

PASEO-PSMA  
SUPER CONFERENCE  
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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.

Need your response/experience/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 Four Pillars

Permitting  
Installation  
Operation  
Maintenance

## WHY SYSTEMS FAIL The Four Pillars

Systems fail because one or more of the pillars collapse

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

## Permitting Issues

Soil and Site Conditions  
Steve Dadio's presentation yesterday

### Limiting Zones

- (i) Seasonal high-water table
- (ii) Insufficient fines between the rock fragments
- (iii) Impermeable rock or soil condition







Permitting Issues  
Soil and Site Conditions

Percolation Test Results

Slope

Landscape Loading

## Permitting Issues System Design

Randy and Charlie presentation yesterday

Prescriptive vs Performance based designs

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

When is pretreatment needed?

Residential vs Non-residential design considerations

May need a wastewater quality sample

## 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?

## Permitting Issues System Design

Gravity vs Pressure  
Distribution  
Demand vs Time Dosing  
Electrical connections  
Panels with event counters

## Permitting Issues System Design

Preventing inflow/infiltration  
Diversion of surface water  
Coarse and fine aggregate  
quality  
Fabric vs other aggregate cover  
Orifice shields

Permitting Issues  
System Design  
System Specific Considerations

Spray Irrigation  
Shallow Limiting Zone Alt Systems  
Sand Mounds  
At-grade systems-pretreatment  
Drip Irrigation  
Eljen GSF  
Seepage Beds or Trenches

Installation Issues  
Two Day Training Course  
*Installation of Onsite Wastewater Treatment Systems*

Regulations alone cannot assure  
construction quality

Need for installer training and  
Certification???

The Delaware Model



## Installation Issues

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

## 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.

## Installation Issues BCDH-DVC Study 1978 Results

Best Results:  
Track machine not to exceed 6.2 psi  
Remove all vegetation  
Chisel plow to a 9-inch depth

## Chisel Plowing















## 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

## Installation Issues

*Tank Buoyancy and Vac Testing  
yesterday talks*

Plastic vs concrete tanks  
Buoyancy issues

Prevention of Inflow and Infiltration  
Vac testing of tanks

Site grading and stormwater diversion

## Field Vacuum Testing of Tanks

*Tips for Vac Testing Tanks  
yesterday by Goguen NPCA*



## Vac Test



## Installation Issues

A good quality installation will fix a poor permit decision.

A poor quality installation will ruin a good permit decision

## Operational Issues

Residential  
Inflow/Infiltration  
Exceed design parameters  
# of bedrooms  
Short Term Rentals  
COVID Effect-Work from home

## Operating Issues

### Residential

Daily flow patterns-demand vs time  
dose

Cleaning products

Body and hair conditioners

Water treatment systems

## Operating Issues

### Non-Residential

Inflow/Infiltration

Wastewater Quality

FOG/BOD/TSS

Food Prep/offices/Warehouses

Rest stops/public restrooms

## Operating Issues

### Community Systems

- Inflow/Infiltration
- Wastewater Quality
- Collection system
- Time Dosing
- Flow recorders/event counters

## Operating Issues

- Kennels
- Industrial Waste (IW)

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



## Operating Issues

Certain pretreatment units cannot be permitted by an SEO.

A DEP Part II permit maybe needed.

## Maintenance Issues

**A MUST FOR ALL SYSYEMS**  
Need ability to verify daily sewage flow

Flow meter/Event counter

Water supply meter

## Maintenance Issues

Septic Tank Pumping  
Grease Traps  
Pretreatment Units  
Dosing Tanks  
Lateral Flushing

## Maintenance Issues

Flushable wipes  
Garbage Disposals  
Water Treatment Systems  
System Resting

## WHY SYSTEMS FAIL

### The Four Pillars

Now that we have reviewed the 4 pillars

Permitting

Installation

Operation

Maintenance

What is a system failure?

## 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

## 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

## 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

## 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 four pillars?

*Permitting-Installation*

*Operation- Maintenance*

Must always determine:

#1= actual daily sewage flow

#2=wastewater quality

#3= I&I

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  
Surge Flow Periods

# Maintenance Issues

History of Tank pumping

Biomat Formation  
(last years presentation)







## 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















## Case Studies

1. Convert the primary treatment from a septic tank to an aerobic tank
2. Physical removal of the biomat
3. Resting the absorption area
4. The alternate system called Soil Air
5. Time Dosing
6. Soil Fracturing, is it time to re-visit this tool ?



