

# How the Products We Use Can Impact Septic Systems and Local Ecology

**Onsite Wastewater Super Conference of Pennsylvania 2024**

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# Presentation Overview

- What makes wastewater challenging?
- Products impacts
  - Why we care?
- What are they?
  - Impacts
  - Alternatives

# What Makes Wastewater Challenging?

## High Strength

- Food service
- Food preparation
- Alcohol
- Dairy
- Sugar
- Toilet flushing only
- In-home business/hobbies

## Hard to Treat

- Cleaning chemicals
  - Sanitizers
    - Anti-bacterial
    - Quats
  - Emulsifiers
- Greases
- Dump stations
- Medicines

# Commercial Wastewater

- Strength
  - Usually greater than residential
  - Operation based
    - Food preparation
    - Restrooms
    - Laundry
- May be high strength
- May be hard to treat



# Products – Why Do We Care?

- Impact to the environment and public health
- Impacts to systems



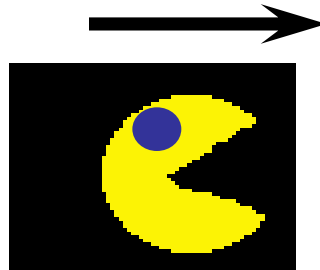
# Bacteria - You May Not Like Them

- But we need these guys
  - bacteria and fungi are the workhorses of wastewater treatment
  - they prefer their carbon source to be non-toxic



illustration: Don Smith

**ORGANIC  
MATTER**



**CO<sub>2</sub>  
CH<sub>4</sub>  
H<sub>2</sub>S  
NH<sub>3</sub>**

**BACTERIA GASES +  
HUMUS**

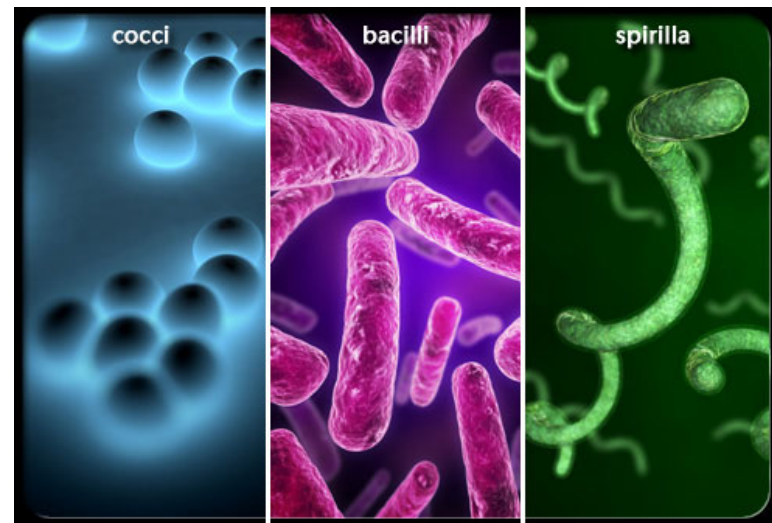
*Septic tank should smell  
“septic” when you open the*

*lid*  
**Anaerobic Digestion**



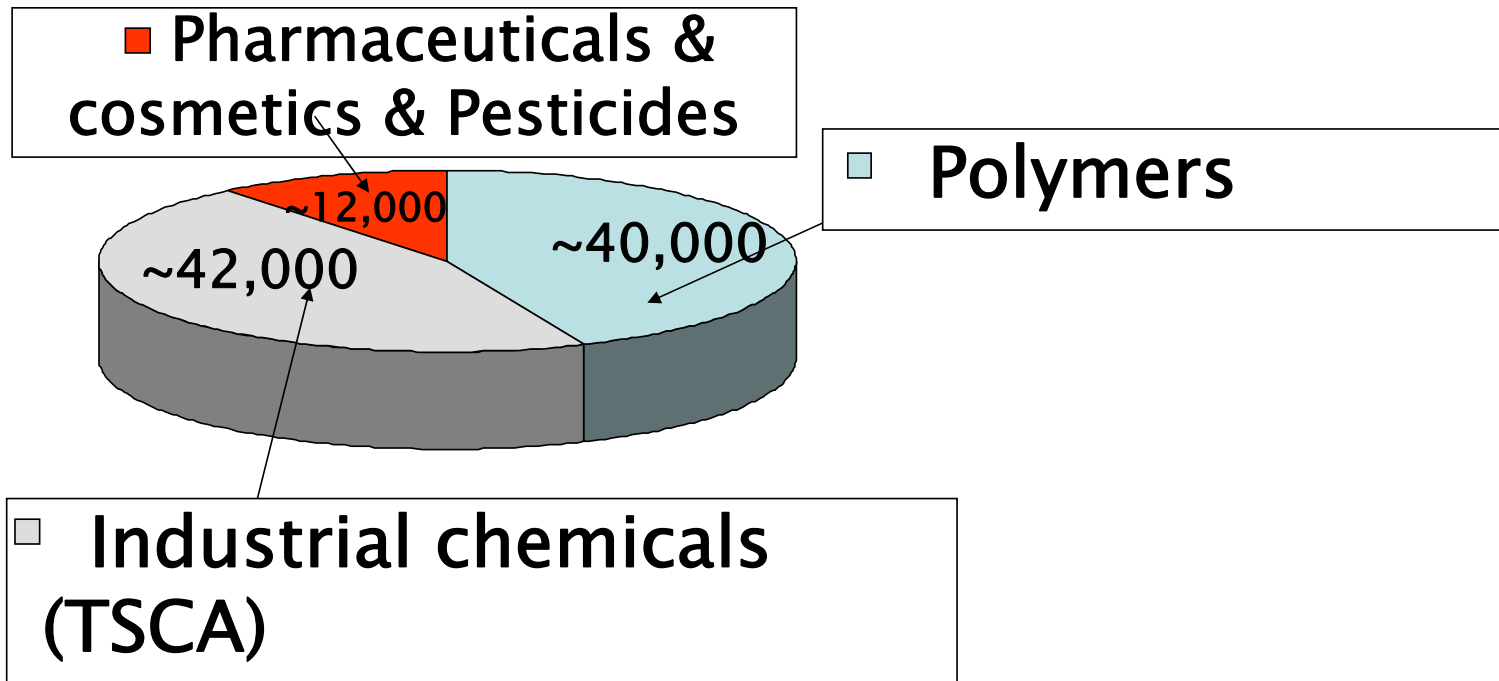
# They are Exposed to Everything we Put Down the Drain

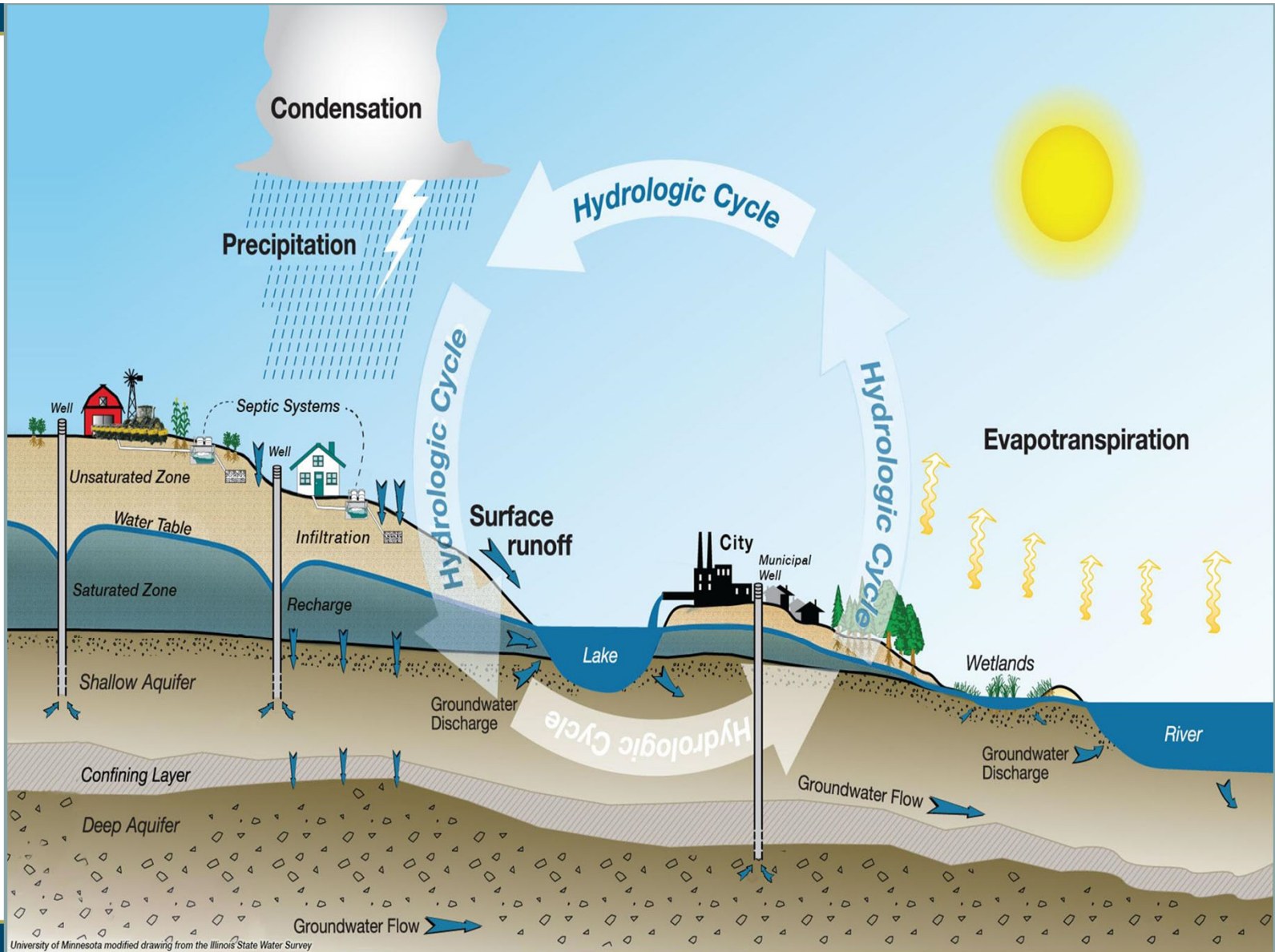
- The good news
  - Most waste organic compounds can be degraded by the microbes
    - in the septic tank
    - in the soil
- The bad news
  - there are plenty of organic compounds that will kill them





## Major Chemicals Registered for Commercial Use in US\*





## Chemicals of Emerging Concern (CECs)

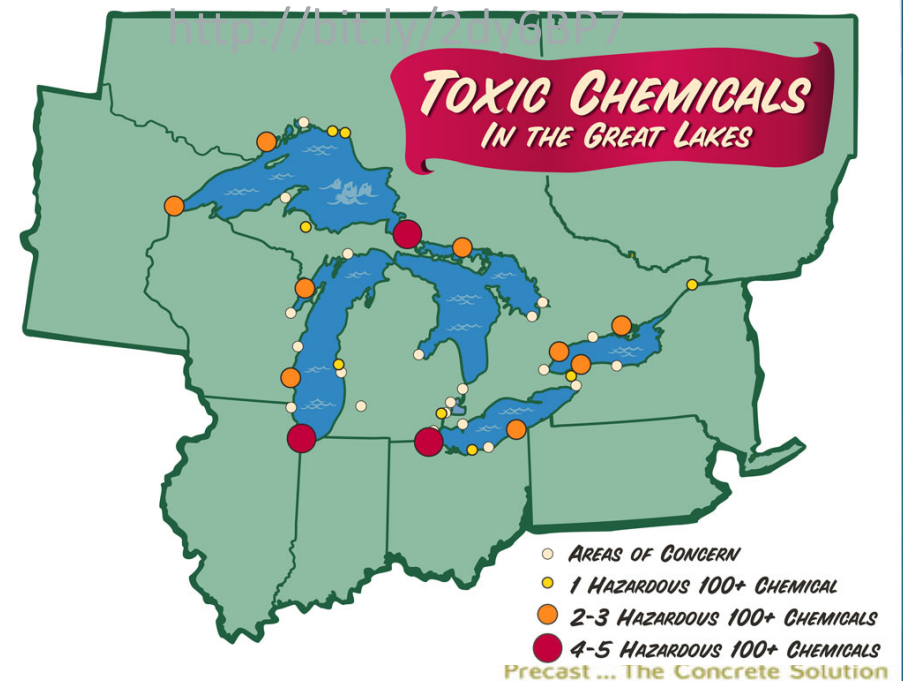
- Those previously unidentified due to advances in analytical techniques
- Those previously identified but with new effects of concern
- Newly marketed chemicals
  - Examples: antibiotics, hormones, psychoactive drugs, lipid regulators, pain relievers, fragrances, chemotherapy drugs, fire retardants, cleaning products, etc.

