PASEO-PSMA SUPER CONFERENCE 2026

WHY SYSTEMS FAIL

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Why Systems Fail

The issues discussed here today are based on the experience and opinion of the presenter.

Any recommendation by the presenter may not be acceptable to the local agency SEO.

The decision to approve a sewage permit or system installation is the sole responsibility of the local agency SEO.

Why Systems Fail

The presenter is not endorsing any specific technology mentioned in this presentation.

There may be other technologies that are appropriate that were not discuss in this presentation.

Why Systems Fail

I will try to point out what might change with the proposed regulations

Please give me your response, experience, and input as we discuss these issues.

PADEP DISCLAIMER

DEP has approved this conference for SEO continuing education conference credits. The approval is based on the organization's narrative for the overall conference and each breakout session. DEP has not reviewed the content of the conference and does not guarantee that the sessions provide complete and accurate information about Pennsylvania's Sewage Facilities Act, the regulations promulgated thereunder, and DEP policy.

WHY SYSTEMS FAIL
The Three Pillars or P's

1. Proper Permitting
2. Proper Installation
3. Proper Operation and Maintenance

WHY SYSTEMS FAIL
The Three Pillars

Systems fail because one or more of the pillars collapse

Which pillar has the greatest effect on the success of the system?

1. Permitting Issues Soil/Site Conditions Design

Limiting Zones

(i) Seasonal high-water table

(ii) Insufficient fines between the rock fragments

(iii) Impermeable rock or soil condition

i. Seasonal high water table

ii. insufficient fines
iii. Bedrock

1. Permitting Issues
Soil and Site Conditions

Percolation Test Results

Slope

Landscape Loading

1. Permitting Issues System Design

Prescriptive vs Performance based designs

Meeting the regulations vs what is appropriate for the site and use.

When is pretreatment needed?

1. Permitting Issues System Design

Residential vs Non-residential design considerations

May need a wastewater quality sample

1. Permitting Issues Other Design Issues

- Gas exchange
- Narrow longer absorption areas
- Trenches vs. beds
- Placement of the wastewater in the bioactive zone of the soil
- Surface vs. subsurface installation
- Preferential macopore flow patterns

1. Permitting Issues System Design

Length to width ratios

On contour design

How water moves thru soil

Saturated vs Unsaturated

Which of these could cause a sewage breakout?

1. Permitting Issues System Design

Gravity vs Pressure Distribution

Demand vs Time Dosing

Electrical connections

Panels with event counters

1. Permitting Issues System Design

Preventing inflow/infiltration I&I

Diversion of surface water

Coarse and fine aggregate quality

Fabric vs other aggregate cover

Orifice shields

1. Permitting Issues
System Design
System Specific Considerations

Standard Systems

Spray Irrigation
Sand Mounds
Seepage Beds or Trenches

1. Permitting Issues
System Design
System Specific Considerations

Alternate Systems

Shallow Limiting Zone Alt Systems
PA at-grade systems
Drip Irrigation
Eljen GSF

2. Installation Issues

Two Day Training Course

Installation of Onsite Wastewater Treatment Systems

SEO inspections alone cannot assure construction quality

Need for installer training and Certification

Act 537 Requires Contractor Training

New regs require video taping

2. Installation Issues

Soil moisture and compaction
Vegetation removal
Scarification techniques
Equipment type and weight
BCDH Scarification Study 1977

2. Installation Issues
BCDH-DVC Study 1978

Evaluated various methods of site preparation/scarification.

Roto tilling, teeth of the backhoe, moldboard plow, chisel plow.

Evaluated various equipment used such as rubber tire backhoe, track machine and their size/weight.

Conducted infiltration tests.

2. Installation Issues
BCDH-DVC Study 1978
Results

Results

Track machine not to exceed 6.2 psi

Remove all vegetation

Chisel plow to a 9-inch depth

How is this different from the Regs?

Current Practice?

Most Common Method
The teeth of a backhoe

Chisel Plowing

2. Installation Issues

- Coarse and fine aggregate quality

What is needed for SEO documentation?

- Pipe and fitting types (pressure rated)
- Watertightness of tanks, pipe penetrations, extensions and lids
- Proper excavation and bedding of tanks and pipes

New sand definition in the proposed regulations

Sand—Natural silica or manufactured silica-based material consisting of hard, durable, and uncoated inert particles reasonably free from clay, silt, vegetation and other deleterious substances such as reactive chert, gypsum, iron sulfide, amorphous silica and hydrated iron oxide. Substances present in amount large enough to cause inconsistent performance for use as media in absorption areas and filters are considered deleterious.

2. Installation Issues
Tank Buoyancy and Vac Testing

Plastic vs concrete tanks
Buoyancy issues

Prevention of Inflow and Infiltration
Vac testing of tanks will be required

Site grading and stormwater diversion

Field Vacuum Testing of Tanks

Vac Test

2. Installation Issues

A good quality installation will improve a poor permit decision.

A poor quality installation will ruin a good permit decision.

