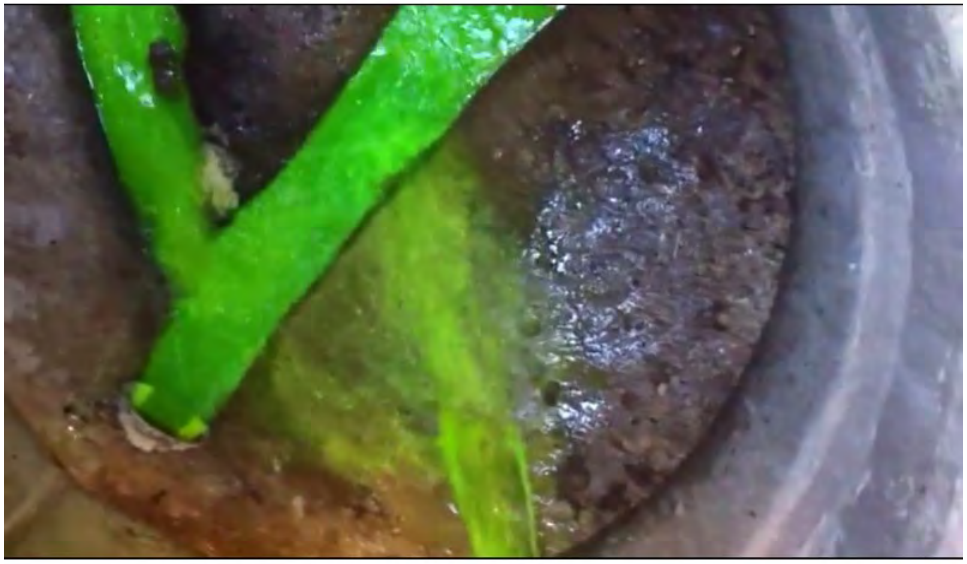
- Quick and inexpensive
- Blower/candles
- Isolation plugs/sand bags
- Public notification
- Detailed documentation
- Advanced planning and communication

Smoke Testing



Dye Water Testing

- Concentrated colored dye
- Establish connections
- Confirm smoke test results
- Test for structure damage
- Customer involvement
- Determine flow characteristics:
  - Velocities
  - Patterns
  - Directions



Closed Circuit TV (CCTV)

CCTV

- Verify service connections
- Identify and document infiltration and exfiltration
- Identify damaged pipe connections
- Evaluate pipe condition
- Determine low points: Bellies
- Identify break as circumventional or longitudinal

Flow Testing

- Flow testing is used to develop a historical record of flows through key manholes in the system
- This data is used to determine the general location of I&I and document changes in flow conditions

Grease Control

- Grease trap control
- Fats, oil, and grease (FOG)
- Grease traps must be maintained by businesses
- Restaurant protocol
- FOG ordinances
- Decomposing material will increase hydrogen sulfide gas
- Grease control agents:
  - Bio-acids
  - Digesters
  - Enzymes
  - Bacteria cultures
  - Catalysts
  - Caustics
  - Hydroxides
  - Neutralizers

Sewer Line Cleaning

Mechanical:

- Power rodders
- Hand rodders
- Snake

Hydraulic:

- Flushing
- Sewer ball
- Kites and bags
- Scooter
- HVC

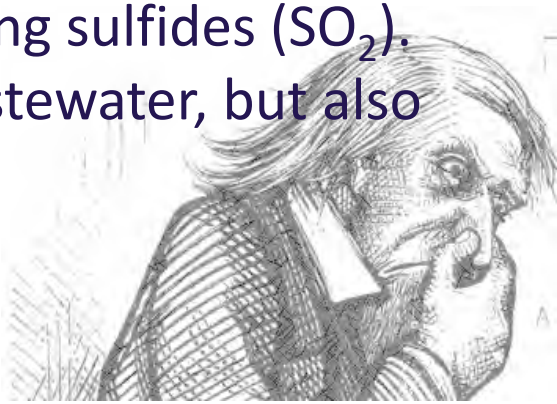
Chemical:

- Chlorine
- Hydrogen peroxide
- Degreasers
- Copper sulfate

Odor/Corrosion Control

Hydrogen sulfide (H_2S)

Gas typically is formed in wastewater collection systems that are conducive to creating septic conditions. Collection systems in warm climates that have a flat grade or do not have the flow-through velocities (minimum two feet per second) to prevent the stagnation of fluid, allow the septic conditions to occur. In general, septic conditions occur when bacteria use all of the available oxygen while decomposing organic matter in wastewater for energy. Sewers with low velocities encourage the growth of anaerobic bacteria in a slime layer coating the sewer. These bacteria reduce sulfur compounds such as sulfate (SO_4), thereby producing sulfides (SO_2). These compounds occur naturally in domestic wastewater, but also can be concentrated in industrial waste streams.



Corrosion Control

If the concrete sewer is normally only partly full, the damp surface above the water line is home to aerobic bacteria that oxidize the H_2S and produce sulfuric acid (H_2SO_4) that attacks the calcium carbonate constituents of concrete. The process results in corrosion of the collection system pipes, wet wells, and manhole. Corrosion is most severe at the crown of the pipe where the acid collects, leading to a weakening of the pipe (or structure) and potential collapses if left unattended.

