WSA's FOG Source Control Guide

Understanding the Fixtures Impacted by FOG, Effective Pretreatment, and Kitchen Best Management Practices (BMP)

March 2021

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Executive Summary

Effective control of fats, oils and grease (FOG) discharges from food service establishments (FSE) begins with a thorough understanding of how FOG is discharged from commercial kitchens. A careful consideration of the fixtures that are impacted by FOG, the most effective means of capturing the FOG that is discharged by those fixtures, and how kitchen best management practices (BMP) can reduce FOG discharges will help any wastewater authority improve their pretreatment program outcomes.

Background

Western States Alliance (WSA) is a project of the Pollution Prevention Resource Center (PPRC). PPRC received a grant from the United States Department of Agriculture (USDA) to provide training and educational resources on control and management strategies for FOG Discharges. The communities that are specifically targeted include eligible small, rural, economically-disadvantaged communities (including tribes) throughout the entire United States. This guide was developed by IW Consulting Service, LLC (https://interceptorwhisperer.com) on behalf of WSA.

Purpose

This guide discusses the fixtures that are impacted by FOG on a daily basis in commercial kitchen preparation and cleanup operations. Wastewater authorities must understand the source control problems that develop from reliance on inadequate plumbing code requirements regarding which fixtures should be connected to and discharge through a pretreatment device, i.e., grease interceptor. Further, for effective pretreatment, wastewater authorities need a clear understanding of how to properly size and select grease interceptors to ensure that there is adequate FOG storage capacity onsite and that these devices are maintained properly. Finally, wastewater authorities need to understand the benefits and limitations of requiring kitchen BMPs to reduce FOG discharges through connected fixtures and to reduce the impacts of FOG on collection and treatment systems.

This guide will review the following:

1. Which kitchen fixtures are impacted by FOG
2. Effective pretreatment of kitchen wastewater
3. Kitchen best management practices

1. Which Kitchen Fixtures are Impacted by FOG

The model plumbing codes such as the Uniform Plumbing Code (UPC), International Plumbing Code (IPC), National Standard Plumbing Code (NSPC) and the National Plumbing Code of Canada (NPCC) requirements regarding the fixtures that should be connected to a grease interceptor are somewhat vague. This can and has led to code compliant installations that don’t adequately protect wastewater collection systems from FOG discharges. For example, the UPC says the following in section 1014.1:

> “Where it is determined by the Authority Having Jurisdiction that waste pretreatment is required, an approved type of grease interceptor…shall be installed…to receive the drainage from fixtures or equipment that produce grease-laden waste located in areas of establishments where grease is introduced into the drainage or sewage system in quantities that can effect line stoppage or hinder sewage treatment or private sewage disposal systems.”

Which of the following fixtures produce grease in quantities that can affect line stoppage?

Figure 1: Code Compliant Fixture Connections

Most people probably agree that the three-compartment sink qualifies as necessary to connect to a grease interceptor, but what about the rest? A lot of people think of floor sinks for condensate drains are not impacted by FOG. Mop sinks are frequently not connected to a grease interceptor either. What about drains from Wok ranges? Or what about hand wash sinks? Plenty of examples from the field of hand sinks being used for thawing frozen food or for draining and rinsing sauce bottles.

What happens to greasy spills on the floor? These are typically handled by filling the mop bucket with straight hot water and dumping it on the spill area. Then employing a floor squeegee and shove all that greasy hot water into the nearest floor drain, floor sink or trench drain. Then a mop is used to finish cleaning up the area. Afterwards the mop is wrong out into the mop bucket, which is then dumped into the mop sink. These kinds of spills are normal for commercial kitchen operations.

Plumbing codes assume that fixtures will be used only as intended by designers or specifiers, but we don’t live in a perfect world and fixtures get used in a lot of ways not intended. The point is, that ***all fixtures in a commercial kitchen are impacted by FOG*** and should be connected to a grease interceptor to ensure that the kitchen is not discharging FOG to the wastewater collection system.

Food Waste Disposers

What about food waste disposers (FWD)? These are typically installed under pre-rinse sinks that sit upstream of a dishwashing machine. The UPC, IPC and NPCC all prohibit FWDs and dishwashers from discharging to a grease interceptor. There are a couple of problems with that strategy.

First, there is a LOT of FOG in food waste that is being routed directly to the sanitary sewer system when not connected to a grease interceptor. The New York City Department of Environmental Protection (NYCDEP) published a study titled, *Commercial Food Waste Disposal Study,* in 2008. The purpose of the study was to evaluate "the costs and benefits of allowing the use of commercial food waste disposers in New York City."

The study concluded that the costs and risks associated with allowing the use of commercial FWDs in New York was not sustainable for a variety of reasons including:

> "While it is illegal to discharge fats, oil, and grease (FOG) into the sewer system, FOG is still a cause of sewer backups. Due to the high fat content of food waste, use of FWDs would discharge substantial amounts of FOG to the sewer system, which could lead to more sewer backups and maintenance needs."

The fat content of the food was assessed from 172 samples taken from colleges and universities, medical facilities, retail food establishments (supermarkets), restaurants and hotels, as well as other FSEs such as caterers, shelters, non-public schools and senior centers. The samples were sent to City College of New York where they were subjected to FWD grinding and then analyzed for chemical composition (Table 1).

Category	No. of Samples	1664 Oil and Grease (g/kg food waste)
Colleges and Universities	15	14.83
Medical Facilities	32	1.03
Retail Food Establishments (supermarkets)	29	6.16
Restaurants and hotels	61	18.59
Other FSEs (caterers, shelters, non-public schools, and senior centers)	35	18.21

Table 1: NYDEP Table of FOG Concentrations from FWDs in g/kg

The original study reported the FOG in grams per kilogram (g/kg) but that's not how FOG concentrations are normally reported or evaluated. Proponents of FWDs have used the lower g/kg numbers to argue that there is more FOG in human feces than in FWD discharges. However, when you convert the numbers to milligrams per liter (mg/L) we observe a very different result in Table 2. To put these numbers into perspective, consider that many pretreatment programs around the country allow a maximum FOG concentration discharge of somewhere between 100 mg/L on the low end up to 400 mg/L on the high end. The FOG concentration discharges recorded from these samples are extremely high, supporting the NYCDEPs conclusion in the study that food waste from FSEs does in fact have a "high fat content".

Category	No. of Samples	1664 Oil and Grease (mg/L food waste)
Colleges and Universities	15	14830
Medical Facilities	32	1030
Retail Food Establishments (supermarkets)	29	6160
Restaurants and hotels	61	18590
Other FSEs (caterers, shelters, non-public schools, and senior centers)	35	18210

Table 2: NYDEP Table of FOG Concentrations from FWDs in ml/L

A recent case study at a secondary private school in the New England area confirmed the issue with FWDs. The main dining hall consisted of two upper floors each with different buffets and full kitchen cleanup operations, and a basement with all of the main cooking and cleanup equipment. All of the fixtures in the facility were routed to a 75 GPM automatic grease removal device (GRD) in a basement storage room. The GRD didn't seem to be receiving much in the way of FOG from the fixtures connected to it. It was discovered that there was a SOMAT system that was not connected to the GRD.

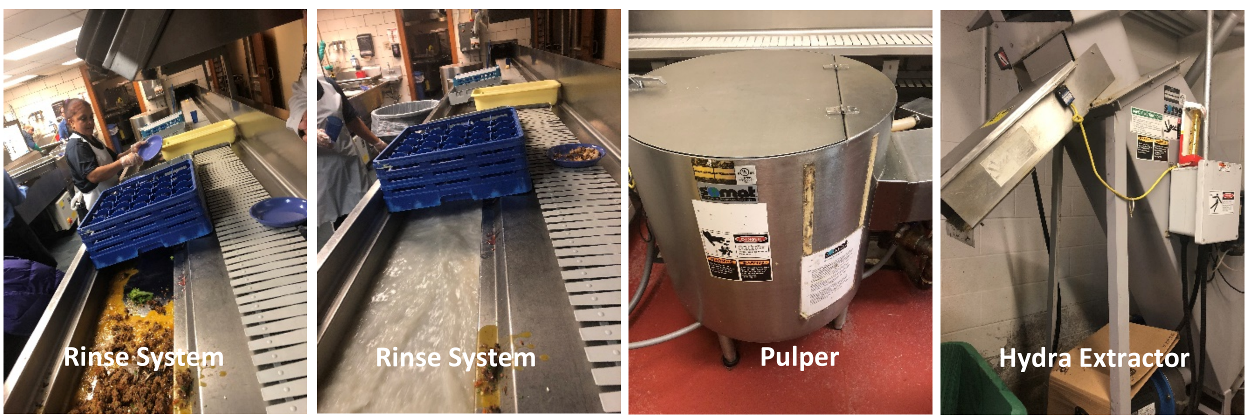

Figure 2: Somat Food Waste Disposal and Composting System

The SOMAT system (Figure 2) consists of a closed loop wastewater rinse system that flows through an open trough (left two pictures) in the upper kitchens. Staff rinse all dishware from cleanup operations in the trough and run them through dishwasher machines. The trough carries the food and FOG into a pulper (center right picture) that grinds the food up and mixes it into a slurry. It gets pumped down to the basement into a Hydra Extractor (far right picture). The extractor dewaters the food debris and discharges it into an external waste bin. The wastewater extracted is recycled back into the closed loop rinse system. At the end of each meal shift, the closed loop system is emptied. Because the system is considered a food waste disposer and the jurisdiction is under the UPC, the closed loop system discharges directly to sanitary.

