APPENDIX B

Aspen Park Metropolitan District

GREASE INTERCEPTORS / SAND AND OIL TRAPS

PRETREATMENT PROGRAM

1.0 BACKGROUND

This document is intended to augment the document entitled " Classification of wastes and General Prohibitions", also located in Appendix C of these Rules and Regulations. The discussions, which follow, include the following topics.

- Potential solutions for reducing oil and grease in the collection system
- Clogged sewer lines and equipment coating
- Inspection of grease interceptors in Littleton and Englewood and the sanitation districts
- Inspection of restaurants and other food services without interceptors
- Sizing criteria for grease interceptors
- Pumping schedules for industries with grease interceptors
- Minimum criteria for new and existing sources of oil and grease
- Biological treatment (enzymes and/or bacteria)

2.0 POLICY/PROCEDURE

Grease interceptors are required for all food preparation establishments which may contribute or cause to contribute, directly or indirectly, any water or wastewater which contains oil or grease. This includes however is not limited to, restaurants, cafeterias, cafes, fast food outlets, schools, fraternal organizations, churches, hospitals, and daycare centers. In-line interior grease traps may not be allowed, unless otherwise approved by the District. Grease interceptors are not required for private residences or dwellings.

Exceptions to the grease interceptor requirement are facilities granted a written variance by the District; following approval of a plan review process. Variances apply strictly to the named facility owner/operator located at the named facility address.

The grease interceptor design and sizing criteria must adhere to the requirements established by the District and will be subject to approval. The District has adopted the sizing criteria developed by the City and County of Denver Wastewater Quality Control Procedures for grease interceptor sizing. Those grease interceptors not able to achieve compliance with Division standards may be subject to modification and/or replacement.

Maintenance of grease interceptors is the sole responsibility of owner or operator. The owner or operator must ensure proper operation to prevent obstruction, interference or damage to the collection system. All grease interceptors must be pumped at approximately 75 percent retention capacity or 25 percent total volume of accumulated bottom solids and top grease layer. They must be pumped dry and the contents hauled and disposed off-site at an approved facility. Grease interceptor pumping, at a minimum, must be completed every three months, unless determined more or less frequent pumping is required. This is subject to approval by the District. The District has implemented an inspection program to

ensure compliance. Inspections are completed in accordance with the guidelines and procedures outlined in the District Inspection Criteria.

The use of bacteria or enzymes is not prohibited; however, they may not be used as a substitute for regular pumping of a grease interceptor.

Existing sources not contributing significant quantities of oil and grease wastes to the collection system may be granted a written waiver to the inspection criteria. The waiver to the inspection criteria applies strictly to the named facility owner/operator located at the named facility address, subject to an initial inspection and approval by the Division. Facilities subject to the inspection waiver may include, however is not limited to, delicatessens, sandwich shops, and pizza take outs whereas other than the preparation of pre-cooked meals, no cooking, food preparation or food service would take place.

3.0 GREASE INTERCEPTOR SIZING CRITERIA

The District has adopted a grease interceptor sizing criteria developed by the City and County of Denver Wastewater Quality Control. The criteria are based on the following:

- Turn-Over Rate
- Gallons Of Water Used Per Setting
- Seating Capacity
- Hours Of Operation
- Categorical Use Factor (CUF)

The Categorical Use Factor is based on the type(s) and quantity of kitchen fixtures used for a particular facility, including ovens, grills, woks, deep fryers, sinks, mop sinks, disposals, dishwashers, and floor drains.

Please contact the District at 303-979-7286 for more information on grease interceptor sizing.

4.0 OIL AND GREASE INTERCEPTOR INSPECTION CRITERIA

4.1 PUMPING

At a minimum, a grease interceptor shall be pumped at approximately 75% volume retention capacity (or 25% total volume of accumulated bottom solids and top grease waste). Below 75% capacity, efficiency decreases which allows for limited separation time and by-pass of the interceptor system.