Corrosion Control

Digestive Gas Treatment Conclusion

Many factors must be evaluated in any evaluation for the treatment of bio-gas:

1. Loading: How much H_2S must be removed?
2. Variability: Changes in concentration/spiking
3. Process conditions: At what pressure and temperature is gas apparent?
4. Labor: Simplistic operations/media (consumable) changeout

Lift Station O&M

- Level controls:
  - Inspect and clean floats and cables
  - Check for grease buildup
- Pumps and motors:
  - Monitor and record run times, run cycles, and amperage draw
  - Check output and pump efficiency
  - Check for grease buildup, pump clogging
- Valves and piping:
  - Clean to prevent clogging and buildup; increased pump run times may be an indicator
  - Operate all components periodically to lubricate parts


QUIZ

Quiz

1. What are sources of I&I?

   Improper connection systems, roots, intrusions

Quiz

2. What is an example of preventive maintenance?

   Lubricating a pump; flushing and vacuuming sewer pipes

Quiz

3. How is CCTV used in sewer systems?

   Small RC unit with camera looks for service connections, quality of pipes, buildup, intrusions

Quiz

4. What is smoke testing used for?

   It locates cracks in the system.

6. INDUSTRIAL PRETREATMENT

Industrial Pretreatment

- Industrial pretreatment is when the customers treat their wastewater before discharging it to the sewer system.
- This could be chemical treatment such as pH adjustment or physical treatment such as a grease trap

Industrial Pretreatment Program

COMPONENTS OF AN IPP PROGRAM

- Identifying and maintaining a list of businesses
- Inspecting businesses
- Evaluating business operations and waste streams
- Notifying businesses of applicable requirements, which could include obtaining an IPP permit and/or implementing best management practices (BMPs)
- Collecting samples
- Reviewing data and reports
- Evaluating compliance
- Providing compliance assistance to businesses
- Taking formal enforcement action where necessary

When should you implement an IPP Program?

- If you have industrial or commercial users whose wastewater might introduce pollutants which can cause damage to equipment and interfere with the wastewater treatment process
- An IPP program is important in preventing harm to workers, the public and the environment.

7. SAFETY

Safety

- OSHA requirements: chemical hazards
- Confined space procedures
- Electrical hazards
- Lockout/tagout procedures
- Bloodborne pathogen hazards
- Personal protection equipment
- Atmospheric hazards
- Traffic control
- Excavation procedures

Perform Your Duties Safely

- Job challenges
- Wide range of responsibilities
- Equipment:
  - Tankers
  - Dump trucks
  - TV rigs
  - Rodding machines
  - Standby generators
  - Foaming trailers
  - Compressors
  - Portable engine-driven pumps

Perform Your Duties Safely

- Confined space
- Electrical equipment
- Mechanical equipment
- Hydraulic and pneumatic systems
- Industrial waste sampling
- Sewer cleaning
- Unplug stopped-up sewers
- Repair broken lines
- Roadway repairs
- Trenching and shoring

Defensive Driving

- Always be aware
- Be in control
- Vehicle limitations
- Consider weather conditions
- Attitude
- Maintain safe stopping distance
- Highly visible public vehicle
- Defensive driving school

Confined Spaces

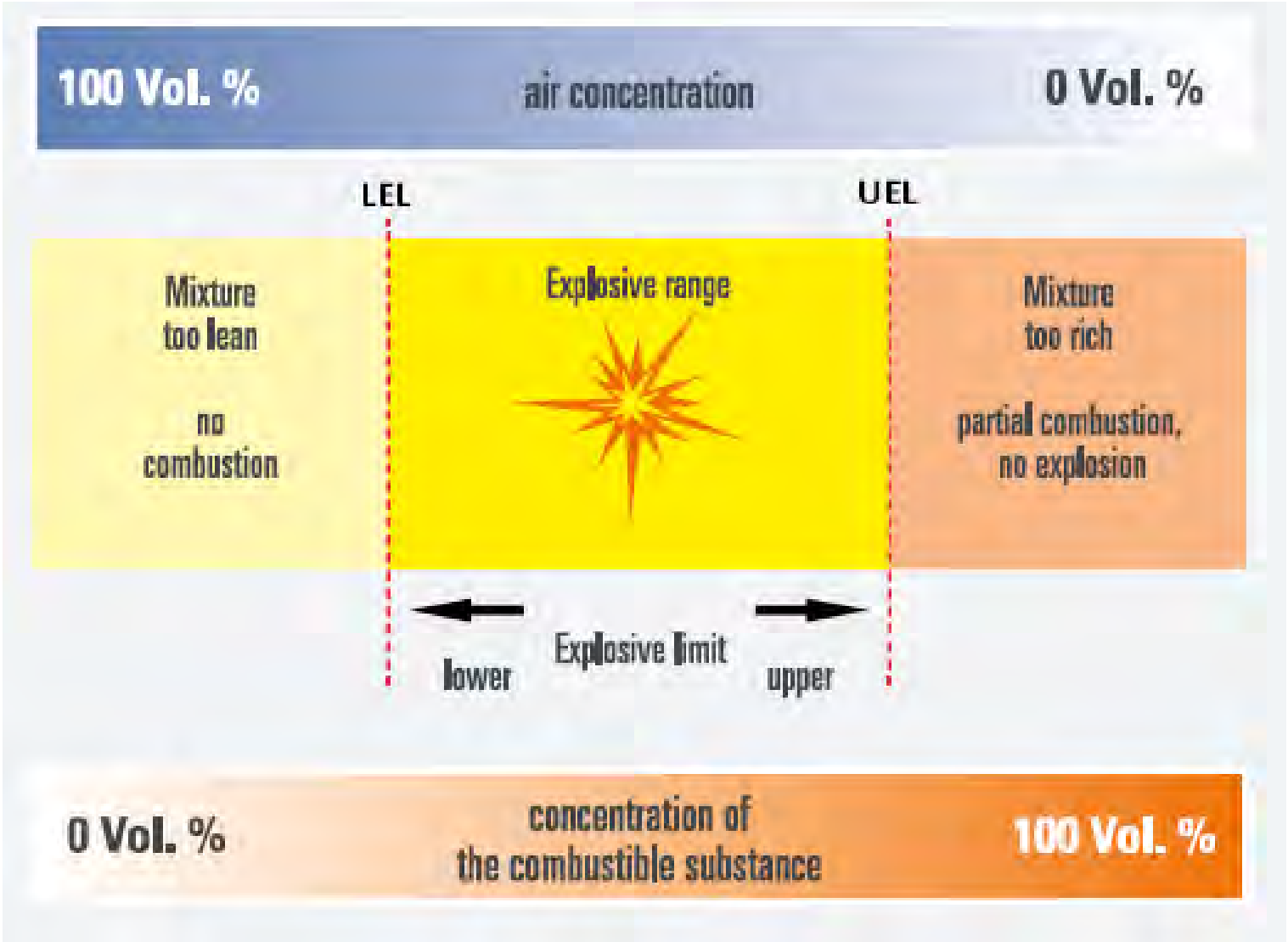
Confined space is defined as a space that has the following characteristics:

- Large enough for entry
- Limited means of entry
- Not designed for continuous occupancy
- Confined space has two general categories
  - Non-permitted confined space
  - Permit-required confined space

Atmospheric Hazards

- Flammable gas, vapor
- Airborne combustible dust
- Oxygen concentrations below 19.5% and above 23.5%
- Any exceedance of permissible exposure limits (PEL)
- Any atmospheric condition immediately dangerous to life and health (IDLH)
- Methane gas: Anaerobic waste decomposition

Atmospheric Testing



Safety Equipment

- Respiratory protection
- Safety harness with lifeline
- Tripod and winch
- Portable atmospheric alarm unit (continuous monitoring)
- Ventilation blower with hose
- Manhole enclosure
- Ladders
- Head, hands, feet, and body protectior
- Protective clothing

Confined Space Pre-Entry Checklist

§1910.146

1910 OSHA GUIDE

Appendix D - 1B

Confined Space Entry Permit (Pre-Entry / Entry Check List)

Date and Time Issued: _____

Job site: _____

Equipment to be worked on: _____

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time _____
   Oxygen _____ %
   Explosive _____ % L.F.L.
   Toxic _____ PPM

   Tester's Signature: _____

2. Source Isolation (No Entry):	N/A	Yes	No
Pumps or lines blinded,	( )	( )	( )
disconnected, or blocked	( )	( )	( )

3. Ventilation Modification:	N/A	Yes	No
Mechanical,	( )	( )	( )
Natural Ventilation only	( )	( )	( )

4. Atmospheric check after isolation and ventilation:

Oxygen _____ %	> 19.5 %
Explosive _____ % L.F.L.	< 10%
Toxic _____ PPM	< 10 PPM H_2S
Time _____	

Tester's Signature: _____

5. Rescue Procedures: _____

6. Communication Procedures: _____

Date and Time Expires: _____

Job Supervisor: _____

Work to be performed: _____

Stand-by Personnel: _____

7. Entry, standby, and back up persons:	Yes	No
Successfully completed required training?	( )	( )
Is it current?	( )	( )

8. Equipment:	N/A	Yes	No
Direct reading gas monitor -tested?	( )	( )	( )
Safety harnesses and life-lines for entry and standby persons?	( )	( )	( )
Hoisting equipment?	( )	( )	( )
Powered communications?	( )	( )	( )
SCBAs for entry and standby persons?	( )	( )	( )
Protective Clothing?	( )	( )	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools?	( )	( )	( )

9. Periodic atmospheric tests:

Oxygen ___ % Time ___		Oxygen ___ % Time ___	
Oxygen ___ % Time ___		Oxygen ___ % Time ___	
Explosive ___ % Time ___		Explosive ___ % Time ___	
Explosive ___ % Time ___		Explosive ___ % Time ___	
Toxic ___ % Time ___		Toxic ___ % Time ___	
Toxic ___ % Time ___		Toxic ___ % Time ___	

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By: (Supervisor) _____

Approved By: (Unit Supervisor) _____

Reviewed By: (Confined Space Operations Personnel) _____
(signature)

