
endura
GREASE MANAGEMENT
The Importance of Grease Interceptor Maintenance

Agenda

- The chemistry of FOG
- The function of GIs
- Sizing for grease capacity
- Maintenance frequency
- Proper cleaning procedures

The Chemistry Of FOG

- What happens when Fats, Oils and Grease (FOG) and degrading food solids spend too long in a Grease Interceptor (GI)?
- The results can be harmful to human, environmental and material health.
- Understanding the chemistry of FOG can help us make informed choices on:
  - GI material of construction
  - Maintenance intervals
  - Infrastructure design and construction

How Long Is *Too* Long?

- Most local plumbing codes will enforce a 90 day maximum period between pump-outs (or 25% accumulation of FOG and solids, which ever comes first).
  - Given the facts we know about acidity and the damage it can cause to a material, 90 days is likely too long between cleanings.
- Multiple reports* have found that the pH of the contents of a GI at the 30 day mark can be as low, or lower than 3.
  - Acidic enough to seriously damage not only the interceptor, but the downstream pipes and sewer lines as well.

* “Grease Interceptor Facts and Myths”. Wiess, M. Plumbing Systems & Design . Nov. 2007. Accessed Oct. 2018. and “Assessment of Grease Interceptor Performance: Supplemental Report to 03-CTS-16T”. Ducoste, J. J., Keener, K. M., Groninger, J. W. and Holt L. M. The Water Environment Research Foundation. 2008. Accessed Oct. 2018

The Chemistry of FOG – the FOG molecule

- FOG enters the kitchen drains as a byproduct of preparing and serving food, but mostly from cleaning.

The FOG molecules are in the form of triglycerides (pictured). These molecules have a glycerol backbone with three (hence “tri”) fatty acid chains attached.

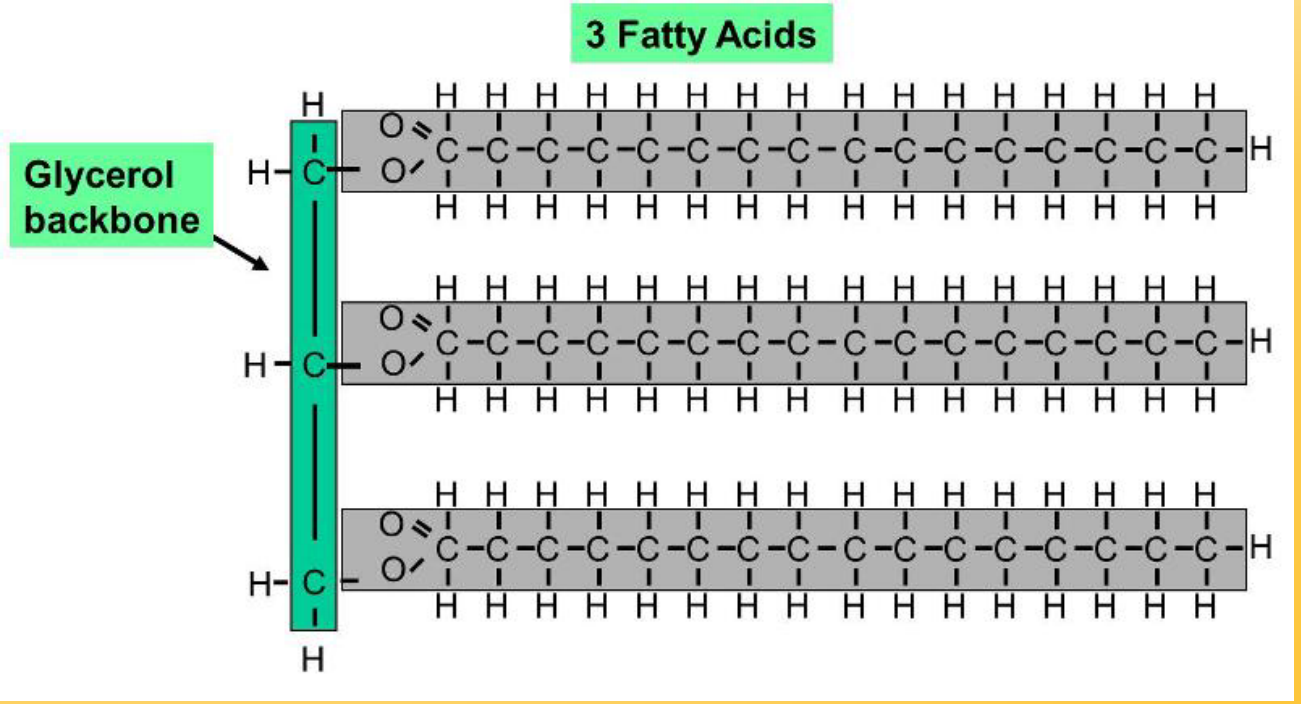


Image: Created by Wayne W. LaMorte, MD, PhD, MPH, Boston University. Copyright 2016.
http://sphweb.bumc.bu.edu/otlt/MPH-Modules/PH/PH709_BasicCellBiology/PH709_BasicCellBIology4.html