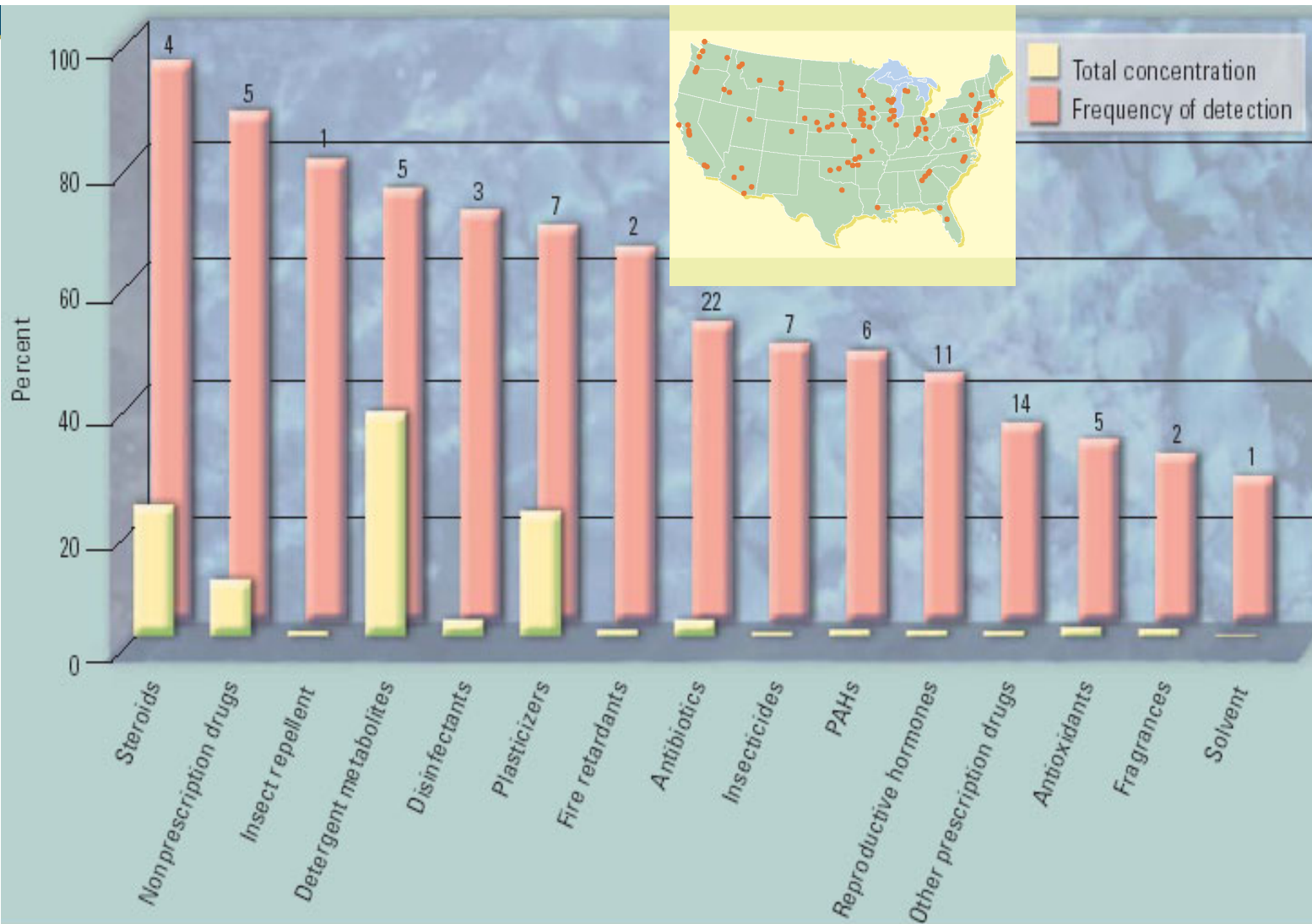
## Surface Water Study

- Sampled downstream of urban areas, intense livestock areas, wastewater systems
- Sampled for 95 CEC
- 139 streams, 30 states
- 82 of 95 detected
- 80% of samples were contaminated

## CEC Units Results

- Nanograms/liter
- 1 part per trillion
- 1 ng/l Analogy – 1 oz. in 7.5 billion gallons of water





## Organic Contaminants in US Surface Waters

## Tap Water Evaluation

- 19 utilities serving 138 million people
- 2006-07
- Sampled for 55 chemicals – found 11 most frequently at levels <10 ng/L
- Atrazine found ~40-50 ng/L





# Survey of 19 US Drinking Water Utilities

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Top 11 of 55 compounds

Median concentrations generally <10 ng/L

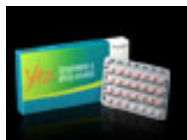
- Atenolol - betablocker
- Atrazine - herbicide
- Carbamazepine - anticonvulsant
- Estrone - hormone
- Gemfibrozil –antilipidemic
- Meprobamate – antianxiety
- Naproxen – anti-inflammatory
- Phenytoin – anticonvulsant
- Sulfamethoxazole - antibiotic
- TCEP - flame retardant
- Trimethoprim - antibiotic

Benotti et al. ES&T 2009



## ....and where do they come from?

- Personal care products
- Detergents
- Industrial discharge
- Residential wastewater
- Agriculture



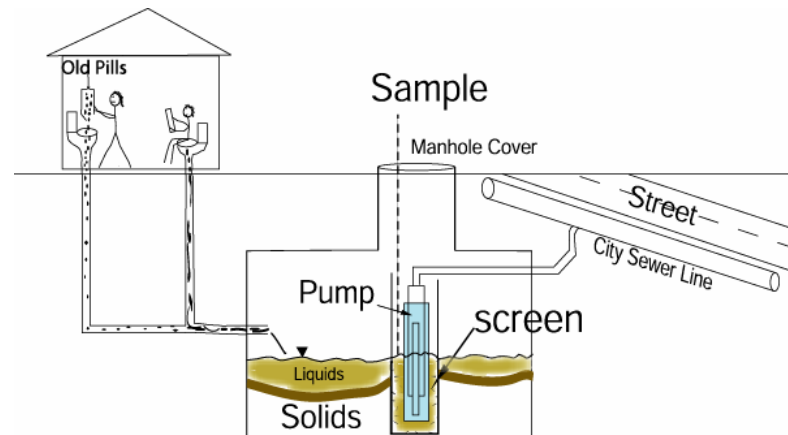
## Prescriptions Drugs

- Average American fills 12 prescriptions each year
- On average, people age 45 and older say they take four prescription medications daily



# Antibiotics and Similar Meds

- Antibiotics are not selective in which bacteria are killed
- While antibiotics help a patient by killing harmful bacteria, the medicine often kills good bacteria also
- Recommendations: Use them only when needed, dispose of unused ones properly (Do NOT flush)



# National Drug Take-Back Day



- According to a press release from The US Department of Justice in May, the fourth national drug take-back day (last spring) collected a record 276 tons of prescription drugs

## We're not the Only Drug Users

Drug residues are excreted in the manure  
and left in the Environment



# CECs Accumulate in Wastewater

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## Wastewater Effluent

- Estradiol & Birth Control Pills
- Nonylphenol from detergents
- Bisphenol A and phthalates from plastics
- Triclosan from household cleaners
- Musks from personal care products



## An Example - Consumer Products

- Ingredients in shampoo
  - 1% pyrithone zinc, ammonium laureth sulfate, ammonium lauryl sulfate, sodium lauroyl sarcosinate, glycol distearate, sodium sulfate, fragrance, dimethicone, DMDM hydantoin, disodium phosphate, sodium phosphate lauryl alcohol, PEG-12, polyquaternium-10, sodium chloride
- It goes down the drain



## For Example - Triclosan

- Forth National Report on Human Exposure to Environmental Chemicals
- CDC (2003-2004)
  - 2,517 people studied
  - 75% had triclosan detected in their urine
- Did not suggest harm – it just suggested that it was in their bodies

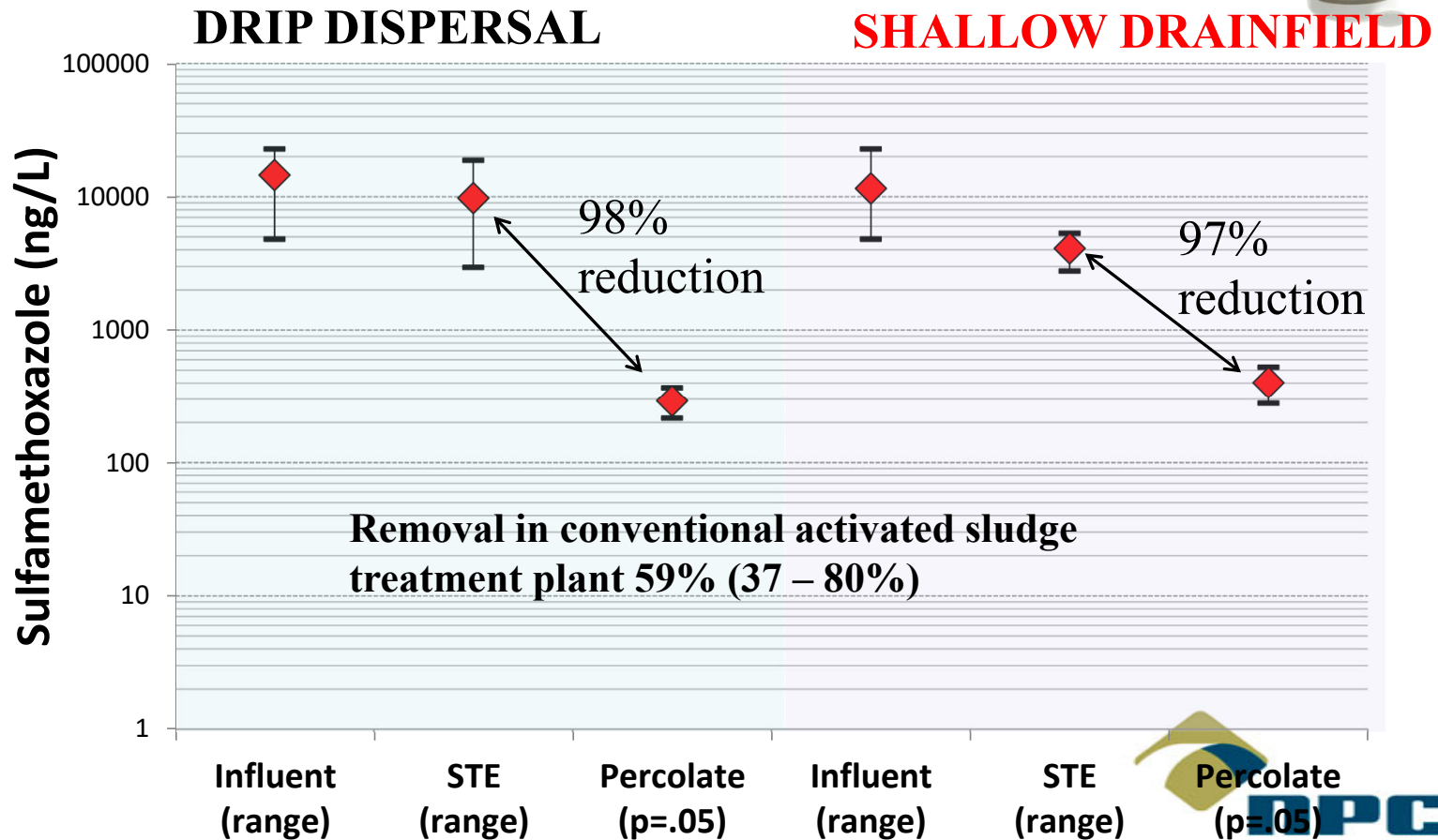
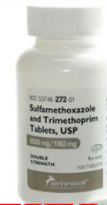


# Contaminants of Emerging Concern Treatment in Shallow Soil- based Septic Systems

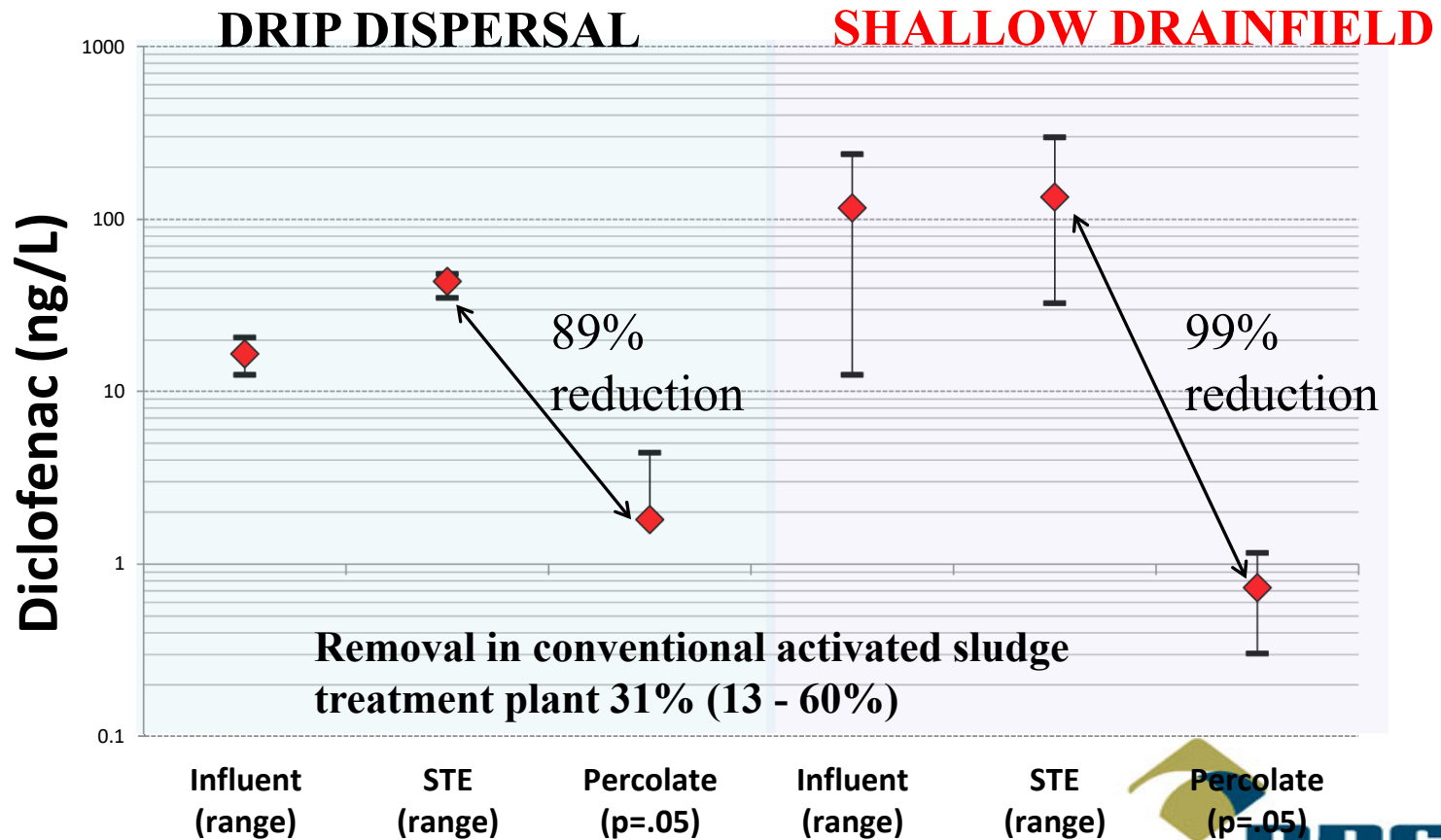
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# Antibiotics



