

Grease Interceptor Design Considerations

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Hood River, OR
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Pollution Prevention Resource Center



Grease Interceptor (GI) Design Consideration Topics

- What are the challenges?
- What can we do to address the challenges?



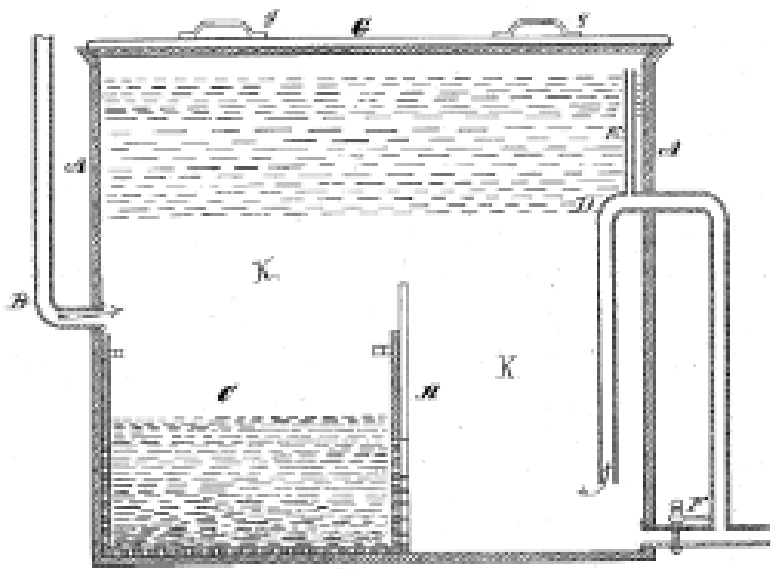
(See Model.)

N. T. WHITING.

GREASE TRAP.

No. 306,981.

Patented Oct. 21, 1884.



GI DESIGN CHALLENGES

WITNESSES

Arthur J. Weeks
C. D. Fowler

INVENTOR

Nathaniel T. Whiting
per *D. P. Kennedy*

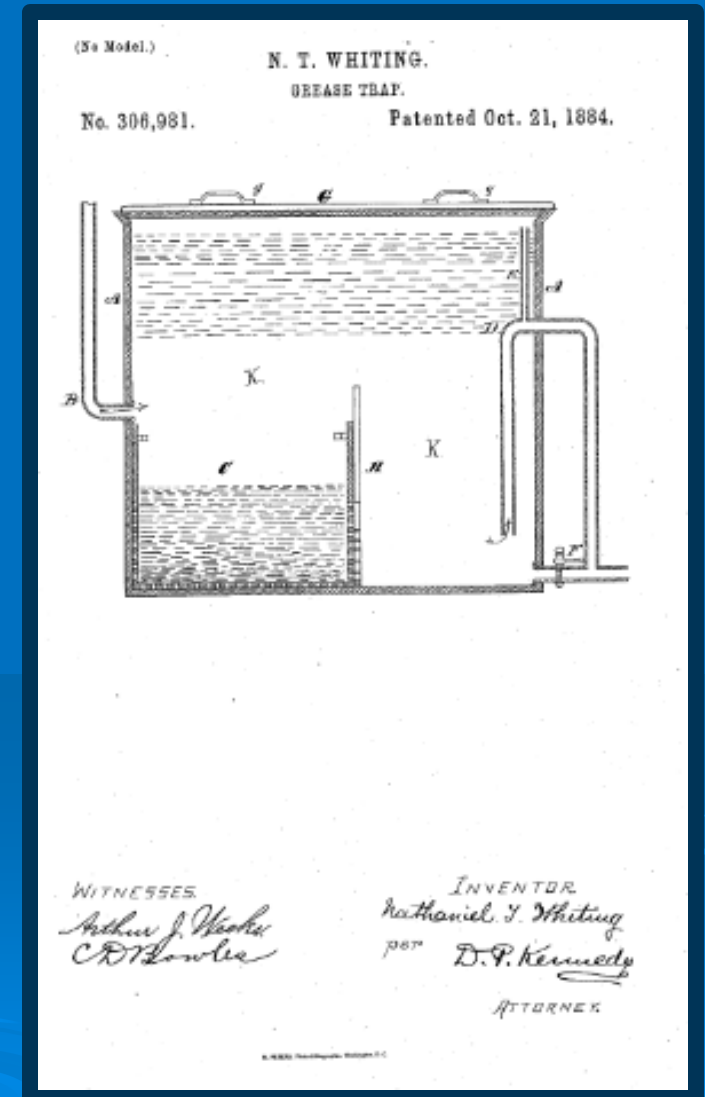
ATTORNEY

First “Grease Trap” Patent

Nathaniel Whiting (1884)

