



OPTIMIZING GREASE INTERCEPTOR PERFORMANCE

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FOG – FATS, OILS & GREASE

- FATS ARE OF ANIMAL ORIGIN, SOLID @ 68°F
- OILS ARE OF PLANT ORIGIN, LIQUID @ 68°F
- GREASE MAN-MADE, USED AS A LUBRICANT
- COLLECT SAMPLE IN AMBER GLASS JAR
- MIX KNOWN VOLUME OF SAMPLE WITH HEXANE (A POWERFUL SOLVENT LIGHTER THAN WATER) IN A SEPARATORY FUNNEL
- TOP LAYER PLACED IN PRE-WEIGHED CONTAINER **INSIDE A FUME HOOD**
- ALLOW HEXANE TO EVAPORATE. RECORD MG WEIGHT INCREASE PER LITER OF SAMPLE (MG/L)



The background is a light blue gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The text is centered in the middle of the image.

**FOG IS A MEASURE OF
FLOATABLE SUBSTANCES**

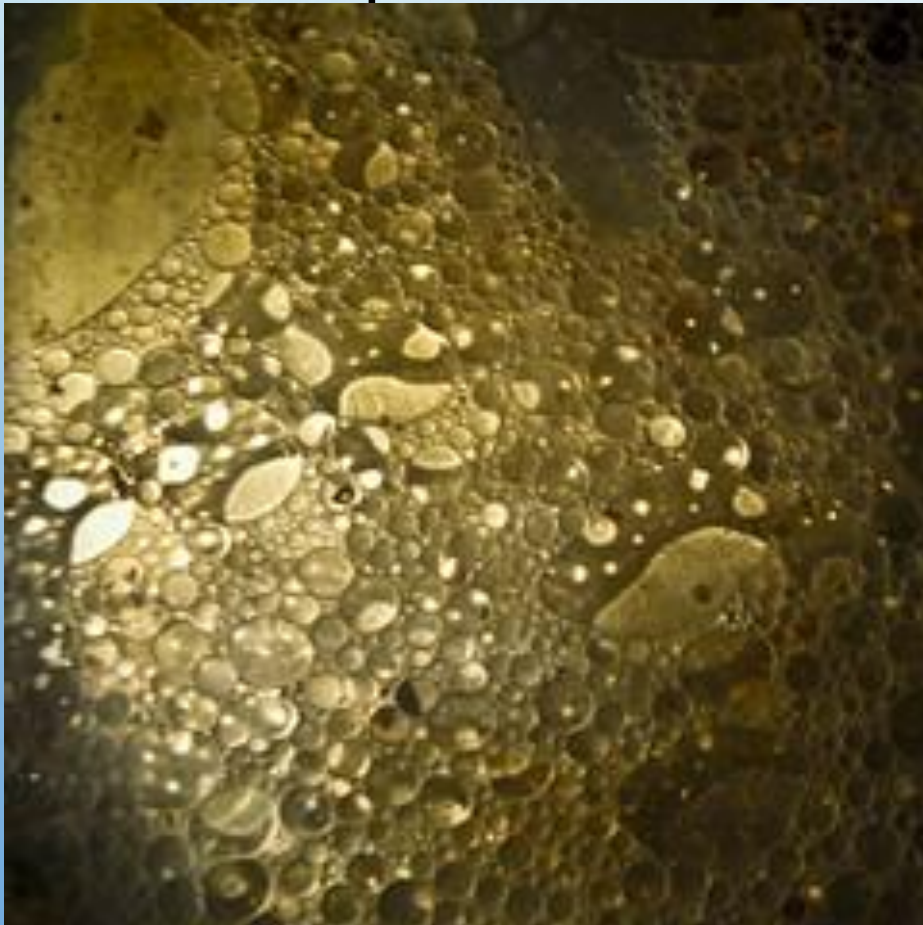
WHAT IS A DESIGN CONCEPT?

- A BRIEF EXPLANATION OF WHAT A DEVICE IS INTENDED TO DO
- EYEGLASSES: IMPROVE VISION
- SUN GLASSES : PROTECT VISION IN BRIGHT SUN,
FASHION STATEMENT



What Are We Trying to Achieve?

