



Environmental Onsite Wastewater SolutionsSM

**Onsite Wastewater Treatment System Malfunction:
Causes, Investigation, and Prevention**

Infiltrator Water Technologies

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Overview



- **Malfunction investigation basics**
 - **Septic tank investigation**
 - **Function**
 - **Malfunction issues and examples**
 - **O&M**
 - **Drainfield investigation**
 - **Function**
 - **Malfunction issues and examples**
 - **Malfunction modes**
 - **O&M**
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Questions, Questions...



1. Do you have a policy for responding to a problem system?
 2. If a homeowner threatens legal action what is your response?
 3. Is it your responsibility to fix the system free of charge?
 4. What is your legal responsibility?
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Malfunction Investigation



Basics



Malfunction investigation - elements



- Owner usage habits
- System siting
- Tank inspection
 - Scum and sludge levels
 - House plumbing leaks
- D-box inspection
 - Presence of solids
- Drainfield inspection
 - Excavate drainfield
 - Presence of solids
 - Signs of infiltration through trench bottom

Malfunction investigation – typical team



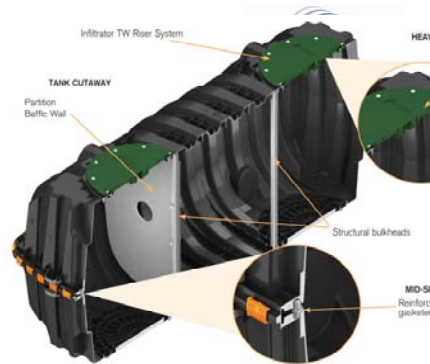
- Regulator
 - Observe mode of system malfunction
 - Owner
 - Provide information on system usage
 - Pumper
 - Measure scum and sludge levels
 - Pump tank and D-box
 - Pump drainfield
 - Soil scientist
 - Evaluate system siting and drainfield soil
 - Engineer
 - Compile and evaluate investigation data
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Questions, Questions...



1. Who will get blamed?
 2. Is everyone being honest?
 3. What are the two biggest factors that determine the life of a system?
 4. Who is responsible for those factors?
 5. Do we have any data on those factors?
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Septic Tank Investigation



Tank functions



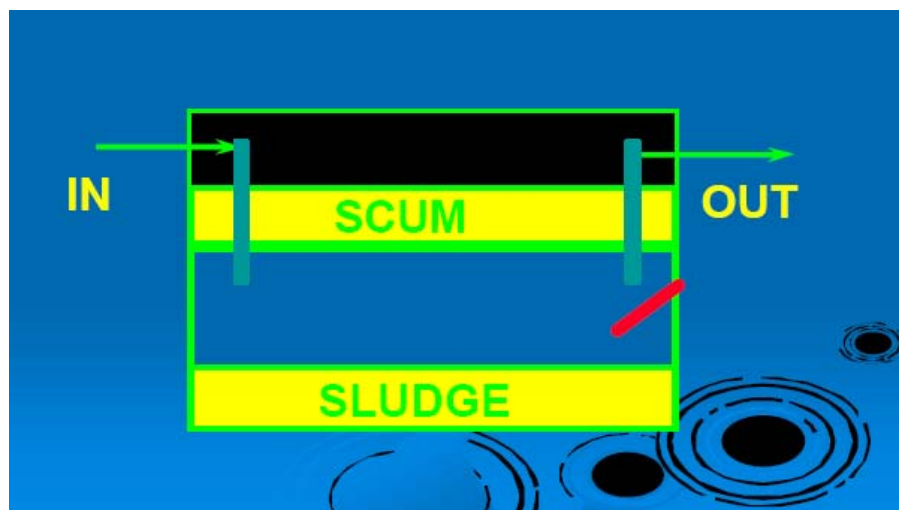
- **Low-velocity flow environment**
- **Solids removal by settling and floatation**
 - 60-80% solids removal
- **Anaerobic digestion**
 - 30-50% BOD reduction
- **Storage of solids**
 - Non-biodegradable or resistant to biodegradation

Treatment classes



- **Primary – Settling and flotation (the septic tank)**
- **Secondary– Usually aerobic biological treatment**
- **Tertiary – Enhanced nutrient removal and disinfection**

Basic tank function – 3 layers

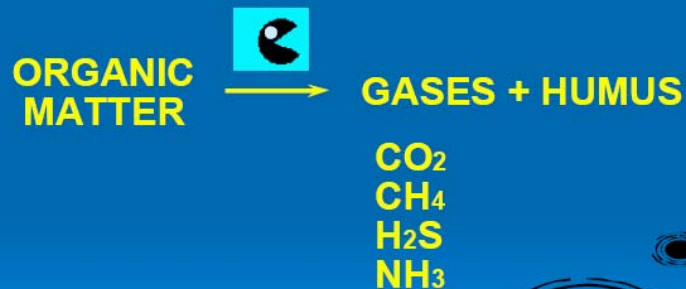


Source of scum

- Due to slow or no degradation, scum includes:
 - Toilet paper
 - Hair
 - Laundry lint
 - Oil and grease