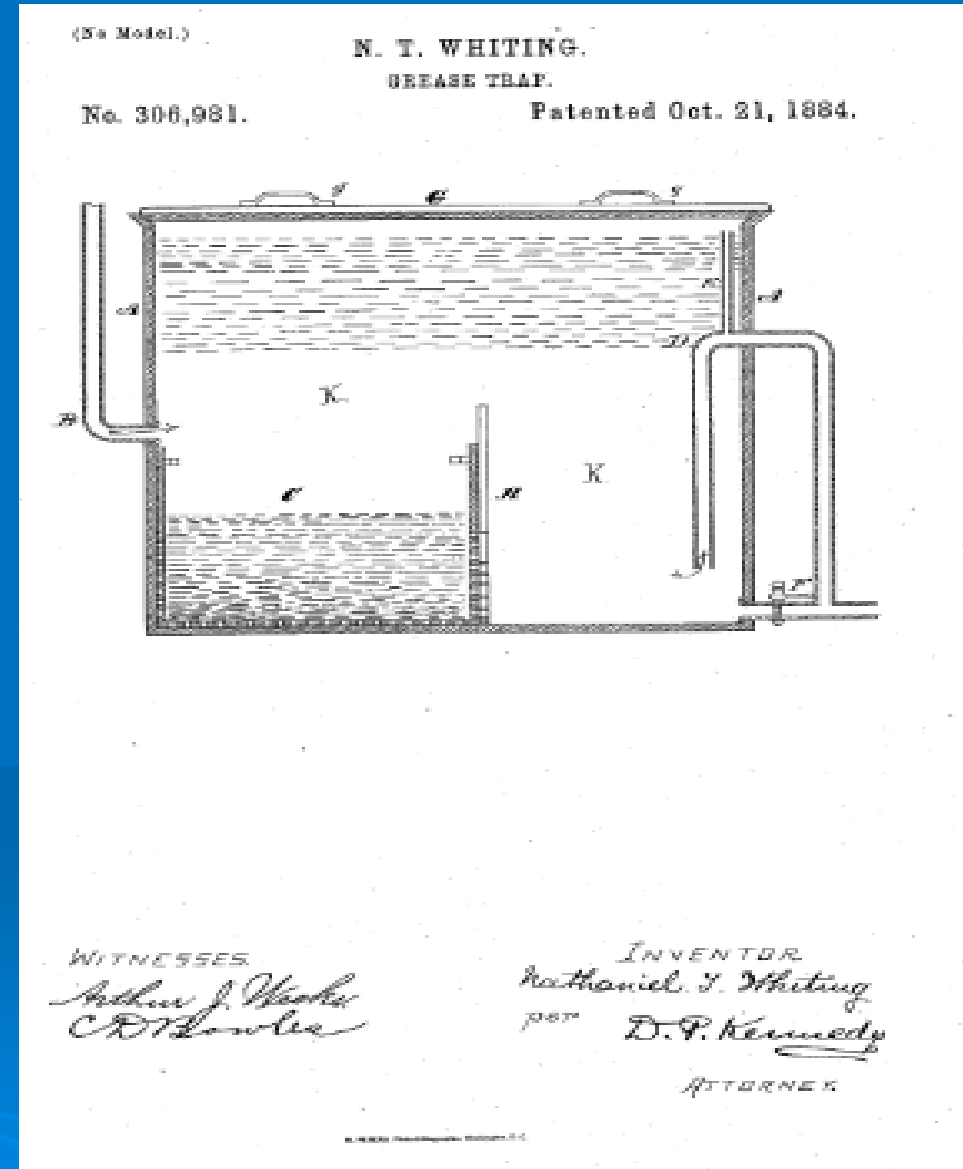
<https://patents.google.com/patent/US306981A/en>

“My invention relates to a trap or apparatus which is to be applied to the discharge-pipes, to of sinks, and which is especially designed to separate grease and sediment from the water and collect it in a body,.....”



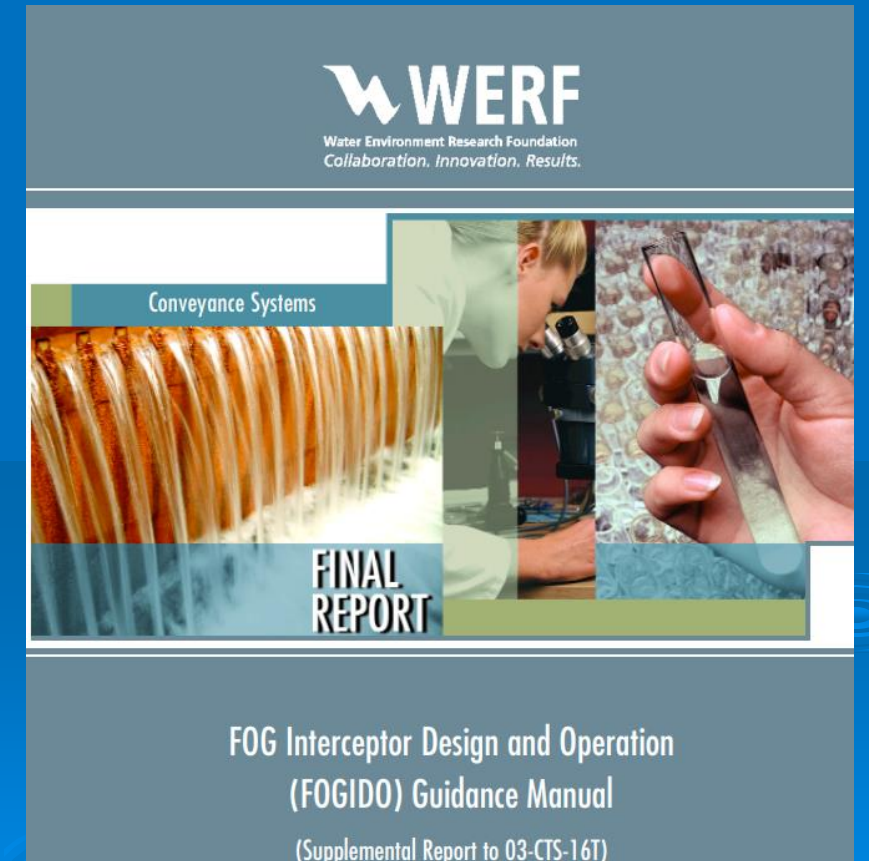
FOG Interceptor Design and Operation (FOGIDO) Guidance Manual

- Sizing formulas,
- GI sizing methodology and considerations
- Factors that affect GI performance