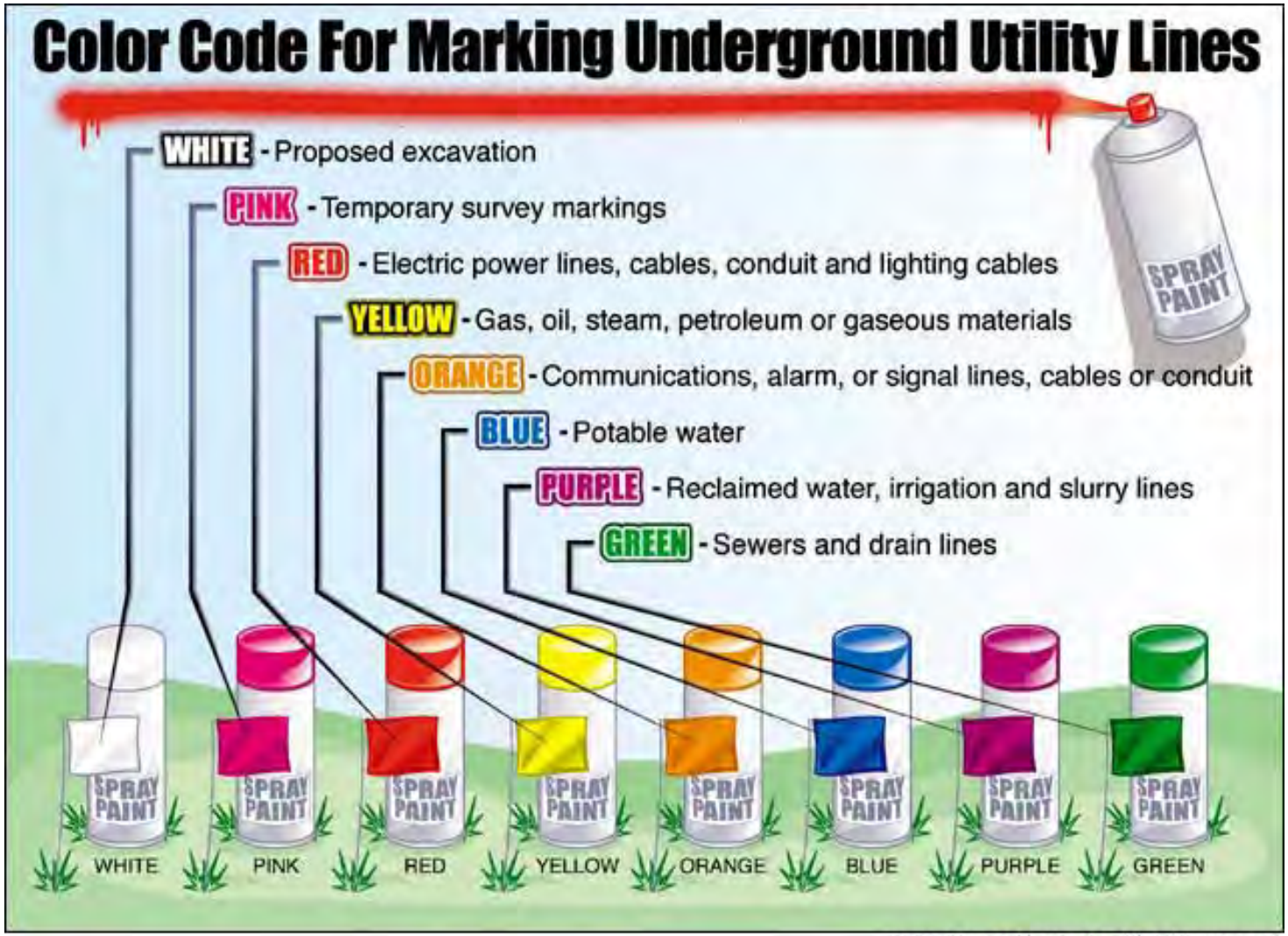
_____
(printed name)

This permit to be kept at job site. Return job site copy to Safety Office following job completion.

Operations of Manhole Entry

- Manhole enclosure
- Calibrate equipment
- Remove cover
- Notify supervisor
- Monitor atmosphere
- Turn off engines
- Traffic control
- Inspect up and downstream manholes
- Notify any facilities
- Attempt to locate problem or failure
- Ventilate: No smoking
- Attach a lifeline
- Continue monitoring

811 Call Before You Dig

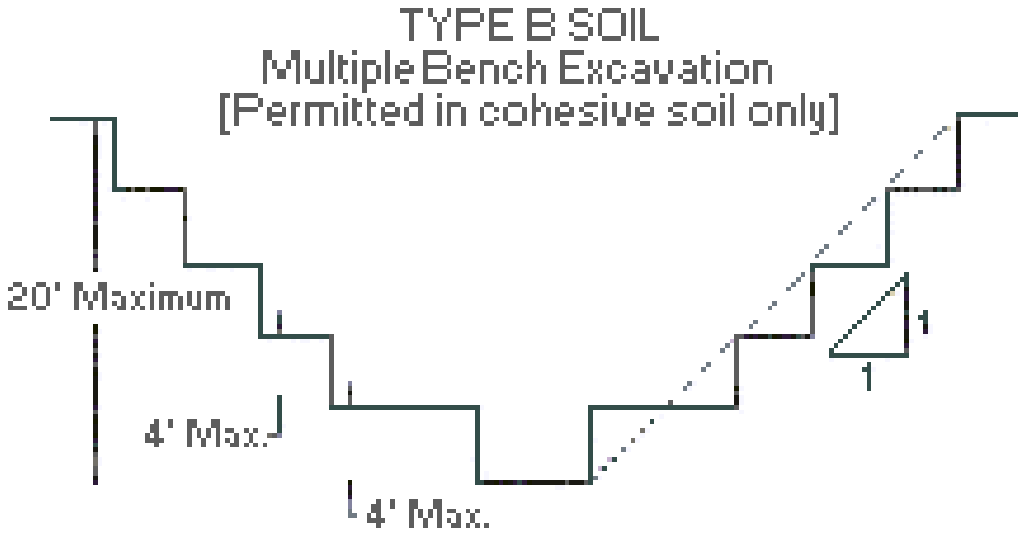


Shoring

- Whenever excavation is performed, shoring may be necessary to protect operators from cave-in
- Typical shoring