The Chemistry of FOG – The Acid Environment

- Hydrolysis happens immediately
  - This reaction breaks the bonds between glycerol and the fatty acids producing a free glycerol and 3 free fatty acids (FFA).

Partial disassociation of the hydrogen molecule from the Carboxyl group on each fatty acid produces a free hydrogen ion (H+).

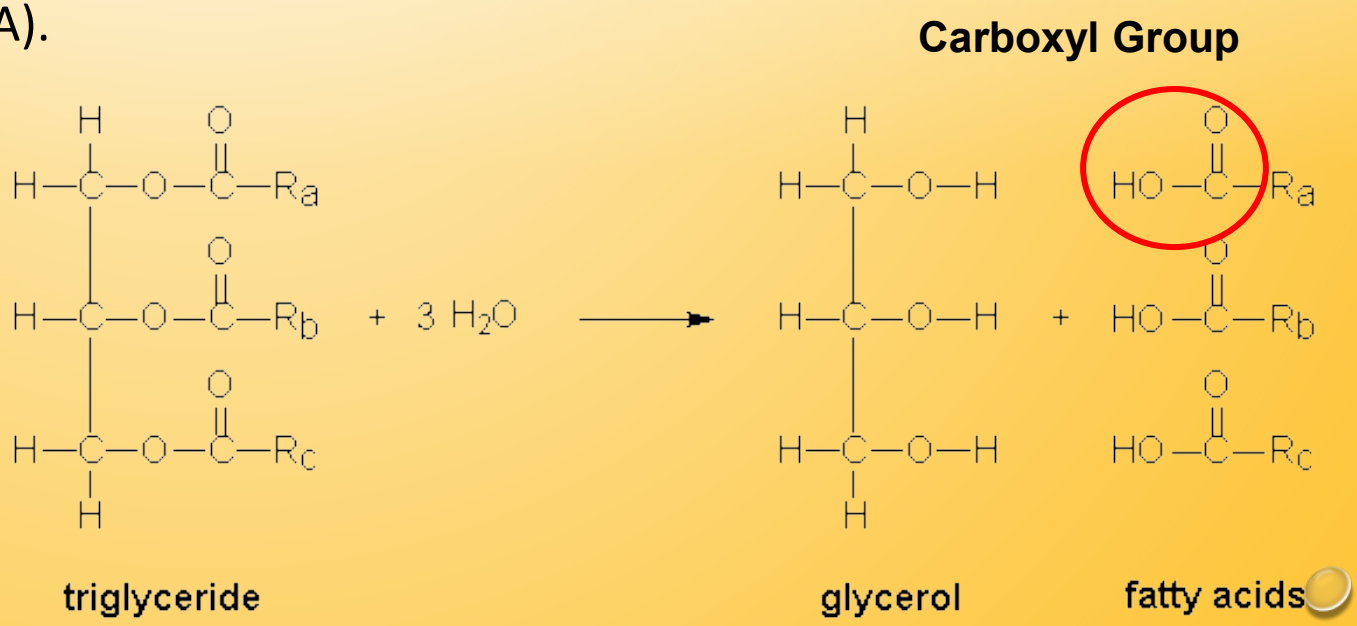
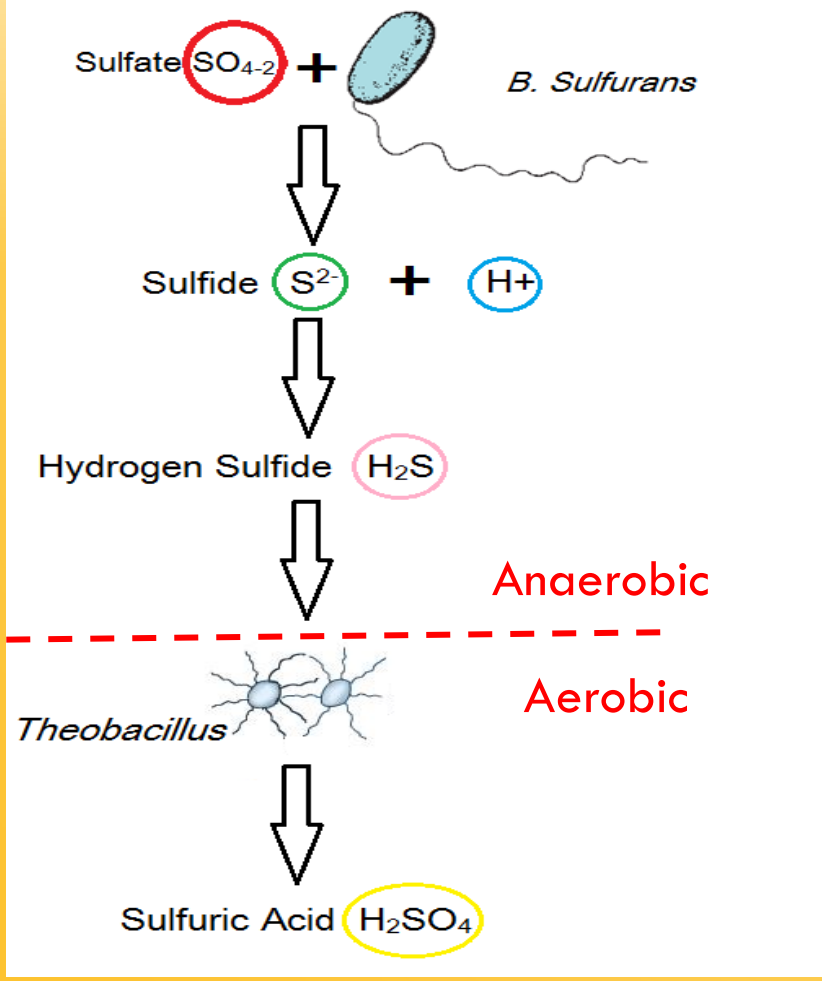