# Nonsteroidal Anti Inflammatory Drugs

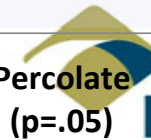
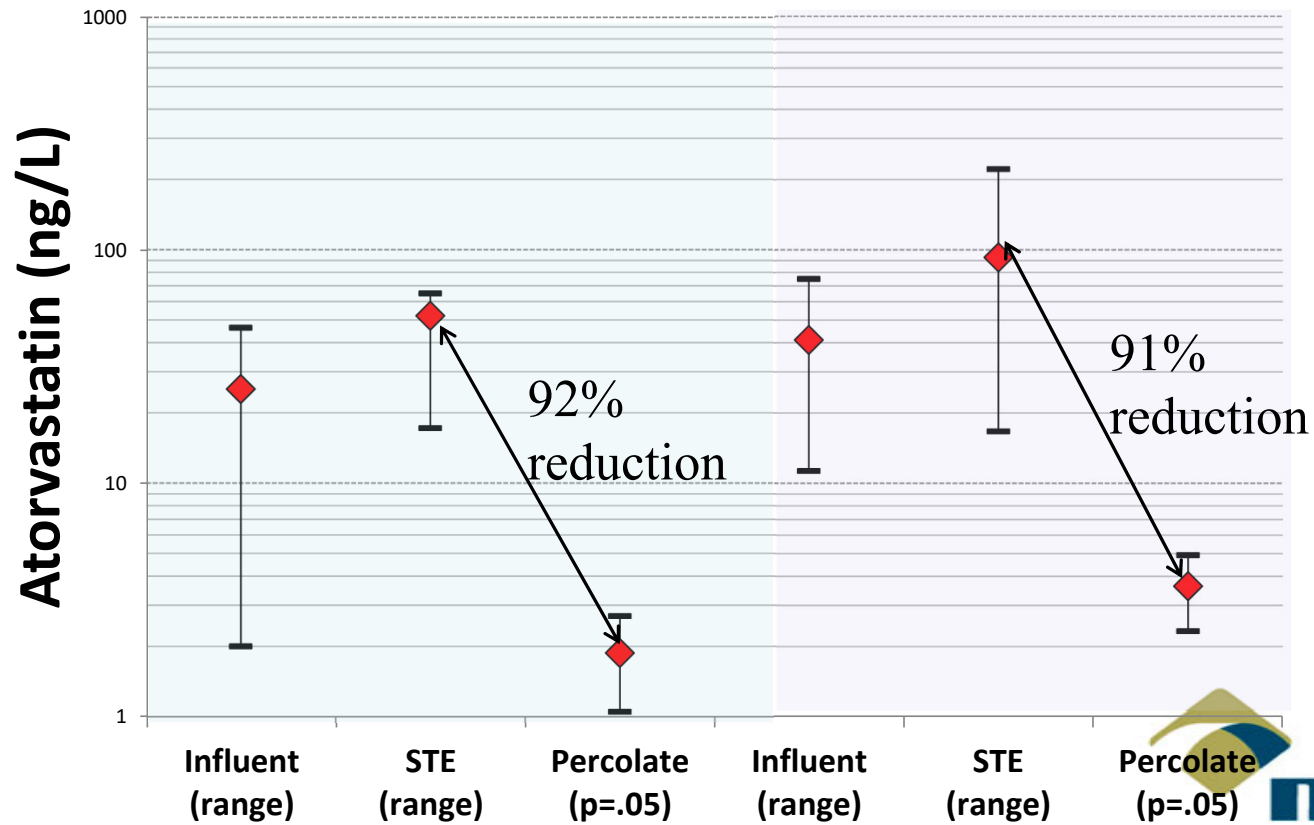


# Lipid regulating drugs



**DRIP DISPERSAL**

**SHALLOW DRAINFIELD**



**NPCA**

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Compound	Drip	Shallow Drainfield	Conventional activated sludge treatment
Acetaminophen	99.99%	99.82%	> 90% - 99.9% (b)
Atenolol	93.62%	99.03%	5.5% ( 2-20%)(a)
Atorvastatin	92.60%	91.18%	85-95% (d)
Caffeine	99.97%	99.93%	94.9% (c )
Ciprofloxacin	97.96%	98.17%	72% (59-85%)(a)
DEET	98.45%	98.24%	69% (48-90%) (e )
Diclofenac	89.16%	99.37%	31% (13-60%)(a)
Furosemide	97.60%	98.40%	59.8% (c )
Ibuprofen	99.94%	99.93%	74%(44-100%)(a)
Miconazole	0.00%	0.00%	
Naproxen	99.50%	96.80%	75% (59-92%)(a)
Propranolol	71.20%	96.89%	96% (a)
Sulfamethoxazole	97.90%	96.50%	59% (37-80%)(a)
TCEP	0.00%	0.00%	
Trimethoprim	99.20%	99.80%	14% (0 - 40%)(a)

## Take Home Message about CECs

- Many pharmaceutical and personal care products, contain compounds that can disrupt the normal functioning of hormones in humans and wildlife
- Although a major route for CEC entrance into the environment is wastewater, the septic systems present opportunity for significant treatment
- Shallow-placed soil absorption systems remove > 90% of many CECs found in household wastewater
- A more complete understanding of the principles of CEC removal in soils may offer opportunities to design optimization

# CHALLENGING PRODUCTS AND ALTERNATIVES

## Product Issues in General

- Problems
  - Sanitizing
  - pH impacts
- Antibiotic soaps and wipes are now used by 75% of American households
- Raises owner awareness
- They have cumulative effects on system performance



# What Do Labels Mean?

Signal Word	Toxicity if swallowed, inhaled or absorbed through the skin
Caution	One ounce to a pint maybe harmful
Warning	One teaspoon or one ounce maybe harmful or fatal
Danger	One taste to one teaspoon is fatal

Look out for words on labels and choose the least hazardous product.

Less toxic ↑ More toxic	Caution	mild/moderate
	Warning	moderate hazard
	Danger	extremely flammable corrosive or highly toxic
	Poison	highly toxic

# Cleaning Product Labels

- **POISON/DANGER:** Means the chemical will kill the bacteria, and its use should be minimized or eliminated
- **WARNING:** Means limited use should have a minimal impact on the system
- **CAUTION:** Typically means the

# Environmental Working Group



- Non-profit organization
- Has a comprehensive website which rates the full range of household products
- <http://www.ewg.org>
- A good resource to find the active ingredient in a product is:
- <http://householdproducts.nlm.nih.gov>



# Quaternary Ammonia

- Typically known as “Quats”
  - Many individual chemicals
  - Present in thousands of end-use formulations, many of which are blends of various Quats
  - Varying levels, some are worse than others
- Common uses include **disinfectants/sanitizers, surfactants, fabric softeners, antistatic agents, and septic tank additives (controls odor by killing bacteria)**

# Quats Impacts

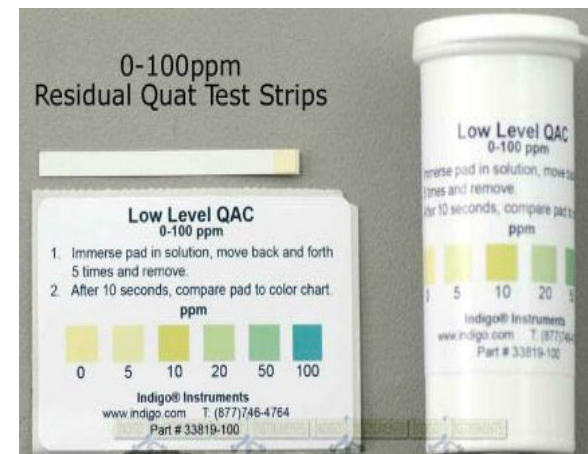
- Compounds are very stable and hard to break, so has long lasting biocidal effect
- Certain quats will biodegrade
  - Biodegradation poor under anaerobic conditions
  - Biodegradability of QACs under aerobic conditions
  - 90% removal cited in literature
- Anaerobic environments
  - Inhibitory at 5-15 mg/l
- Aerobic
  - Inhibitory at 10 – 30 mg/l for BOD
  - 2 – 5 mg/l for nitrification

## Quat Impacts Continued

- Gross study - Lysol concentration of 5.0 ml/l destroyed all the bacteria in the domestic septic tanks (2.5 days for recovery)
- Corresponds to 5.0 gallons of Lysol in a 1000 gallon septic tank
- Cumulative impact of these chemicals can impact system performance, especially in combination with other household products

## Testing Quats

- Quat test strips
- Most are used to test the concentration in commercial kitchen sinks at 200 mg/l
- Need one that can get down to 5 mg/l



<https://www.indigo.com>,  
<http://www.lamotte.com/en/laundry-sanitation/test-strips/2934.html/>

## Quat Recommendations

- Avoid whenever possible
- In home disinfectant - Use borax: 1/2 cup in a gallon of water; deodorizes also (baking soda/vinegar too)





## Quat Recommendations Cont'd

- Commercial sanitizing is done by either a chemical or with high temperature (165°F)
  - Bleach/iodine preferred
  - Benefect botanical disinfectant (on EPA registered disinfectant list) which contains hydrogen peroxide that breaks down to water and oxygen
  - Many national or regional restaurant chains will not stop using Quats
    - For these sites, consider the use of NeutraQuat, a QAC neutralizer for wastewater systems ([hydrosolutions.com/](http://hydrosolutions.com/))

# Drain Cleaners

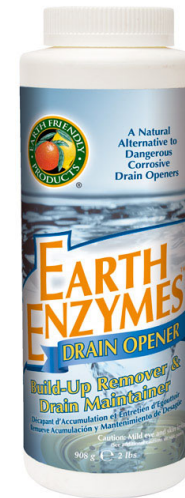
- Harsh chemicals used in many drain cleaners kill the essential bacteria
- Gross (1987) study found significant decreases in concentrations of coliform bacteria at very low Drano concentrations
  - 0.1 mg of Drano per liter of septic tank effluent reduced the concentration of coliforms ten-fold
  - 1.3 mg/l is enough to kill most bacteria
  - 3 mg/l they are completely destroyed
    - This amount would typically be used by a homeowner in a short time period while unclogging a drain

## Drain Cleaner Recommendations

- Use adequate catch basins in all drains from sinks, showers, tubs, laundry, etc.
  - Inexpensive metal or plastic drain screens
- When drains do plug usually in trap below sink
  - Take it apart, use a plunger or snake
- Call a professional
- DIY
  - Pour 1/2 cup salt and 1/2 cup baking soda down drain
  - Then, pour 6 cups of boiling water after it
  - Allow to sit overnight and then flush with hot water

## Natural Drain Cleaners?

- As a last resort, chemical drain cleaners may be used but they **MUST** be enzyme based rather than caustic to limit impact to the good bacteria in septic systems
- Earth Friendly or Naturally Yours are two brands of enzyme based drain cleaners



THE



## Bathroom Impacts

- Many toilet cleaners contain corrosive ingredients:
  - Sulfates, sodium hydroxide, sodium hypochlorite (bleach), or phosphoric acid
  - Antibacterial
- Tub and tile cleaners often contain:
  - Emulsifiers
  - Antibacterial, disinfecting and sanitizing products
- Rust removers contain very strong bases, emulsifier and surfactants

## And the Leaks....

- Toilet bowls are notorious for adding 100s of gallons of clean water when the flap either leaks or stays open
- Recommendation (particularly for rental and commercial properties): install a device that PREVENT running toilets
  - One example is the Fluidmaster Sentry Toilet Tank Fill Valve: only allowing one tank of water to exit if



## Recommended Toilet Cleaners

- Sprinkle baking soda or Bon Ami, then scrub with a toilet brush
  - Bon Ami is non-scouring, biodegradable, nontoxic and hypoallergenic
- Lime and hard-water deposits can sometimes be removed with hot white vinegar





## What Should go in the Bowl

- Single ply toilet paper because it breaks down in the septic system faster and better than higher ply count toilet paper
- No lotions
- No wipes
- Human waste
- Nothing else!