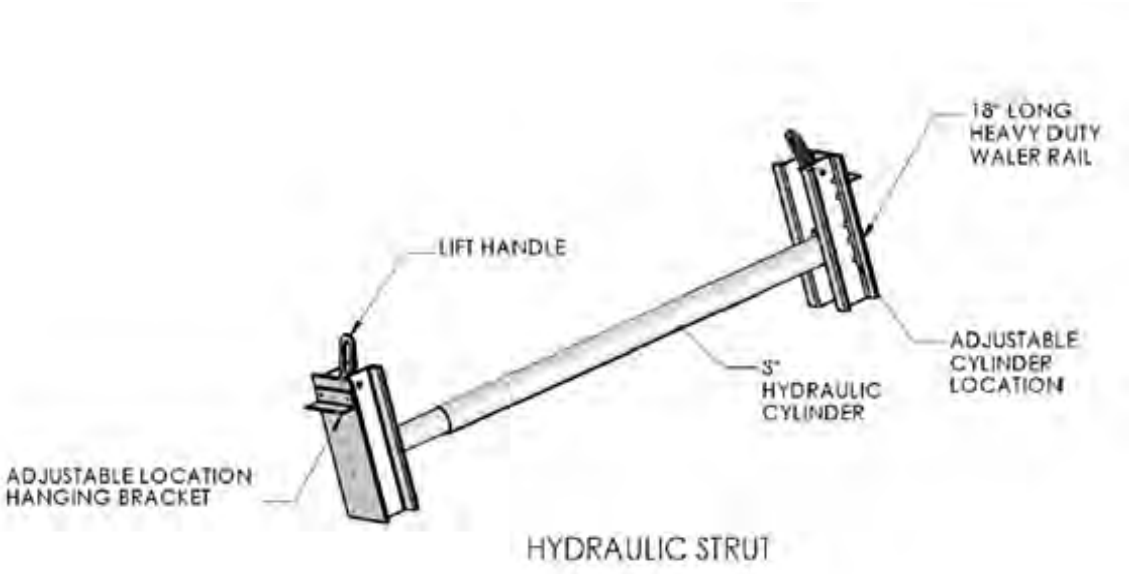
Shoring Regulations

- Operator safety
- Soil conditions
- Sloping excavation walls
- Access to construction area
- Pedestrian safety



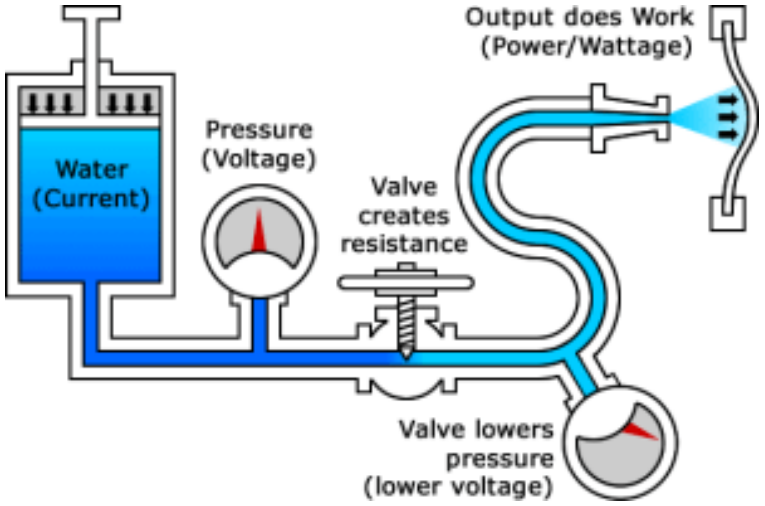
Types of Shores

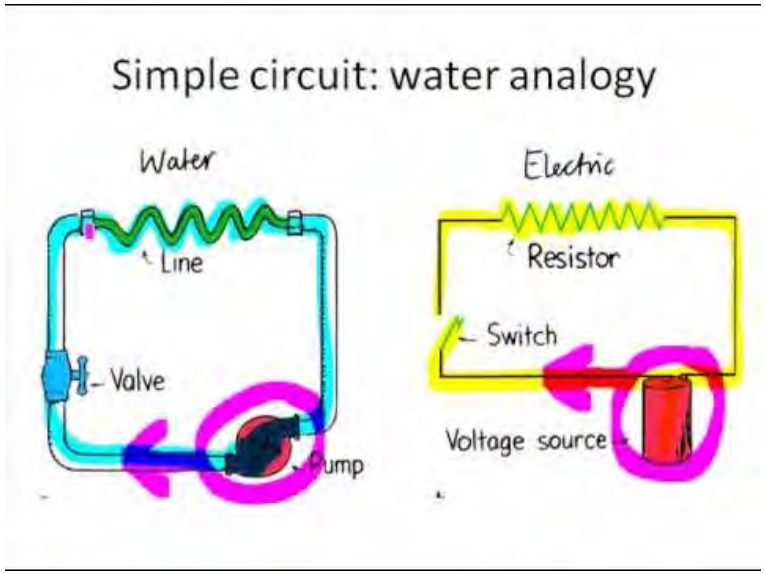
- Hydraulic shores
- Screw jacks
- Air shores
- Solid sheeting
- Cylinder shoring
- Shield shoring