Image: Composition of Palm Oil. Wordpress. January 25, 2014. https://oilpalmblog.wordpress.com/2014/01/25/1-composition-of-palm-oil/

The Chemistry of FOG - Creation of Sulfuric Acid (the *BAD Stuff!*)



- Many microorganisms exist in the wastewater and food particles that also contribute to the acidic environment.
- *Bacillus Sulfurans* is an anaerobic (does not need oxygen to survive) microbe commonly found in GIs.
- *Thiobacillus* is an aerobic (requires oxygen) microbe that converts hydrogen sulfide into sulfuric acid (H_2SO_4).
- Sulfuric acid is highly corrosive and contributes to an overall lower pH of solution.

Corrosion…*more BAD Stuff!*

- Microbial Induced Concrete Corrosion (MICC) refers to the *B. Sulfurans – Thiobacillus* reaction that creates Sulfuric acid (H_2SO_4) which will corrode porous materials such as concrete (as well as metals, to some extent).

Longevity of Materials

Due to the acidic environment inside a GI, the following life expectancies have been sited for various materials:

	Metal	Plastic	Fiberglass	Concrete
Average Life Expectancy	5-7 years	Lifetime	Lifetime	4-10 Years (epoxy coating will increase this)

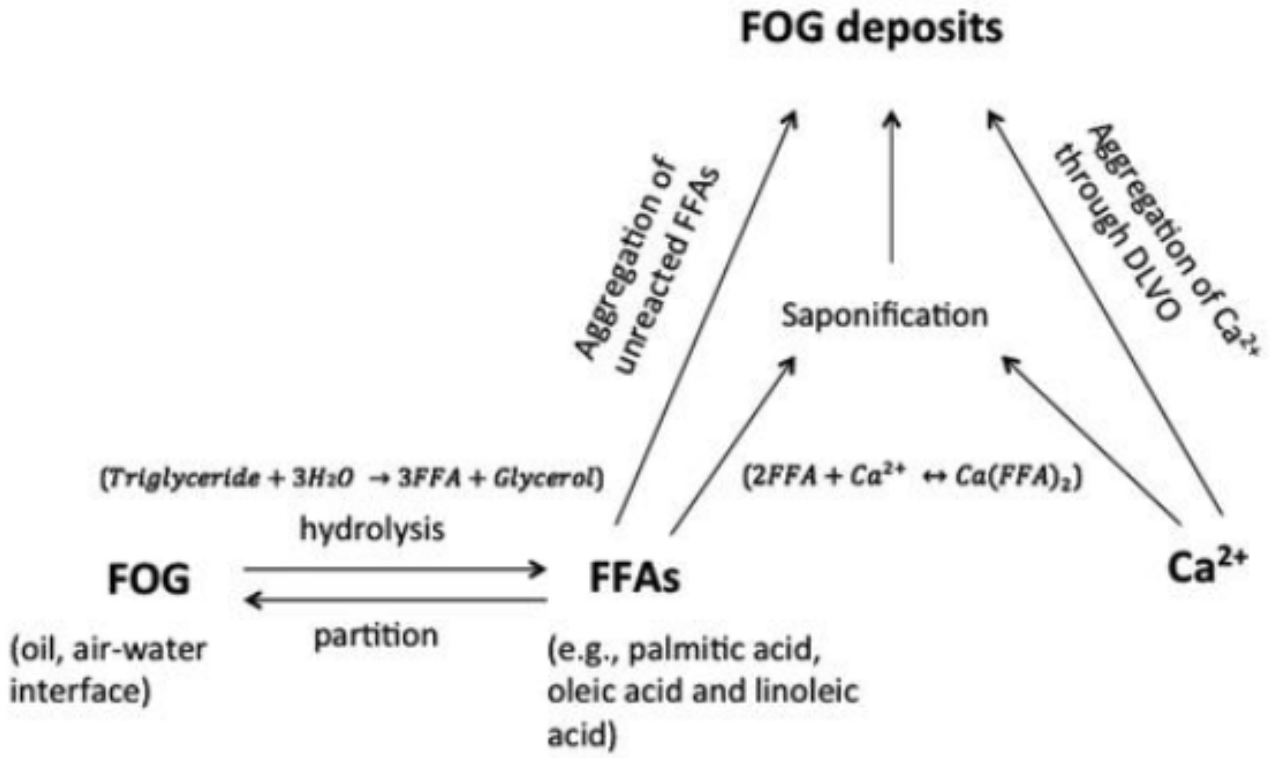
Factors such as cleaning intervals, maintenance practices and preventative strategies can all affect the life expectancy of the unit. However, there is simply no denying that eventually, a porous material will corrode to the point that it will need to be replaced.

How Long is *Too* Long?

"A critical review of fat, oil, and grease (FOG) in sewer collection systems: Challenges and control". He, X., de los Reyes III, F. L. and Ducoste, J. J. Critical Reviews in Environmental Science and Technology. Volume 47:13. 2017. Accessed Oct 2018.

- Very acidic water can damage the GI as well as downstream infrastructure.
- Reports have suggested that it is specifically the components of concrete (calcium, sulfur, iron) that contribute to FOG deposits in the sewer system.
- Calcium was found to be an integral component to FOG deposits
  - Saponification: the reaction between an acid and a base to form a salt.
- The salts created in the lab were very similar to those taken from sewers.
- Further, these salts were found to be highly resilient