It was estimated that the food service operations at the school produced approximately 58,320 pounds of grease per year and was bypassing 82.2% of it to the wastewater collection system through the SOMAT FWD system (Figure 3). The city recently required the school to clean out three miles of sewer system piping downstream of the facility because of a severe buildup of FOG, costing the school thousands of dollars.

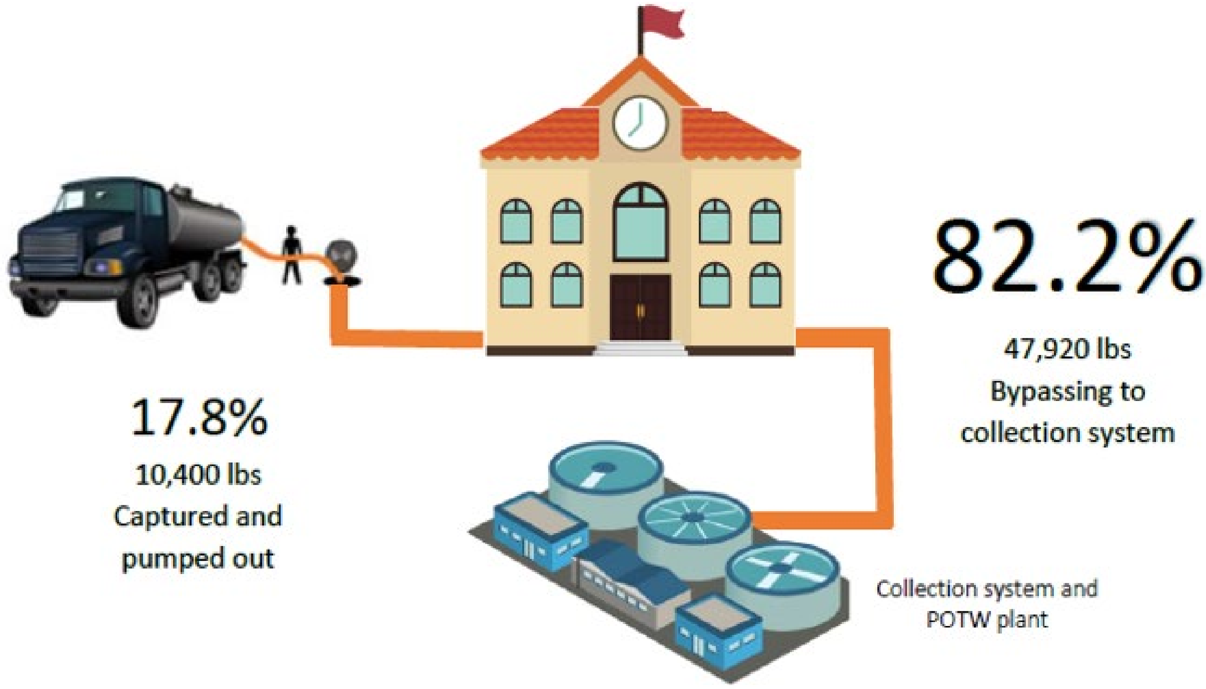

Figure 3: Illustration of FOG Capture and Bypass at School

A convention center in Bismarck North Dakota illustrates the problem even further. The left picture in Figure 4 shows the three-compartment sink and to the left under the shelf is an Endura hydromechanical grease interceptor (HGI). When opened, the unit proved to be clear of FOG buildup. The center picture in Figure 4 shows a pile of dirty plates, glassware, pots, pans, and so on in front of the prerinse sink. The last image shows a dishwasher downstream of the pre-rinse sink, which is where everything gets washed.

Figure 4: HGI Connected to Sinks, Pre-rinse Connected to Sanitary

Observation of the center picture shows food debris in the pre-rinse sink. What may not be obvious is that there used to be a food grinder under that sink. The normal operation was to rinse all food waste during cleanup operations into the pre-rinse sink where the FWD would magically make everything go away. Because the food grinder was connected to the pre-rinse sink, the sink was connected directly to the sanitary system in compliance with the plumbing code. When the facility removed the FWD, the cleanup operation didn't change.

Just as with the school in the previous example, this facility is discharging most of the FOG it produces directly to the sanitary system where it wreaks havoc on the wastewater collection system. This is why

FWDs should either be disallowed or be connected to a grease interceptor with a solids interceptor upstream to capture and separate the food debris to prevent it from clogging up the grease interceptor. When plumbing codes require these devices be routed directly to sanitary, they are unwittingly undermining pretreatment efforts and harming the system.

Dishwashers

Another fixture in a commercial kitchen which bears more careful consideration is the dishwasher. There is a lot of assumptions, confusion, and misunderstandings about whether a dishwasher should be connected to a grease interceptor. The answer is that it depends on the type of grease interceptor (see 2. Effective Pretreatment of Kitchen Wastewater).

First, there is a difference between different types of grease interceptors and how they work. Briefly, all grease interceptors rely on *gravity differential separation*. That's a term that simply refers to the difference in specific gravity or density between FOG and water. FOG is lighter than water and as such will ascend to the top when mixed together. This effect is enhanced by the fact that oil and water are immiscible liquids which naturally repel one another.

There are several factors that affect gravity-differential separation that bear review and at least at a rudimentary understanding. Those factors are:

- Size of bubble
- Specific Gravity
- Temperature
- Viscosity
- Velocity
- Emulsification

Size of Bubble

The larger the grease bubble, the faster its rise rate. Table 3 illustrates the importance of size. The table identifies:

- Three-inch vertical travel distance
- 68^0F temperature
- Specific gravity of 0.90
- Travel time for various droplet sizes in microns

At 300 microns, it takes a bubble 15 seconds to rise three inches. At 150 microns, half the size of the 300-micron bubble, it takes 1 minute and 3 seconds. At 50 microns, 1/3 the size of the 150-micron bubble, it takes 9 minutes and 18 seconds. That's NINE times longer at just 1/3 the size. This is why size matters when it comes to grease interceptors.

Travel Time for 3" Distance at 68° F (hr:min:sec)	
Droplet Diameter (microns)	**Oil (rise time) SG 0.90**
300	0:00:15
150	0:01:03
50	0:09:18
15	1:43:22

Table 3: Rise Rate bv Diameter

What size of grease bubble should be retained in an effective grease interceptor design? When you consider how much longer it takes as the diameter of the grease bubble gets smaller, it becomes necessary to select a lower limit in diameter that we should reasonably expect to be retained in a grease interceptor with a good design.

Dating back to the very first testing and rating protocol developed for the military in the early 1940's, it was decided that the lower limit for the diameter of a grease bubble should not be less than 150 microns. Anything larger will easily and rapidly separate and anything much smaller will take exponentially longer to separate. The length required for a grease interceptor to retain grease bubbles in the sub 150-micron range would be prohibitive to installation parameters (Figure 14).

Specific Gravity

Specific gravity is defined here as the ratio of the density of oil (fats or greases as well) to the density of water. Water has a specific gravity of one (1.0) at room temperature. Anything with a specific gravity of greater than one will sink in water and anything with a specific gravity of less than one will float in water. Table 4 provides a variety of oils and their specific gravity at 60^{0}F. Observe that the specific gravity of each of these oils is very close and, in fact, they are within less than 1% of each other. The lower the specific gravity the quicker the rise rate will be for a grease bubble.