## Septic Safe?

- Even if items are marked as "septic safe" do not flush them
- For example, some wipes, toilet bowl cleaners and cat litter may be labeled this way
- In many instances it means they will flush



**CA**

...reconstituted... The Concrete Solution

# Spray Shower Cleaners

- By spraying or at the push of a button the shower cleaner will spray a cleaning mist, and remove soap scum, mildew and other buildup from your shower walls
- Daily dose of sanitizer and emulsifier
- Recommendation: Sprinkle baking soda on a damp sponge or add 4 Tbs. baking soda to 1 qt. warm water or use Bon Ami

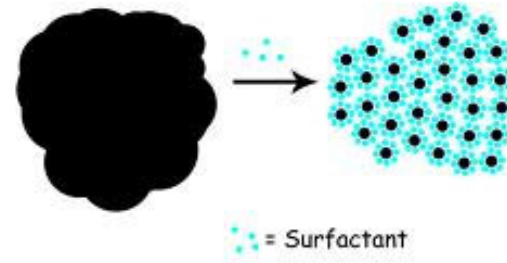


## Rust Removal Recommendation

- Pumice stone
  - These can be found in most hardware and home improvement stores and are inexpensive
  - 'Elbow grease' to use this method but it is environmentally friendly and non-caustic
  - There are many online recipes for homemade bathroom cleaners



# Surfactants



- Soaps and cleaners that bubble
- Surfactants are found in almost all soaps because they help separate the soil or oily stains from the fabric, skin, etc.
- Two types
  - natural or oleochemical surfactants derived from plant oils such as palm or coconut oil
  - synthetic or petrochemical surfactants are derived from crude oil

## Surfactant Impacts

Concentration (mg/L)	Potential Effects
$\geq 1.0$	Risk of long-term accumulation of surfactants in soil, leading to decreased hydraulic conductivity and increased water repellence
10	Inhibition of hydrolysis, leading to greater accumulation of solids in anaerobic sewage treatment systems
30	Direct degradation of soil structure and decrease in hydraulic conductivity

## Example from 6 Adult Care Facilities in MN

Site	Anionic Surfactants mg/L
A.	2.0
B.	0.76
C.	3.8
D.	8.6
E.	1.5
F.	3.4
G. Control	2.7

## Laundry Soaps

- Typical laundry products contain petroleum based detergents and surfactants, enzymes, bleaches, optical brighteners, pH adjustors, processing aids, corrosion inhibitors, anti-redisposition agents, and fragrances
- Powdered varies also contain fillers – inert substances including clay that keep the powder flowing some as much as 50%
- Nearly all commercial brands of laundry soap leave chemical residues on your clothes



## Dishwashing Soap

- Dishwashing products may contain bleach, enzymes, and rinsing aids
- Some detergents still contain phosphorus
- Phosphorus is removed from wastewater by being chemically bound by minerals and held on exchange sites on soil

## Bathing and Handwashing

- In 2000, the American Medical Association issued the statement that **antibacterial soaps were no more effective against germs than common soap**
  - Although they initially kill more germs than soap, within an hour or so there is no difference in the numbers of germs that have repopulated the area
  - Use is promoting the developing of “super” bugs
- In September of 2016, the U.S. Food and Drug Administration issued a final rule eliminating the use of 19 specific active ingredients in antiseptic hand wash including tricolsan
  - This rule does not affect consumer hand “sanitizers or wipes”, or antibacterial products used in health care settings

## General Surfactant Recommendations

- **Reduce the amount** - 50% of the recommended amount will usually work (particularly with soft water)
- Bar soap which does not contain an anti-bacterial agent is recommended as less product is typically used than liquid
- Free of scents, dyes, phosphorous and preservatives



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## General Surfactant Recommendations

- Choose:
  - Plant-based surfactants (or just plain soap, like Dr. Bronner's)
  - 1,4 Dioxane-free
  - Petrochemical-free
  - Glycol-free
  - Phosphate-free
  - Caustic-free

## Laundry Recommendations

- Buying vegetable based detergents
- Choose powders (that do not contain clay as a filler) as they contain fewer chemicals
- Try pure soap flakes instead of detergent – add ½ cup of borax or vinegar to the rinse cycle to remove soapy residue
- Do not use enzyme based detergent as they can be irritating to the skin and are the cause of allergic reactions

# Liquid Fabric Softener



- Coat the surface of a fabric with a subtle layer of slimy chemical compounds
  - Petroleum based
  - Contain Quats
  - Adds additional salts
  - Should not be used
  - Emulsification
- Recommendations:
    - Add a ½ cup of baking soda or vinegar or both
    - Drier balls
    - Anti-static- aluminum foil ball

## Degreasers

- At home, limit use of dishwashing soaps
- In a restaurant, should be avoided
- Recommendations:
  - Use distilled vinegar
  - Make a baking soda paste to cut grease



## Washing Machine Recommendations

- 82% of households have a washing machine
- High-efficiency washing machine
  - Use less water and will save money on your utility bills (as much as \$100 per year)
  - Both front-loading and top-loading high-efficiency models will use less water & reduce drying time
  - Front-loaders generally have earned the highest overall scores in our Consumer Reports combining washing performance and efficiency
  - Front loading washers use an average of 30% to 50% less water than top loading high efficiency models





## General Cleaning Recommendations

- Use non-chlorine, non-ammonia, non-antibacterial, non-toxic and biodegradable cleaning products
- Most all-natural cleaners are septic safe
- Use the least amount you need to get the job done
- When it comes to chemicals, it's a good idea to remember that if you only feel safe wearing gloves when you handle them, then it's a good bet that you won't want to put these items down your drain

## Second Hand Chemotherapy

- Some forms of chemotherapy are called cytotoxins
- Cytotoxic drugs can be used to destroy tumors, boost the outcomes of surgery or radiotherapy, reduce metastases and alleviate cancer symptoms
- [27 chemotherapy drugs](#) have been identified with a high risk to the impact human health at low doses
- 85% percent of those undergoing chemo get their infusions at a hospital and are immediately sent home

## Chemo cont'd

- In December of 2019 USP 800 a new federal regulation on hazardous drug handling will take effect
- This will require that the bodily fluids from those undergoing some forms of chemo will be required to be collected and properly disposed of
- Until this is fully implemented septic system professionals servicing septic systems should inquire if anyone is undergoing chemotherapy when troubleshooting or servicing systems

## Second Hand Chemo

- 2 – 3 days after treatment the patient is excreting relatively high amounts of the cytotoxin in their urine, feces, vomit, and sweat
- Cytotoxins are known to cause birth defects, immune dysfunction such as myelodysplastic syndrome (pre-leukemia), and miscarriages
- Risk in septic system due to the lack of dilution the cytotoxins could be at high enough concentrations to damage the beneficial bacteria needed in the septic system

# Potential Solutions

- Education
  - Eliminate as many of the issues as possible
- Management
  - More management may be needed
- Secondary treatment
  - Treatment breaks down many components



# Options

- Shock load
  - One time addition
  - Wait and see if it comes back or clean out and start over
- Short-term usage (<1 year)
  - Monitor tank
  - Holding tank if very upset
  - Manage
- Long term usage
  - Monitor
  - More maintenance needed?
  - Design in advanced treatment?

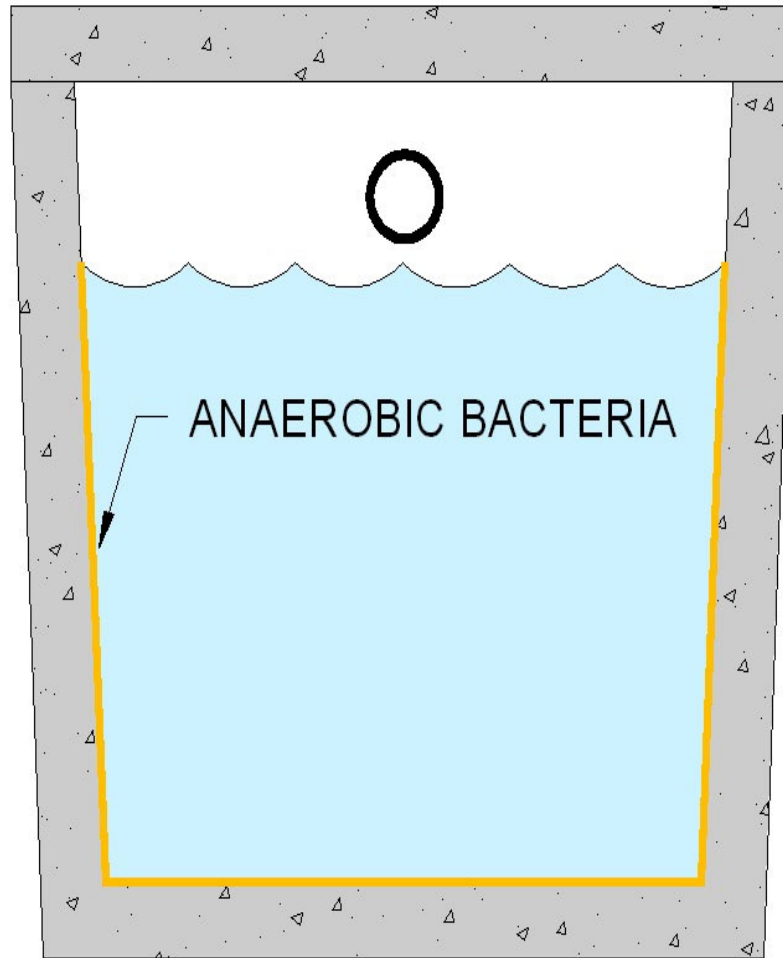
## Concluding Thoughts

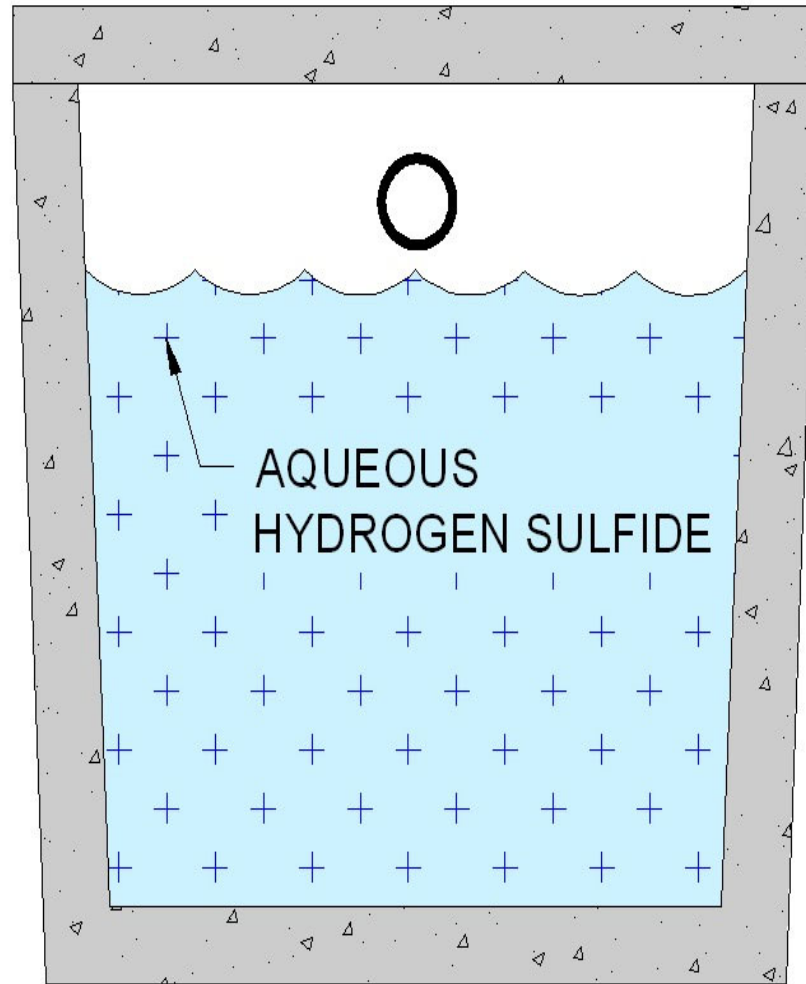
- As an industry (and public in general!), we need to keep educating users/customers
- The septic system and soil has a tremendous potential to capture trace organics
  - but it's not bulletproof
  - someday we may have to evaluate more contaminants

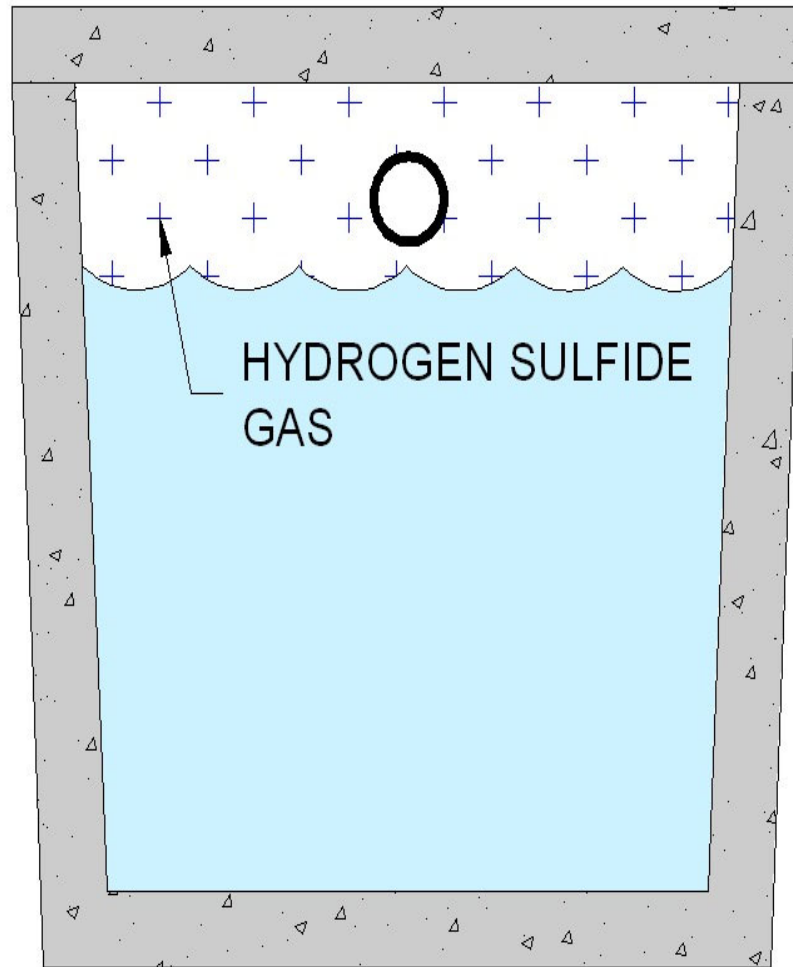
## Microbially Induced Concrete Corrosion