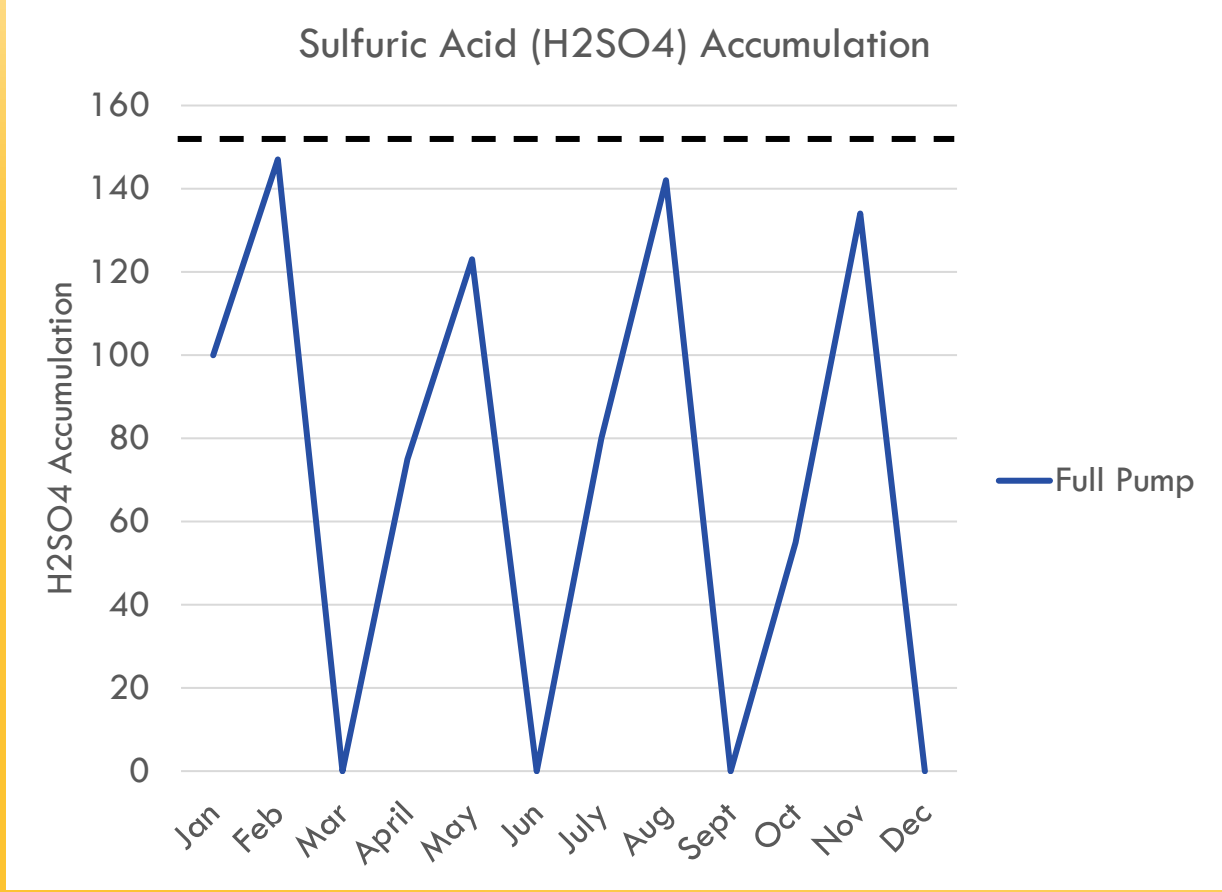
Figure 2. General understanding of FOG deposit formation in sewer pipelines (adapted from He et al., 2013 He, X., de los Reyes, F. L., Leming, M. L., Dean, L. O., Lappi, S. E., and Ducoste, J. J. (2013). Mechanisms of fat, oil and grease (FOG) deposit formation in sewer lines. Water Res., 47, 4451–4459).