## Case Study # 1

Convert primary treatment from a  
septic tank to an aerobic tank

University of Wisconsin

PSU Study

De-watering is key

## Case Study # 2

Physical removal of the biomat or  
soil compaction

*A Top Job or Hair Cut*

### Case Study # 3 Resting the Absorption area

PSU Study  
Use of a diversion valve

Fairfax Co VA requirement  
(de-watering is key)

### Case Study # 4: Soil Air System research at DVC

If a biomat is the predominate  
cause for the water ponding and  
there is no soil based reason

Soil Air maybe an option





## What are the soil conditions?



## Case Study # 4

### The Alternate System-Soil Air

Only an option if a biomat is the predominate cause for the water ponding

Will not resolve inherent soil limitations



## What is Soil Air?

An approved Alternate system in PA

A blower that supplies air (oxygen) directly to the infiltrative surface to satisfy the BOD demand of the wastewater

De-watering of absorption area is required

## Soil Air Blower Cover



## Soil Air Residential Blower

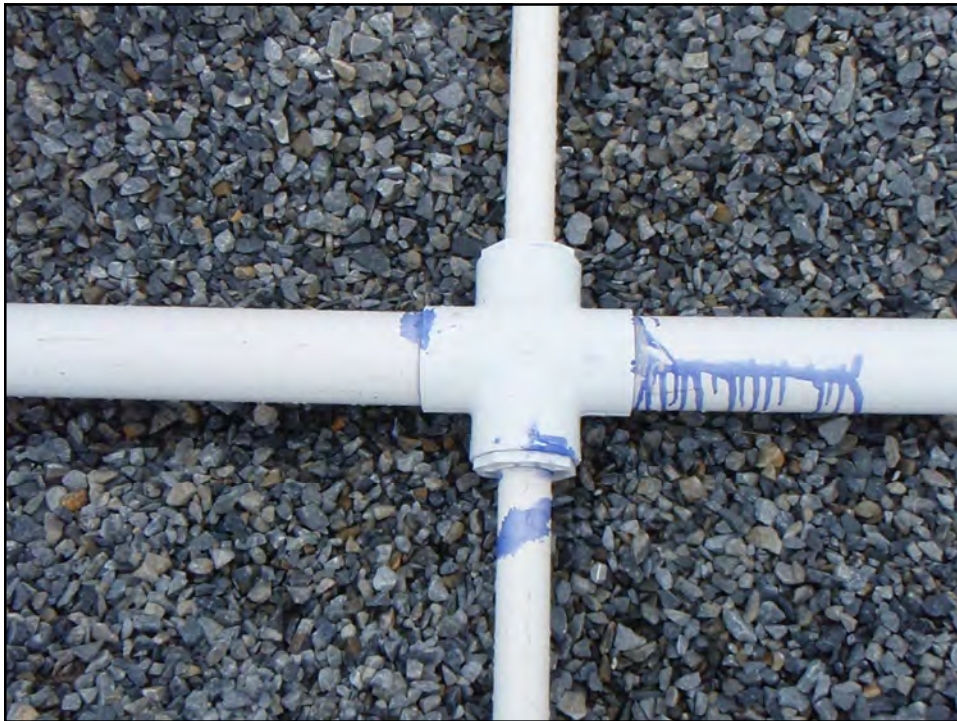


## Case Study # 5: Time Dosing and Pressure Dosing

Conversion of gravity flow to pressure distribution

Time Dosing

# Pressure Distribution



## Time Dosing



## Case Study # 6: Soil Fracturing

If soil compaction is the predominate cause for the wastewater ponding, why can we not alleviate this condition by soil fracturing ?

- Terralift
- Soil Reliever

Was previously approved in PA

Why was the approval rescinded by the DEP?