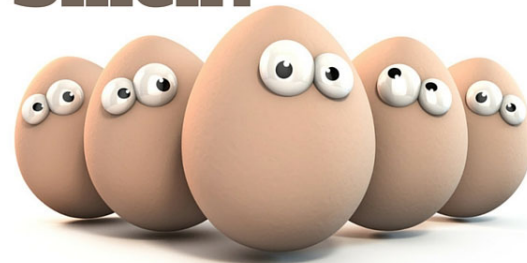




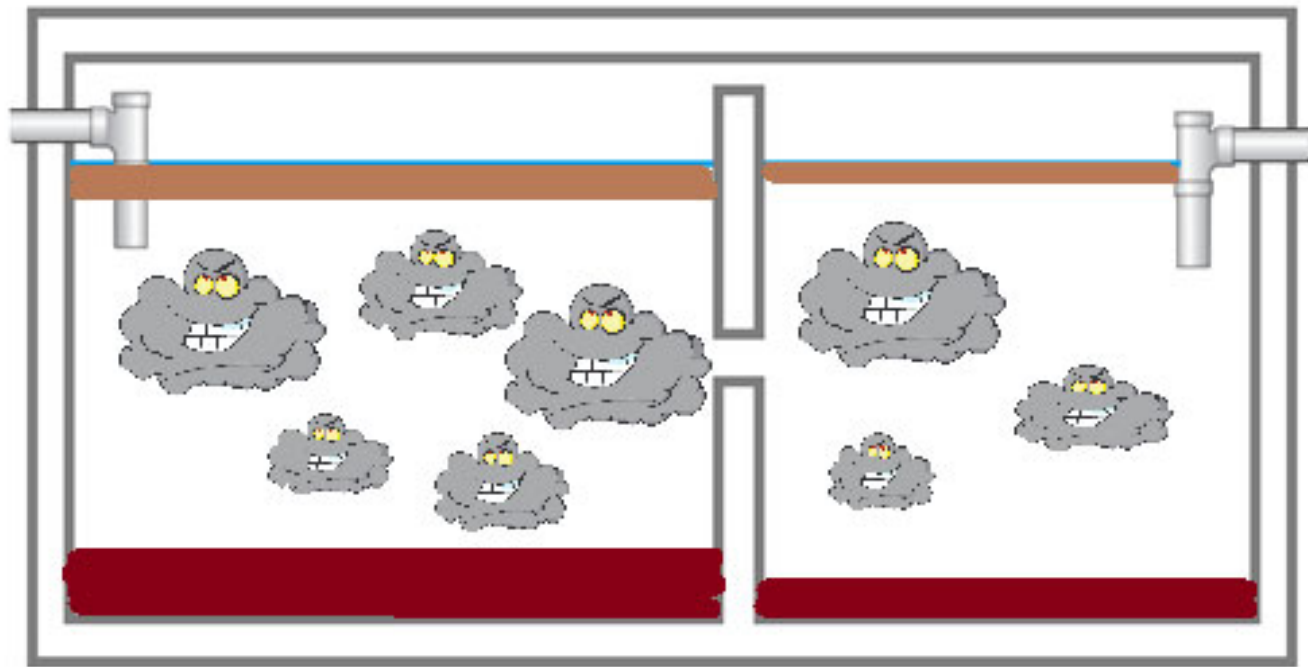
## What is H<sub>2</sub>S?

- Colorless Gas
- Breakdown of organic matter
- Dangerous
- Food source for bacteria

**What Is That  
Rotten Egg  
Smell?**



$\text{H}_2\text{S}_{(\text{aq})}$  trying to get to  $\text{H}_2\text{S}_{(\text{gas})}$

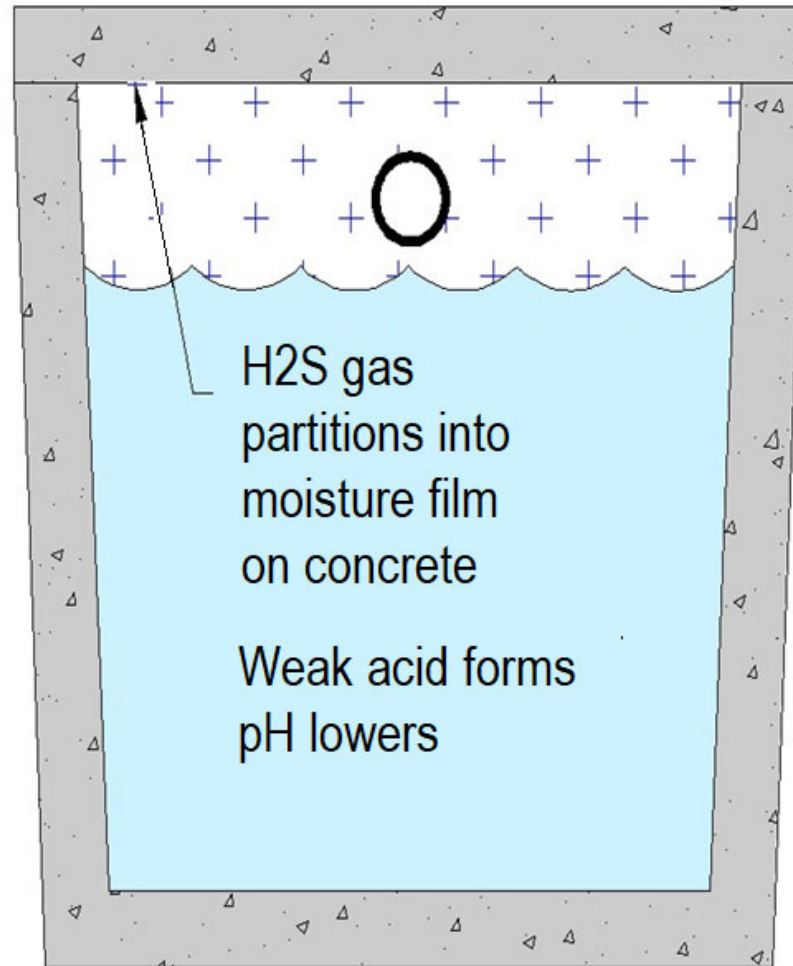


# H<sub>2</sub>S Gas Release

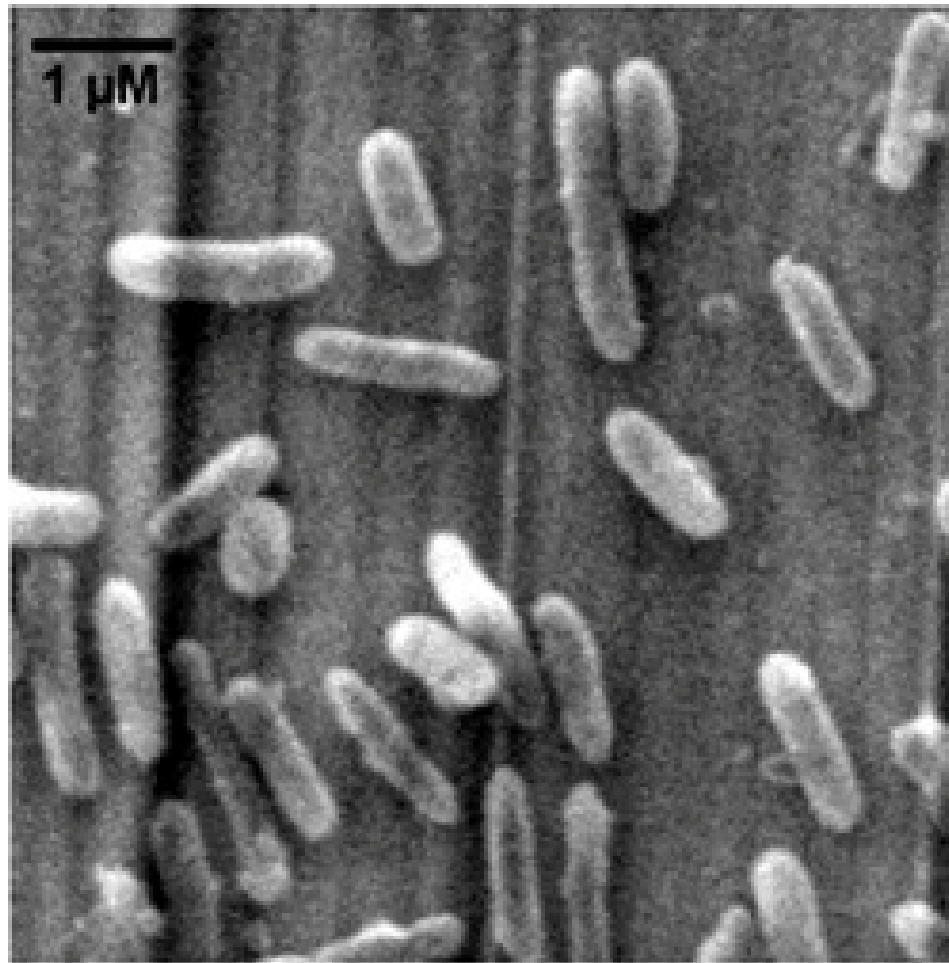
## Factors Influencing Release of H<sub>2</sub>S from liquid to gas phase

Factor	Effect
pH	Low pH encourages speciation of sulfides to favor H <sub>2</sub> S <sub>(aq)</sub> , the species capable of partitioning to the gas phase
Aqueous concentration of H <sub>2</sub> S	High aqueous concentrations encourage release of H <sub>2</sub> S <sub>(aq)</sub> according to Henry's Law
Temperature	Increasing temperature increases the release of H <sub>2</sub> S <sub>(aq)</sub> to the gas phase by reducing H <sub>2</sub> S solubility
Turbulence	High turbulence increases liquid-gas surface area for H <sub>2</sub> S to partition to the gas phase

House, 2013



# Thiobacillus





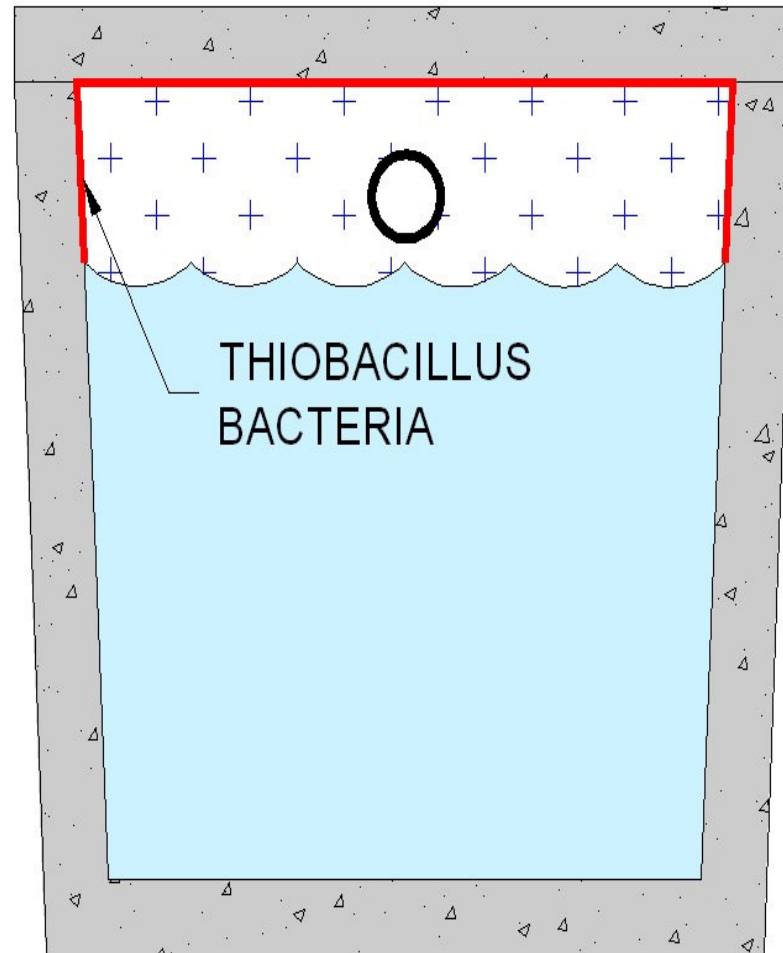
# Sulfate Oxidizing Bacteria (SOB)

- Thiobacillus
- Aerobic
- Thrives in pH below 9

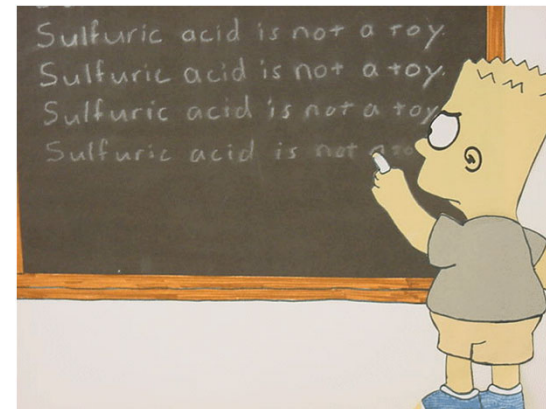
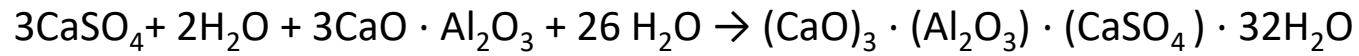
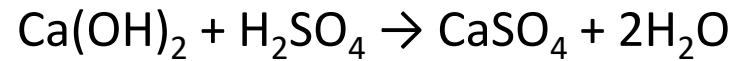
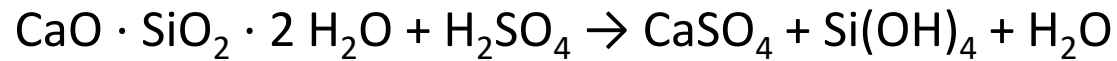
Table 2. Preferred substrates and pH ranges for SOM involved with MIC in concrete sewer networks (Islander et al., 1991, Madigan, 2006)

Species	Preferred Substrate	Preferred pH Growth Range
<i>T. thioparus</i>	H <sub>2</sub> S, S <sup>0</sup> , S <sub>2</sub> CO <sub>3</sub> <sup>2-</sup>	5-9
<i>T. novellus</i>	S <sub>2</sub> CO <sub>3</sub> <sup>2-</sup>	2.5-8
<i>T. intermedius</i>	S <sub>2</sub> CO <sub>3</sub> <sup>2-</sup>	2.5-8
<i>T. neapolitanus</i>	S <sup>0</sup> , S <sub>2</sub> CO <sub>3</sub> <sup>2-</sup>	3-7
<i>T. thiooxidans</i>	H <sub>2</sub> S, S <sup>0</sup>	0.5-3

Source: Review of Microbially Induced Corrosion and Comments on Needs Related to Testing Procedures - M. W. House and W. J. Weiss



