Sanitary Sewage Systems

Objectives
- Understand basic needs of sanitary sewage systems
- Learn basic sanitary sewage systems
- Read and comprehend a State Code book

Important definitions
- Aerobic – treatment of sewage with the use of oxygen
- Anaerobic – treatment of sewage when no oxygen present
- Building sewer – piping from house to sewer system.
- Common collector – piping system that transports manure from 3 or fewer properties.
Important definitions

- Liquid capacity – the volume of a tank below the outlet pipe
- Subsurface seepage system – subsurface seepage field, seepage bed and system that treated sewage is released

How is the Code made?

- Federal regulations
  - EPA
- State regulations
  - EPA
  - Department of Public Health
- ASTM – American Society for Testing and Materials
- NSF – National Sanitary Foundation

General Requirements

- Appendix A
- Used to determine sewage flows
General Requirements

- Systems are Designed to accept domestic sewage and NOT the following;
  - Discharge from roof or footing tile lines
  - Backwash water from water softener
  - Go thru seepage field but not septic tank
  - Hot tub wastewater
  - Motorized vehicle grease, oil & chemicals

Separation distances

- Horizontal sewer lines need to be 10 ft away from water lines
- If sewer line is within 10ft of water line, the water line needs to be at least 18” above sewer line

Sanitary Sewer

- Hook up to sanitary sewer when it is within 200ft of residential property w/ flow <1500gpm
- >1500gpm hook up to sanitary system w/in 1000 ft
### Pipe Size, Materials & Slope
- **Type**
  - Ductile iron
  - Vitrified clay
  - Plastic pipe
- **Minimum 4” diameter**
- **Gravity flow 1:100**
- >50’ requires clean out

### Sewer System Development
- Do not design in area where surface water accumulates
- Proper distances away from critical areas
- No swimming pools, sprinkling systems, underground utilities in area
- No limestone or bedrock within 4’ from bottom of system

### Variance/Experimental Design
- Variance – an extension for a proposed installation that cannot be compliant with regulations
- Experimental design – an unapproved sewage system that is being tested for approval by Dept of Health
Garbage Disposals
- Receives waste from kitchen
- At least ½ size of liquid volume in septic tank or 500 gal

Private Sewage Design Systems
- Primary Systems
  - Septic Tanks
  - Imhoff Tanks
  - Aerobic treatment Plants

Private Sewage Design Systems
- Secondary Systems
  - Subsurface seepage field
  - Waste stabilization pond
  - Seepage bed
  - Sand filter
  - Gravelless seepage
  - Chamber
  - Peat filter
Private Sewage Design Systems

- Holding Tanks
- Raised Filter Beds
- Mounds

Other systems

- Privies
- Chemical Toilets
- Recirculating toilets
- Incinerator toilets
- Compost toilets

Septic Tanks

- Prefabricated
- Made from
  - Poured concrete
  - Precast concrete
  - Concrete block
  - Plastic
  - Fiberglass
  - Thermoplastic

Septic Tanks

- Depth
  - Liquid min = 42"
  - Max depth = 72"
- Water tight connections
- Proper access
  - 12" diameter
  - Over inlet and outlet
Septic Tanks - Baffles

- Septic Tanks
- <500 gpm = 750 gal
- >500 gpm = 1.5 * sewage flow
- >1350 gpm
  - 2 or more tanks in series
  - Multi-compartment tanks

Distribution Boxes

- A manifold between primary and secondary systems
- Need access to box for:
  - Inspection
  - Maintenance
  - Cleaning
Soil Tests

- Why?
- Percolation Test
- Required by qualified person

Seepage Fields

- Gravel
  - With gravel around piping
- Gravelless
  - No gravel around piping
- Chamber
  - Similar to gravelless

Seepage Fields

- Size based on soil type
- Between 6-24" of backfill over bed
- 5' of undisturbed earth between septic tank & field
- Top of seepage field at least 1" lower than distribution box or septic tank outlet
Seepage Fields
- Bottom of field >3' from bedrock with original soil
- Max 2' of fill soil can be used
- Do not compact
- Percolation test required

Gravel Seepage Field
- Bedding material
  - Clean gravel
  - ¾"<diameter<4"
  - Full width of trench
  - 6" below bottom of line
  - 2" above top of line

Gravel Seepage Field
- Distribution lines
  - Suitable materials
  - Perforated line
    - ½"<holes<¾" tile sections<⅝"
  - open joint line
  - 3-5" oc
  - 2 rows
  - Holes point downward
Gravel Seepage Field

- Separation Material
  - Straw
  - Newspaper
  - Untreated building paper
  - Geotextile fabric
  - Other permeable or biodegradable material

