Septic Systems 101

Claire A. Golden, MassDEP
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Topics to Be Discussed

• Wastewater Disposal History
• Disposal vs. Treatment with Dispersal
• Septic System Basics
• Advanced Treatment
• Keys to Maximizing Septic System Life
• Miscellaneous Issues
• Questions
A Few Notes Before We Proceed

• Any proprietary technology mentioned in this presentation is used purely as an example and its inclusion does not constitute a comment on or endorsement of the technology by the presenter or MassDEP.

• This presentation is intended to be general in scope but may, at time, refer back to 310 CMR 15.000, Title 5 of the Massachusetts State Environmental Code.

• Many municipalities have regulations that are more restrictive than the appropriate State Code.
Wastewater Disposal History
Wastewater Disposal to Surface Water

Resulted in the Clean Water Act (EPA)

Resulted in the Clean Waters Act (MA)
Wastewater Treatment Plants Resulted
The same things were happening in the on-site wastewater disposal field...

Initially it was “out of site...out of mind...”
Sanitary Privies Are Cheaper Than Coffins

For Health’s Sake let’s keep this Privy CLEAN. Bad privies (and no privies at all) are our greatest cause of Disease. Clean people or families will help us keep this place clean. It should be kept as clean as the house because it spreads more diseases.

The User Must Keep It Clean Inside. Wash the Seat Occasionally

How to Keep a Safe Privy:
1. Have the back perfectly screened against flies and animals.
2. Have a hinged door over the seat and keep it CLOSED when not in use.
3. Have a bucket beneath to catch the Excreta.
4. VENTILATE THE VAULT.
5. See that the privy is kept clean inside and out, or take the blame on yourself if some member of your family dies of Typhoid Fever.

Some of the Diseases Spread by Filthy Privies:
Typhoid Fever, Bowel Troubles of Children, Dysentery, Hookworms, Cholera, some Tuberculosis. The Flies that You See in the Privy Will Soon Be in the Dining Room.

Walker County Board of Health
Cesspools

Privies

Cesspits
Disposal vs. Treatment with Dispersal
Why Treat and then Disperse?

• Solids removal
• Grease/scum reduction
• Better sanitary conditions
• Less human contact with the wastewater
• An engineered leaching area which will provide pathogen reduction/removal

Out of sight, out of mind is no longer sufficient. So, exactly what is in wastewater?
Wastewater Facts

Sources

• Domestic
  • Residences
  • Institutions
  • Retail
  • Commercial
  • Offices

• Industrial

Types of Domestic

• Blackwater
  • Toilets
  • Kitchen Sinks

• Greywater
  • Showers/baths
  • Whirlpool tubs
  • Washing machines
  • Sinks other than kitchen
What’s In Wastewater?

- Water (about 99%+ )
- Nutrients
  - Nitrogen
  - Phosphorus
- Fats, Oils & Grease
  - Cooking oils
- Pathogens*
- Biochemical Oxygen Demand (BOD$_5$)
- Solids
Pathogens

- Bacteria
  - Salmonella
  - Typhoid
- Parasites
  - Protozoa
    - Giardia
    - Cryptosporidiosis
  - Roundworm
- Viruses
  - Hepatitis A
  - Gastroenteritis
  - Polio
- Fecal Coliform - indicator
Hepatitis A

Typhoid

Giardia

Cryptosporidium
Conventional Septic Systems
Conventional Septic System Components

• Grease Trap (optional)
  • Restaurants/Cafeterias
  • Nursing Homes/Hospitals/Schools
• Septic Tank
• Pump Chamber (optional)
  • Pressure dosing: Pump chamber to distribution box (elevation)
  • Pressure distribution: Pump chamber to leaching area
• Leaching Area, aka Soil Absorption System (SAS)
  • Engineered solution
  • Soils - a factor in design
  • Filtration and adhesion are provided
Credit: Groundstone, Canada
Grease Traps

• Kitchen flows at restaurants, nursing homes, schools, hospitals, etc.
• Separate and external
• Under sink grease traps are an add-on
• Maintenance

• Specifications:
  • Material
  • Depth
  • Minimum Capacity
  • Detention time
  • Watertight
  • Tees
  • Access
  • Remote monitoring (optional)
How a grease trap works