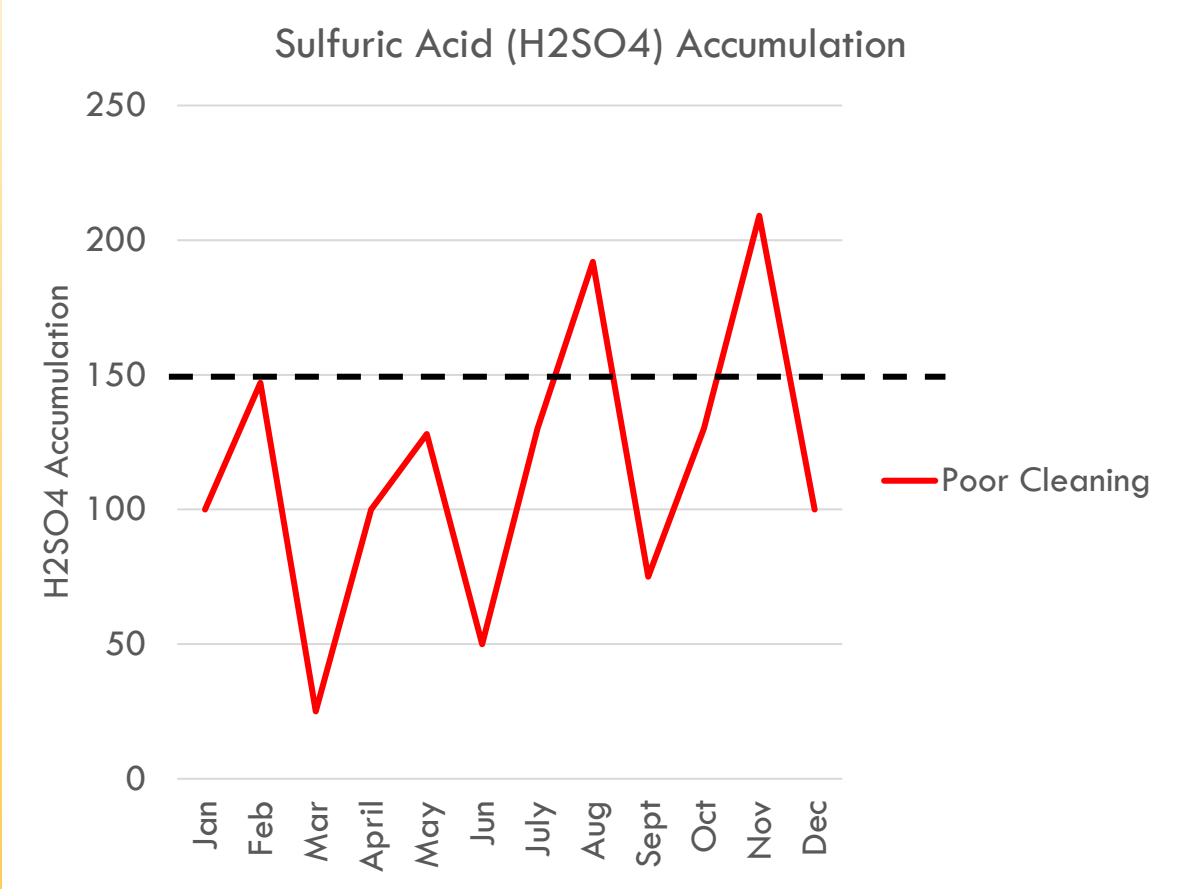


How Long is *Too* Long?

- Even if a cleaning interval does not exceed 30 days (recommended), the *quality* of the cleaning job will also affect the life expectancy of the GI.
- If the cleaning job is not done sufficiently and debris are left in the tank, they can accelerate the drop in pH of solution and the decay of the interceptor walls.
- Further, any remaining food solids or FOG remnants will increase the odor in the interceptor as sulfur content increases.

How Long is *Too* Long?