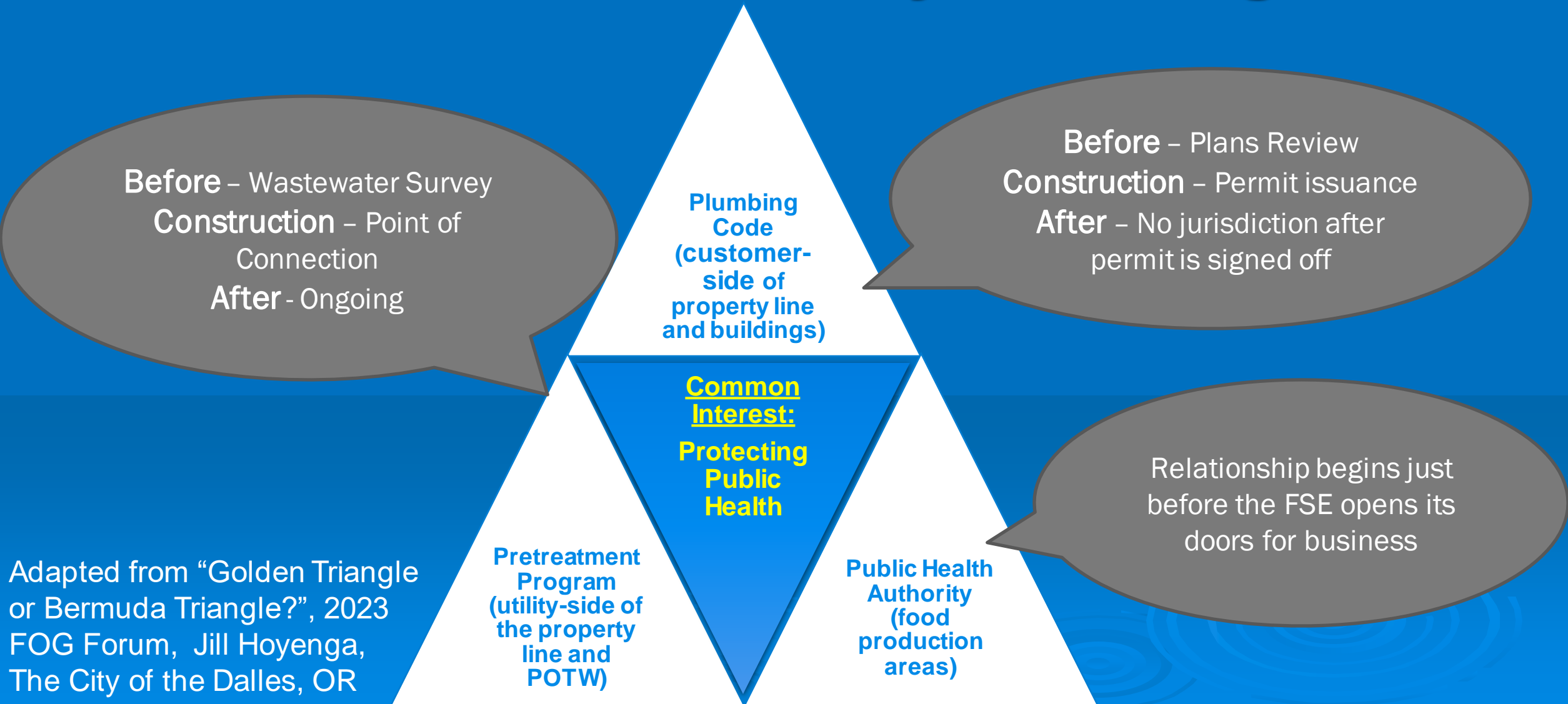


Assessment of Grease Interceptor Performance

- FOG removal results from several restaurants
- Diagrams of typical daily variations of flow for different types of restaurants
- Impacts of temperature and other factors on performance
- Inlet, outlet, and baffling configurations;
- Modeling of flow patterns
- FOG and solids accumulations for different types of internal GI configurations



Jurisdictional Authority Challenges



Adapted from "Golden Triangle or Bermuda Triangle?", 2023 FOG Forum, Jill Hoyenga, The City of the Dalles, OR

What' are some of the challenges with Plumbing Codes?

There are 6 major challenges with model plumbing codes:

Adopted standards focus on minimum retention capacities for hydromechanical interceptors

No performance testing required for gravity interceptors (*no GGI performance standard*)

Sizing of interceptors focuses only on flow rates or liquid gallons of holding capacity

Vague and confusing language regarding fixtures that should be routed through an interceptor

Pump out frequency not considered

FOG loading not considered

What Affects the Performance of Grease Interceptors?

- Flow and detention time variance
 - Too much detention time or not cleaning frequently enough will cause $\text{pH} < 5$ (*federal violation, corrosion*)
- Turbulence (*separation*)
- Temperature (*separation*)
- Excessive amounts of detergents and sanitizers (*emulsification*)
- Use of additives (*pass-through*)
- FOG and solids accumulation (*storage capacity*)

What's Wrong with Current Practices?

Typical Plumbing Code methodologies

- **Flow rates based on connected fixtures**
 - **Peak flow?**
 - **Which fixtures are connected?**