- System can be open or closed loop

Gravelless Seepage Field

- At least 8” or 10” polyethylene pipe

Gravelless Seepage Field

- Holes
  - 2 rows
  - 8” = 3/8”
  - 10” = ½”
Gravelless Seepage Field
- Must have filter wrap encased in pipe
- Bedding material
  - Excavated soil
- Bends > 5’ radius
- Closed loop not required but must be capped at end

Serial Distribution
- Open loop system
- Min 6” of earth backfill over bedding material
- Trench should follow surface contours
- Min 5’ between septic tank & trench
- First line lower than septic tank

Serial Distribution
- Relief lines flow waste to next trench
- Connects to top of pipe of higher trench
Seepage Beds
- Total bottom area = 1.5 * area specified
- Appendix A
- Illustration H

Chamber Systems
- Chambers minimum 7” apart
- Example Appendix A Illustration I Exhibit E
- Can use backfill since it will not prevent backflow

Buried Sand Filters
- Will have discharge from filter area
- Residential = 200 ft²/bedroom
- Aerobic treatment before filter reduces size by 50%
- Minimum size to treat 100 GPD
Buried Sand Filters

- Media
  - Minimum 24" depth
  - 0.5mm < granular size < 2.0mm
  - Clean
  - Other media can be used
    - Chemically & biologically inert
    - Support biological growth
    - Hardness equivalent >= sand

Recirculating Sand Filter
Waste Stabilization Pond

- Setbacks
- No trees
- Length 3X width
- Capacity = 60X daily flow
- 3 ft < depth < 5 ft
- 2 ft freeboard
- Impermeable bottom

Raised Filter Bed

- Loading rate = 4 gal/ft²/day for residential systems < 1500 GPD
- >1500 GPD = 2.5 gal/ft²/day
- Maximum area >600 ft²
- More area needed = multiple beds at least 15' apart
- 0.5mm < media size < 2.0mm
- 30” depth

Raised Filter Bed

- Mantle area
  - \[ A = Q \times T / 25 \]
    - \( A \) = Area of mantle
    - \( Q \) = quantity of wastewater/day
    - \( T \) = percolation time, min/in
  - Mantle area = area of filter bed
  - Not designed for percolation rates > 120 min/in
Raised Filter Bed

- Distribution piping
  - 4" perforated piping
  - Level
  - 15" o.c.
  - Surrounded by 12" of 3/4" stone
  - Sod placed over mantle and bed

Aerobic Treatment Plants

- Only for houses used full time
- Class I effluent discharge to
  - Subsurface seepage if at least 2/3 size necessary
  - Surface discharge
- Class II effluent discharge to
  - Subsurface seepage system
  - Sand filter
  - Waste stabilization pond
Aerobic Treatment Plants

- **Sizing**
  - Class I & 500 gpd can be used for houses up to and including 4 bedroom house
  - Table in section 905.100

- **Access**
  - 18” grade level entrance

- **2 year service policy**
- **Required service within 2 days**
- **Mandatory owners manual w/ critical information**
- **Meet biological, chemical & physical treatment requirements**
Effluent Discharges
- Class I effluent can be discharged within 10' of any surface water with 5:1 dilution
  - Discharges to water not flowing limited to 2:1 ratio
- Common collector can discharge as long as not within 1 mi of public place and not >1500 GPD
- Ground surface as long as 1 discharge/ac

Discharges Requirements
- Physical
  - Suspended solids
  - Settable solids
  - Color
  - Odor
  - Turbidity
  - Floating debris
  - Oil, grease, scum, etc.

Biological
- Fecal coliform

Chemical
- BOD₅
Disinfection
- Surface discharges disinfected with chlorine
  - Ground surface & leaves property
  - Into surface water where recreational activities occur
- Chlorine contact time
  - 30 minutes
  - Based on 2.5 * average flow
  - Minimum tank capacity = 30 gal
  - Chlorine residual between 0.2 & 1.5 mg/L

Other Items in Code
- Pumps
- Ancillary equipment
- Holding tanks
- Sanitary dump stations
- Swimming pool wastewater
- Transporting of waste
- Human waste disposal
  - Privies
  - Portable toilets
  - Recirculation toilets
  - Incinerator toilets
  - Compost toilets
- Licenses & fees
- Installation approval

Penalties
- Type A
  - Prohibited discharge, repeat violations
- Type B
  - Improper construction practices
- Type C
  - Administration violations
Penalties

- Repeat violation
  - Same violation within 3 years
- Serious health violations must be corrected within 7 days
- Other violations within 30 days of notification