## Biogenic Sulfuric Acid and Concrete

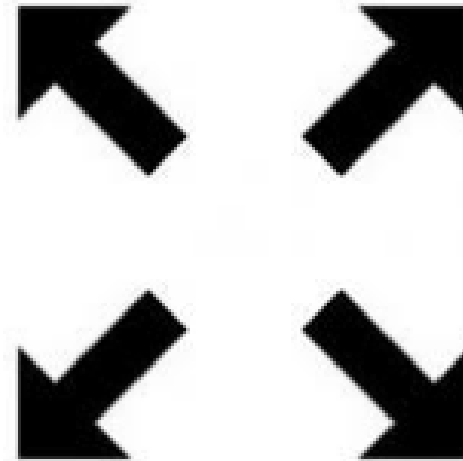
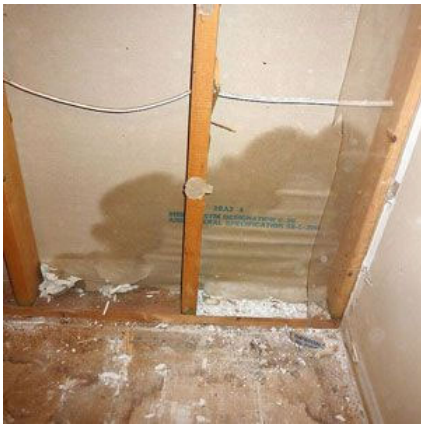


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## Biogenic Sulfuric Acid and Concrete

- Hydrated cement paste is composed of 50- 60% CSH and around 25% CH.
- Dissolution of CH results in formation of calcium sulfates (gypsum)
- Gypsum reacts with aluminate phases ( $C_2A$ ) to form ettringite
- Gypsum and Ettringite are expansive

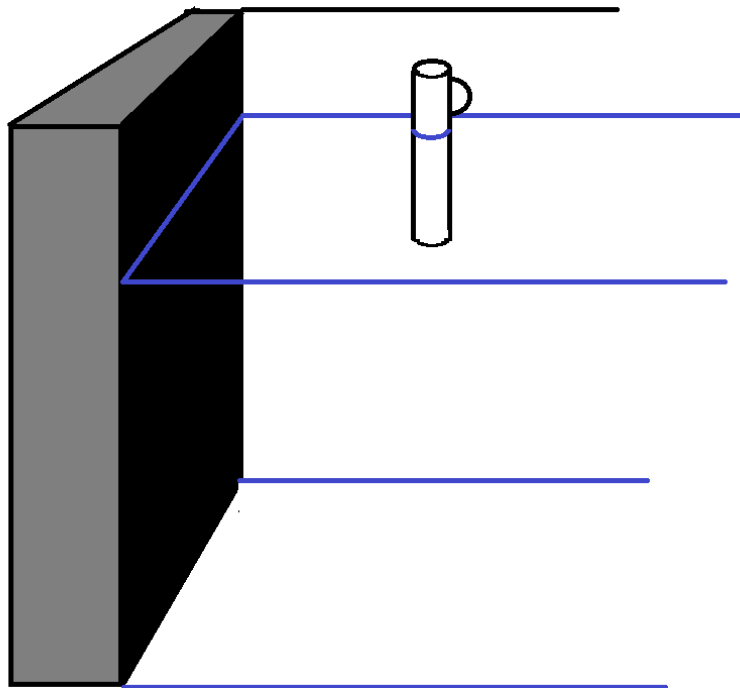


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# Strategies for Mitigation

- Material
- Environment
- Material / Environment Interface



# Strategies

## Material

Use core quality control practices to produce strong concrete with low porosity

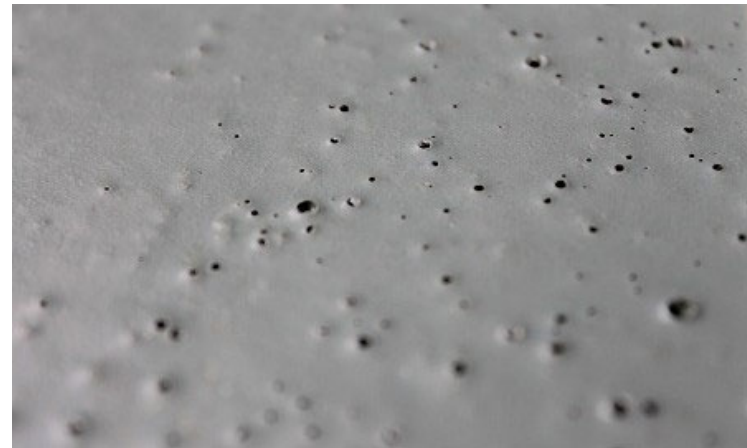
# Strategies

## Concrete Environment Interface

- Coatings
- Sealants
- Liners

## COATINGS

- Bituminous not always best
- Cold-applied single component, waterproofing compound that cures by exposure to atmospheric and substrate moisture
- Acid resistant
- High Build
- Proper application is key



