Design and Management Issues
Distributed Wastewater Systems to Protect Public Health and Environmental Quality
EPA Webinar
23 August 2012

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USEPA Decentralized Program Strategy

Vision:

Decentralized wastewater systems are appropriately managed, perform effectively, and are widely acknowledged as components of our nations’ wastewater infrastructure.

Mission:

EPA will serve as a catalyst for improving system performance through partnering to upgrade professional standards of practice and institutionalize the concept of perpetual management.
Albany, March 31, 2000 – State Health Commissioner Antonia C. Novello, M.D., M.P.H. today released the final report detailing results of the New York State Department of Health's investigation into the 1999 *E. coli* 0157:H7 outbreak associated with attendance at the Washington County Fair. The findings indicate that the outbreak may have resulted from contamination of the Fair's Well 6 by a dormitory septic system on the fairgrounds, although manure runoff from the nearby Youth Cattle Barn cannot be ruled out as a possible contamination source.
STUDIES

GROUNDWATER STUDIES

• Boundary conditions?
• Cogger and Sobsey (1993)
  – Virus indicators, coastal sands
• Otis and Anderson (2000)
  – Various indicators, Florida sands
• Many Others – attenuation with distance from source
• DETECTION IS NOT HAZARD

EPIDEMIOLOGY STUDIES

• Door County; poor soil, inappropriate design, improper well development: result-Norovirus outbreak at restaurant. Patrons and employees sickened
• DETECTION WAS HAZARD
Issues

• USEPA and state programs
• Planning Issues from Distributed Wastewater Perspective
• Sound science and engineering
• Management Approaches to protect:
  – Public health
  – Environmental quality
  – Community aesthetic
Functions of Onsite Systems

- Hydraulic – accept and transmit liquid
- Process – accept and attenuate constituents
- Proper design and management essential
  - Soil treatment necessary
  - Where soil presents limitation
    - Alternative design
    - Pretreatment
    - MANAGEMENT necessary for risk reduction
System dysfunction attributed to

• Poor site selection and assessment
  – Inadequate separation to limiting condition

• Improper design
  – Inadequate capacity causing surfacing effluent or untreated discharge to groundwater

• Improper installation, operation and maintenance
  – Infiltration and hydraulic overload
  – Leakage of untreated effluent from components
US EPA resources at www.epa.gov/owm/septic

- Design guidance
- Management guidelines
- Case studies
- Technology fact sheets
- State and local examples
- Research, demonstration projects, and other tools
Program Elements

• Public Participation
• Planning
• Performance
• Site Evaluation
• Design and permitting
• Construction
• Sound O and M
• Residuals Management
• Certification and licensing
• Education and training
• Inspection and monitoring
• Corrective action
• Records and reports
• Financial assistance
Consider source water protection areas when establishing wastewater program requirements.

**Ground Water**

**Surface Water**
Science based technology incorporated into Rule

- USEPA Design Manual for Onsite Systems
- Soil integral part of treatment process
- State rules - i.e.
  - 15 A NCAC 02U, Reclaimed water standard – DWQ applied to onsite reuse
  - 18 A NCAC Ch 18, Sub-Ch 18, 0.1900 – DEH
    - Sizing, siting, design, operation, management criteria
    - Risk management strategy incorporated into rule
      - Separation distance
      - Loading rates
Site and Soil Factors Determine Treatment Potential

- **Site:**
  - Slope
  - Landscape position
  - Drainage features
  - Boundaries
    - Hydraulic
    - Property

- **Soil:**
  - Depth
  - Color
  - Texture
  - Structure
  - Consistence
Slope Positions

- Summit
- Shoulder
- Foot slope
- Side or back slope
- Toe slope
Soils on slope

Up Slope

Down Slope
Site and soil assessment

• Limiting constituent
  – Hydraulic
  – Nutrient
  – Depth
  – Boundaries
    • Property
    • Hydrologic