Determine Number of Drainage Fixture Units (DFU) for Connected Fixtures



Cross-reference required capacity from a table



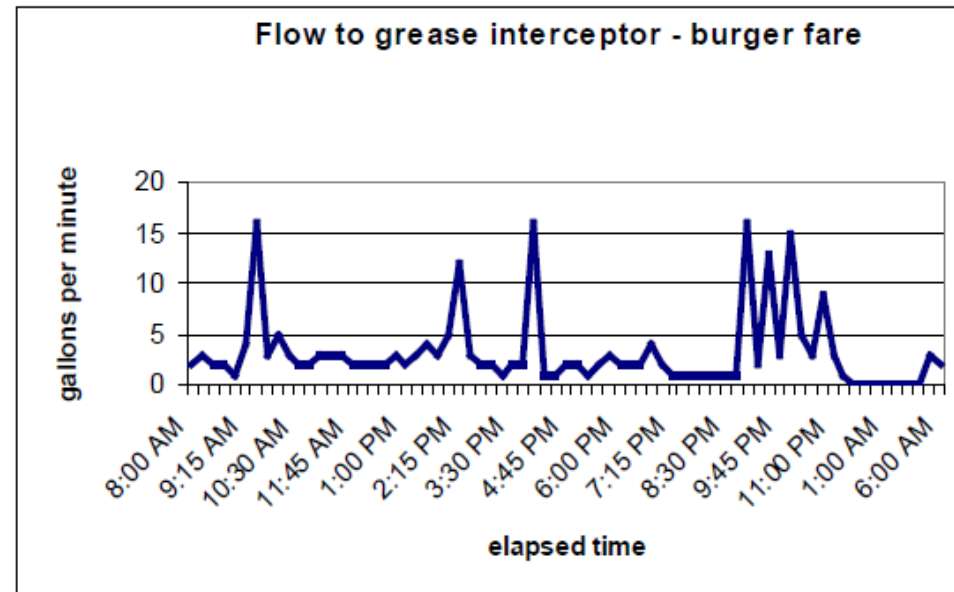
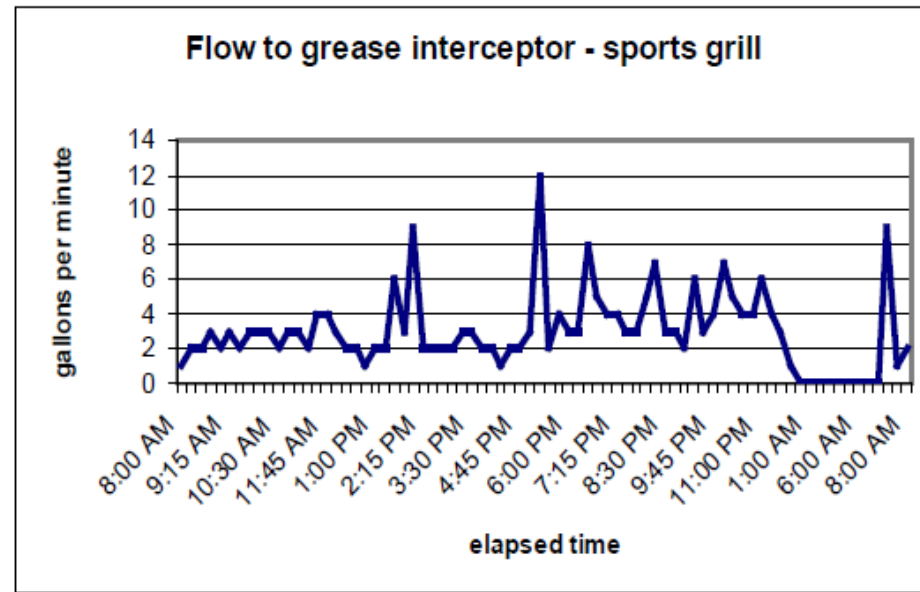
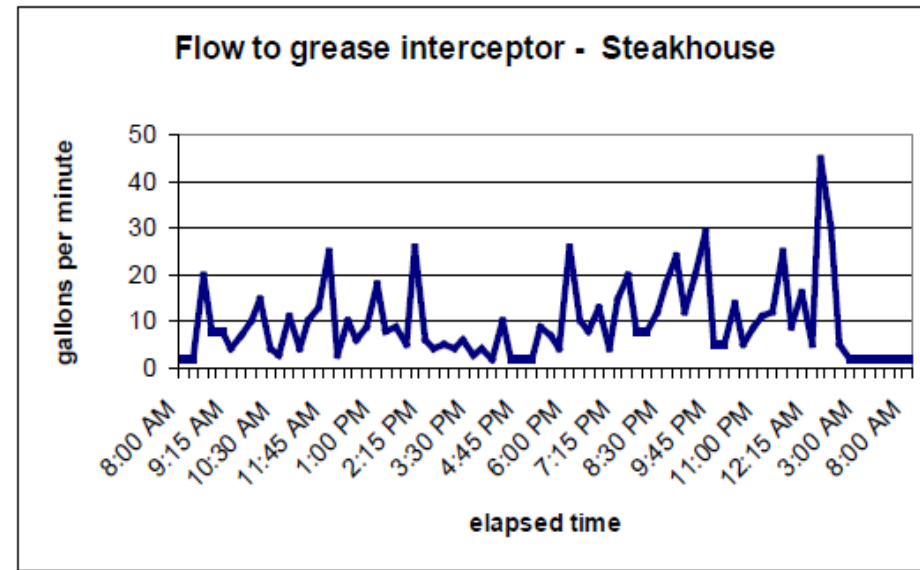
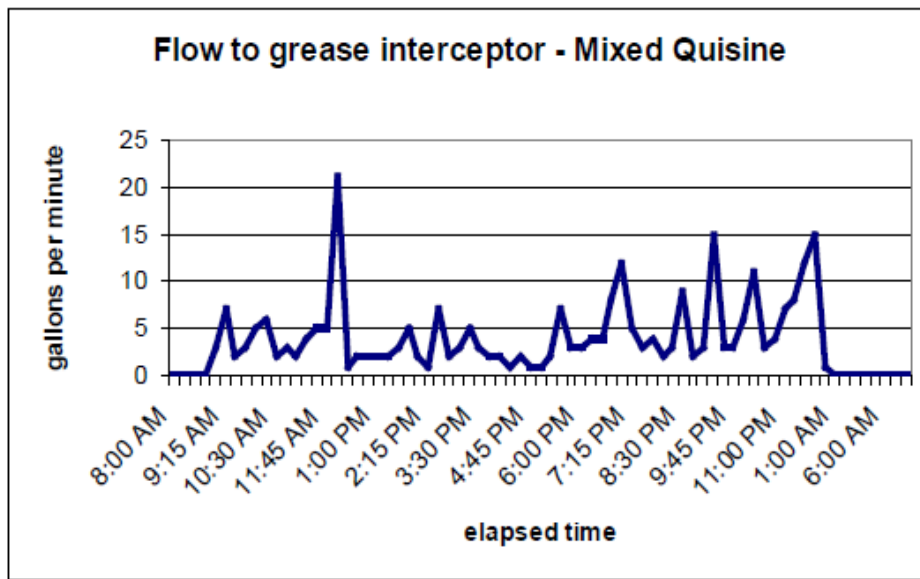
Select largest capacity if in between a value in the table



Assessment of Grease Interceptor Performance
(Supplemental Report to 03-CTS-16T)



Typical Flow Patterns



Which Fixtures Produce Grease in Quantities That Can Affect Line Stoppage?



What about Dishwashers and Food Waste Disposal Unit Connections?

2018 & 2021 International Plumbing Codes (IPC):

1003.3.1 Grease interceptors and automatic grease removal devices required

A grease interceptor or automatic grease removal device shall be required to receive the drainage from fixtures and equipment with grease laden waste located in food preparation areas, such as in restaurants; hotel kitchens; hospitals; school kitchens; bars; factory cafeterias and clubs. Fixtures and equipment shall include pot sink; prerinse sinks; soup kettles, or similar devices; wok stations; floor drains or sinks into which kettles are drained; automatic hood wash units; and **dishwashers without prerinse sinks.**

1003.3.2 Food waste disposers restrictions

A food waste disposer shall not discharge to a grease interceptor.