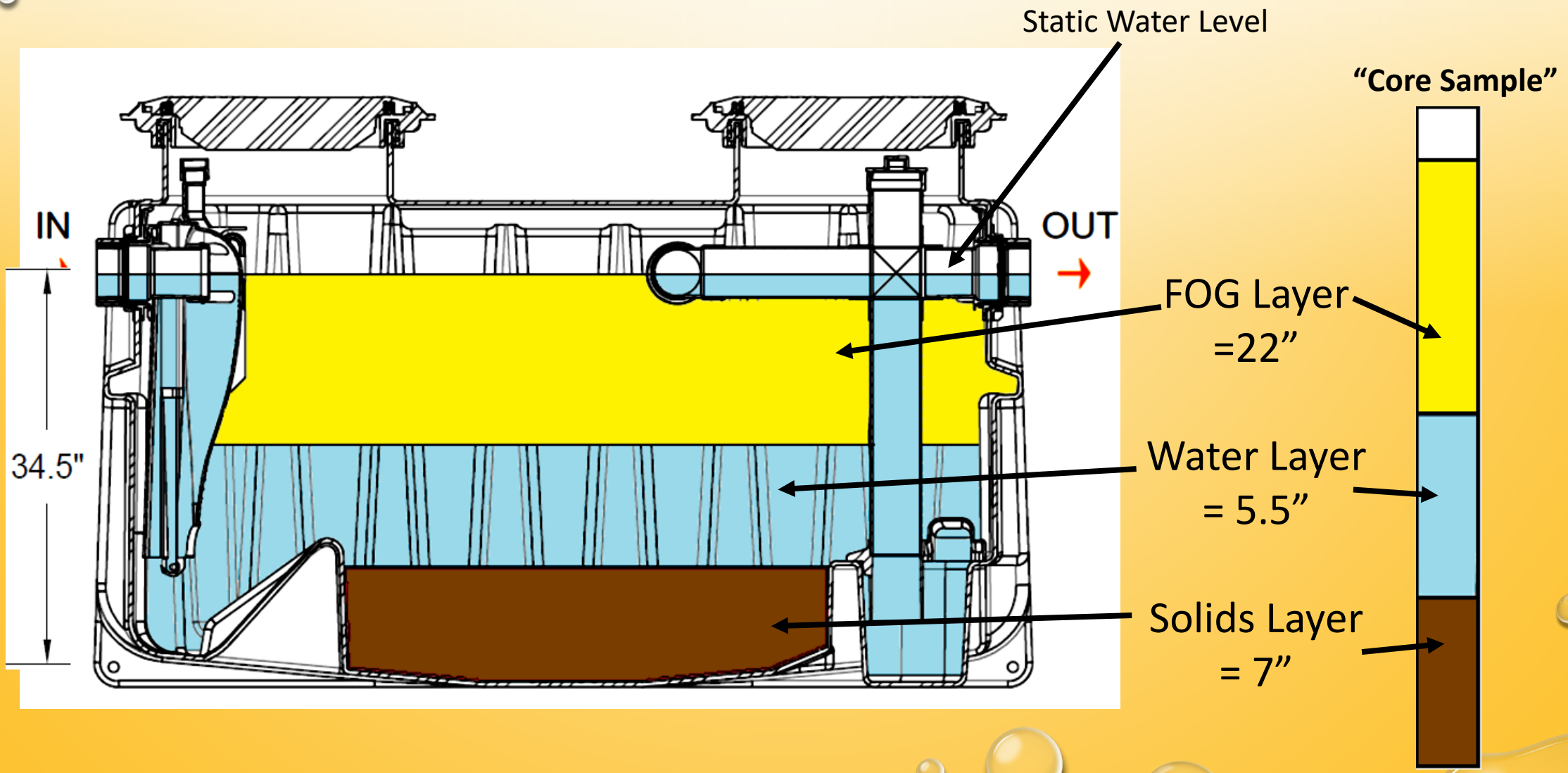




Grease Interceptor Sampling

- 2 types: cross section sampling and effluent sampling
- A cross-section sample or a “core” sample is obtained directly at the GI.
  - Can determine the percent of the tank’s volume that is occupied by FOG and/or solids.