Specific Gravity (Density)	
Type of Media	**Temperature 60° F**
Corn Oil	0.924
Coconut Oil	0.924
Soybean Oil	0.919
Grapeseed Oil	0.92
Lard	0.915

Temperature

Density (S.G.) at Different Temperatures		
Type of Media	**Temperature**	
	60° F	**160° F**
Corn Oil	0.924	0.88
Coconut Oil	0.924	0.879
Soybean Oil	0.919	0.879
Grapeseed Oil	0.92	0.869
Lard	0.915	0.875

Table 5: Specific Gravity of Different Oils

Temperature has many positive effects on the performance of grease interceptors. Notice that in Table 5 the specific gravity of oil decreases as temperature increases. Going from 60^{0}F to 160^{0}F results in a 5% decrease in specific gravity. As noted earlier, the lower the specific gravity, the faster the rate of rise of a grease bubble.

Viscosity

Viscosity is defined as the property of resistance to flow in any material with fluid properties. It may be thought of as how easily something pours. Temperature also has a direct and inverse relationship with viscosity. As temperature increases viscosity decreases. The lower the viscosity the more easily something pours. The lower the viscosity the faster the rate of rise of a grease bubble.

Figure 5: Viscosity

Velocity

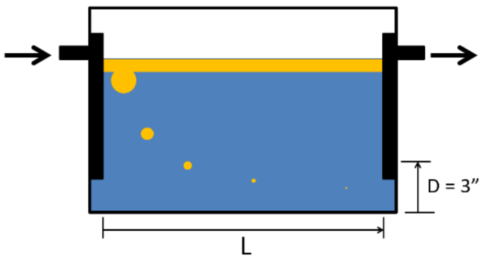

Figure 6: Viscosity

Velocity and flow rate are not the same thing. Flow rate describes the volume of a fluid moving over time and is typically measured in gallons per minute. Velocity describes the speed of a fluid moving over time and is typically measured in feet per second.

With oil and water in a static environment, the only velocity present is vertical – how quickly the oil rises. Oil and water in a glass or jar have no flow path and therefore only vertical velocity is present in the rise rate of the oil.

In a grease interceptor, there is a flow path and therefore horizontal velocity is present as well as vertical velocity. So long as the vertical velocity (rise rate) exceeds the horizontal velocity (travel rate in flow path) a grease interceptor should be able to capture and retain the grease that enters.

Flow Pattern

Controlling the velocity of the wastewater entering a grease interceptor critical. This is achieved by distributing the flow path throughout the cross-sectional area of the grease interceptor to create a laminar flow environment. The more completely this is accomplished, the more efficient the grease interceptor will be.

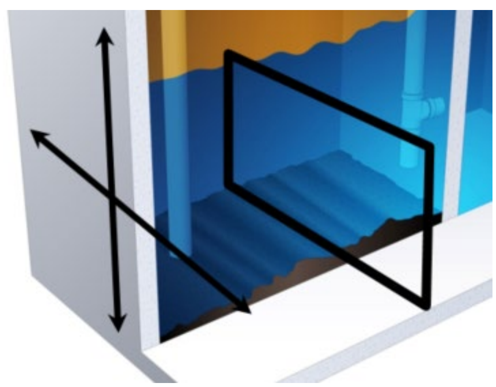

Figure 7: Controlling Velocity

The application of residential septic tanks as commercial gravity grease interceptors (GGI) has proven problematic because of a lack of control over the influent. It's important to understand that there is a difference between residence time and flow through period. Residence time is a calculation based on dividing the volume of an interceptor by the incoming flow rate. The flow through period is the actual time it takes for the influent to travel across the interceptor and exit.

Ideally, the flow through period would be equal to the residence time calculated. Whether that happens as anticipated, is a function of the flow environment. If the tank does not control the influent and

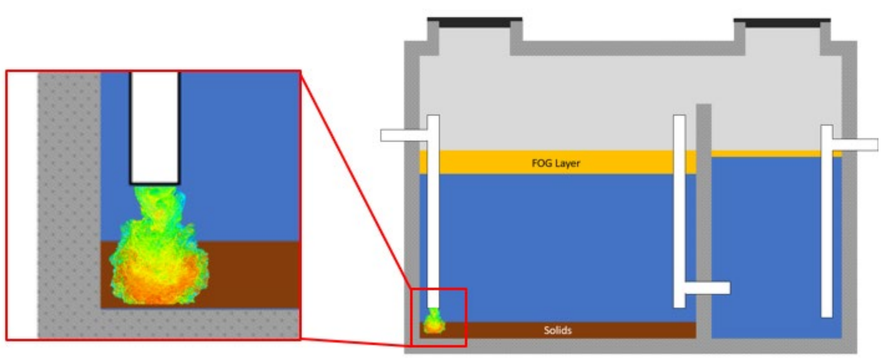

Figure 8: Controlling Velocity

distribute the flow throughout the cross-sectional area, the tank will suffer from turbulence and short-circuiting.

Figure 8 shows a typical IAPMO/ANSI Z1001 GGI. Notice that the inlet consists of basically a four-inch diameter tee and PVC pipe that is open at the top and bottom and simply dumps the influent into the bottom of the tank.

At very low flow rates, typical in a residential septic tank, the volume of wastewater entering is low enough that velocity is not an issue. As flow rate increases velocity increases. When used as a GGI, these tanks have no control over the influent and do not distribute the flow throughout the cross-sectional area resulting in high-velocity zones and turbulence, leading inevitably to short-circuiting.

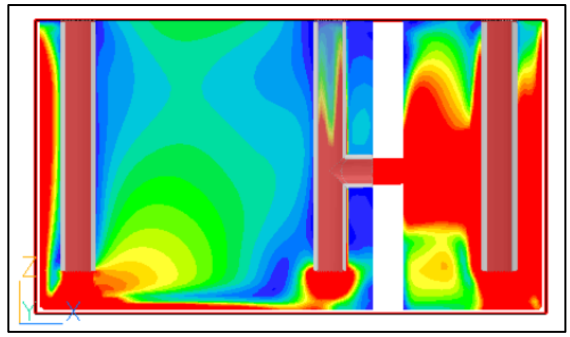

Figure 9: Controlling Velocity

The WERF report titled, *Assessment of Grease Interceptor Performance*, published in 2008, used Figure 9 to illustrate the velocity profiles that researchers were observing and the resultant short-circuiting they were documenting. We should not be surprised to find this to be the case because the design is not intended to deal with elevated flow rates and does not mitigate velocity. This is why these tanks tend towards a turbulent flow pattern and short-circuiting.

Emulsification

Ideally, a grease interceptor would only have to separate free-floating FOG from a kitchen waste stream, however that is typically not the case. Wastewater from sinks emptying into the drainage piping system is naturally emulsified with any FOG present as a result of the gravity-flow environment, reduced diameter pipe and fittings, various directional transitions, and increased velocity.

Emulsification is best understood as the process of making two liquids into a colloidal suspension, in which particles of one liquid are dispersed throughout the other but not dissolved in it. Emulsions between oil and water are created by adding a ***shearing force***, which breaks the oil up into smaller and smaller particles dispersed into the water. The more rigorous the shearing force is applied, the smaller the particle sizes of the dispersed oil will be. Once the shearing force is removed and a quiescent environment resumes, the oil will naturally coalesce and agglomerate together ascending to the surface of the water.

It is broadly assumed that soaps, detergents, and degreasers "cause" emulsions. This is NOT the case. Emulsions are caused by a shearing force. Soaps, detergents, and degreasers are surfactants or surface acting agents. Briefly, water is hydrophilic (attracted to water), but oleophobic (repels oil). Oils are oleophilic (attracted to oils), but hydrophobic (repels water). They use their surface tension to repel one another. Surfactants have oleophilic heads and hydrophilic tails which means they are attracted to both types. They act by reducing the surface tension between the oil and water allowing for smaller oil particle size when dispersed into water by a shearing force.

There are a few important characteristics of surfactants and emulsions that should be understood. First, surfactants do not create emulsions, which are instead created by the presence of a shearing force. Second, surfactants to not change the specific gravity or density of oils suspended in water. Instead, they facilitate smaller particle size, which reduces coalescence and agglomeration. In the absence of a shearing force, emulsified FOG, with or without surfactants, will still separate and ascend to the surface of water over time.

