The Importance of Grease Interceptor Maintenance
Agenda

• The chemistry of GIs and FOG
• 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.

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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.
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+).

![Chemical structures showing hydrolysis reaction](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)
- *Thiobacillus* is an aerobic (requires oxygen)
  - microbe that breaks down hydrogen sulfide into sulfuric acid ($\text{H}_2\text{SO}_4$).
- 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$_2$SO$_4$) 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:

<table>
<thead>
<tr>
<th>Material</th>
<th>Average Life Expectancy</th>
<th>Plastic</th>
<th>Fiberglass</th>
<th>Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>5-7 years</td>
<td>Lifetime</td>
<td>Lifetime</td>
<td>4-10 Years (epoxy coating will increase this)</td>
</tr>
<tr>
<td>Plastic</td>
<td>Lifetime</td>
<td></td>
<td>Lifetime</td>
<td></td>
</tr>
<tr>
<td>Fiberglass</td>
<td>Lifetime</td>
<td></td>
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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?


- 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
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?

**Sulfuric Acid (H2SO4) Accumulation**

- **Full Pump**
  - Jan: 160
  - Feb: 120
  - Mar: 100
  - Apr: 140
  - May: 200
  - Jun: 160
  - Jul: 120
  - Aug: 100
  - Sep: 140
  - Oct: 200
  - Nov: 160
  - Dec: 120

- **Poor Cleaning**
  - Jan: 150
  - Feb: 100
  - Mar: 140
  - Apr: 200
  - May: 150
  - Jun: 100
  - Jul: 140
  - Aug: 200
  - Sep: 150
  - Oct: 100
  - Nov: 140
  - Dec: 200
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 HGIIs 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 HGI

Applies to HGI 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.
1. Sizing

<table>
<thead>
<tr>
<th>Restaurant Type</th>
<th>Grease Production Values</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low grease producer</td>
<td>0.005 lbs (2.268 g)/meal (no flatware)</td>
<td>Elementary cafeteria, grocery meat department, hotel breakfast bar, sub shop, sushi, take-and-bake pizza</td>
</tr>
<tr>
<td></td>
<td>0.0065 lbs (2.948 g)/meal (with flatware)</td>
<td></td>
</tr>
<tr>
<td>Medium grease producer</td>
<td>0.025 lbs (11.340 g)/meal (no flatware)</td>
<td>Coffee shop, convenience store, deli, Greek, Indian, Japanese, Korean, Thai, Vietnamese</td>
</tr>
<tr>
<td></td>
<td>0.0325 lbs (14.742 g)/meal (with flatware)</td>
<td></td>
</tr>
<tr>
<td>High grease producer</td>
<td>0.035 lbs (15.876 g)/meal (no flatware)</td>
<td>Full-fare family, fast-food hamburger, fast-food grill, German, Italian, fast-food Mexican</td>
</tr>
<tr>
<td></td>
<td>0.0455 lbs (20.638 g)/meal (with flatware)</td>
<td></td>
</tr>
<tr>
<td>Very high grease producer</td>
<td>0.058 lbs (26.308 g)/meal (no flatware)</td>
<td>Full-fare BBQ, fast-food fried chicken, fast-food Mexican, steak and seafood, Chinese, Hawaiian</td>
</tr>
<tr>
<td></td>
<td>0.075 lbs (34.019 g)/meal (with flatware)</td>
<td></td>
</tr>
</tbody>
</table>

Meals Per Day: 500

Grease (lbs) Per Meal: 0.0325lbs

Pump Out Frequency: 30 days

Grease Capacity Required: 487.5lbs
### 2. Estimated Maintenance Schedule

**Max. Grease Capacity:** 559 lbs

**Meals Per Day:** 500

**Grease (lbs) Per Meal:** 0.0325 lbs

**Pump Out Frequency:** 34.4 days

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<td>0.005 lbs (2.258 g)/meal (no flatware)</td>
<td>Elementary cafeteria, grocery meat department, hotel breakfast bar, sub shop, sushi, take-and-bake pizza</td>
</tr>
<tr>
<td></td>
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<td>Cafe, coffee shop, convenience store, grocery deli, Greek, Indian, Japanese, Korean, Thai, Vietnamese</td>
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# Brown Grease Supply Study