## Current Research

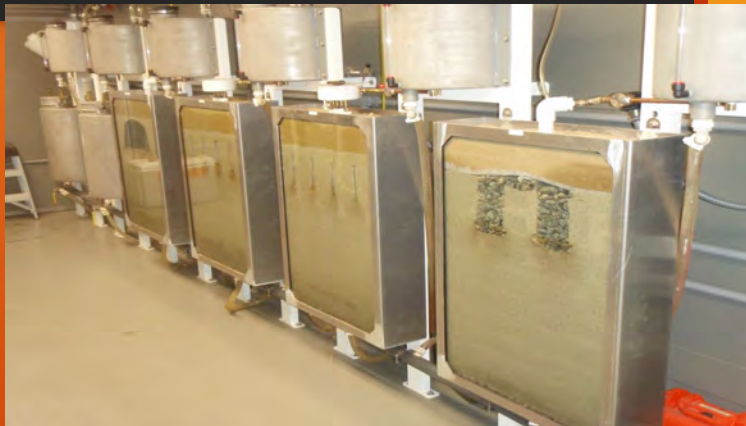
Increasing the surface area of the aggregate/soil contact

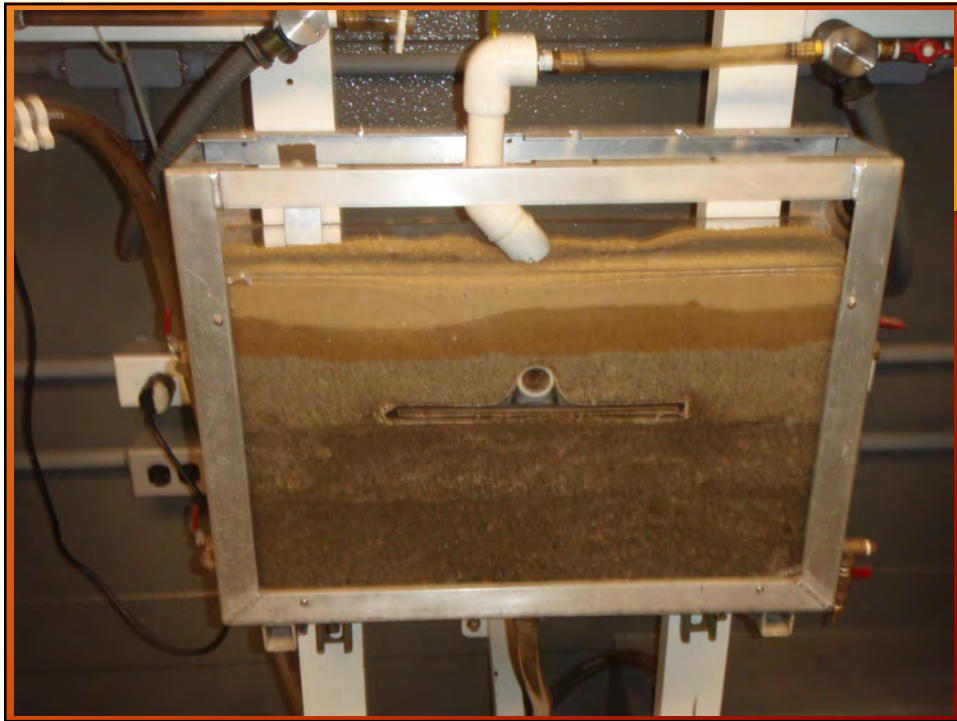
Trenches vs Bed design

Wisconsin Mound

## URI Research-Mesocosms

not open to free atmosphere





GEOMAT



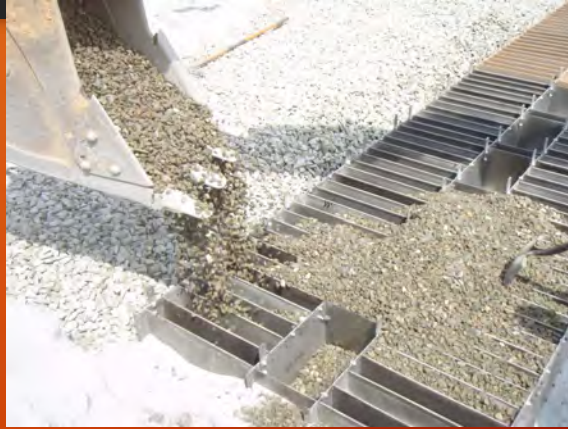
## GEOMAT



## Formed Stone and Sand



## Formed Stone and Sand



## Formed Stone and Sand





## WHY SYSTEMS FAIL

### Conclusion

The Four Pillars  
Which has the most Impact?  
Permitting  
Installation  
Operation  
Maintenance

## Happy 50<sup>th</sup> Birthday !

July 22, 1974  
SEO certification required to  
issue permits in PA  
The Elevated Sand Mound  
What have we learned ?  
Where are we heading?

# Why Systems Fail

## Questions/Discussion

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