3. Operational Issues

Residential

Inflow/Infiltration

Exceed design parameters

# of bedrooms

Short Term Rentals

COVID Effect-Work from home

3. Operating Issues

Residential

Daily flow patterns-demand vs time dose

Cleaning products

Body and hair conditioners

Water treatment systems

3. Operating Issues

Non-Residential

Inflow/Infiltration

Wastewater Quality

FOG/BOD/TSS

Food Prep/offices/Warehouses

Rest stops/public restrooms

3. Operating Issues

Community Systems

Inflow/Infiltration

Wastewater Quality

Collection system

Time Dosing

Flow recorders/event counters

What is High Strength Waste? Defined by the proposed Regs

BOD of 350 ppm or greater

TSS of 400 ppm or greater

Total N of 70 ppm or greater

FOG of 100 ppm or greater

If you have high strength waste a PE will be required to design the pre-treatment system by the proposed new regs

3. Operating Issues

Kennels

Industrial Waste (IW)

Both are not allowed to be discharged to an SEO permitted system

3. Operating Issues

Certain pretreatment units cannot be permitted by an SEO.

A DEP Part II permit maybe needed.

3. Maintenance Issues

A MUST FOR ALL SYSYEMS

Need ability to verify daily sewage flow

Flow meter/Event counter

Water supply meter

3. Maintenance Issues

Septic Tank Pumping
Grease Traps
Pretreatment Units
Dosing Tanks
Lateral Flushing

3. Maintenance Issues

Flushable wipes
Garbage Disposals
Water Treatment Systems
System Resting
PSU and Wis Studies

Penn State Study
Petersen and Fritton

Seasonal or yearly alteration of absorption areas

By pump or diversion valve

In addressing a malfunction retained the original absorption area and used a diversion valve

Wisconsin Studies
Bouma and Vepraskas-JEQ

Column studies with bioactive soil

Three classes of wastewater:

Septic-ATU-Tap water

Results:

They all formed a clogging biomat

ATU mat took longer but was thicker

Formed even with tap water

Why?

Clogging Biomat Formation

Certainly, wastewater quality will affect it

Lack of gas exchange (Tyler was looking at this aspect to modify his loading chart)

The most important aspect:

Absorption areas must dry out between doses

Think about that…why do gravity systems develop a biomat at the first row on holes in the lateral and we get a creping failure.

O&M Required by the Proposed Regulations

Sewage Management Program

SMP

Municipality to have an SEO inspect all systems within that municipality every 3 years

WHY SYSTEMS FAIL
The Three Pillars

Now that we have reviewed the 3 pillars

Proper Permitting

Proper Installation

Proper O and M

What is a system failure?

The Delaware Model

A license is required for all aspects of a sewage system:

Site Investigation

Design

Installation

Management

The responsibility for the failure can be traced to the source

What is a System Failure?

Malfunction not defined in the regulations

Webster definition of malfunction:

Fail to function as it should

Is there a difference between:

- a system failure
- a system malfunction
- an Act 537 violation

Current DEP SEO Training

DEP SEO training defines a malfunction as:

- Surface discharge of untreated wastewater
- Back-up of wastewater into the building
- Discharge of untreated wastewater to the Waters of the Commonwealth

Current DEP SEO Training

If you need to use BTG

Can only be used for non-critical isolation distances

Must have a malfunction

Proposed Regulations

New definition of a malfunction

We went for 3 to 7

The first three are the ones DEP trained SEO's but were never in the regulations

An additional 4 have been added.

Proposed Regulations

§ 72.35 Correction of malfunctioning onlot sewage systems.

(a) The local agency shall ensure the correction of a malfunctioning onlot sewage system when the malfunction is identified. The following conditions are considered a malfunction:

Proposed Regulations

(1) Partially treated or untreated sewage on the ground surface.

(2) Backup of partially treated or untreated sewage into a structure the onlot sewage system is serving.

(3) Partially treated or untreated sewage entering, either directly or indirectly, into the surface water of this Commonwealth.

(4) Partially treated or untreated sewage entering the ground water.

Proposed Regulations

(5) Cesspools, seepage pits or other pre-regulatory system in contact with the seasonal high-water table, whether perched or regional.

(6)Backup of partially or untreated sewage into a tank or other component of the system.

(7)Saturated conditions or ponding in the absorption area that persist over a period of 7 or more consecutive days.

PSMA Standards

The term system failure is not used

A PSMA system inspection will come to one of four conclusions:

- Satisfactory
- Unsatisfactory
- Satisfactory with concerns
- Further investigation is needed

How to correct the malfunction?

What is the malfunction?

Needs an investigation to determine the cause(s)

Must determine the cause(s) in order to fix it and not transfer the issue to a new system

How to correct the malfunction?

Is it a DEP defined malfunction?

Is it a PSMA unsatisfactory conclusion?

Is it simply a system not functioning as intended?

How to correct the malfunction?

Investigate the three pillars?