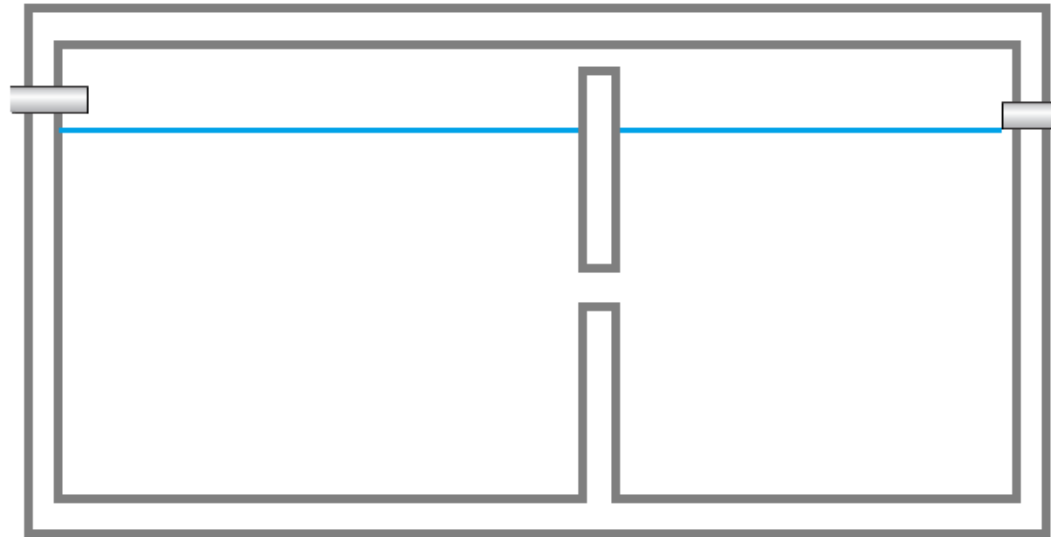


# Strategies

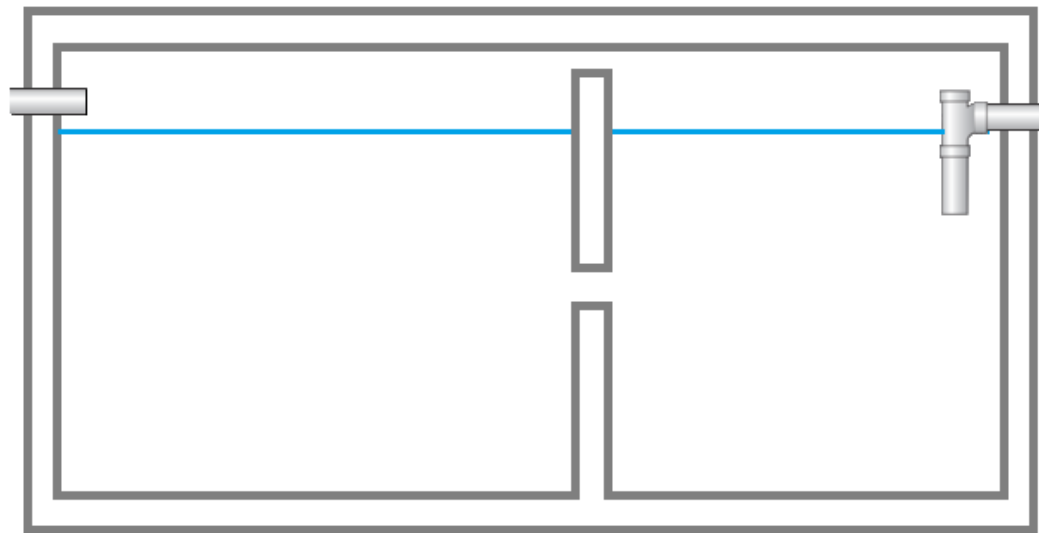
## Environment

- Design for low turbulence
- Venting

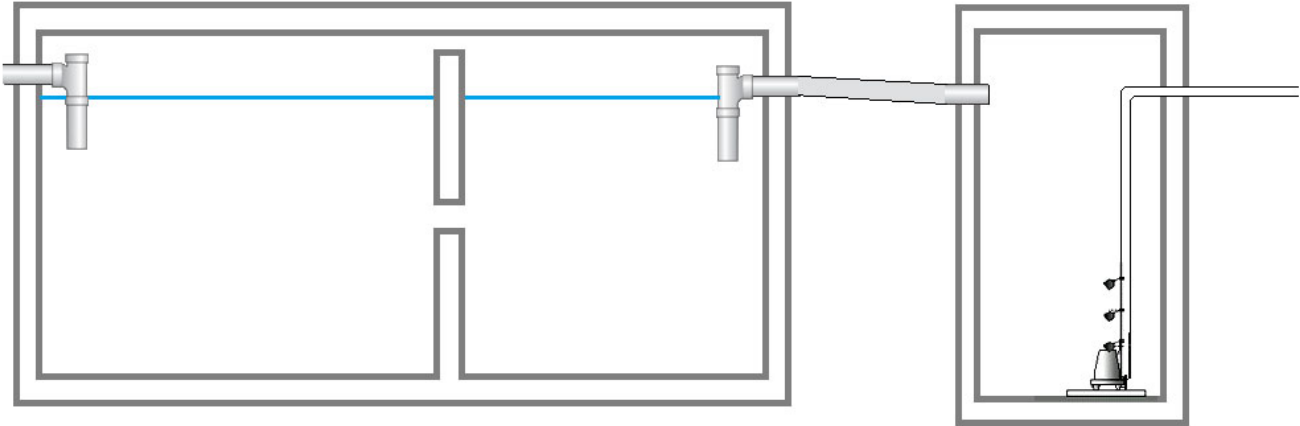
## Reducing Turbulence



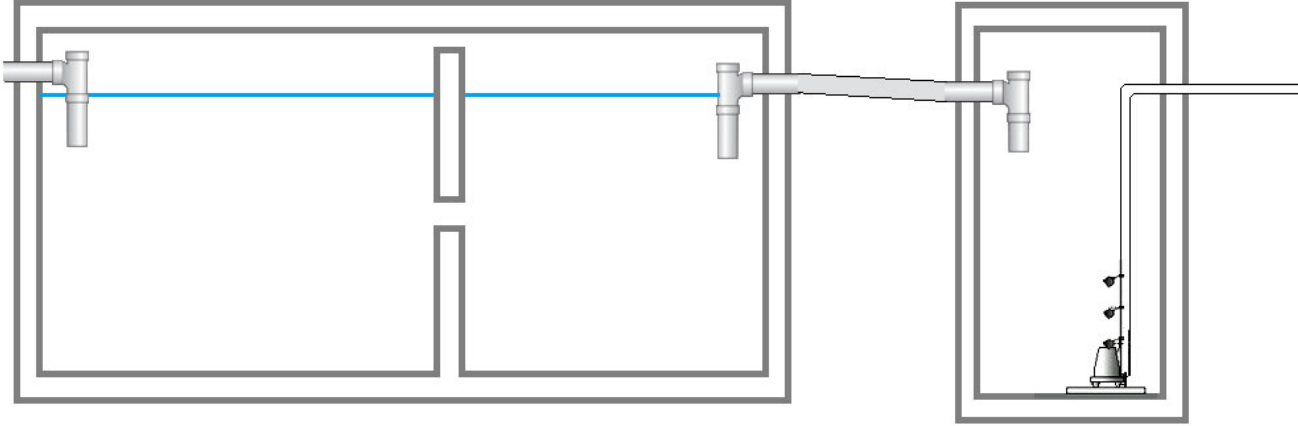
## Reducing Turbulence



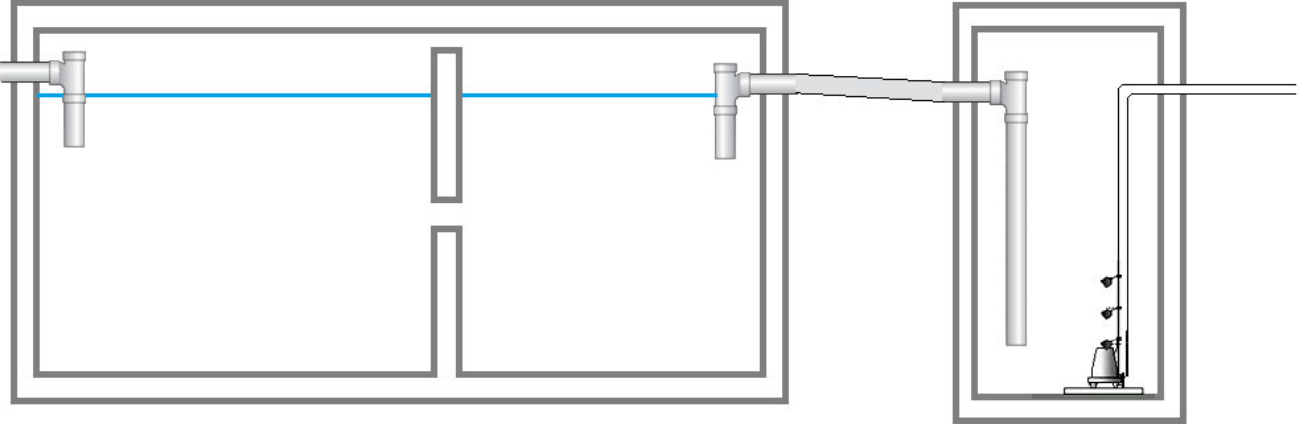
# Pump System



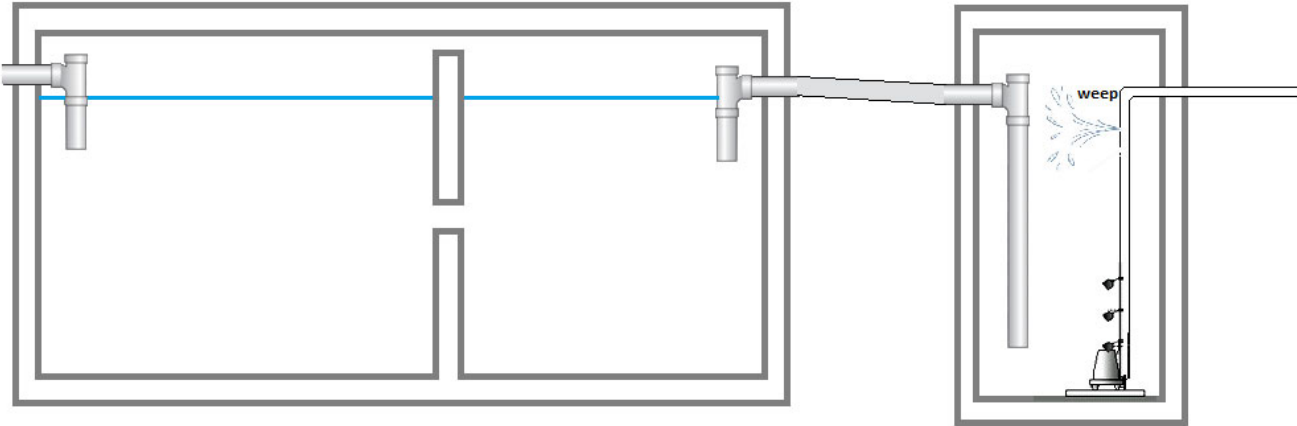
# Pump System



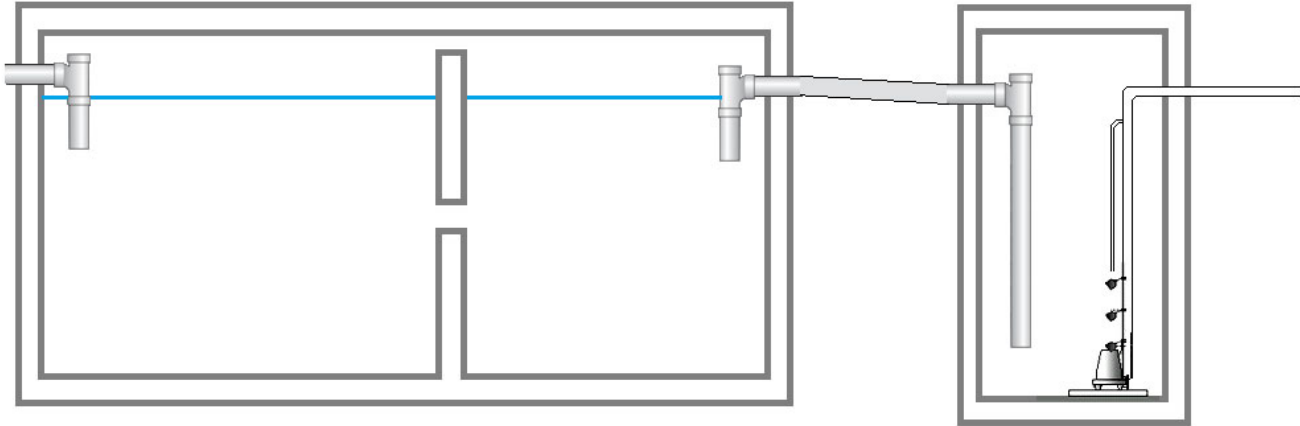
# Pump System



# Pump System



# Pump System



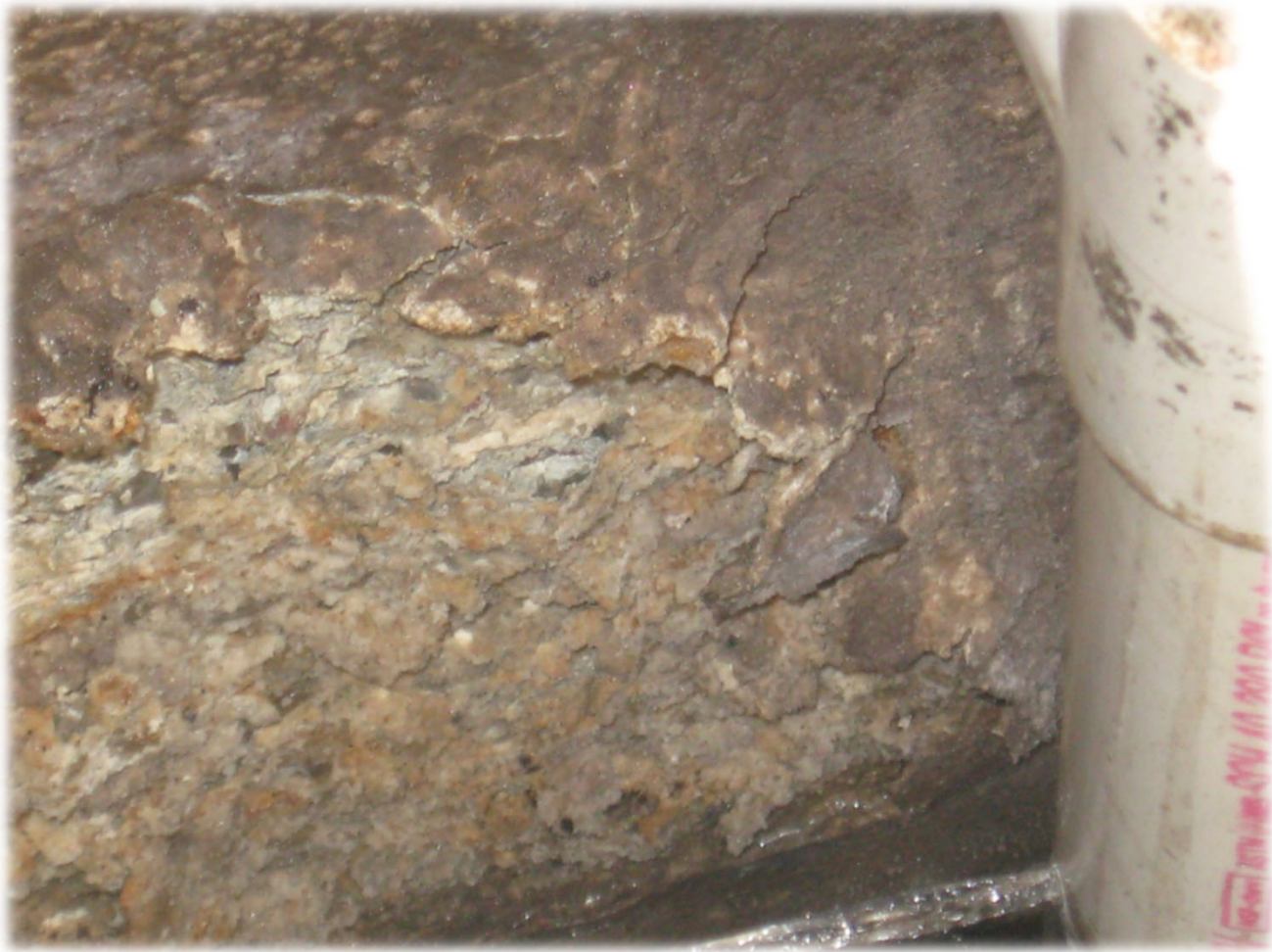


# Pump Chamber



## Weep hole design for drain-back







## Deterioration of wall and cover

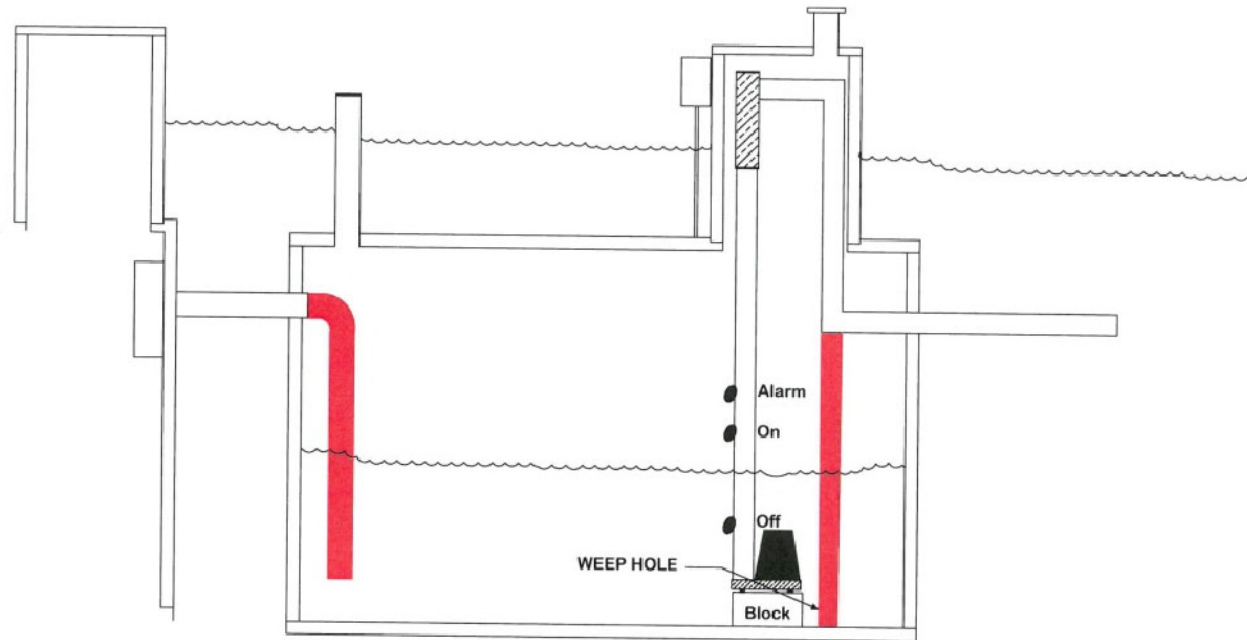


## MIC modification option



Pipe must extend below liquid

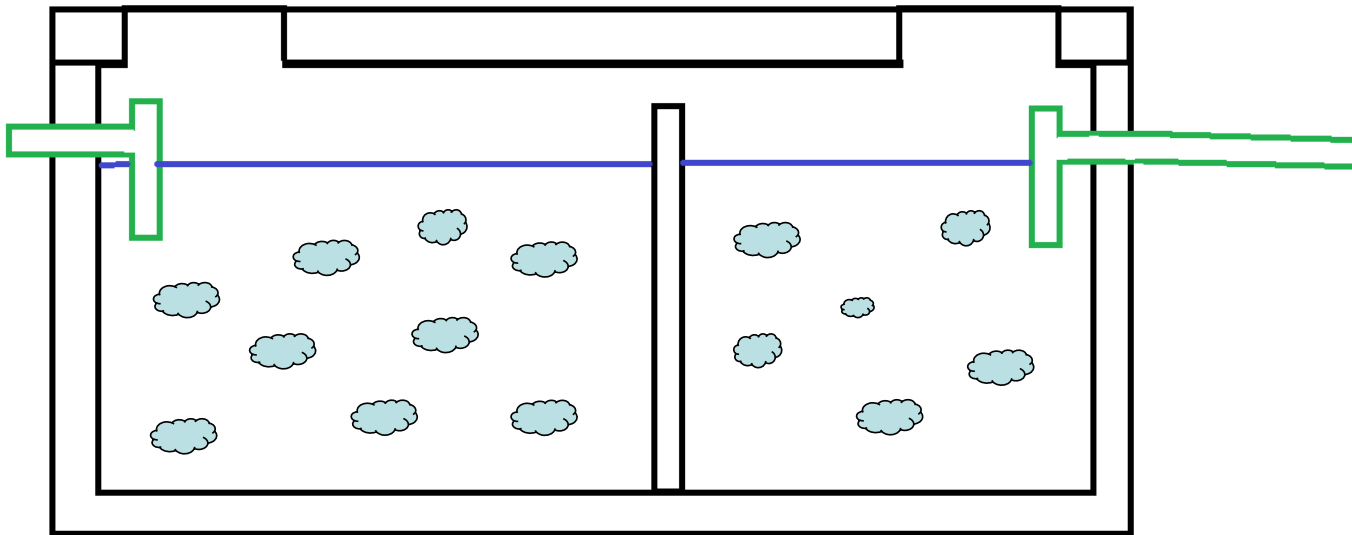




**ICA**

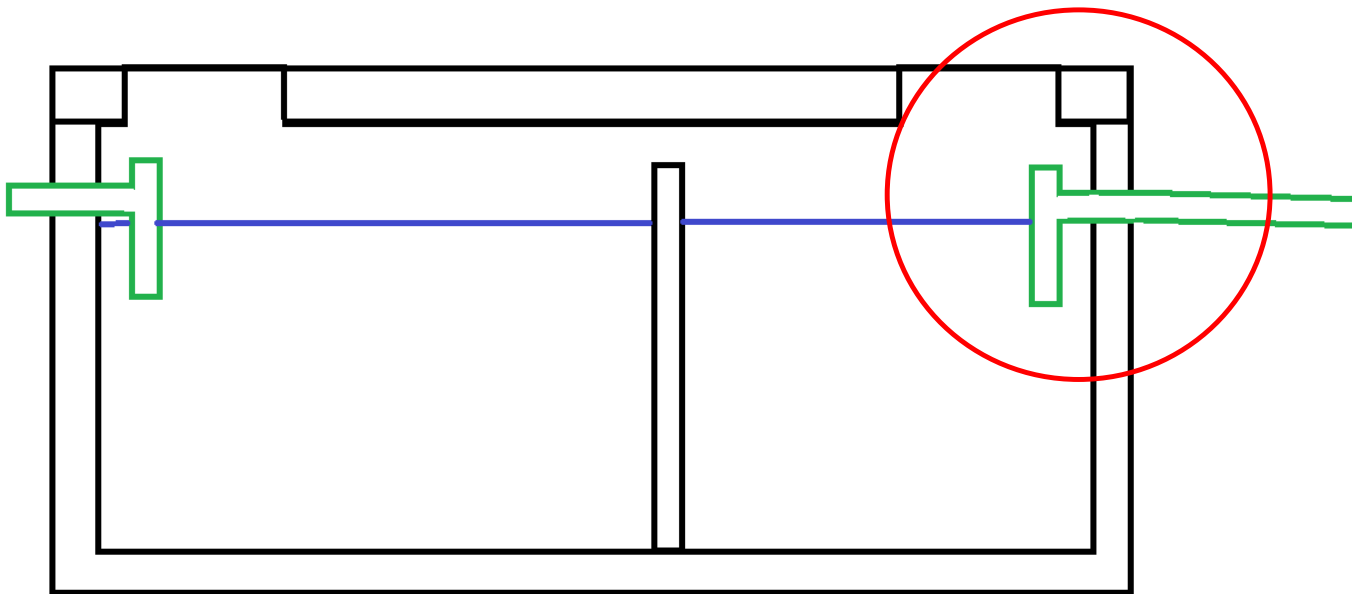
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## Inside the Tank