  - Immediate feedback
  - Less accurate of the GI’s actual performance.

Example:

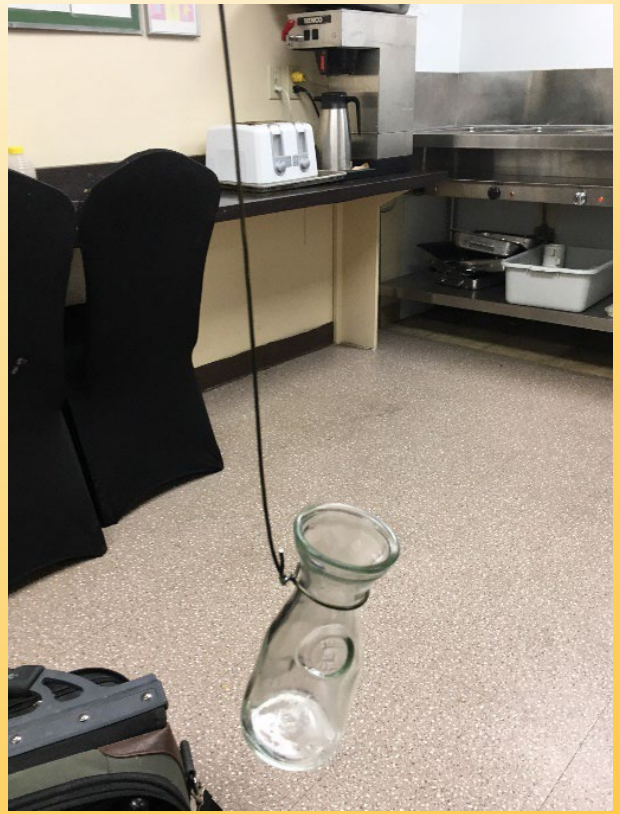

Static Water Level
IN
OUT
34.5"
FOG Layer
=22”
Water Layer
= 5.5”
Solids Layer
= 7”
“Core Sample”