- Take wastewater with high levels of FOG and food solids and effectively retain much of those solids and FOG as possible.
- Release treatable wastewater into the next downstream component



Design Concept for a Grease Interceptor

- Accepts the FOG-laden liquid from a food service establishment
 - hold it and let the contained liquid cool
 - the lighter than water FOG fraction rises to form an upper layer
 - solids settle on the bottom in a sludge layer
 - flotation and settling must occur under *calm* conditions
- Allow a cooled, clarified liquid to exit the interceptor(s) by hydraulic displacement

- Gravity Grease Interceptor (GGI)



- Hydromechanical (HGI)



- Automatic (AGI)



3 KEYS TO GRAVITY GREASE INTERCEPTOR PERFORMANCE

- **TIME** - FUNCTION OF TOTAL CAPACITY AND FLOW PATH (USE BAFFLES & COMPARTMENTS TO PREVENT SHORT CIRCUITING). COMMERCIAL GRADE FILTRATION CAN ALSO BE BENEFICIAL
- **TEMPERATURE** - FUNCTION OF HOT WATER SETTINGS, DETENTION TIME AND SURFACE AREA
- **TURBULENCE** - DON'T WANT ANY. ALLOW MATERIAL TO SETTLE BASED ON ITS SPECIFIC GRAVITY

MORE ON TEMPERATURE

- A commercial dishwasher will discharge 170°F water. Switching to a chemical sanitizer allows lowering water temperature to 130°F
- This lower temperature is significant, because some animal fats will begin to solidify at ~90 to 100°F
- Some designers have used air lines to strip temperature out of a grease interceptor. But doing this makes the tank turbulent!