- **Kitchen Grease**
- **Inlet Pipe**
- **Flow Diverter**
- **Grease**
- **Food Solids**
- **Normal Liquid Level**
- **Primary**
- **Secondary**
- **Crossover Pipe**
- **Outlet Pipe**
- **Vent**
Septic Tank Components

• Watertight tank (concrete, fiberglass, polyethylene);
• Inlet pipe with inlet tee;
• Outlet pipe with tee/filter;
• Center inspection port (MA - minimum 8-inch manhole); and
• Inlet/outlet manholes (MA - minimum 20 inches)
- Floating soap
- Grease
- Toilet paper

• Water
• Other liquid
• Suspended Solids

• Heavy organics
• Heavy inorganics
• Other solids

- Sewage Enters From House
- Scum
- Wastewater
- Sludge
- Depth Of Sludge Varies With Use
- Treated Wastewater Goes To Drainfield
Distribution Box (d-box)

• Distributes effluent from the septic tank to the SAS
Soil Absorption System ("SAS")

- Treats and disperses wastewater
- Various natural physical, chemical and biological processes
  - Filtering action
  - Bacterial action
  - Aerobic conditions

Credit: www.gibneyce.com
Leaching Trenches

Leaching Field/Bed

overdig/fill

d-box

septic tank
Estimated Seasonal Groundwater Elevation

- Minimum Depth of Naturally Occurring Pervious Material
- Minimum Vertical Separation To GW
- Gravel or Chamber
- 4 Inch Gravity Distribution Pipe
- Inspection Port
- Finished Grade
- Vent

Inspection Port
Nonconventional Septic Systems
Types of Nonconventional Septic Systems

• Tight tanks
• Greywater systems
• Shared systems

• Advanced Treatment Units
  • Innovative/alternative ("I/A") technologies in MA
  • Secondary treatment units ("STUs")
  • Advanced treatment units ("ATUs")
Purpose of Advanced Treatment

If permitted under applicable regulations, nonconventional systems may be used for the following reasons:

• Site constraints for repairs
• SAS area reduction
• Nitrogen or phosphorus reduction
• Compensation for wetlands proximity
Nonconventional Treatment Technologies

- Proprietary
  - Micro-FAST/FAST
  - Bioclere
  - Advantex
  - Hoot
  - JET
  - RUCK
  - Singulair
  - Waterloo Biofilter

- Generic
  - Recirculating sand filters
  - Bottomless sand filters
Alternative SASs and Patented Sand Filters

• Alternative SAS (including chambers)
  • Cultec
  • Infiltrator
  • Perc-Rite

• Patented sand filters
  • Presby
  • Eljen

Credit: Perc-Rite

Credit: Cultec

Credit: Perc-Rite
1. Collection system
2. Pretreatment
3. Soil treatment area

Trash trap/Septic tank, Gravity, Pump tank, Pressure trenches, Blower, ATU, Controls

Credit: NOWRA A to Z Course
Keys to Maximizing Septic System Life
Miscellaneous Issues
Regulatory Considerations

• Approving Authority
• Setback distances
• Design flows
• Sizing
  • Concrete/plastic components
  • Soil absorption system
• Qualified designers
  • Soil evaluators?
• Qualified installers
• Operation and maintenance/Owner awareness and responsibility
Universal Guidelines Regardless of Your State

• Regulations can often be verbose and may be hard to comprehend.
• Accompanying policies, guidance and approvals can further complicate things.
• The enormity of the topic, whatever state you are from may seem overwhelming, but don’t despair!
• You have resources!
When in Doubt, Take Advantage of:

• Knowledge and experience of co-workers or personnel from neighboring communities
  • Shadow them on site visits or in plan reviews
  • Some areas have quarterly meetings for the sharing of ideas/issues/problems

• Seminars and workshops to expand your knowledge base

• Websites and self-paced educational on-line tools

• Local/State resources
  • MA: Local Board of Health; and Regional MassDEP offices
  • CT: DPH and DEET
  • RI: DEM
Questions?
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Connecticut Septic System Contacts

- Advanced or alternative technology;
- Community system; and/or
- Any flows over 7,500 gpd

Michael Hart
CT DEEP
860-424-3819
michael.hart@ct.gov

- Conventional septic systems with flows up to 7,500 gpd

Robert W. Scully, P.E.
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Rhode Island Septic System Contacts

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- Advanced or alternative technology
Thank you!