Biological treatment in tank

Anaerobic Digestion

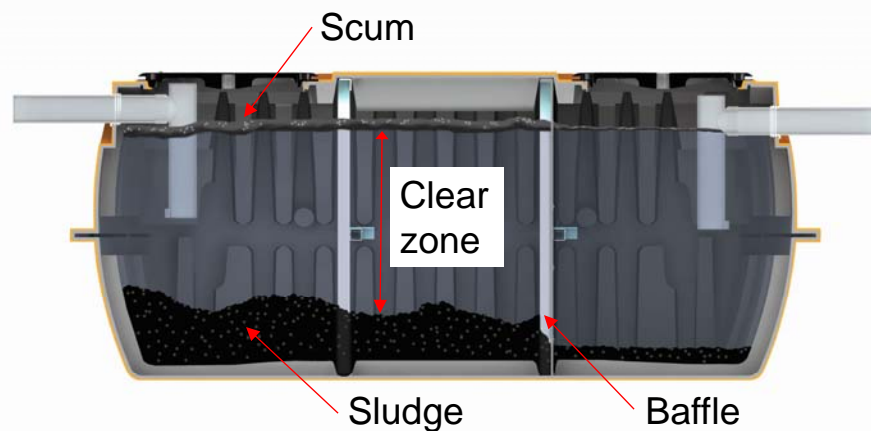


Factors affecting anaerobic digestion



- Wastewater strength
- pH
- Chemicals
- Fats, oil, and grease (FOG)
- Flow pattern and flow rates – tank residence time
- Pharmaceuticals
- Water softener backwash

Typical tank design - compartments



Importance of 2 compartments



- Lower water velocity
- Reduced turbulence from inlet
- More complete solids removal
- Improved effluent quality
- Protect against solids discharge
 - Due to turbulence
 - Due to lack of maintenance

Typical tank design - baffles



➤ Inlet baffle

- Directs the flow
- Minimizes turbulence and short circuiting

➤ Outlet baffle

- Assures outflow comes from clear zone
- Holds floating scum in the tank



Factors affecting tank performance



- Frequency of pumping
 - Pumping reduces solids level
 - Hydraulic overloading
 - House plumbing leaks = hydraulic overload
 - Frequency and volume of loading
 - 5 loads of laundry/day = reduced residence time
 - Number of compartments
 - 2 compartments improve treatment
 - System leakage
 - Infiltration
 - Exfiltration
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Factors affecting tank performance

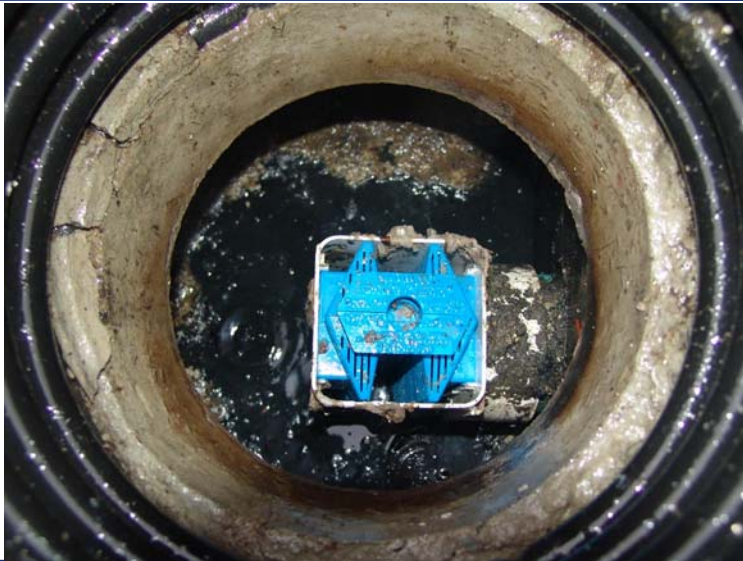


- **Garbage grinders**
 - **Add to solids accumulation rate**
 - **Add to organic load**
 - **May add grease and oil**
 - **Increase hydraulic load**
 - **Sewage (basement) lift pumps**
 - **Increase turbulence in the septic tank**
 - **Increase hydraulic load to tank**
 - **Should discharge into sewer line – not directly to tank**
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Issue: Hydraulic overload