2018 & 2021 Uniform Plumbing Codes (UPC):

1014.1.3 Food waste disposers and dishwashers

No food waste disposer or dishwasher shall be connected to or discharge into a grease interceptor

Commercial food waste disposers shall be permitted to discharge directly into the building's drainage system.

Exception: Food waste disposers shall be permitted to discharge into grease interceptors that are designed to receive the discharge of food waste.

There Goes the FOG!

**First
Cycle
from the
Dishwasher**

**What about
temperature?**

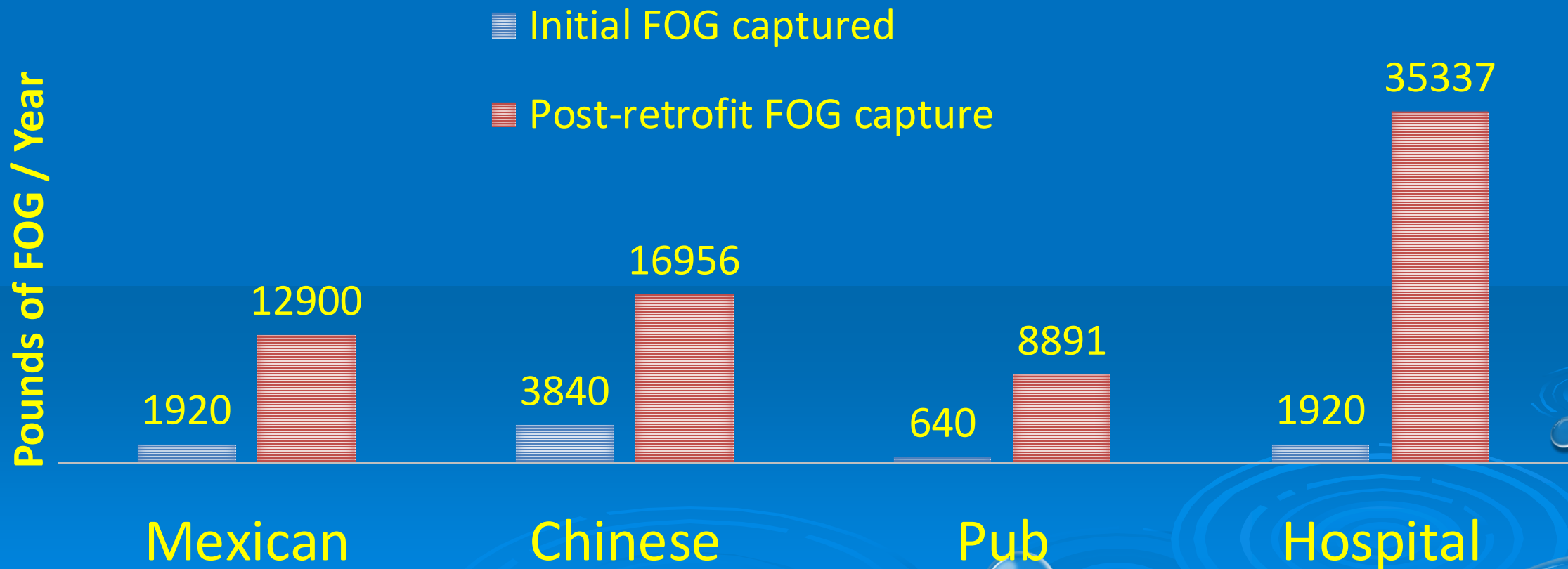
12/29/2009

NEW YORK CITY FSE COMMERCIAL WASTE DISPOSAL STUDY

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

Retrofit Case Studies Reveal Increased FOG Capture

Oregon Specialty Plumbing Code now requires all fixtures be connected



What's Wrong with Current Practices?

Typical Plumbing Code methodologies

- **FOG loading not considered**
 - **Facility type**
 - **Number of meals served by food service establishments(FSEs)**



FOG Production Varies by FSE Type

- Very High
- High
- Medium
- Low



ESTIMATED FSE FOG PRODUCTION ESTIMATES

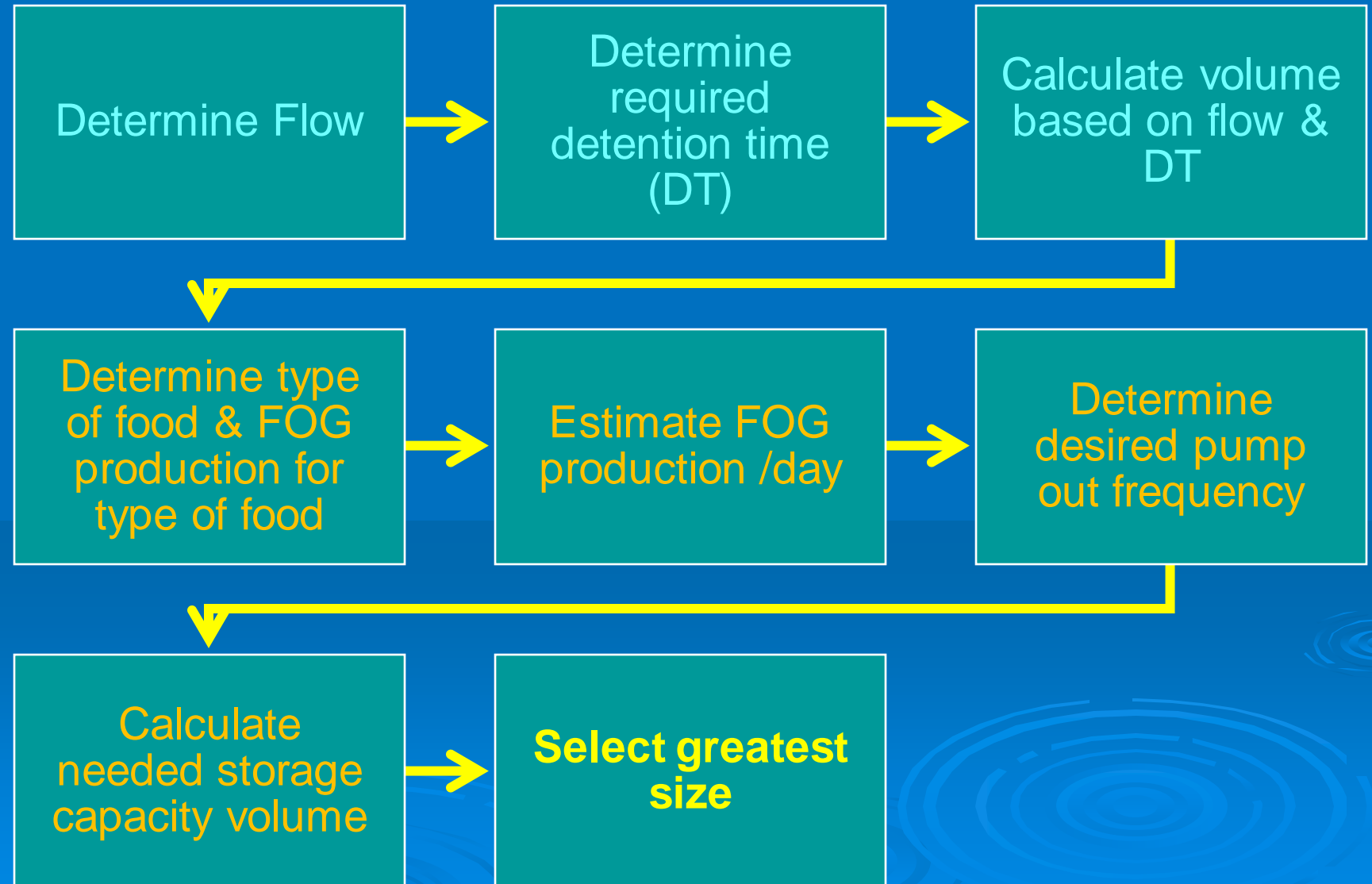
Source:

American Society of Plumbing Engineers - Plumbing Engineering Design Handbook, Vol. 4, Chapter 8, Table 8.3.

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

Sizing Should Be a Two-Step Process

- ❖ Needed Capacity
 1. Flow and detention time
 2. FOG/Solids Storage Capacity



- ❖ Consider total volume needed and pump out frequency
- ❖ Initial cost vs. annual pump-out cost
- ❖ Consider life-expectancy

How to Calculate the Estimated Number of Meals

Estimated number of meals

- Convenience stores = 50 meals/hr
- Child Daycare = listed occupancy on Cert. of Occupancy x 2
- Hotel Breakfast Bars = Total rooms x 2 (double occupancy)

Source: "Why the average number of meals sold per hour is important to grease interceptor sizing, and how it can be calculated," James Richardson, American Society of Plumbing Engineers and City of Columbus, OH

How to Calculate the Estimated Number of Meals

Estimated number of meals/day

- Fast Food/Quick Service Restaurants
 - Avg. meals/day = 40 meals/hr x operating hrs/day
- Full-Service Restaurants
 - Avg. meals/day = 50 meals/hr x operating hrs/day

Source: "Why the average number of meals sold per hour is important to grease interceptor sizing, and how it can be calculated," James Richardson, American Society of Plumbing Engineers and City of Columbus, OH

How to Calculate the Estimated Number of Meals

Estimated number of meals/day

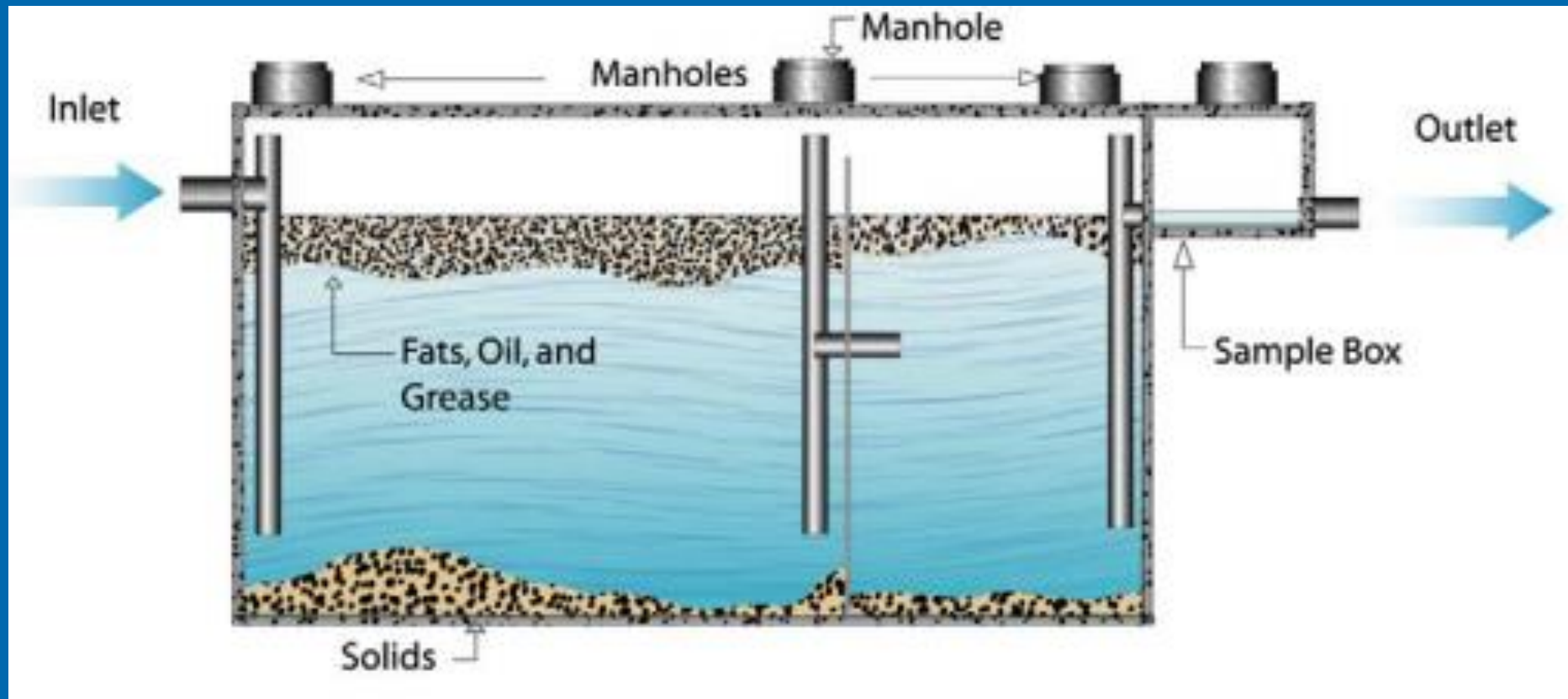
Other FSE Types

- Cafeterias = #meal services/day x (students + staff served)
- Nursing Homes/Adult Daycare = #meal services/day x (residents + staff served)
- Prep Kitchens for Mobile FSEs = #units using kitchen x avg. 67 meals/hr