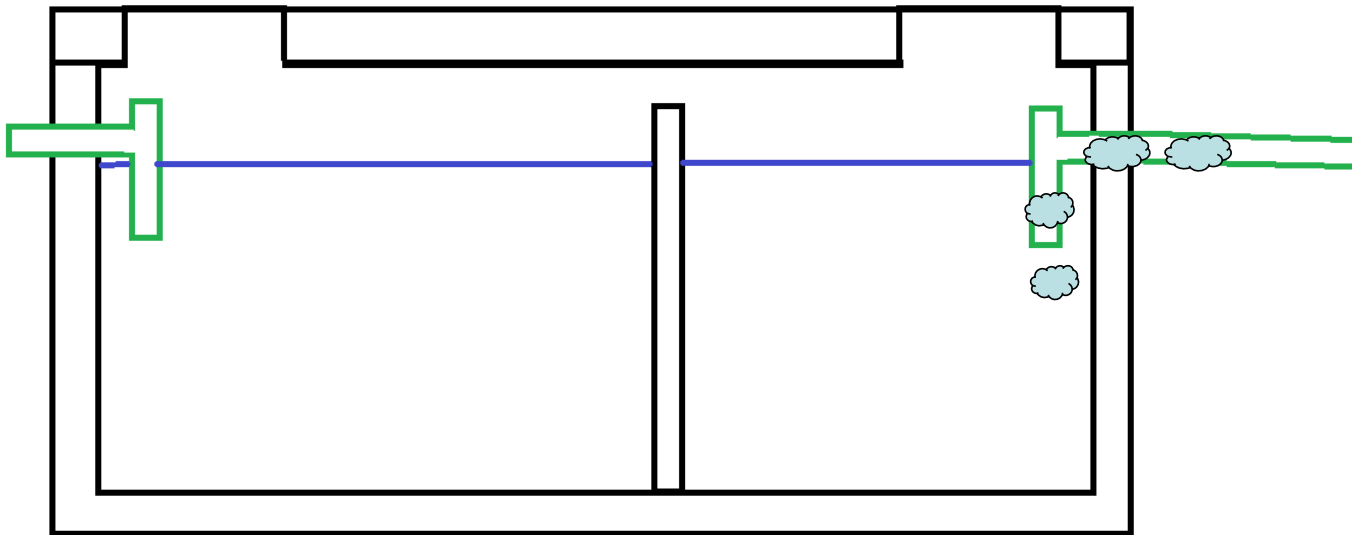




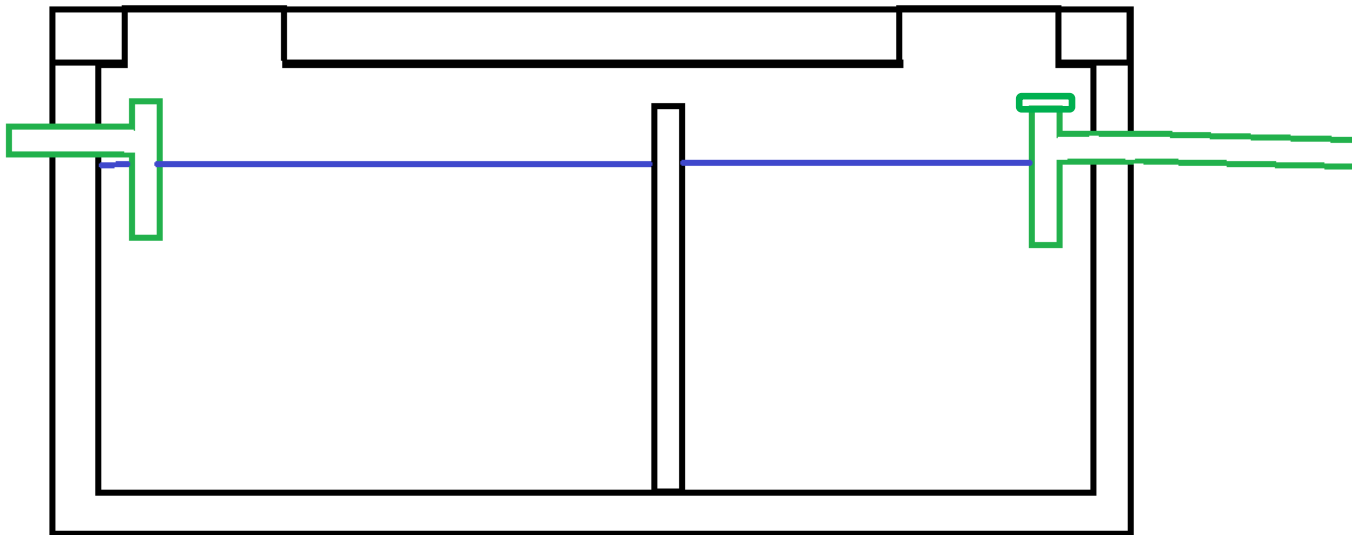
## Inside the Tank



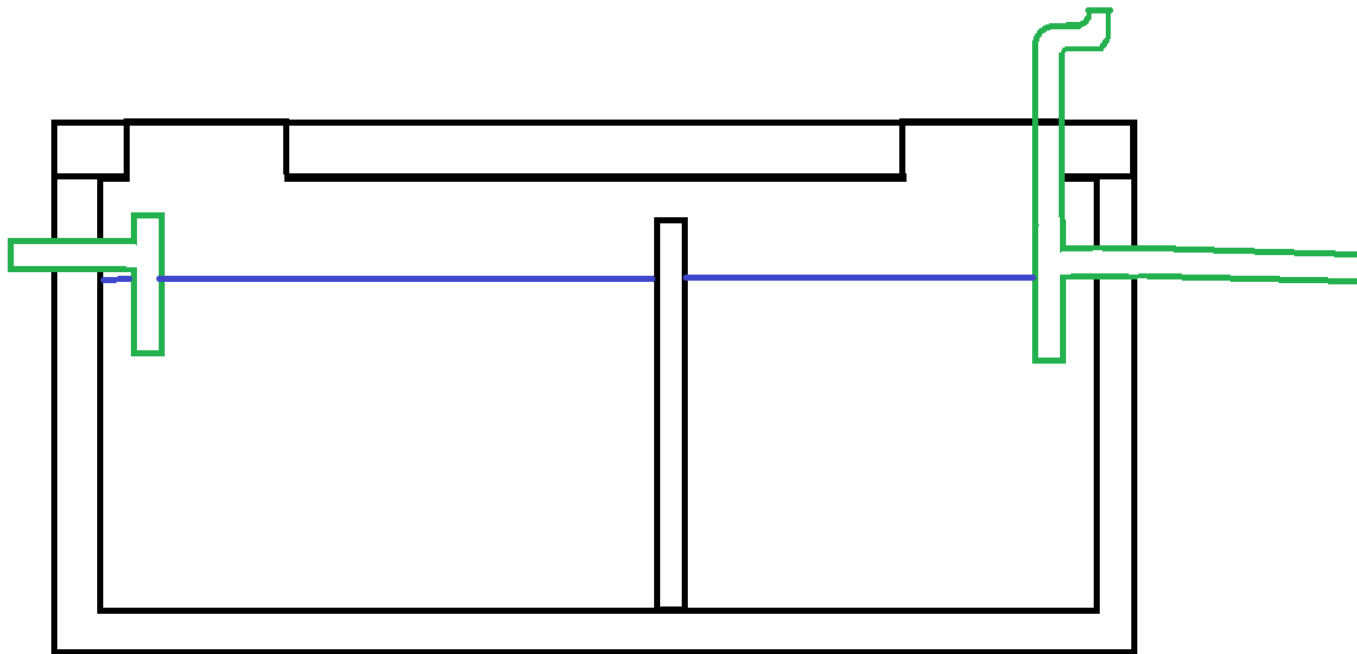
## Inside the Tank



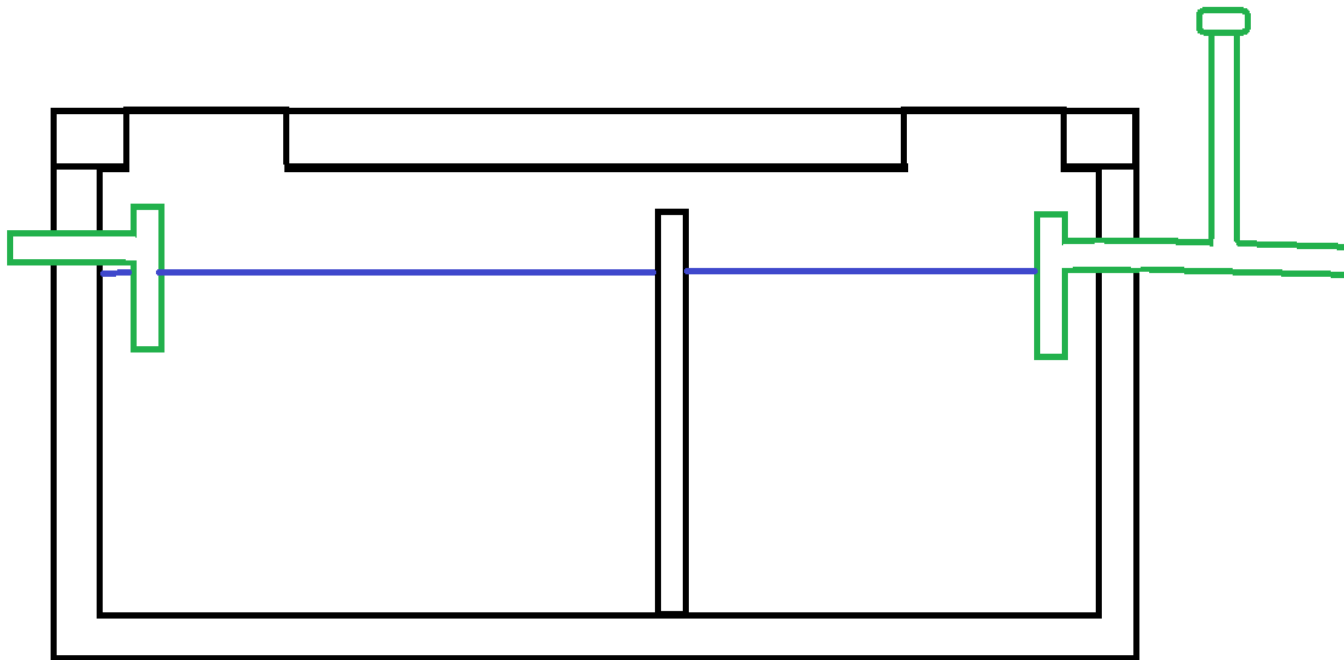
## Inside the Tank



## Inside the Tank



## Inside the Tank



## Summary



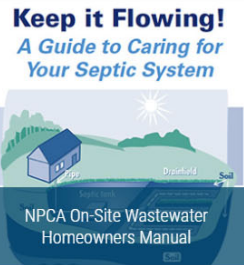




- Proper design is essential for tank functionality and durability
- Concrete strong in compression
- Reinforcing strong in tension
- Reinforced concrete has significantly higher capacities
- Anticipate all loading scenarios in design
- Use NPCA as a resource!!!

# Best Practices Manual



# Additional Information & Resources

## PRECAST.ORG

 <p><b>BEST PRACTICES MANUAL</b></p> <p>On-Site Wastewater Tank Best Practices Manual</p>	 <p><b>PRECAST CONCRETE ON-SITE WASTEWATER TANKS</b></p> <p><b>GUARDING THE GROUNDWATER</b></p> <p>On-Site Wastewater Tank Brochure</p>	<p>Precast Concrete Septic Tanks</p> <p>Rock Solid Tanks, Rock Solid Treatment</p> <p>On-Site Wastewater Tank Presentation</p>	 <p><b>Keep it Flowing!</b> <i>A Guide to Caring for Your Septic System</i></p> <p>NPCA On-Site Wastewater Homeowners Manual</p>	 <p>On-Site Wastewater Optional Ballot</p>
 <p><b>INSIGHTS FOR INSTALLERS</b></p> <p><b>The Precast Advantage</b></p> <p>On-Site Wastewater Installer Ad Campaign</p>	 <p>On-Site Wastewater Tank Standards</p>	 <p>Search Septic Tank Products</p>		



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## Questions?

- If you have any questions about this presentation or anything about precast concrete onsite wastewater structures, please contact:

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NPCA

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Web: [www.precast.org](http://www.precast.org)

THANK YOU!



# How the Products We Use Can Impact Septic Systems and Local Ecology

**Onsite Wastewater Super Conference of Pennsylvania 2024**

Monday February 5<sup>th</sup>, 2024



Claude Goguen, PE, National Precast Concrete Association