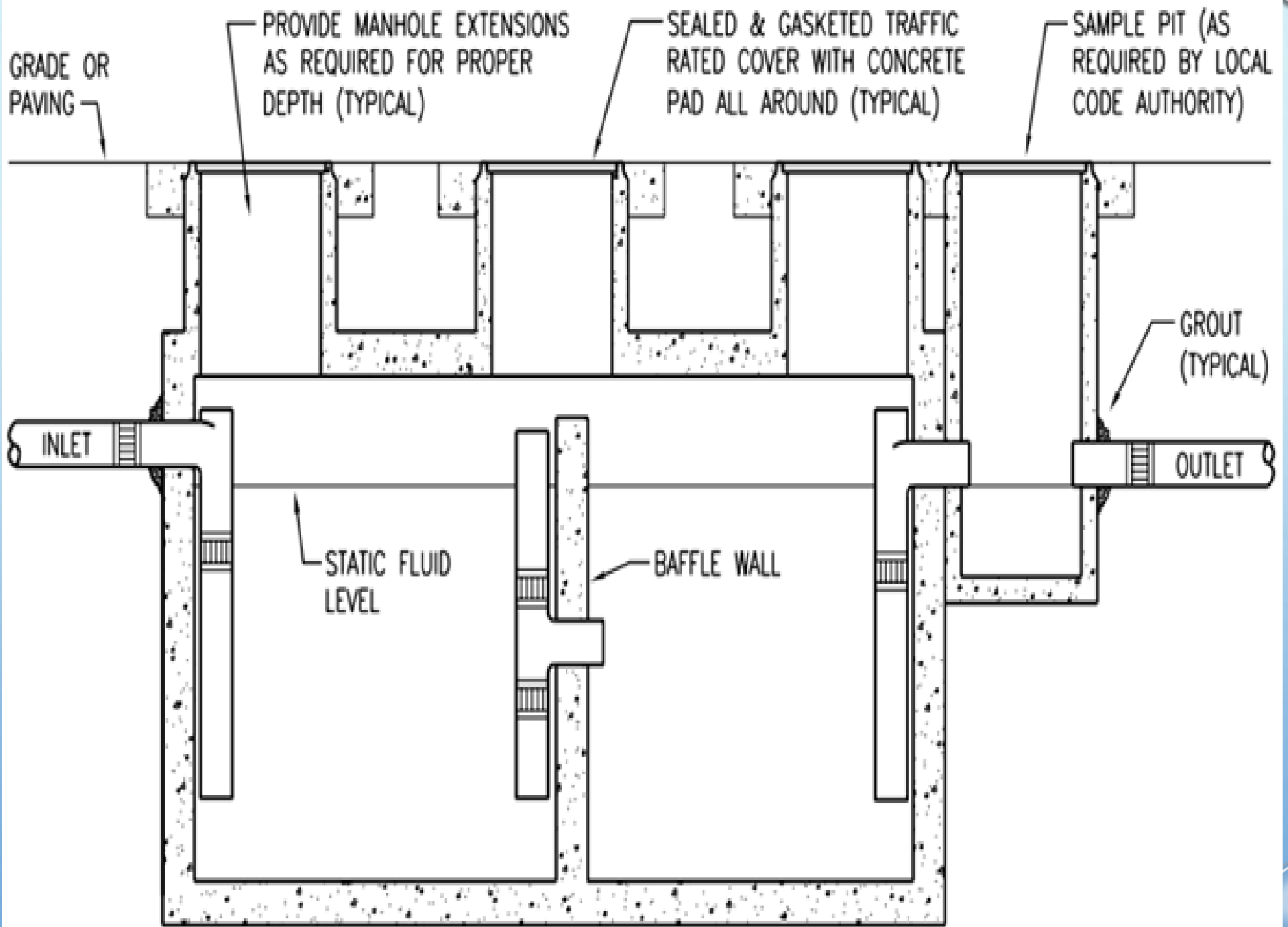
MELTING POINTS OF VARIOUS LIPIDS

Source	Pig	Sheep	Cattle (corn fed)	Butter	Olive oil
Melting Point °F	84°	104°	90°	90°	43°

- Melting points are different based on the species of animal/plant
- Melting points are different for lipids taken from different parts of the same animal.
- Melting points are different based on the animal's diet

MORE ON TURBULENCE

- FOG SPECIFIC GRAVITY < 1 , FLOATS
- SUSPENDED SOLIDS SG > 1 , SINKS
- PLACE INTAKE OF OUTLET DEVICE DEEPER THAN IN STANDARD SEPTIC TANK



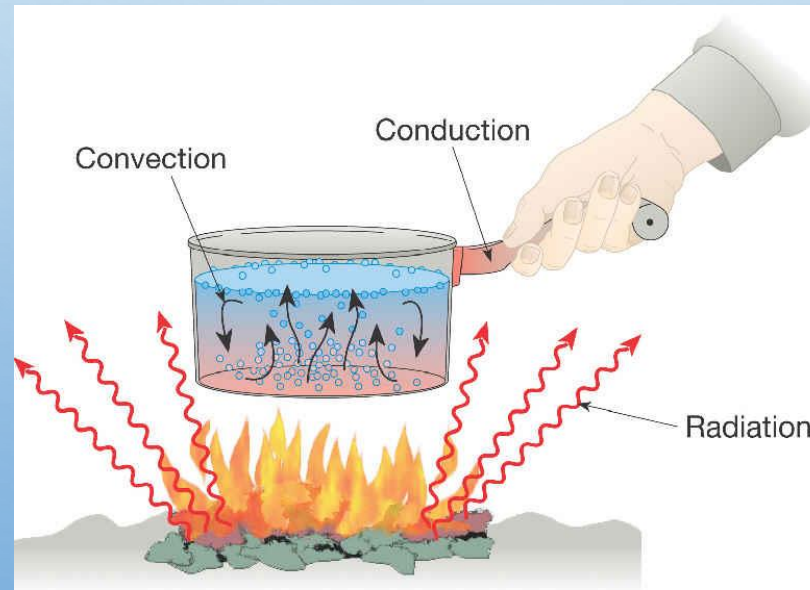
GRAVITY GREASE INTERCEPTOR PLACEMENT

- Located outside of food preparation areas
- Distance from building a factor
 - too close - water too hot and emulsified fat, oil & grease get through interceptor(s)
 - too far - sewer line clogs before discharge reaches interceptor
- Menu has an impact - vegetable oils are somewhat water soluble and will only be retained if there is some animal fat for them to coat



HEAT TRANSFER MODES

- Convection – caused by fluid (liquid or gas) moving close to hot surface
- Conduction – transmitted through solids or stationary fluids (heat diffusion through a 2nd material)
- Radiation – heat transmitted as electromagnetic waves



DENSITY OF AIR AT ATMOSPHERIC PRESSURE AS A FUNCTION OF TEMPERATURE

Air Temperature °F	Density in pounds per cubic foot
60°	0.076
70°	0.075
80°	0.074
90°	0.072
100°	0.070
110°	0.069
120°	0.068

* Source: The Engineering Toolbox

GRAVITY GREASE INTERCEPTOR DESIGN CONSIDERATIONS

- PEAK FLOW RATES
- SURFACE AREA (COOLING)
- TOTAL STORAGE VOLUME
(RETENTION TIME)
- BAFFLES/FILTERS, ETC.