Electricity

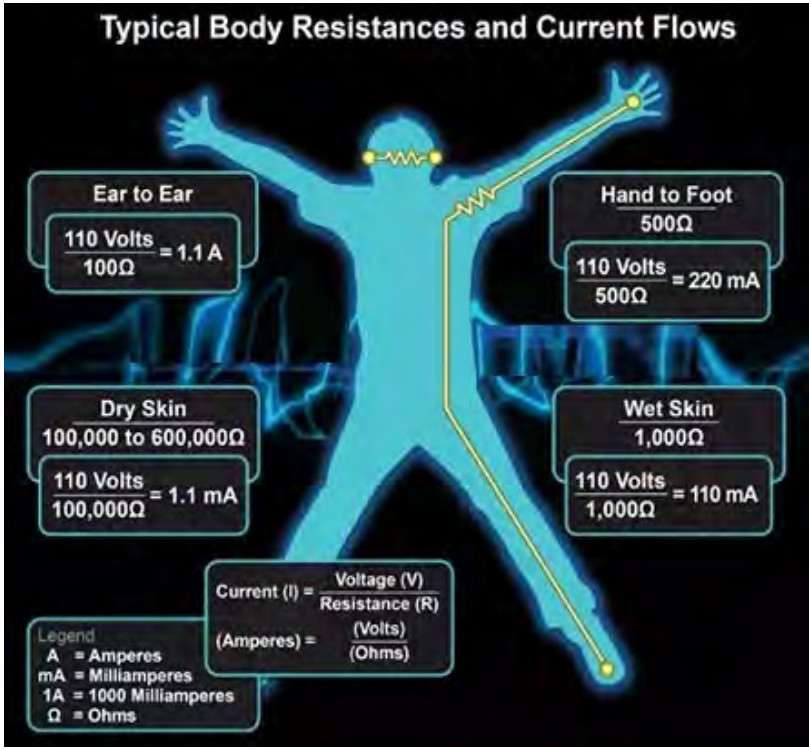
- Collection system operators are exposed to electricity
- Similarities to water
- Pump supplies water and pressure
- Electricity supplies current and voltage





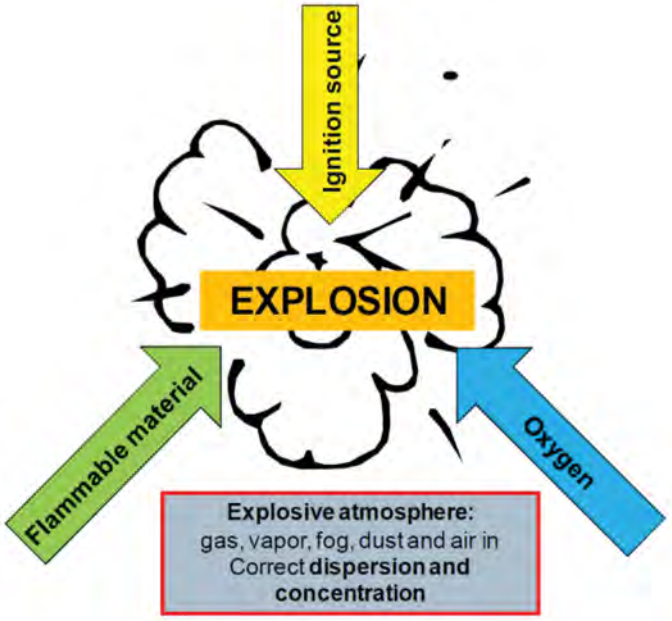
Hazards

- Lift stations
- Flow metering in wet locations
- Telemetry systems
- Standby equipment
- Voltages range from 24 to 4,160 V
- Difficult conditions
- Night failures
- Underground utilities
- Failures to lock out
- Electrical explosions
- Severe burns



Explosive Atmospheres

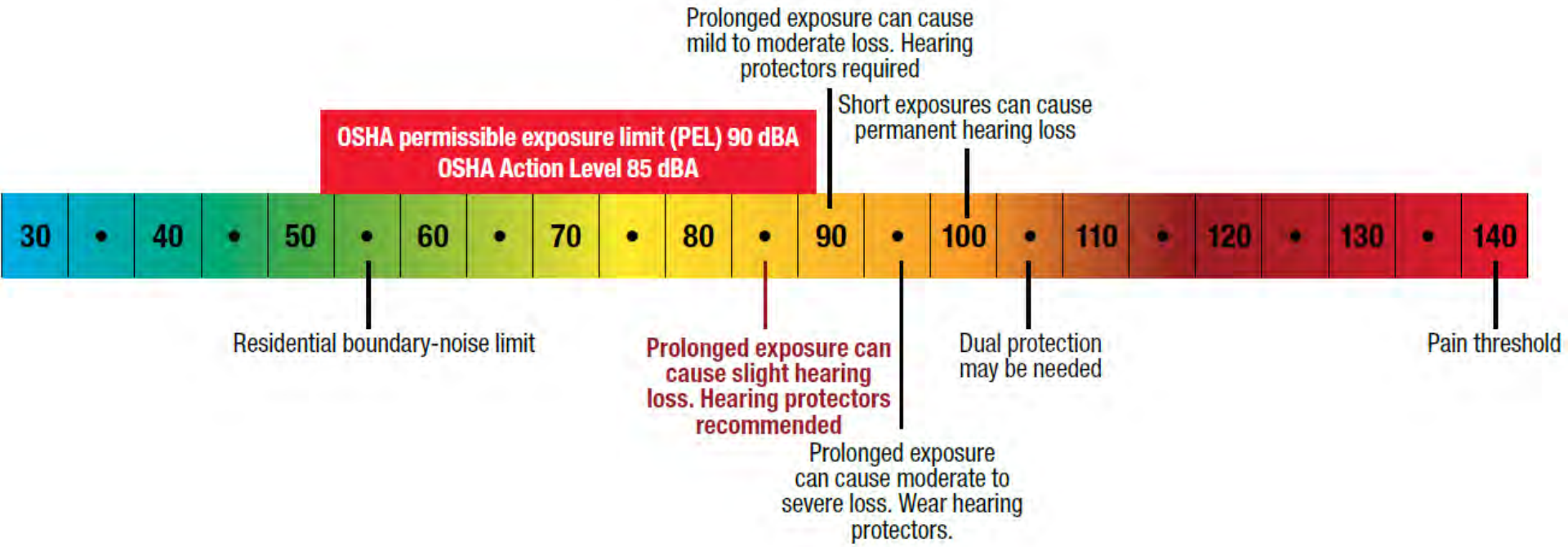
- Class 1 location where explosive gases or vapors are present