Source: "Why the average number of meals sold per hour is important to grease interceptor sizing, and how it can be calculated," James Richardson, American Society of Plumbing Engineers and City of Columbus, OH

Another
Challenge

GI piping and configuration



Impact of Baffling – 20-Minute Retention Time

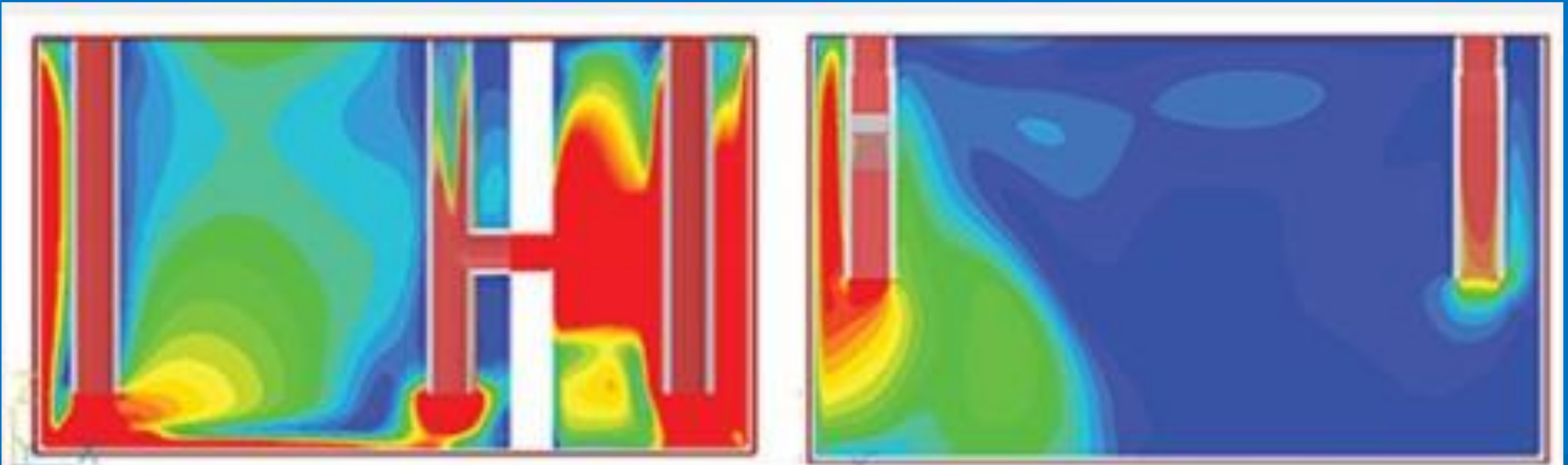


Figure 2. Comparison of Fluid Velocities in Single-Compartment and Two-Compartment Tank When Narrow Transfer Baffle is Used. Fluid velocity is indicated by color (blue is slow, red is fast). *Figure courtesy of the Water Environment Research Foundation.*