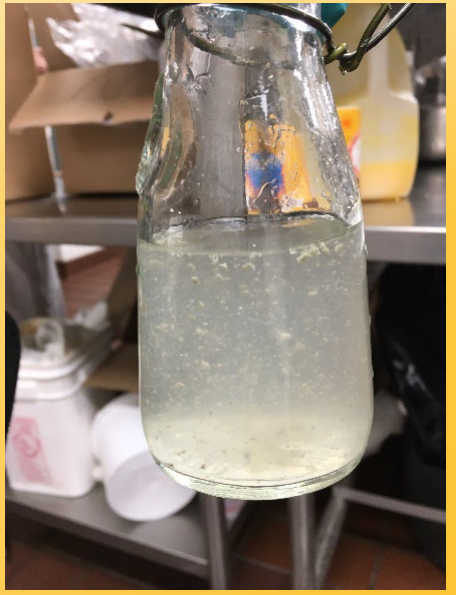
Grease capacity Sampling

Model	*7*	*10*	*15*	*20*	*25XT*	*25 Lo*	*35*	*50*	*XL75*	*XL100*
Total Liquid Depth (Static Water Line) (in)	11.8	11.8	11.8	11.8	10.5	6	11	17	27	32.5
Total Liquid Capacity (Static Water Line) (USG)	12.96	12.96	21.6	21.6	30.6 (2”) 29.5 (3”)	18.9	39.4	52.0	153	257
Max FOG capacity (lbs)	31.95	38.07	35.14	76.4	72.55 (2”) 73.01 (3”)	62.59	138.5	122.07	559	1058
Max FOG capacity (USG)	4.43	5.28	4.88	10.61	10.08 (2”) 10.14 (3”)	8.69	19.24	16.95	77.64	146.94
Max Grease Capacity (%)	34.2%	40.7%	22.6%	49.1%	32.9% (2”) 34.4% (3”)	46%	48.9%	32.6%	49.2%	57.2%
Max FOG Layer Thickness (in)	5	7	3	5	5	3	5	6	16	22
Max Solids Depth (in)	1	1	1	1	1.5	0.5	1.5	1.5	7	7

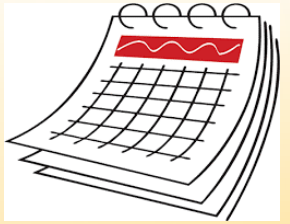
Grease Interceptor Sampling

- Effluent sampling is done downstream of the GI
  - Water samples are taken and sent to a lab to be analyzed
  - Can take several days
  - Very accurate. Allows for customization on cleaning frequency (beyond 25%)





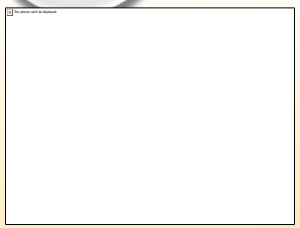
When to Clean



- There is no “one-size-fits-all” solution for determining GI.
- In most jurisdictions, Local codes/ordinances will mandate pump out frequencies, or give guidelines as to when GIs must be maintained.
  - May range from 90 days to 30 days.
  - These codes may also reference something called the “25% rule”.
- The ASME A112.14.3 test calculates maximum grease capacity for HGIs which is often in excess of 25% (often in excess of 50%) of their volume.
- Always check with local codes for cleaning requirements.

Two Step Sizing Method for HGIs

ASPE Plumbing Engineer Design Handbook, Volume 4 Ch. 8 Table 8-3



- Applies to HGIs tested to Max. Grease Capacity defined by ASME A112.14.3.
- Identifies generic types of FSE & suggests average grease discharge per meal – Types A-D
- Two uses:
  1. “two step sizing” to aid in choosing between two interceptors of the same flow rate (but different Grease Capacities)
  2. Number of operational days before max. Grease capacity is reached and maintenance required.

What to Clean

- Smaller, Point of Use (POU) interceptors can be cleaned by Food Service Establishment (FSE) employees .
  - A third party hauler can also be used.
- Extended capacity HGIs (>50GPM) and GGIs require a third party hauler due to their increased volume.
- Both require frequent, consistent maintenance. Most jurisdictions require cleaning records to be kept on site at the FSE.
- All internal components should be removed and cleaned then replaced.
- Clean outs and flow controls should be inspected and cleaned if needed.

Planning Ahead

- When designing a kitchen, consider the long-term needs of the FSE
- Accessibility to the GI is essential for maintenance and sampling

Remember the FCD:

No flow control

Image courtesy of the City of London, ON

Prevention

1. Properly sized interceptor
2. Estimated cleaning frequency to be validated by sampling/monitoring
3. Location, Location, Location!
4. Frequent and thorough maintenance – keep records!
5. Education and awareness

What to Watch for:

Old, rotted out interceptors

Images courtesy of the City of London, ON

Summary

- FOG hydrolysis and Microbial generation of H_2SO_4 drop pH inside the GI.
- Corrosion of porous materials used to make GIs contributes to FOG blockages.
- Frequent and proper cleaning is necessary.
- Sampling at the GI or just after can indicate GI performance.
- Sizing for flow rate and grease production of a facility can provide an estimated cleaning frequency.
- Where we put the interceptor in the kitchen is an important consideration.

This concludes today's session

Travis Hardy. MDS

Market Development Specialist

C: 803-747-6333

E:travis.hardy@ipexamerica.com