Tank monitoring & inspection



Monitoring and inspection should cover:

- Excessive scum height compared to baffle
- Evidence of solids in outlet baffle
- Sludge level too close to baffle
- Screen clogging
- Damaged tank components
- Leakage or damage to risers and lids

Tank monitoring & inspection



Monitoring and inspection should cover:

- Damaged or missing baffles
- General tank deterioration esp. in the head space above the water
- Honeycomb in concrete surface
- Root intrusion
- Other indications of leaks
- Fluctuating tank levels

Tank pumping

- **Calendar recommendation**
 - Every 2 to 5 years
 - Based on occupancy and usage
 - **As needed**
 - Measurement of sludge and scum
-

Educate homeowners

- **Homeowners need basic information on operation:**
 - How the system works
 - How to use the system
 - **What should not be put into septic systems**
 - **Homeowner must be encouraged to:**
 - Have the system inspected periodically
 - Pump the tank on a schedule or based on measurements
-

Tank disposal taboos

This list should be discussed with or given to every owner every time the tank is pumped:

- **Cigarette butts**
 - **Coffee grounds**
 - **Cooking fats**
 - **Paints & chemicals**
 - **Paper towels**
 - **Feminine sanitary products**
 - **Disposable diapers**
 - **Condoms**
 - **Kitty litter**
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Tank best practices

- **Avoid simultaneous discharges**
 - **Shower, laundry, and dishwasher**
 - **Spread laundry out – avoid consecutive loads**

 - **Install laundry lint filter on washing machine discharge**

 - **Keep non-sewage water out of the system**
 - **Water softener backwash**
 - **Footing drain sump pump discharge**
 - **Floor drain discharge**
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Myths and additives

- Tanks used normally do not require additives
 - Myths
 - No need to “start” a tank with a dead chicken/possum
 - Adding yeast, while harmless, is not needed
 - Commercial additives are normally not needed
 - Beware of additive that suggests no tank pumping required
 - Normal function means solids accumulation
 - Additive can be washed out to drainfield or next downstream treatment component
 - Independent research shows no benefit
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Drainfield Investigation



SYSTEM STATISTICS and CALCULATIONS		ROBINSON, LARRY	
SITE CHARACTERISTICS:			
Limiting zone:	20 inches	Sand required:	28 In.
Perc. rate:	142.85 /Min/inch		
Number of bedrooms:	4	Slope:	12.0%
SEPTIC TANK:			
Minimum size required:	1250 gal.	2 - compartment	
To be installed:	1000 gallon, 1 - compartment septic tank connected to an existing 1000 gallon septic tank.		
ABSORPTION AREA DESIGN:			
500 gal./day flow x 3.856 = 1928 sq. ft. (800sq.ft.Min.Req. by Township)			
To be installed: Infiltrator chambers, which yield up to a 40% reduction in disposal area will be used. Each infiltrator chamber is rated at 29.50 sq. ft. of absorption are equivalent. Infiltrator chambers to be arranged in a rectangular pattern consisting of an array of (7) rows of chambers X (10) col. total of (70) infiltrator chambers. Total disposal rating of the infiltrator chambers is (2065) sq. ft.			
Side A		Side B	
Lateral length:	32.65 Ft.	Lateral length	32.65 Ft.
Number required	7 Laterals	Number required	7 Laterals
Hole size:	1/4 In.	Hole size:	1/4 In.
Hole spacing:	6 Ft. on ctr	Hole spacing:	6 Ft. on center
Lateral diameter:	1 1/2 In.	Lateral diameter	1 1/2 In.
	Manifold		Manifold
	Diameter:		Diameter:
	2 In.		2 In.
	Manifold length:		Manifold length:
	21.60 Ft.		21.60 Ft.
PUMP SIZING:			
7 Laterals(Side A) x 5 holes + 7 laterals (Side B) x 5 holes = 70 Holes x 1.28 gal/min/hole = 89.60 Gal./min.			
HEAD LOSS:			
	Terminal head:	3.00	ft.
	Elevation change:	8.64	ft.
	Friction loss:	13.05	ft.
	Total ft. head:	24.69	ft.
EQUIV. PIPE LENGTH:			
	Delivery pipe:	69.70	ft.
	Manifold pipe:	21.60	ft.
	1 Tee Fitting:	11.10	ft.
	1 Quick disconnect:	1.35	ft.
	2 Elbows: (45°)	7.74	ft.
	1 Coupler:	2.70	ft.
	Total:	114.19	ft.