The efficiency of an interceptor is a function of the solids/grease thickness versus the total depth of the interceptor. In a typical grease interceptor, 75% volume retention capacity can equate to approximately 6 to 12 inches of solids/grease thickness.

4.2 REPAIR/MAINTENANCE

All grease interceptors shall be inspected for the following systems:

Outside

1. Manhole cover. Easily accessible and removable.
2. Identification of single or double compartments.
3. Exterior clean-outs.
4. Vent lines.

Inside

1. Identification of inlet and outlet compartments.
2. Identification of Inlet and outlet plumbing (i.e., sanitary 'Ts' with caps or 90 degree elbows).
3. Inlet and outlet extended risers installed below water surface.
4. Location of baffle wall.
5. In the event any of the aforementioned system(s) is damaged or is missing, the system(s) must be repaired or installed, where reasonably applicable. Defective equipment can cause inadequate operating processes.

4.3 NOTICES

Facilities which are required to pump and/or repair interceptors, as documented by inspections, shall be given written notices of violation. Pumping and repairs shall be completed within 5 days and 30 days upon receipt of notice, respectively, and where reasonably applicable.

4.3 FOLLOW-UP INSPECTIONS

Facilities with violations shall be re-inspected following the elapsed time period to ensure compliance. Failure to comply shall result in further notice of violation or enforcement actions. The enforcement procedure is as follows:

- Written notice of pump or repair – issued by inspector
- Written notice of non-compliance – issued by inspector
- Written Director's Order – issued by Director of Utilities

4.4 EXISTING SOURCES

Existing sources not connected to grease traps or interceptors are identified through inspection of the collection system. Once these sources are identified, they are required to implement Best Management Practices (BMP) to keep oil and grease out of the system. Examples of BMPs include:

- Do not use a garbage disposal.
- Scrape food from plates into a garbage can.
- Pre-wash plates by spraying them off with cold water over a small mesh catch basin positioned over a drain. This catch basin should be cleaned into a garbage can as needed.
- Pour all liquid grease and oil from pots and pans into a waste grease bucket stored at the pot washing sink. Heavy solids buildup of oil and grease on pots and pans should be scraped off into a waste grease bucket.

- If the BMPs are not successful at the facility and it continues to contribute significant amounts of oil and grease to the sewer, as documented by inspections, then the facility is required to install an adequately sized grease interceptor.

For detail drawings of Oil and Grease Interceptors, please refer to drawings 3-4B, 3-5A and 3-5B.

SIZING CRITERIA
GREASE INTERCEPTORS

The basic formula is: (turn-over rate) x (categorical use factor) x 2.5 (gal. of water) x (seating capacity)

The varying sizing applications have been broken into the following categories:

CATEGORY A: RESTAURANTS/CAFETERIAS FORMULA:

3.0 x 1.0 x 2.5 x Seating

- Full or limited service with the capability to serve or prepare 100 meals per day.
- Plumbing fixtures: one pot sink, one 2 or 3 compartment sink, one hand sink, one mop sink, one floor sink, one dishwasher, one garbage disposal – NOT CONNECTED TO THE GREASE INTERCEPTOR.
- Equipment: one grill, one fryer, one to three ovens.

CATEGORY A-1 FORMULA

2.0 x 1.25 x 2.5 x Seating

Same criteria as Category A with these additions:

- Plumbing fixtures: the same as Category A, EXCEPT the garbage grinder will be directed to the interceptor.
- Equipment: the same as Category A.

CATEGORY A-2

Same criteria as Category A-1, with the following additions and differences listed:

- Plumbing fixtures: For each additional garbage grinder and dishwasher that is to be directed to the Grease Interceptor, there will be a factor of .25 added to the Categorical Use Factor (C.U.F.).
- Equipment: For each additional "wok" stove, deep fryer and grill, there will be a factor of .50 added to the categorical factor.