Kennedy/Jenks Consultants

## Table 2: Target FSEs for FOG Sampling

<table>
<thead>
<tr>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky Fried Chicken (West on 185th)</td>
<td>Jack In The Box</td>
<td>Vietnamese (Nyberg Road)</td>
<td>Thrifty: Meat Department (Cornell)</td>
</tr>
<tr>
<td>Pastini</td>
<td>Red Robin</td>
<td>Gloria’s Café (Hillsboro)</td>
<td>Forest Grove School</td>
</tr>
<tr>
<td>Muchas Gracias</td>
<td>Baja Fresh</td>
<td>Jennings McLaw</td>
<td>Papa Murphy</td>
</tr>
<tr>
<td>Famous Daves</td>
<td>McDonalds</td>
<td>Dutch Bros (Cornelius)</td>
<td>Starbucks (Walker and 154th)</td>
</tr>
<tr>
<td>Hawaiian Time</td>
<td>iHop</td>
<td>McMenamins (Grant Lodge)</td>
<td>Subway (TV Highway)</td>
</tr>
<tr>
<td>Popeyes</td>
<td>Bambuza</td>
<td>Raccoon Lodge</td>
<td></td>
</tr>
<tr>
<td>Claim Jumper</td>
<td>Thrifty - Deli and Bakery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PF Chang</td>
<td>Romano's Macaroni Grill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outback Steakhouse</td>
<td>Ruby Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providence St. Vincent's Hospital</td>
<td>Gustav's Bar and Grill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffalo Wild Wings</td>
<td>Red Lobster</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panda Express</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.
How to Clean

• Remove lid
  • Inspect gaskets and latches
• Scoop off the surface grease layer
  • Can be done with a large spoon, bucket or other container
  • Deposit grease into a garbage bag or bucket
• Remove baffles and other components for cleaning
  • Ensure you remember (or take a picture) of how these parts are installed.
• Remove remaining contents (grease, solids and water)
  • A shop vac is often used to remove the water & solids
  • The contents should be placed in a garbage bag or bin for disposal.
If you don’t properly maintain a GI, it could look like this!
How to Clean

- Clean internal components (including baffles).
  - Power wash or rinse away debris.
  - **DO NOT USE SOAP OR ENZYMES ON THE INTERIOR OF THE GI.**
- Inspect tank, components and flow control device
- Replace all internal components in their original position.
- Fill tank with water. Replace lid.
- Add kitty litter/absorbent material to the garbage bag with the disposed grease.
How to Clean – GGI’s or Ext. Cap. HGI

1: Remove Lids
   - Visually check seals and cover.
   - If bolts come out of the lid, put them in a safe place!

2: Remove solids from the bottom of the tank.

3: Remove grease layer from surface of tank.

4: Remove any remaining water from the tank.

5: Clean down sides of the tank and internal components.

6: Visually Inspect tank and components

7: Fill tank with water

8: Replace lids and hardware (if necessary)
Cleaning records

- FSEs must maintain records of when they have their GIs cleaned; whether this is done by a hauler, or by an employee.
- Records will be examined during inspection to ensure that proper cleaning intervals are being upheld.
- Most codes will dictate the amount of time an FSE is required to keep these records though it is typically around 2-5 years.

Image courtesy of the City of London, ON
What to Watch for:

Old, rotted out interceptors

Images courtesy of the City of London, ON
What to Watch for:

No flow control
What to Watch for:

Smaller GI installed inside proper size

Bypass pipe through GI

Images courtesy of the City of London, ON
Summary

• FOG hydrolysis and Microbial generation of $\text{H}_2\text{SO}_4$ 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.
This concludes today’s session

Faith Winter  
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