As will be discussed in the next section, performance validated grease interceptors, i.e. HGIs, do not have a shearing force present. They have quiescent or laminar flow (smooth layer over layer) which allows for emulsified FOG to coalesce, agglomerate and ascend to the surface inside the interceptor. Of course, size matters, as was explained above, and the presence of surfactants will reduce the coalescence and agglomeration process, but the majority of the FOG laden wastewater from a dishwasher will be captured.

The assumption that soaps, detergents, and degreasers will "scrub" or "scour" a grease interceptor is unsupportable. Surfactants do not create emulsions, shearing forces do. Performance validated grease interceptors do not have a shearing force and therefore cannot create emulsions. This is why dishwashers should be routed to a grease interceptor.

But not all grease interceptors are the same. For example, GGIs are not performance validated, while HGIs are. GGIs do not have design elements that deal with the factors that affect gravity-differential separation, while HGIs do. GGIs have an uncontrolled and turbulent flow path, while HGIs have a laminar and quiescent flow path. GGIs suffer from short circuiting and scouring as temperature and flow rate increase because the turbulent flow path creates or sustains emulsions, while HGIs do not. Therefore, dishwashers should not be routed to GGIs but should be routed to HGIs. This is counter-intuitive to the ubiquitous assumptions about how these different types of grease interceptor's work.

2. Effective Pretreatment of Kitchen Wastewater

Effective pretreatment of kitchen wastewater requires all fixtures in kitchen preparation, service, and clean up areas to be connected to a properly sized and selected grease interceptor. The proper application of grease interceptors requires an understanding of what distinguishes them.

There are three basic types of grease interceptors:

- Hydromechanical Grease Interceptor (HGI)
- Grease Removal Device (GRD or AGRD)
- Gravity Grease Interceptor (GGI)

<u>Hydromechanical Grease Interceptors</u>

HGIs are governed by three North American product standards; PDI G101, ASME A112.14.3, and CSA B481. Each of these standards includes a performance validation test. Figure 10 illustrates what the test apparatus used in these standards looks like. The water and lard used in the test are heated to 160^0 Fahrenheit. An incremental test requires the volume of water and lard from the test sinks to be discharged to the grease interceptor at the specified flow rate over a two-minute period. Whatever lard escapes the HGI during the test is captured by the collection or skim tank which sits downstream of the HGI during the test. The lard is skimmed out of the tank, dewatered and weighed. Efficiency is determined as follows:

$$\text{Efficiency} = \frac{\text{Lard Added} - \text{Lard Skimmed}}{\text{Lard Added}}$$

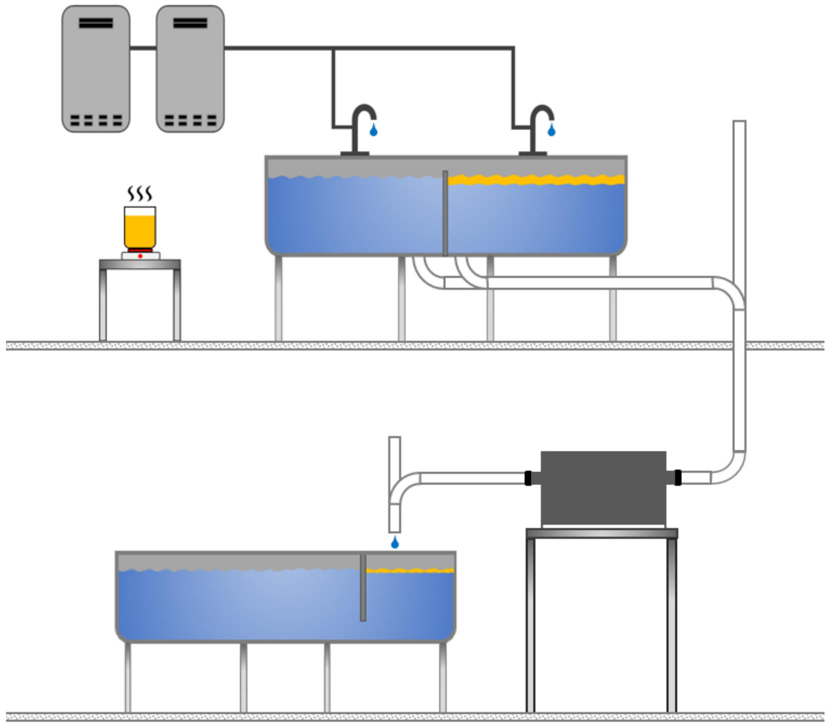

Figure 10: HGI test apparatus illustration

The incremental testing procedure is repeated until the minimum required increments have been conducted or the test failure or breakdown point is reached. To pass the test an HGI must have an average efficiency of at least 90 percent while retaining not less than two pounds of lard/grease for each gallon per minute of flow at the minimum required increments or the breakdown point. The breakdown point is established at the increment that precedes two (2) successive increments in which the either the average efficiency is less than 90 percent or the incremental efficiency is less than 80 percent.

HGIs that are tested to the minimum required increments (legacy HGIs) generally meet the minimum requirements for performance and grease retention. More modern HGI concepts (high-capacity HGIs) tend to substantially exceed the minimum performance requirements. The sizing recommendations covered later will illustrate the advantages of these newer HGIs.

Grease Removal Device

These devices are conceptualized to offer an automatic grease removal process that should reduce the need for third party servicing. However, these devices are considered passive HGIs first and as such must be tested and rated for performance in accordance with ASME A112.14.3. This ensures that the device will operate efficiently as an HGI even if its primary automatic grease removal functions are non-operational. Additional testing under ASME A112.14.4 ensures that the removal process when the device is operating is such that the removed FOG is 95 percent free of water by volume.

Figure 11: Thermaco Big-Dipper GRD

While specific design elements vary by manufacturer, there are several general design elements that most GRDs share:

- Heating element – keeping the contents of the GRD liquefied makes transporting the FOG to a collection chamber easier.
- Motorized skimming device - the means of transporting the accumulating FOG from the GRD to a collection chamber.
- Attached exterior collection container - where the accumulated FOG is transported to by the skimming device.

The nature of the collection container being attached to the side of the unit requires it to be readily accessible for removal and replacement. Normally this restricts the installation of these devices to above the floor or inside of a vault when buried.

Gravity Grease Interceptor

Perhaps the most widely used grease interceptor across the USA today is the GGI. The problem with their ubiquitous use is that they have never actually been validated for the application. GGIs are actually residential septic tanks that have been misapplied as commercial grease interceptors. The original application was developed by a precast concrete prefabricator of residential septic tanks in metro Los Angeles. They successfully lobbied the EPA to include their concept for the use of these tanks as commercial grease interceptors in the EPA's 1980 Design Manual, *Onsite Wastewater Treatment and Disposal Systems*. They also helped draft a new section for the 1982 edition of the Uniform Plumbing Code called "Appendix H" which also adopted residential septic tanks as commercial grease interceptors.

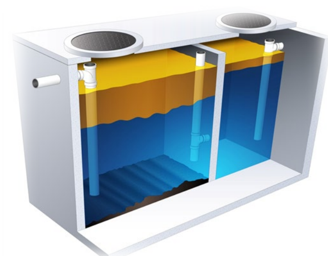

Figure 12: Gravity Grease Interceptor

The product standard that governs GGIs is IAPMO/ANSI Z1001. It's a design standard that has its roots in the IAPMO/ANSI Z1000 standard governing prefabricated septic tanks. Z1001 has become the primary standard governing gravity grease interceptors (GGI), recognized by national model plumbing codes and most independent state or local plumbing codes. Figure 12 illustrates a typical GGI meeting the design requirements of this standard, such as a minimum of two compartments, minimum liquid volume of 300 gallons, minimum free airspace, size and location of manhole covers, and so on. The standard also governs construction material requirements including concrete, fiberglass, polyethylene and coated steel. The standard **does not require a performance test** for certified units, but instead only mandates leakage testing.

How to Size and Select Grease Interceptors

The proper application of grease interceptors requires properly sizing them. Plumbing codes always focus on flow rate alone. The problem with that approach is that it fails to consider whether the grease interceptor has adequate grease storage capacity for the application. To solve that it is recommended to use a two-step method. Step one sizes by flow rate, either fixture volume or pipe diameter. Step two determines the estimated grease production and required grease storage capacity for the appropriate grease interceptor for any project. The recommendations provide here are based on HGIs and NOT GGIs because GGIs lack performance data that can be relied up on in sizing by grease storage capacity.