Lock Out/Tag Out

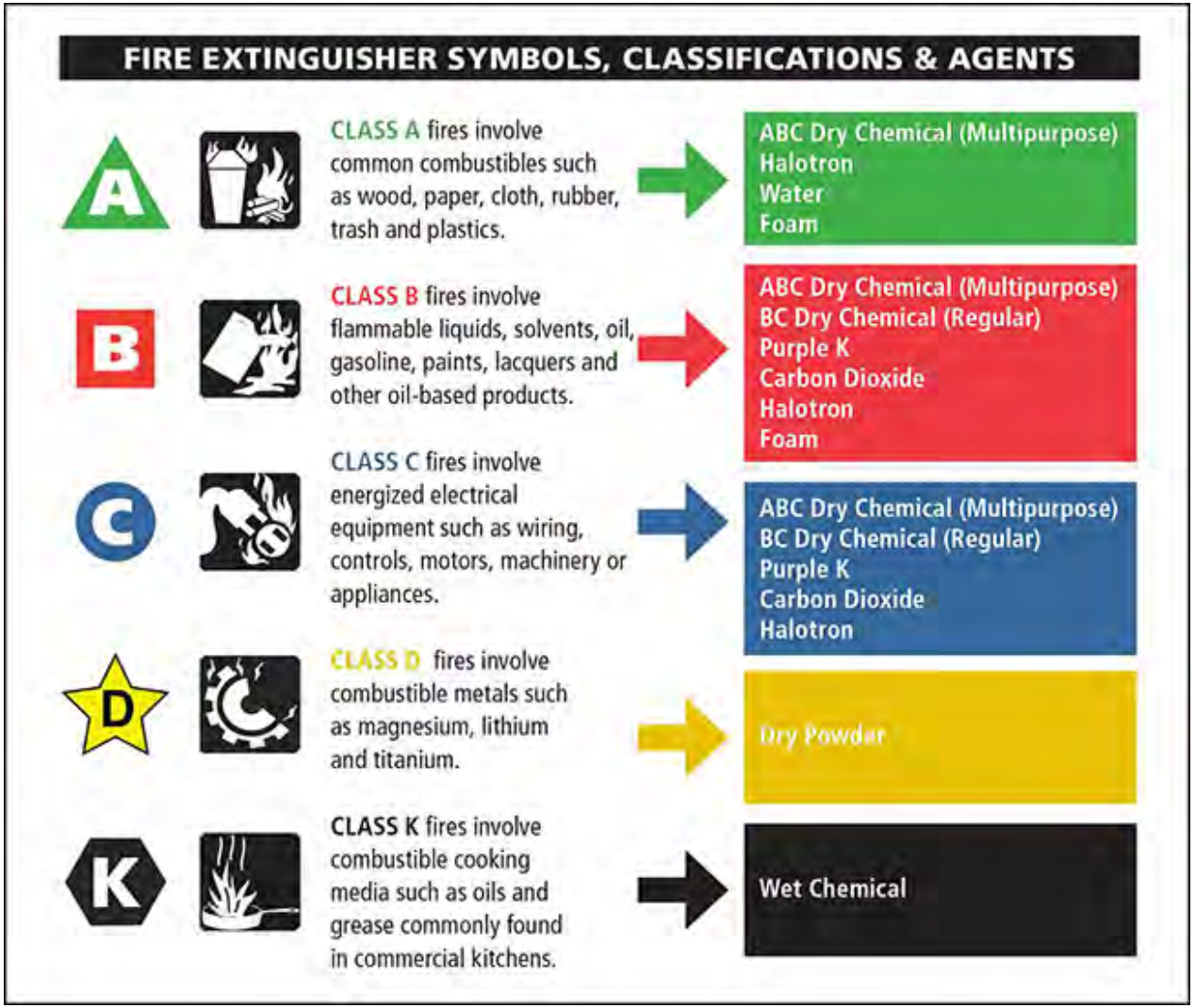
- OSHA standards require that all equipment that could unexpectedly start up must be locked out
- Operator performing the work installs the lock
- Sequence of lockout/tagout
- Restoring machines or equipment to normal operations