IN FOOD SERVICE APPLICATIONS

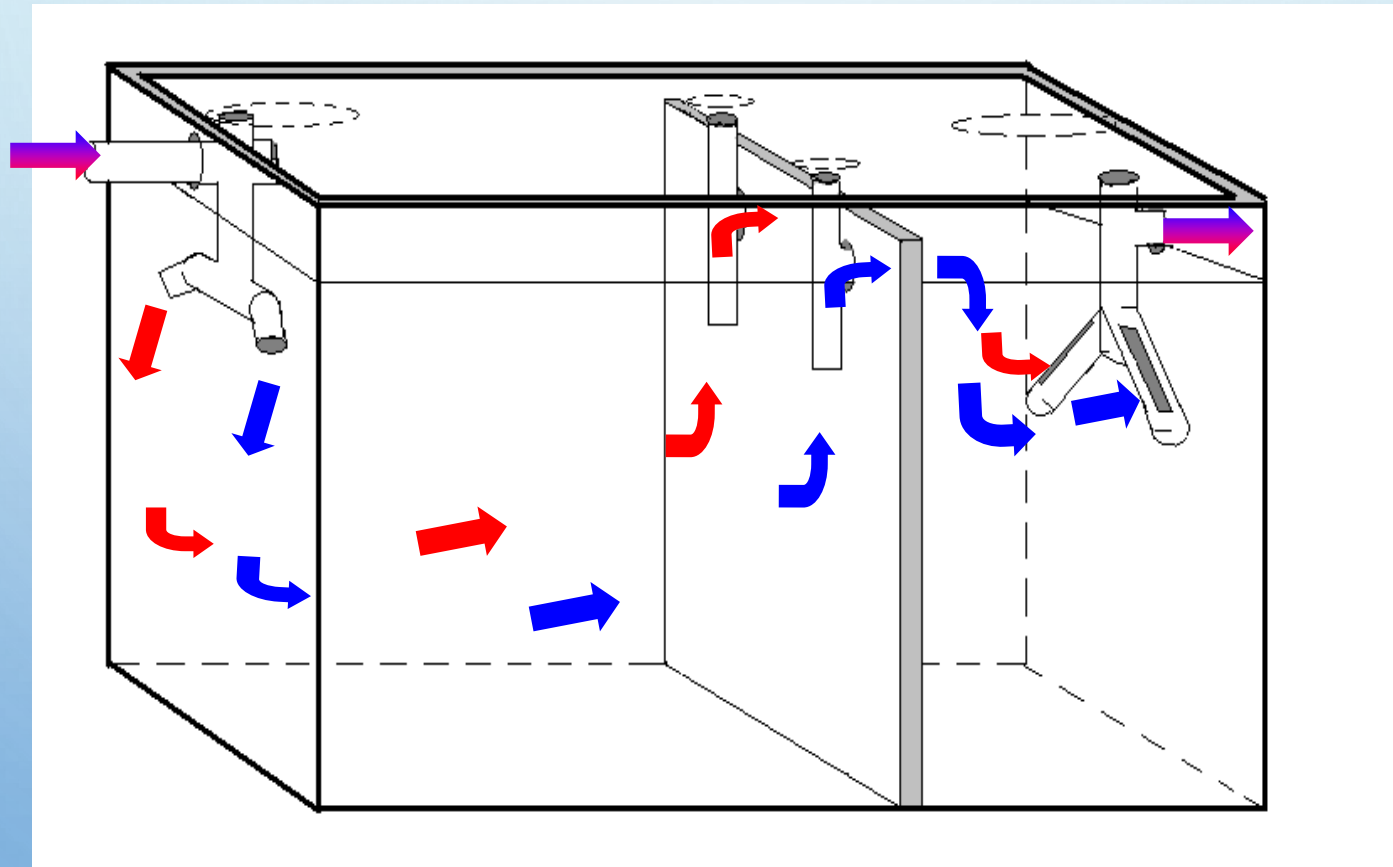
- the kitchen flow must be routed to a gravity grease interceptor **BEFORE** being routed to the septic tank

GRAVITY GREASE INTERCEPTOR LOCATION AND SERVICE FREQUENCY

- Parking Lot
- Loading dock
- Under decks (with hinged access)
- 30 days to 90 days between service typical
- If more frequent service needed, interceptor is severely undersized
- If you can stand inside the tank on solid fat, its too long without service!