Step 1: Size by Flow Rate

The minimum flow rate for a passive HGI may be calculated by either fixture volume or pipe diameter using either a one-minute or two-minute drainage period. Use a one-minute drainage period when the interceptor is installed within 20 feet of directly connected fixtures and/or has indirectly connected fixtures. When the interceptor will be installed exterior to the building beyond 20 feet of the connected fixtures, use a two-minute drainage period.

Fixture Volume Sizing

Use the following formula for sizing fixtures by volume with a 75% fill factor:

$$\left[\frac{L \times W \times H}{231}\right] \times 0.75 = \text{Fixture Capacity Gallons}$$

Fixture Capacity Gallons x 1 = one-minute drainage period (GPM)
Fixture Capacity Gallons x 0.5 = two-minute drainage period (GPM)

Example: three-compartment sink with each compartment being 18 x 24 x 12 inches

18 x 24 x 12 = 5184 cubic inches (in^3)
5184 / 231 = 22.44 fixture capacity gallons
22.44 x 3 = 67.3 total fixture capacity gallons (three bowls)
67.3 x 0.75 = 50.4 total fixture capacity after loading factor (75%)
50.4 x 1 = 50 GPM one-minute drainage period
50.4 x 0.5 = 25 GPM two-minute drainage period

To determine the minimum required flow rate for the HGI, calculate the capacity of each fixture (i.e. Figure 45) that will be connected and add the volumes together and use the appropriate drainage period. An appropriate HGI must be certified to meet the minimum flow rate as calculated. Multiple HGIs may be used separately or combined to meet the flow rate requirement.

It is advisable to use a one-minute drainage period when the HGI will be installed in the kitchen area near the fixtures being serviced. It is essential to use a one-minute drainage period when an indirectly connected fixture is connected to the grease interceptor. A two-minute retention time assumes only directly connected fixtures are routed to the interceptor. A two-minute drainage period will negatively affect the total time for draining fixtures and is often a complaint of owners.

Pipe Diameter Sizing

When the final configuration of kitchen fixtures in an establishment is unknown, or to allow for the addition of fixtures in the future, the minimum interceptor volume may be determined by the diameter of the drainage pipe leading from the establishment, according to Table 6:

Pipe Size (inches)	Full-Pipe Flow (GPM)[1]	One-minute drainage period (GPM)	Two-minute drainage period (GPM)
2	20	20	10
3	60	75	35
4	125	125	75
5	230	250	125
6	375	400	200
8	426	500	250
[1]1/4 inch per foot based on Manning's formula with friction factor N = 0.012			

Table 6: GPS Pipe Diameter Sizing Table

When using pipe diameter sizing and the interceptor is installed inside the kitchen near the fixtures being serviced, it is advisable to use a one-minute drainage period to ensure the drainage time is not a nuisance. When installed in the kitchen near the fixtures being serviced and there is an indirectly connected fixture it is essential to use a one-minute drainage period. When installed exterior to the building, where the developed length of piping can be quite long, a two-minute drainage period will provide a satisfactory result in drainage times.

Step 2: Calculate Grease Capacity

Once the minimum flow rate has been established in Step 1, calculate the minimum grease storage capacity for the HGI required for the desired pump-out frequency as follows (Figure 13):

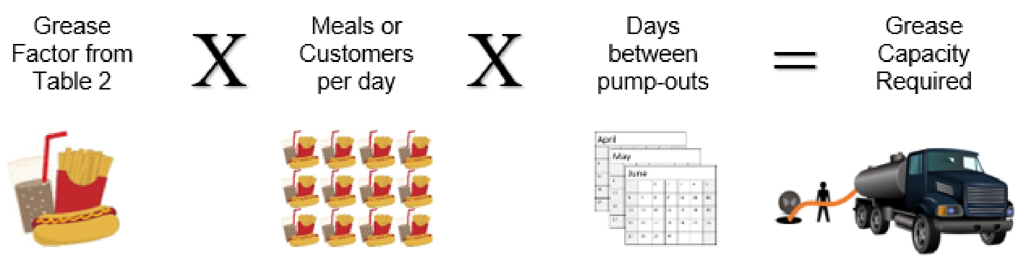

Figure 13: GPS Formula

<u>Grease Factor Table</u>

The concept of low grease producer, medium grease producer, high grease producer, and very high grease producer have been perceived as threatening by FSEs. To alleviate concerns, we developed a more complete table of *factors* that comprehensively breaks down FSEs by menu type, whether they have fryers or not, and the type of flatware in use.

To determine the correct grease factor, using Table 7, select the menu type (1 through 30), then the correct column (A through D) for whether there is a fryer, and whether the establishment uses disposable or washable plates, glasses, knives, forks, and spoons (flatware)

Type	Menu	Grease Factor ->	without Fryer without flatware **A**	without fryer with flatware **B**	with fryer without flatware **C**	with fryer with flatware **D**
1	Bakery		0.025	0.0325	0.035	0.0455
2	Bar and Grille		0.005	0.0065	0.025	0.0325
3	Barbeque		0.025	0.0325	0.035	0.0455
4	Breakfast Bar - Hotel		0.005	0.0065	0.025	0.0325
5	Buffet		0.035	0.0455	0.058	0.075
6	Burger and fries, fast food		0.025	0.0325	0.035	0.0455
7	Cafeteria		0.025	0.0325	0.035	0.0455
8	Caterer		0.005	0.0065	0.025	0.0325
9	Chinese		0.035	0.0455	0.058	0.075
10	Coffee shop		0.025	0.0325	0.035	0.0455
11	Convenience Store		0.005	0.0065	0.025	0.0325
12	Deep fried Chicken / seafood		0.035	0.0455	0.058	0.075
13	Deli		0.005	0.0065	0.025	0.0325
14	Family Restaurant		0.005	0.0065	0.025	0.0325
15	Frozen Yogurt		0.005	0.0065	0.025	0.0325
16	Greek		0.005	0.0065	0.025	0.0325
17	Grocery Bakery		0.005	0.0065	0.025	0.0325
18	Grocery Deli		0.025	0.0325	0.035	0.0455
19	Grocery Meat Department		0.025	0.0325	0.035	0.0455
20	Ice Cream		0.025	0.0325	0.035	0.0455
21	Indian		0.005	0.0065	0.025	0.0325
22	Italian		0.025	0.0325	0.035	0.0455
23	Mexican, fast food		0.025	0.0325	0.035	0.0455
24	Mexican, full fare		0.035	0.0455	0.058	0.075
25	Pizza		0.025	0.0325	0.035	0.0455
26	Religious Institution		0.005	0.0065	0.025	0.0325
27	Sandwich shop		0.005	0.0065	0.025	0.0325
28	Snack Bar		0.005	0.0065	0.025	0.0325
29	Steak and seafood		0.035	0.0455	0.058	0.075
30	Sushi		0.005	0.0065	0.025	0.0325

Table 7: Table of Grease Factors

<u>Example Using Grease Production</u>

Fast food burgers and fries, with fryer, with disposable flatware, serving 300 meals per day

Grease factor from Table 24: _6C_ = 0.035 pounds per meal
Meals per day = 300
Days between pump-outs* = 30 x 0.035 x 300 = 315 pounds grease capacity required
60 x 0.035 x 300 = 630 pounds' grease capacity required
90 x 0.035 x 300 = 945 pounds' grease capacity required

*FSEs that are not open every day, should calculate the number of days actually open in a 30/60/90-day period and use that to calculate the total amount of grease capacity required.

The correctly sized and selected grease interceptor will have the minimum flow rate determined in Step 1 and the grease storage capacity calculated in Step 2. Multiple grease interceptors may be installed to satisfy the minimum flow rate requirement, the minimum grease storage capacity, or both. Grease interceptors certified to meet the <u>minimum</u> requirements of ASME A112.14.3, CSA B481, and/or PDI G101, shall have the flow rates and minimum grease storage capacities as listed in Table 8:

HGI Flow Rate	Minimum Grease Storage Capacity[2] (lbs)
20	40
25	50
35	70
50	100
75	150
100	200
[2]Minimum grease capacity as required by ASME A112.14.3, PDI G101 and CSA B481	

Table 8: Table of Flow Rates and Capacities

High-capacity HGIs will have much higher grease storage capacities than the minimum shown in Table 8. However, it is advisable to check the third-party test reports for any grease interceptor that is unknown. In the past, some have claimed grease storage capacities that are much higher than the HGI was actually tested and rated at, which only came to light during a review of their test reports.