Review design/construction:

- Verify through as-built drawings that system was installed per design
- Verify that site soil characterization and groundwater depth are accurate
- Check design calculations for drainfield sizing vs. regulations



Water Use



**Not a
Trash Can!**

Water Use



**No Paint,
Oils or
Chemicals!**



Chamber field checks



Excavate drainfield and verify:

- Chambers are open
- Chambers not broken
- Soil appears to match design soil type
- No objects/materials obstructing flow



Unique root system obstructed the louvers and trench bottom



Inspect drainfield area for water-loving vegetation



Clogged Drain Lines



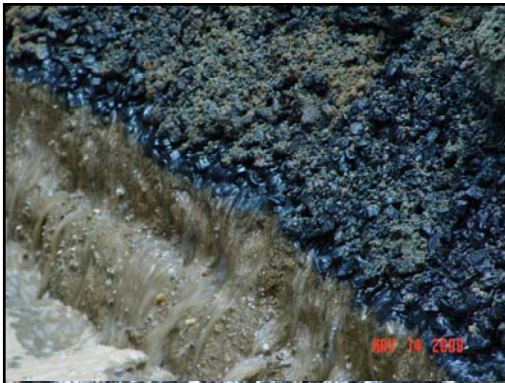
Root Intrusion



Issue: Solids in drainfield



- Solids clogged trench bottom
- No vertical water infiltration
- Sand at trench bottom shows no evidence of treatment taking place (absence of discoloration)



Issue: Solids in drainfield



Sand below biomat/solids layer is clean – no evidence of vertical infiltration



Issue: Solids in drainfield



Staining



Sand below biomat shows slight staining – evidence of some vertical wastewater infiltration

Issue: Solids in drainfield



Biomat/solids layer is extraordinarily thick, consists of settled solids that clogged the trench bottom, preventing vertical infiltration

Issue: Solids in drainfield



Clod of powdered laundry detergent found in chamber; demonstrates that effluent flowed over top of both baffle and outlet tee in septic tank to carry material to drainfield



Issue: Unhealthy biomat accumulation



Notice the clean soil beneath the biomat. Effluent cannot infiltrate this layer.

Issue: Unknown substance clogging infiltrative surfaces



What does an unhealthy trench bottom look like?

Drainfield



Is This Sewage?

Drainfield



Or This?



Issue: Fats, oil, and grease discharge



Oily slime was discharged to this drainfield, clogging the infiltrative surface and causing malfunction

Issue: Fats, oil, and grease discharge



Adirondack Environmental Services, Inc

Date: 24-Nov-08

CLIENT: Infiltrator
 Work Order: 081112006
 Reference: /
 PO#:

Client Sample ID: B10 Mat Sludge
 Collection Date: 11/11/2008
 Lab Sample ID: 081112006-001
 Matrix: SLUDGE

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE AND DIESEL RANGE ORGANICS SW8015M						Analyst: MG
(Prev: SW8015B - 11/12/2008)						
TPH (Diesel)	735	100		µg/g	1	11/12/2008 8:31:18 PM
TPH (Gasoline)	< 100	100		µg/g	1	11/12/2008 8:31:18 PM
OIL AND GREASE E1664						Analyst: VZ
Oil & Grease	1070	10		µg/g	1	11/24/2008

Issue: Effluent close to surface



Dark green grass indicates presence of nitrogen-rich effluent in root zone; note striping along trenches

Issue: Effluent discharge to surface



- Look for signs of effluent discharge to ground surface at inspection port
- Evaluate the effluent in system through inspection port
- Sample and measure biomat in the bottom of the system through the inspection port



Issue: Landscape and vegetation



Other visual keys
determination to saturated
conditions



Vegetation is a good indicator
Vegetation is a good indicator

Issue: Siting in wetland soils



Drainfield was constructed near wetlands

Issue: Siting in wetland soils



Drainfield was constructed proximal to area of surficial ponding

Issue: Siting in wetland soils



Drainfield was constructed below groundwater table

**Viewing pre-
construction photos
can help diagnose the
problem**



**The septic system
was installed here**

Drainfield disposal taboos

**This list should be discussed with or given to every
owner every time the tank is pumped:**

- **Simultaneous discharges**
- **Excessive flows**
- **Cooking fats**
- **Paints & chemicals**
- **Products with fines (kitty litter)**

Drainfield best practices



- **Keep tank pumped**
 - **Keep tank healthy**
 - **Don't dispose of taboo items**
 - **Avoid simultaneous discharges**
 - **Spread laundry, shower, dishwasher use out**
 - **Keep non-sewage water out of the system**
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System repair options



- Clogged infiltrative surface – remove and replace
 - Poor siting – relocate or elevate system
 - Incorrect soil characterization – expand system
 - Malfunctioning tank – pump regularly
 - Hydraulic overload – repair plumbing fixtures
 - Old system/excessive biomat – remediate with aerobic bacterial generator
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Questions ?



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