Working Near Noise



Firefighting

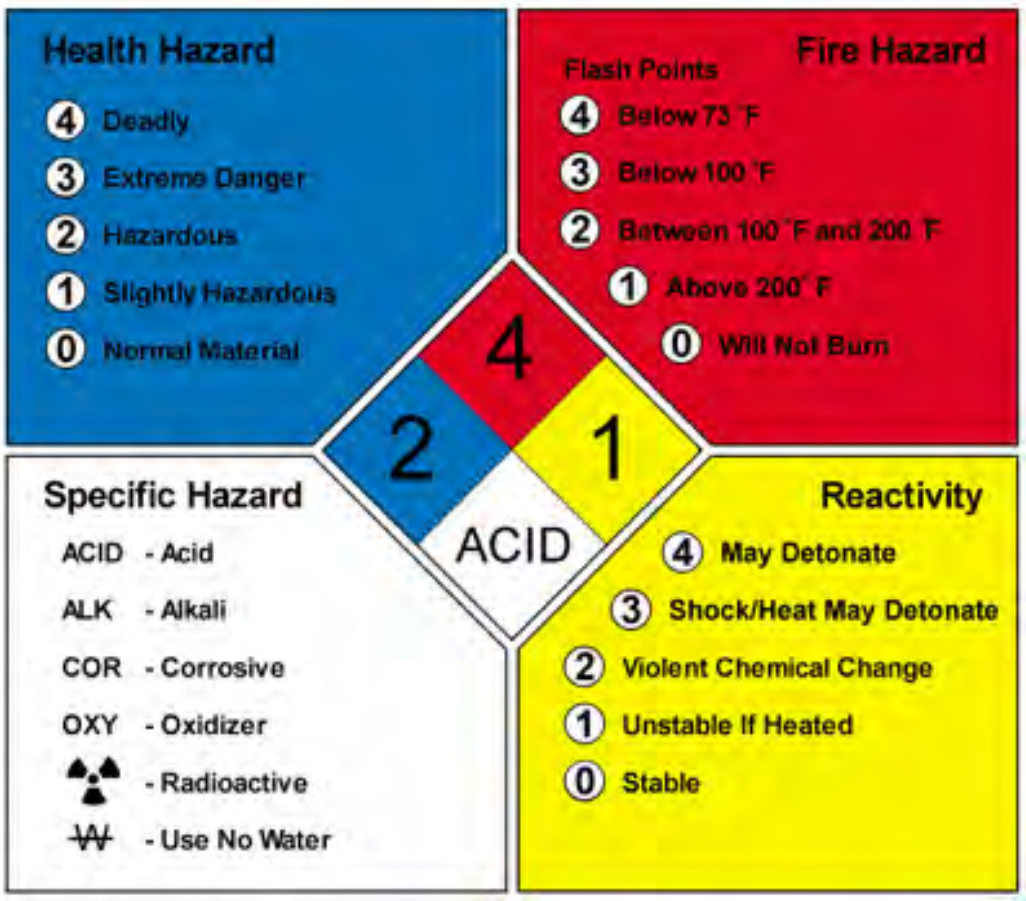
- Class A
- Class B
- Class C
- Class D
- Class K



Hazard Communication

- Worker: Right to know
- 29 CFR 1910.1200
- SDSs (safety data sheets)
- Understandable Information on any and all hazards

Hazardous Materials Identification System



MANAGEMENT

- Job duties
- Reporting
- Communications
- Public relations
- Security


QUIZ

Quiz

1. What is a confined space?

   A space large enough for entry, with limited means of entry and not designed for continuous occupancy

Quiz

2. What are some hazards associated with manhole entry?

   Flammable gas or vapor, combustible dust, low oxygen, methane gas

Quiz

3. What is the procedure for manhole entry?

   Respiratory protection, safety harness, atmospheric alarm unit, ventilation hose, ladders, protective clothing

8. REGULATORY COMPLIANCE

Federal regulations

- Clean Water Act
- National Pollutant Discharge Elimination System (NPDES) Program
- Combined Sewer Overflow Control Program
- Great Lakes, Upper Mississippi River

Ten States Standards (guidance)

- Recommended standards for wastewater facilities
- Policies for the design, review, and approval of plans and specifications
- For wastewater collections and treatment facilities
- Great Lakes, Upper Mississippi River

Sanitary Sewer Overflows

- SSOs are illegal under the CWA
- EPA will levy fines for SSOs

Combined Sewer Overflows

- Definition: Combined sewers receive both wastewater and stormwater
- CSO's are regulated under the National Pollutant Discharge Elimination System (NPDES) Program
- Through the NPDES program, EPA established a national framework for controlling CSOs, called the CSO Control Policy.

Recordkeeping: EPA Guidelines

WASTEWATER UTILITY RECORDKEEPING, REPORTING AND MANAGEMENT INFORMATION SYSTEMS

Questions?

POST-

Post-Quiz

1. What are 3 types of collection systems?
2. Why do we need manholes?
3. What is a drop manhole?
4. What is a lift station?
5. What's the difference between preventive maintenance and corrective maintenance?
6. What does I&I stand for?
7. What are the 2 types of leak testing?

Post-Quiz

1. What are 3 types of collection systems?

- ✓ Sanitary sewer
- ✓ Storm sewer
- ✓ Combined sewer

Post-Quiz

2. Why do we need manholes?

   Access to sewer pipes

Post-Quiz

3. What is a drop manhole?

   It is a manhole in which the elevation of the pipe into the manhole is much higher than the elevation of the pipe out of the manhole.

Post-Quiz

4. What is a lift station?

A lift station pumps sewage in a collection system.

Post-Quiz

5. What's the difference between preventive maintenance and corrective maintenance?

   Preventive maintenance is routine maintenance to prevent failure of an asset; corrective maintenance is to fix something that's not working right.

Post-Quiz

6. What does I&I stand for?

Infiltration and *Inflow*:

Infiltration is groundwater getting into the collection system through cracks or breaks.

Inflow is stormwater, drains or other direct connections of fresh water to the collection system.

Post-Quiz

7. What are the 2 types of leak testing?

- ✓ Smoke testing
- ✓ Dye testing

¿Preguntas?