CATEGORY B: HOSPITALS, SCHOOLS, INSTITUTIONS and CARE FACILITIES FORMULA

HOSPITALS/SCHOOLS = 2.0 X .75 X 2.5 X bed usage or seating

INSTITUTIONS/CARE FACILITIES = 2.0 x 1.0 x 2.5 x seating or bed usage

These formulas will be adjusted by the following when necessary:

• A value of .25 will be added to the Categorical Use Factor for each dishwasher or garbage disposal directed to the Grease Interceptor above the number of one each.
• A value of .50 will be added to the C.U.F. for each additional deep fryer or grill above the number of one each.

CATEGORY C: DELI STORES, SUPERMARKETS BUTCHERS and BAKERIES (with meat cutting capabilities) FORMULA

(hours of operation) x 4.0 x 10

For each of the following conditions, a factor of .50 is to be added to the C.U.F. value of 4.0 when dealing with meat cutting:

- more than one floor drain
- complete cooking of meats

When dealing with retail-type bakeries or supermarkets that have bakery facilities in addition to a deli and/or meat cutting, the bakery shall be sized separately using the same formula as above with the deletion of the .50 adjustment for the cooking of meats.
There is an adjustment of an addition of 1.5 to the C.F.U. when dealing with bakeries that are wholesale only, or are of the industrial classification.

CATEGORY D: FOOD COURTS and "COMMON" TRAPS

Each case shall be sized by separating each of the potential contributors into its own category then combining the operations for a total trap size.

Example:
Mile High Food Court Tenants List: McDonalds, Taco Bell, Wong Le's Mongolian, Mrs. Fields Cookies, Little Caesar's Pizza.

McDonalds, Taco Bell and Wong Le's would be sized using the formula applicable for Category A-2. Little Caesar's could be sized by using Category A-1. Mrs. Field's would use the formula for Category C.

CATEGORY E: COMMISARIES, COMMERCIAL KITCHENS and CATERERS

These must be sized on an individual basis. However, it should be noted that the minimum acceptable size for a commercial kitchen shall be 1500 gallons.

CATEGORY F: FOOD MANUFACTURERS

Each case shall be evaluated separately. Whenever a manufacturing operation is evaluated, it must be noted that a Control Manhole will be required in most cases in addition to a minimum of 1500 gallon Grease Interceptor.

RATIONALE FOR A LOCAL LIMIT FOR ANIMAL\VEGETABLE OIL AND GREASE

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LITTLETON/ENGLEWOOD WASTEWATER TREATMENT PLANT
April 1994

A study was performed by the pretreatment staff to determine the need to develop new local limits for oil and grease. This study involved the collection of documentation data relating to oil and grease problems at the treatment plant and in the collection system. The worker health and safety, pass through, process inhibition, and sludge quality factors were investigated at the treatment plant through interviews with the operation, maintenance and laboratory personnel. Oil and grease problems in the collection system were investigated through a phone survey conducted of all the utility departments in the service area.

Results of the study indicated no documentation for worker health and safety, pass through, and sludge quality at the treatment plant. Some process interference problems relating to animal fat oil and grease at the treatment plant were discovered. Problems identified were clogging of the DAFT lines and the rag dewatering station and scum buildup in the primary clarifiers. Animal fat oil and grease in the collection system was found to clog sewer lines and coat equipment.

This document serves as a local limit rationale for animal\vegetable fat Oil and Grease in the service area of the L\E WWTP. The Best Available Technology for the treatment of oil and grease was investigated and an applicable limit was based on the practical application of this technology.

Conventional Animal\Vegetable Oil and Grease Treatment

If pretreatment of Oil and Grease is required,. the Uniform Plumbing Code (U.P.C.) recommends that an U.P.C. approved grease trap be installed. It does not mention any other type of treatment. The U.P.C. recommends proper sizing of the grease trap and that the trap be cleaned out or pumped at the proper interval. The current technology for grease traps include the passive grease traps that need to be pumped when overloaded with free, floating oil and grease and the automatic grease\oils removal traps.