Examples Using Two-Step Process

<u>EXAMPLE 1:</u>

Burger and fries, fast food, with fryer, without flatware, 300 meals per day, all fixtures connected, 3" drainage piping, exterior installation

HGI Required Information:
1. ☐ Interior Installation ☒ Exterior Installation

2. Are there indirectly connected fixtures routed to the HGI? ☒ Yes ☐ No

3. Will the HGI be installed within 20 feet of the fixtures? ☐ Yes ☒ No

Note: For interior installations, if the answer to either question 2 or 3 is YES, use a one-minute drainage period, otherwise use a two-minute drainage period. For exterior installations, use a two-minute drainage period.

Step 1: Calculate Flow Rate

1. Total Fixture Volume: ________ Flow Rate GPM (one or two-minute): ________

2. OR, Pipe Diameter (Table 23): 3" Flow Rate GPM (one or two-minute): 35 GPM

Step 2: Calculate Grease Capacity

Grease Factor (Table 24): 0.035 Meals or customers served per day: 300

Days open 30-day period: 30 Grease produced 30-day period (lbs): 315

Days open 60-day period: 60 Grease produced 60-day period (lbs): 630

Days open 90-day period: 90 Grease produced 90-day period (lbs): 945

Once we have the grease capacity required for the desired maintenance frequency, we can decide on the right grease interceptor, based on both Step 1 and Step 2.

Manufacturer	Model	Flow Rate (GPM)	Grease Capacity Pounds	Pumpout Frequency Days	Annual Maintenance Cost
Jay R Smith	8035	35	70	7	$ 5,400.00
Josam	60107	35	70	7	$ 5,400.00
Wade	5100-35	35	70	7	$ 5,400.00
Watts	WD-35	35	70	7	$ 6,000.00
Zurn	1170-700	35	70	7	$ 5,400.00
Endura	3935A	35	138.5	13	$ 2,729.24
Schier	GB-2	35	130	12	$ 2,907.69
Trapzilla	TZ160	35	168	16	$ 2,250.00

Table 9: 35 GPM Capacities and Cost of Maintenance

As we can see (Table 9), none of the HGIs in the 35 GPM category have enough grease storage capacity to allow for more than 6 days on the low end and 16 days on the high end. What if we move up in flow rate to 50 GPM?

Manufacturer	Model	Flow Rate (GPM)	Grease Capacity Pounds	Pumpout Frequency Days	Annual Maintenance Cost
Jay R Smith	8050	50	100	10	$ 3,780.00
Josam	60108	50	100	10	$ 3,780.00
Wade	5100-50	50	100	10	$ 3,780.00
Watts	WD-50	50	100	10	$ 6,000.00
Zurn	1170-800	50	100	10	$ 3,780.00
Endura	3950A	50	122	12	$ 3,098.36
Schier	GB-2	50	127	12	$ 2,976.38
Schier	GB-3	50	272	26	$ 1,389.71

Table 10: 50 GPM Capacities and Cost of Maintenance

Even at 50 GPM (Table 10), there is not an option that would allow for 30 days between pump-outs. What if we move up to 75 GPM?

Manufacturer	Model	Flow Rate (GPM)	Grease Capacity Pounds	Pumpout Frequency Days	Annual Maintenance Cost
Jay R Smith	8075	75	150	14	$ 3,780.00
Josam	60109	75	150	14	$ 3,780.00
Wade	NA				
Watts	NA				
Zurn	1170-900	75	150	14	$ 3,780.00
Endura	XL-75	75	559	53	$ 1,014.31
Schier	GB-3	75	175	17	$ 3,240.00
Schier	GB-75	75	653	62	$ 868.30
Trapzilla	TZ600	75	636	61	$ 891.51

Table 11: 75 GPM Capacities and Cost of Maintenance

Finally, at 75 GPM (Table 11) we begin to see options for HGIs that could work for the FSE. The Endura XL-75, Schier GB-75, and Trapzilla TZ-600 offer around a two-month cleaning interval with some margin for error in case the FSE has particularly poor kitchen best management practices.

EXAMPLE 2:

Italian, with fryer, with flatware, 469 meals per day, all fixtures connected, 4" drainage piping, exterior installation

HGI Required Information:

4. ☐ Interior Installation ☒ Exterior Installation

5. Are there indirectly connected fixtures routed to the HGI? ☒ Yes ☐ No

6. Will the HGI be installed within 20 feet of the fixtures? ☐ Yes ☒ No

Note: For interior installations, if the answer to either question 2 or 3 is YES, use a one-minute drainage period, otherwise use a two-minute drainage period. For exterior installations use a two-minute drainage period.

Step 1: Calculate Flow Rate

3. Total Fixture Volume: ____________ Flow Rate GPM (one or two-minute): ____________

4. OR, Pipe Diameter (Table 23): 4" Flow Rate GPM (one or two-minute): 75 GPM

Step 2: Calculate Grease Capacity

Grease Factor (Table 24): 0.0455 Meals or customers served per day: 469

Days open 30-day period: 30 Grease produced 30-day period (lbs): 639

Days open 60-day period: 60 Grease produced 60-day period (lbs): 1278

Days open 90-day period: 90 Grease produced 90-day period (lbs): 1917

Once we have the grease capacity required for the desired maintenance frequency, we can decide on the right grease interceptor, based on both Step 1 and Step 2.

Manufacturer	Model	Flow Rate (GPM)	Grease Capacity Pounds	Pumpout Frequency Days	Annual Maintenance Cost
Jay R Smith	8075	75	150	7	$ 7,668.00
Josam	60109	75	150	7	$ 7,668.00
Wade	NA				
Watts	NA				
Zurn	1170-900	75	150	7	$ 7,668.00
Endura	XL-75	75	559	26	$ 2,057.60
Schier	GB-3	75	175	8	$ 6,572.57
Schier	GB-75	75	653	31	$ 1,761.41
Trapzilla	TZ600	75	636	30	$ 1,808.49

Table 12: 75 GPM Capacities and Cost of Maintenance

Looking at the minimum required 75 GPM category (Table 12), we can see that the Endura XL-75, Schier GB-75, and Trapzilla TZ600 all allow for approximately one month between cleaning intervals. The problem is that there is no margin for error. If the FSE has particularly poor kitchen best management practices resulting in the HGI becoming full more quickly, more frequent cleanings would require multiple cleanings in a month and compliance drops off significantly in that case.

Manufacturer	Model	Flow Rate (GPM)	Grease Capacity Pounds	Pumpout Frequency Days	Annual Maintenance Cost
Jay R Smith	8100	100	200	9	$ 7,668.00
Josam	60110	100	200	9	$ 7,668.00
Wade	NA				
Watts	NA				
Zurn	1170-1000	100	200	9	$ 7,668.00
Endura	XL-100	100	1058	50	$ 1,449.53
Schier	GB-250	100	1751	82	$ 875.84
Schier	GB-500	100	3049	143	$ 502.98
Schier	GB-1000	100	6547	307	$ 234.24
Trapzilla	TZ1826	100	1826	86	$ 839.87

Table 13: 100 GPM Capacities and Cost of Maintenance

Table 13 illustrates that there are many more and better options in the 100 gpm category for this application. The Schier GB-250 and Trapzilla TZ1826 both offer nearly a 90 capacity, which would be acceptable in this example. One might be tempted to lean towards the GB-500 or even the GB-1000 since they offer such a dramatic increase in capacity over the others. Caution should be used when approving an oversized grease interceptor, especially as oversized as these would be. The reason is that the ratio of collected FOG to the volume of water in the tank would lead to significant increases in sulfide production which leads to Hydrogen Sulfide gas generation above the water and sulfuric acid pH levels in the water of the tank. It's always best to avoid that situation if possible, by choosing a tank that has a capacity that more closely matches the FOG production of the facility.

3. Kitchen Best Management Practices to Prevent or Divert FOG waste

Food Service Establishments (FSEs) are in the business of providing delicious food to their guests. Whether it is a five-star restaurant, a quick-service deli, or a school cafeteria, all chefs and kitchen personnel are trying to put forward a delicious product to please their guests.