Influent Baffling System to More Evenly Distribute Flow

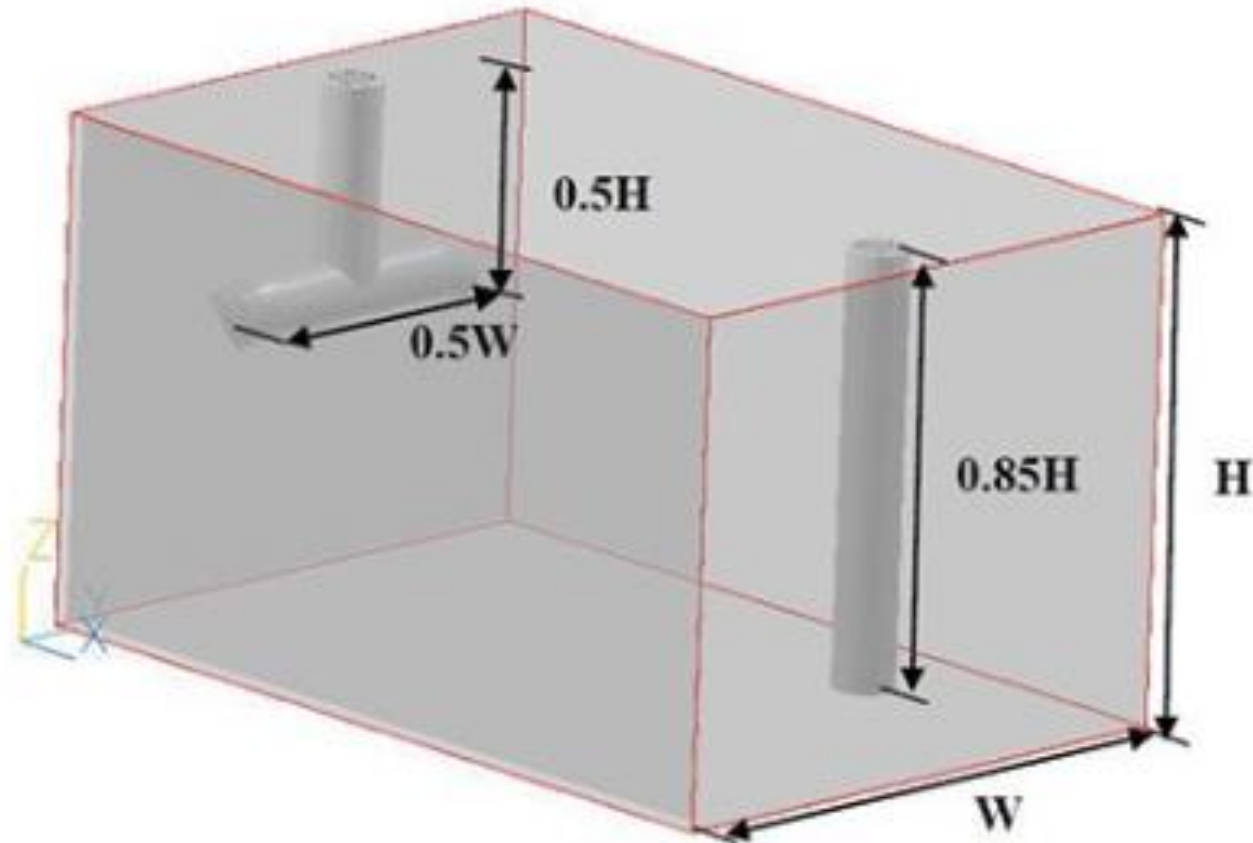
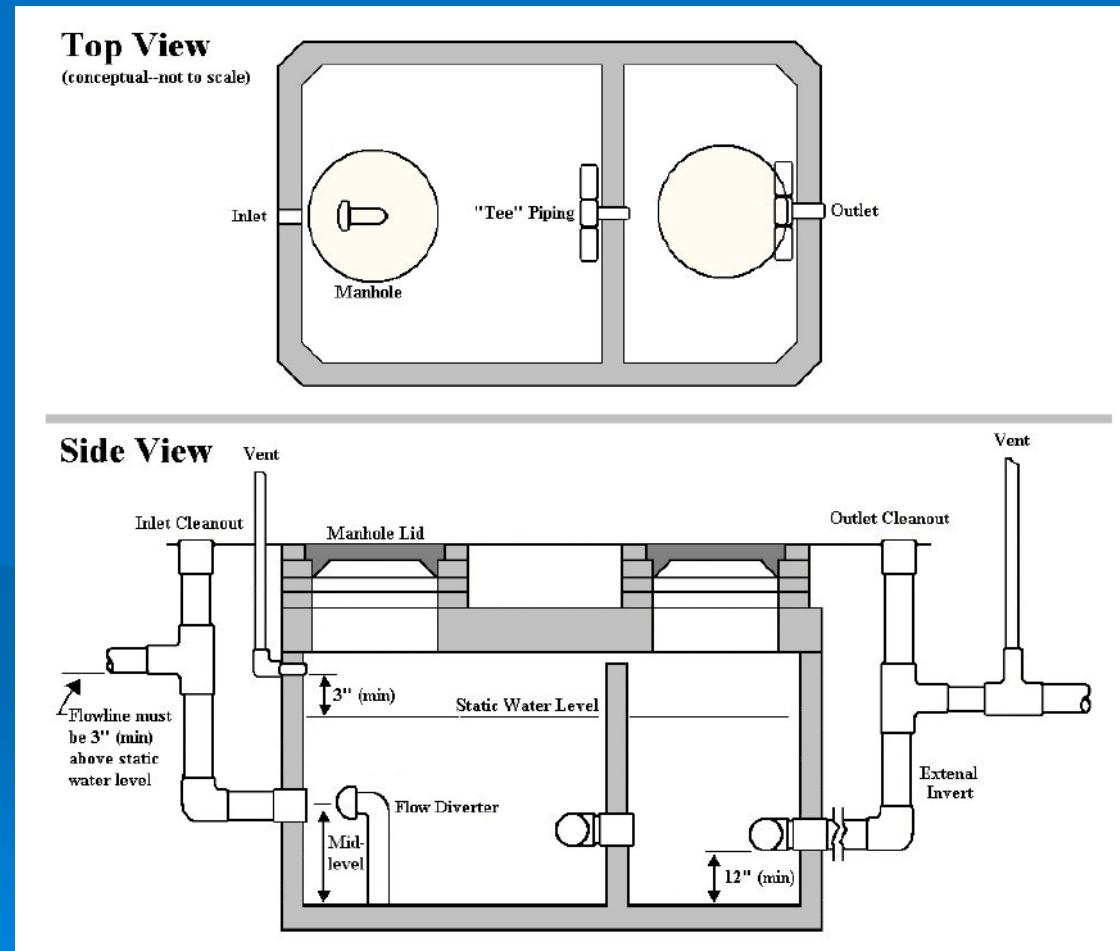


Figure 3. Example of an Influent Baffle System that Could Distribute the Flow Throughout the Grease Interceptor Tank. Figure courtesy of Water Environment Research Foundation.

Conceptual Drawing of GGI Design



Courtesy City of Austin - [Design Criteria for Grease Interceptors](https://www.austintexas.gov/DesignCriteriaforGreaseInterceptors) | [AustinTexas.gov](https://www.austintexas.gov)

What's Wrong with Current Practices?

- ❖ **Pump out costs not considered**

- ❖ **Cost/Benefit**

- ❖ Larger GI vs fewer pump outs
- ❖ Smaller GI vs more pump outs

- ❑ **Pump Out Frequency**

- ❑ 30-day
- ❑ 60-day
- ❑ 90-day

- ❑ **Pump Out Cost Range**

- ❑ ~ \$0.17 to \$1.50 per gallon

- ❑ **1,000 GI Pump Out Cost**


- ❑ \$175 to \$1,500 per pump out

GGI vs HGI - Replacement Cost Comparison



	GB-250 (100 GPM)	CONCRETE (1,000 gal.)
Initial installation	\$6,665	\$9,744
Pumpouts over 10 years	\$6,050	\$16,400
Replacement cost after 10 years	\$0	\$14,744
10-year cost of ownership	\$12,715	\$40,888

How Can We Address These Challenges?

- ✓ Be a “Change-Agent.”
 - ✓ Build strong relationships...internal and external
 - ✓ Get a “seat at the table” for plumbing plan reviews.
 - ✓ Educate plumbers and design engineers
 - ✓ Amend state/local plumbing codes, when needed and if possible.
 - ✓ Address retrofits needs
- 

Questions

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