• Appropriate design
  – Conservation/treatment
  – Treatment
  – Treatment
  – Treatment
Wastewater treatment and dispersal

• Simple septic tank
• Aerobic or aeration for advanced treatment
  – Fixed media
  – Suspended medic
• Disinfection
• Standards
  – NC DHHS TS 1 or 2
  – NSF/ANSI 40 or 350

• Soil based
  – Surface
    • Spray/drip/recharge
  – Sub-surface
    • Deep
    • Shallow
    • Drip
Advanced Wastewater Treatment

**Processes**
- Process capabilities (BOD, TSS, Nutrients, biologicals)
  - NSF
  - State Rules

<table>
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<tr>
<th>Parameter</th>
<th>BOD</th>
<th>TSS</th>
<th>Coliform</th>
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<td>TS1</td>
<td>15 mg/l</td>
<td>15 mg/l</td>
<td>10000</td>
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<tr>
<td>TS2</td>
<td>10 mg/l</td>
<td>10 mg/l</td>
<td>1000</td>
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<tr>
<td>Reuse</td>
<td>5 mg/l</td>
<td>5 mg/l</td>
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**Pretreatment**
- Fixed Media
- Suspended media
Dispersal Alternatives

Conventional
- Typically gravity induced
  - 3-4 feet soil required
  - Prescriptive soil properties

Alternative
- Typically pump dosed
  - Shallow placement possible
  - Performance standards may be imposed
  - Monitoring
Gravity 4” Pipe System

- Vent Pipe (Opt)
- Vegetated Finished Grade
- Synthetic Fabric
- Aggregate
- Creeping failure
- 18 to 36 inch Minimum Separation
- Observation Tail-piece (opt)
- Shallow Groundwater or Bedrock
Pressure Dosed

- **LPD**
  - Follow contours
  - 18 x 18 (typ) trench
  - 65 foot (Max) run with 1.25” PVC
  - Orifice protection recommended
  - Drill perforations
    - Spacing variable

- **Drip**
  - Follow contours
  - Direct burial
  - 300 – 400 ft max run
  - No orifice protection required
  - Engineered orifice
    - Pressure compensating or non-pressure compensating
    - Set spacing
Pressure Pipe or Drip System

Vegetated Finished Grade

Synthetic Fabric

Aggregate or direct soil bury for drip

6 to 12 In Minimum Required Separation

Observation Pipe

Pressure Distribution Pipe

Shallow Groundwater or Bedrock
Next Step – Onsite Reuse

• Highest level of protection mandated
• NSF 350 Standard
• State Standards
  – California Title 22
  – Virginia (9 VAC 25-740)
  – North Carolina (15 A NCAC 0.2U or .1900)
  – Many others
Solaire, Battery Park, Manhattan, NYC

- Decentralized reuse in highly urbanized area
- LEED Platinum
- Green roof filters and captures stormwater
- Wastewater and stormwater treated for reuse
  - Toilet flushing
  - Cooling tower supply
  - Irrigation of park
- 48% reduction in potable water consumption
- 56% reduction in wastewater discharge

Reference – Battery Park City Authority Manhattan Borough, NYC, The Solaire – Alliance Environmental, LLC
LEED Gold in NC

High School
25000 GPD
Indoor use (toilet flush)
Outdoor use (irrigation)
Constructed wetland and UV

City Park
1500 GPD
Indoor use (toilet flush)
Onsite MBR, UV and Cl
System Management

- Treatment Component
- Dispersal Component
- Management entity
  - Operators
  - Owners
  - Onsite infrastructure
- Regulatory Component
Resources

• USEPA, 2004 Reuse Guidelines, 625R-04-108
• WEF MOP 16 Natural Systems
• WERF Decentralized Systems
• NSF standards
• State rules and regulations
Conclusions - Design and Operate to Reduce Risk

- Wastewater characteristics and treatment
- Site and soil conditions and limitations
- Performance based designs to address site and soil limitations
- Management vital
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