WAYS TO PREVENT SHORT-CIRCUITING

- Larger or multiple pass throughs in compartment wall(s)
- Use a distributed inlet/outlet to create multiple flow paths



Courtesy Leon Holt, Cary, NC

MULTIPLE FILTERS



FAT SOLIDIFIED AND STARTED CATCHING OILS!



INTERCEPTOR SIZE (VOLUME) A KEY DESIGN DECISION

- Multiple easily cleanable interceptors in series are better than one gigantic interceptor
- Goldilocks dilemma, first interceptor will be too hot
- Next interceptor may show fats solidifying (pump)
- Final interceptor allows more floating/settling (pump less often)



PEAK FLOW AS A FUNCTION OF FIXTURE UNIT EQUIVALENTS

Equipment Name	Equivalent Fixture Units
Commercial Dishwasher	3 FU
Pot Sink	3 FU
Clean up/Mop sink	3 FU
Floor Drain	2 FU
3 compartment sink	2 FU

PROJECTED PEAK FLOW

Total Equivalent Fixture Units	Peak Flow
1 to 6	30 gallons/minute
7 to 9	40 gallons/minute
10 to 12	50 gallons/minute
Greater than 12	4.1 gpm/FU

DESIGN SURFACE AREA VS. PEAK FLOW

Peak Flow Rates	Required Surface Area (sq. ft)
30 gallons/minute	62
40 gallons/minute	82
50 gallons/minute	104
60 gallons/minute	124

SAMPLE PROBLEM STATEMENT

- **A 40-SEAT LUNCH & DINNER SIT-DOWN RESTAURANT HAS ONE DISHWASHER, ONE POT SINK, ONE MOP SINK, ONE FLOOR DRAIN AND ONE 3-COMPARTMENT SINK**
- **WHAT SIZE GREASE INTERCEPTOR(S) WOULD YOUR INSTRUCTOR DESIGN FOR THIS FACILITY USING THE PROCEDURE SUGGESTED HERE?**

SAMPLE PROBLEM SOLUTION

- PEAK FLOW = $3+3+3+2+2=13$ FU
- >12 FU = $13 * 4.1 = 53.3$ (ROUND UP)
- DESIGN SURFACE AREA (USE 60 GPM) = 124 SQ FT
- TYPICAL 3,000 GAL GREASE INTERCEPTOR IS 129 SQ FT
- RECOMMEND 3-1000 GALLON TANKS IF SPACE ALLOWS
- OR 2- 1,500 GALLON TANKS IN SERIES
(UPC 06 RECOMMENDS ONE 1,000 GALLON GGI)

FACILITY TIPS

- TYPICAL OPERATING HOURS (PEAK FLOW)
- # MEALS SERVED GIVES ANOTHER CHECK ON SIZING
- SELF-SERVE SALAD BAR #1 SOURCE OF FOG (OVERUSE OF DRESSING)
- BETTER PLATE SCRAPING (USE DISPOSABLE PAPER) #1 IMPROVEMENT IN EFFLUENT

FACILITY TIPS (CONT.)

- IS DEEP FAT FRYER MAKING ENOUGH MONEY TO BE WORTH THE COST OF DESIGN?
- ICE CREAM DRIPPINGS VERY HIGH IN BOD
- ICE MACHINE CAN SEND MANY GALLONS OF WATER TO SYSTEM UNNECESSARILY, MAKE SURE ITS NOT LEAKING

FIELD METHOD TO TROUBLESHOOT EFFLUENT CHARACTERISTICS

- IF TEMPERATURE AT EXIT OF LAST GRAVITY GREASE INTERCEPTOR ABOVE 110°F (YOU CAN'T HOLD YOUR GAUNTLETED HAND IN THERE), IT IS SHORT CIRCUITING OR IS TOO SMALL
- SOLUTION, CHEMICAL RINSE, DISTRIBUTED INLET, COMMERCIAL GRADE FILTERS (TWO IN PARALLEL), ADD AIR VENT TO LAST TANK, ADD MORE TANKS IF POSSIBLE
- IF pH IS LOW (UNDER 4) EXCESSIVE CHEMICAL USE

FINAL TIPS AND TRICKS

- IF EXCESSIVE FOG EVEN AT 90-100°F TEMPERATURE, MENU CHANGE TO VEGETABLE SHORTENING
- WILL SOLIDIFY AT A HIGHER TEMPERATURE AND WILL ALLOW VEGETABLE OILS (CANOLA, OLIVE) TO COAT
- SERVICE ALL TANKS JUST BEFORE COLUMBUS DAY