While no one intentionally creates waste, in the course of creating and serving meals, some wasted food may result. Since the wasted food represents a loss in money due to the price of the food, the labor to prepare it, the energy to cook and store it, and the disposal costs, it makes sense to find ways to use the food. In addition to the monetary impact, wasted food can have a negative impact on the environment.

Foods typically include or are cooked with fats, oils or greases (FOG). When FOG is introduced into the sewer conveyance lines, by pouring grease into the drain, using a food disposer, pouring oils into the drain, or putting greasy wash waters down the drain, the result can be clogged sewer lines. Clogged sewer lines can cause sanitary sewer backups, which are a danger to human health, plus they are expensive to clean and repair.

There are two strategies to avoid this issue. One is to connect all drains with potential to convey FOG to a properly sized grease interceptor and to maintain it (covered in chapters 1 & 2 of this guide). This strategy has the advantage that it is an engineered solution, depending less on people's behavior than on technical control. Of course, even with a grease interceptor that is connected to all kitchen drains, it still needs to be pumped out at the right time and the materials removed need to be properly disposed of.

A second strategy is to incorporate Kitchen Best Management Practices (BMPs). Kitchen BMPs include many strategies to reduce wasted food, as well as keeping FOG out of the drain. While BMPs rely on people performing them, they have the potential to save a considerable amount of money and reduce the impact of the FSE on the environment. There can be a lot of employee turnover in the FSE business, but all kitchen employees are trained to produce delicious food. Can education about reducing waste and how to properly dispose of it be incorporated into the training? These practices become part of the culture created at the FSE.

Hierarchy of Food Recovery

To better understand the best ways to manage wasted food, the USEPA created a hierarchy of food recovery.

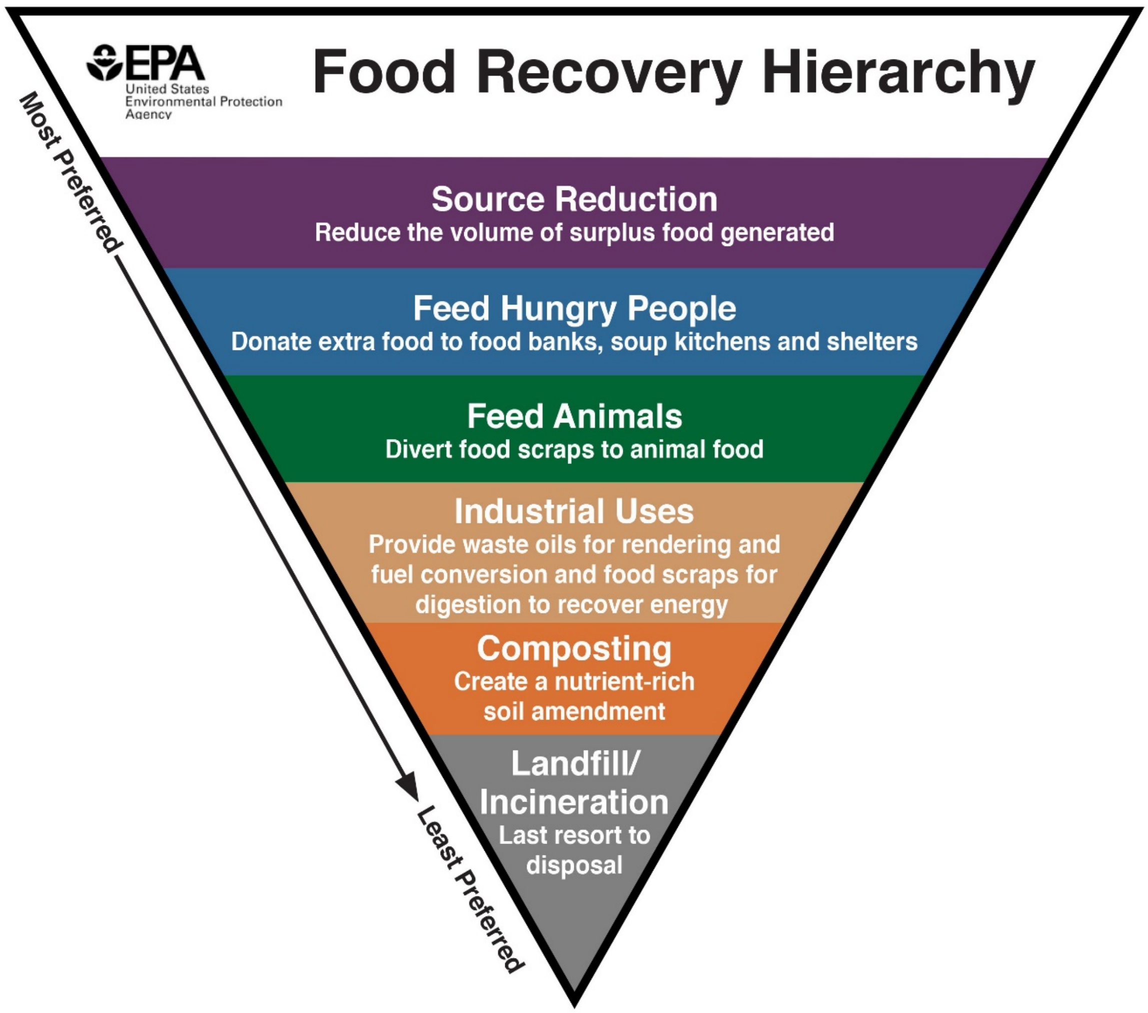

Figure 14: EPA Food Recovery Hierarchy

Source reduction is the first and best option of food management.

To begin, spend a bit of time looking at the wastes generated in the kitchen. How much is from food prep? How much is spoiled food?

Avoiding wasted food from preparation may take creativity in addition to skill. While some parts of food that are undesirable in appearance or spoiled must be removed, sometimes "ugly" foods or produce that is a bit past its prime can be used in soups, salads, smoothies, stir fry, frittatas, or sauces. Be creative with leftover food that has not been served or when the amount of food purchased exceeds what has been sold. Create a "chef's special" using the ingredients. This food has already been purchased, so preparing and selling it will contribute to the bottom line as well as be better for the environment.

There are typically easy ways to control food inventory and manage what is delivered to avoid waste. Compare purchasing inventory with customer ordering to assure foods are not kept in storage too long. Food may be initially received in an unusable state or may spoil during storage. Be sure food storage is maintained at proper temperatures/conditions to keep food fresh or frozen. Rotate stock within the dry storage, refrigerated, and frozen areas, using the oldest produce and products first. Be systematic and label foods so everyone in the kitchen can easily identify what to use first. Know the difference among the terms "sell by," "use by," and "best by" dates. "Sell-by" is a date for the store to remove the product for its inventory management. It is not a safety date. "Use-by" is the last date recommended for the use of the product while at peak quality. It is not a safety date except when used on infant formula. "Best-by," or "Best if Used by/before" indicates when a product will be of best flavor or quality. It is not a purchase or safety date.

Looking at what diners throw away is also important. There may be easy changes that can be made in portion size that will satisfy diners and reduce waste. If dressing is offered "on the side" can smaller portions be offered? If fresh bread is automatically delivered to all tables, can the server ask if the diners want the bread? Can less bread be delivered but seconds provided if requested? It may be important to communicate with diners that changes are being made to avoid wasted food. This communication is especially important for buffet dining, to encourage people to only take what they will eat.

Feed Hungry People

America has more than enough food to feed everyone but each year, an enormous amount of food is wasted in the United States. The USEPA estimates that food and packaging/containers account for almost 45% of the materials landfilled in the United States. In 2010, more than 33 million tons of food was landfilled in the U.S. That is equivalent to a half pound per person per day, or enough food to fill the Rose Bowl stadium every day. FSEs generate a significant amount of wasted food and packaging. Between 4-10 percent of food purchased by FSEs is thrown out before it ever reaches the plate. Meanwhile, the USDA estimates that 10.5 percent of American households, about 13.7 million households, had difficulty providing enough food for all their members due to a lack of resources during 2019.

Many FSEs choose to feed people, not landfills, by partnering with organizations that help serve the hungry in their community. Excess food, including raw and prepared food are often accepted. Rules about food safety and restrictions about quantities and categories of food accepted will vary by location. Many non-perishable and unspoiled perishable foods can be donated. Typically, food rescue organizations seek to ensure the FSE meets the food safety requirements of the partners that serve the food to the hungry. The Federal Good Samaritan Act may limit liability for the FSE. Donating extra food to help eliminate hunger in the community can provide a tax benefit for the FSE.