Permitting

Installation

Operation and Maintenance

Should always determine:

#1= average vs peak flows

#2=wastewater quality

#3= Inflow and Infiltration

Causes for an Unsatisfactory PSMA Conclusion based on the DRY Aggregate Rule

Soil Conditions LZ's
Soil Compaction
Inflow/Infiltration
Wastewater Quality
Wastewater Amount
Biomat

What is Causing the Ponding?

What are the soil conditions?

Installation Issues

Component Failure
Soil Compaction
Grading Issues
Inflow or infiltration

Operational Issues

Wastewater Quality

Wastewater Amount
peak flow vs. average flow

Surge Flow Periods

Maintenance Issues

History of Tank pumping

Biomat Formation

Biomat

CAR ANALOGY

What is the cause of the car problem?

Will new tires and brakes fix the problem?

Does it need a new motor?

Do we buy a new car if the brakes are bad?

Site Evaluation Protocol to determine the cause for the water ponding in the aggregate

Confirm the wastewater quality and amount

Any inflow/infiltration issues

Core the absorption area to determine where and why the ponding is occurring

Site Evaluation Protocol to determine the cause for the water ponding in the aggregate

Test pit to determine the soil conditions at the installed absorption area

Test pit to determine what new system options may be available

Determine the soil limitations

Proposed New Regulations Waivers have replaced BTG

Listed are two:

Length to width ratio (4%)

Non-critical isolation distances

DEP would like your input on what others you routinely encounter. Your Top Ten

Otherwise, if you do not meet the regulations, waivers or alternative system, a PE and Soil Scientist will be required

How to determine if the malfunction is due to a biomat or soil conditions

Intact Core Method

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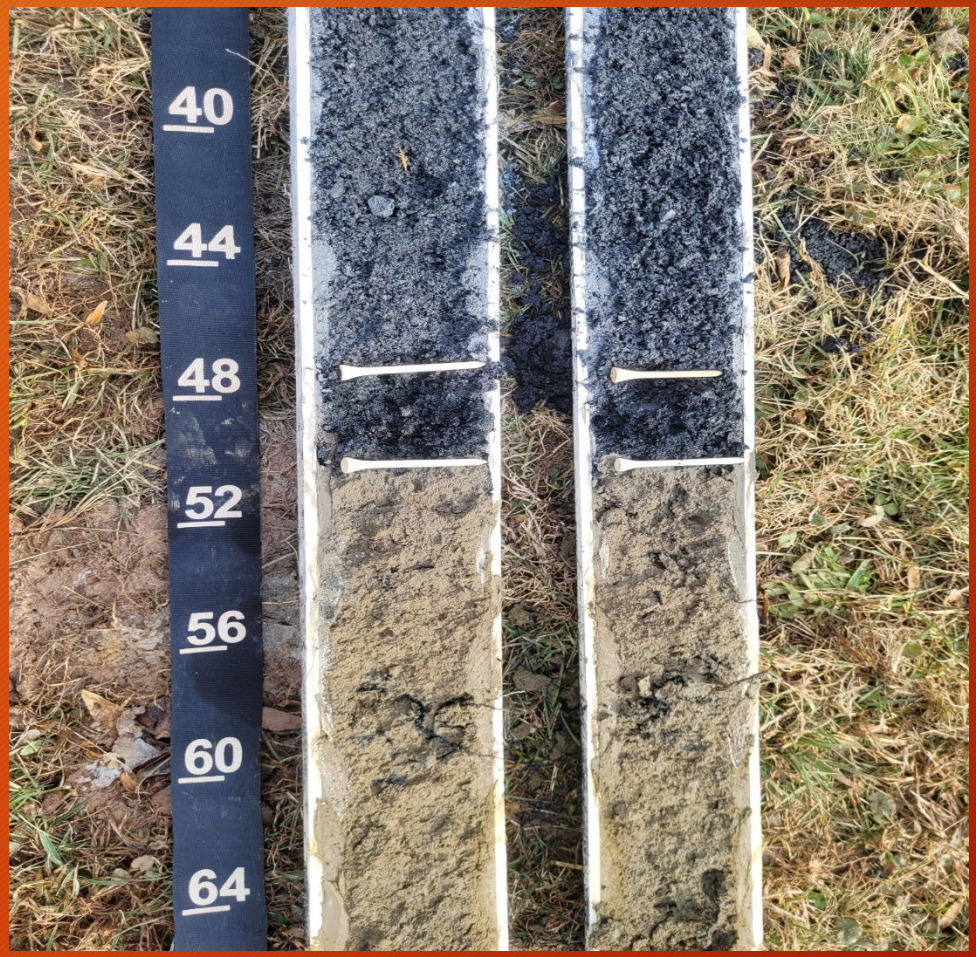

WHY SYSTEMS FAIL
Conclusion

The Three Pillars

Which was has the most Impact?

1. Permitting
2. Installation
3. Operation and Maintenance

Happy 52st Birthday ! July 22, 1974

SEO certification required to issue permits in PA

The Elevated Sand Mound became an SEO permit

What have we learned ?

Where are we heading?

Why Systems Fail

Questions/Discussion

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