Feed Animals

With proper and safe handling, anyone can donate food scraps to animals. Food scraps for animals can save farmers, zoos, and companies money. It is often cheaper to feed food scraps to animals instead of having them hauled to a landfill. Regulations vary in each state and some states ban donation for animal feed. Other states regulate what can be donated, often no meat or dairy. Coffee grounds and foods high in salt can harm animals and cannot be donated. Contact the local solid waste authority, county extension service, or public health agency for information.

Industrial Uses

Many FSEs are familiar with separating yellow grease for collection and conversion by local manufacturers into biodiesel. Biodiesel is an environmentally preferable, alternative fuel produced from renewable sources, such as virgin oils, including soybean, canola, palm, etc., waste cooking oil, or other biowaste feedstocks. Biodiesel significantly reduces greenhouse gases, sulfur dioxide emissions, and asthma-causing soot. Biodiesel not only creates less pollution, it is easy to use, biodegradable, and nontoxic.

Liquid fats and solid meat products can be used as raw materials in the rendering industry, converting them to animal food, cosmetics, soap, and other products. Many rendering companies will provide storage barrels and free pick-up service.

Anerobic digestion is also gaining popularity as an industrial treatment for various organic materials, including food scraps and fats, oils, and greases (FOG). There are some companies, farmers, and wastewater treatment facilities that have invested in anerobic digesters to generate renewable energy in the form of biogas plus a soil amendment. These digesters have the advantage of being able to process brown grease as well as food scraps, manure, sewage sludge, and other organic materials. The digestion is done in a closed vessel in the absence of oxygen.

Composting

While preventing wasted food is the most desirable option and using it to feed people, then animals is the next most preferable, another process to consider beyond industrial processing is composting. As with all these choices, a partner is likely needed so the FSE can concentrate on its core business of serving delicious foods to customers.

Composting creates a product that is used to help improve soil, grow the next generation of crops, reduce water usage, and improve water quality. It produces less greenhouse gasses than are produced in a landfill. In 2018, about 25 million tons of municipal solid waste was recovered through composting. Curbside composting served about 6 million households in 2017. Commercial composting facilities can provide an easy way to recover wasted food that cannot be used for a higher purpose.

Compost is created by combining organic materials, such as wasted food, manure, yard waste, and other organic materials in the right ratios and piling the mixture in rows or vessels so that it undergoes a curing process which destroys pathogens and weed seeds resulting in a dark brown humus. The finished compost is used by gardeners and farmers to improve the properties of soil.

Landfill

When all other options are exhausted, food waste should be disposed in the landfill. If all kitchen drains are not connected to a grease interceptor, the best management practice is to scrape plates, dispose of used grease, and dispose of greasy wash water in the trash.

Organic waste in landfills decomposes anaerobically, creating methane, a greenhouse gas with a global warming potential 25% greater than carbon dioxide. Landfills are the third-largest human-generated source of methane emissions in the United States. Methane is also a precursor to creation of smog, proven to be harmful to human health. Some landfills collect methane and use it to produce energy, however, even if the landfill has a methane capture system, 40% of methane generated can escape into the atmosphere.

<u>Best management is to prevent wasted food and feed people (first) or animals (second) with leftover food. Capture used greases and oils for industrial uses.</u>

The role of management

Management is in the position to evaluate the causes of wasted food and to help implement source reduction solutions, such as described above, or to find partners who can help distribute usable food to hungry people or animals, or to find a local composter or anerobic digester for wasted food that cannot be fed to people or animals. Likewise, the manager is responsible for assuring that drains are properly connected to an appropriately-sized grease interceptor and that it is routinely pumped out. Even with these considerations, there is still a role for kitchen staff to enact procedures to keep FOG out of the sewer lines. Management must train kitchen staff and other employees about the problems with wasted food, FOG, and how they can help.

Training kitchen staff

Employees want to do a good job for the FSE. Typically, the focus is on preparing a delicious meal for the customer, as it should be. However, there are a few other practices that should be emphasized to the employees to help prevent wasted food and prevent FOG in the sewer lines. Once the management changes have been made to prevent wasted food and to distribute food to the hungry, the following Best Management Practices (BMPs) help limit FOG into the sewer conveyance lines. The following table lists the BMPs, the reasons they are important – which should be communicated to the employees, and the benefits of implementation.

BMP	Reason	Benefits
Train kitchen staff on BMPs to prevent wasted food and FOG from entering the sewer lines.	People need to understand the problem and what steps they can and are expected to take.	All the BMPs are more likely to be followed if people understand the reason.
Post "No Grease" signs above the sinks, on front of dishwashers, and floor mop sinks.	These prompts are a constant reminder right where they are needed.	Reminders help prevent grease discharge to traps and interceptors, reducing back up and frequency of pump outs
"Dry Wipe" pots, pans, and dishes into the garbage prior to rinsing and washing.	The grease and food that remain will go to the landfill. This grease will not go into the traps and grease interceptor.	Dry wiping reduces the amount of material going to grease traps and interceptors, thus there will be fewer pump outs and cleaning, lowering maintenance costs
Use water temperature less than 140° in all sinks, especially the pre-rinse sink. **The dishwasher operates at 160° but wastewater is not discharged to the grease trap.**	Temperatures above 140° dissolve greases, which can re-congeal or solidify in the sanitary sewer conveyance system as the water cools.	Using lower temperature water saves the FSE money in energy costs used to heat the water.

Use a three-sink dishwashing system: wash, rinse, and sanitize in a 50-100 ppm bleach solution. Water temperatures in this system are less than 140°	The three-sink system uses water temperatures less than 140° where a dishwasher operates at 160°.	The FSE will reduce its costs of energy for heating the water and operating the dishwasher.
Install screens on all kitchen sink drains (openings less than 3/16").	Screens prevent introduction of solids into the sewer conveyance system.	Solids and greases in the sewer system contribute to blockages.
Remove garbage disposal.	This equipment allows an excessive load of solids to be introduced into the sewer conveyance system.	Reducing the amount of material being discharged into the conveyance system minimizes the threat of blockage.
Recycle used cooking oil. Do not pour it down the sink/drain.	There are many waste oil recyclers and could be a source of revenue.	The FSE must pay to have garbage removed, but used oil will be collected at no charge, or perhaps the FSE will be paid for it.
Cover outdoor oil and grease containers.	Rainwater can cause these containers to overflow into storm drains, sending the grease directly to streams.	The grease and oil are more valuable when undiluted.
Locate grease storage containers away from storm drain catch basins.	If there is a leak or overflow, the FOG can flow directly to streams.	Decomposition of FOG in fresh water uses oxygen, reducing its availability for biologic creatures.
Scrape up spilled FOG into a dustpan and then into the trash or use absorbents for FOG spills.	Water dilutes the FOG and causes more clean-up and more overall waste.	FOG is directly disposed into the garbage and not down any drain where it could cause a backup or clog.
Regularly clean kitchen exhaust filters.	Keeps grease from being deposited on the building exterior where it is a stormwater hazard.	Grease build-up is a major fire hazard.
Clean the Grease interceptor regularly and record it.	Scheduled cleaning is easier to remember and accomplish. Recording the cleaning communicates this action among all staff.	Maintenance of the grease interceptor will extend its life and reduce the risk FOG pass through to the sewer conveyance system.

Signage at the point of decision-making, the sinks or drains in which the employee is about to dump greases, is very helpful to kitchen staff. It not only reminds them of what to do, but it reminds them that management cares that they follow the proper procedure.

One company, Goldstreet Designs, has worked with many public utilities to development many kinds of signage. This poster has photos, graphics, and multiple languages to quickly communicate best practices. View other predesigned products at [https://goldstreetdesigns.com/pre-designed-materials/.](https://goldstreetdesigns.com/pre-designed-materials/)

As mentioned earlier, kitchen BMPs primarily depend upon people carrying them out. Building a culture of adhering to these BMPs will save money and prevent sewer back-ups and clogs. Don't let someone else create a problem for you kitchen due to lack of training!

Periodic evaluation of wasted food sources and possible diversion of usable food should be done. Periodic training and engaging employees in kitchen BMPs is important. The employees know how to make things better if they understand the principles the FSE is trying to achieve.

Figure 15: Goldstreet Design Brochure