The passive grease traps are receptacles designed to collect and retain oil and grease substances normally found in kitchen or similar wastes. These receptacles take advantage of the difference in specific gravity of oil and grease versus water by allowing for oils and grease to rise to the surface under quiescent conditions. The effectiveness is dependent upon sufficient retention times for the separation of oil and grease. The correct sizing of the grease trap is vital to allow sufficient retention times. The strength of the wastestream, the flow rate and the temperature of the wastestream are important considerations when sizing a grease trap. Another important consideration of this type of treatment unit is to pump the trap when it becomes overloaded with oil and grease. The treatment efficiency of these units decrease as the retained volume of oil and grease increase. Some studies

have determined that in a typical 20 gpm separator, the separation efficiency may approach 95% in an empty state. This efficiency decreases to 85% with 40 pounds of retained oil and grease and further decreases to 20% with 50 pounds of retained oil and grease. According to the Manual of Practice FD-3 published by the Water Environment Federation's technical practice committee, "cleaning should be done when 75% of the retention capacity of the unit is filled with accumulated grease."

The automatic oil and grease removal traps utilize a self-skimming unit which remove the oil and grease in the trap once a day and place it into a storage container. The collected oil and grease can then be disposed of or recycled. These units theoretically eliminate the need for the periodic pumping of the grease trap. Reference material on the self-skimming grease traps indicate that removal efficiencies of these units can approach 98%.

Of these two types of oil and grease interceptors, the automatic oil and grease removal units are the most efficient at removing the point source discharges of oil and grease. However, both types of technologies can be ineffective if large quantities of the discharged oil and grease are in the emulsified form. These types of oil and grease are held in suspension (soluble in water), are approximately the same density of water and flow through the interceptor without the physical separation. High levels of emulsification can occur due to elevated temperatures, presence of a large concentration of detergents, enzymatic ionization and mechanical shearing.

If the temperature of the wastewater rises, the oil and grease that is in the free, floating form can liquefy and become more soluble in water. An ideal temperature of less than 110° F is required to facilitate efficient oil and grease separation.

In the presence of detergents, the molecules of oils and grease can be made more soluble in water. The detergent can act as a "bridging mechanism" to bind the molecules of oils and grease together with water. This essentially "emulsifies" the oil and grease.

High pressure sprays, garbage disposals, and other kitchen cleanup techniques may mechanically shear or break down the oil and grease molecule into smaller groups which can be more soluble in water.

The use of enzymes, whether in the extracted form or in a bacterial culture break down the oils and grease into the smaller fatty acid molecules. These fatty acids, the emulsified form of oils and grease, are not separated in the interceptor and pass through.

The EPA has identified the use of biological treatment (i.e.; bacterial cultures) in the direct discharge of edible oil refining wastewater as a Best Practicable Treatment. However, this treatment method is utilized in activated sludge processes and aeration basins, not in grease traps.

The Littleton/Englewood Wastewater Pretreatment staff conducted phone surveys of various companies who market either enzyme or biological treatment products used in grease traps. Of the seven companies identified, five were contacted. Of these five companies, none sold extracted enzyme products. The general consensus of these companies was that enzyme treatments only emulsify the oil & grease, causing by-pass of the oil and grease treatment system. A few of these companies stated that enzyme treatment only delays the separation of oil and grease. The oil and grease may then separate downstream potentially causing clogging problems of the collection system.

All contacted companies market bio-products that consist of various strains of bacteria. The method

of bacteria application varied. Some used automatic bacteria dispensers. These dispensers would dispense a predetermined amount of bacteria into the treatment system. Some systems would dispense up to twelve times daily. Other types of systems are manually maintained requiring daily monitoring.

Of the contacted companies none could provide information regarding specific amounts of oil and grease reduction. The general comment was that each biological treatment system was site specific. Each system is designed for flow volume, potential grease volumes, and location of treatment within the drain system.

The use of enzymes in a bacterial culture theoretically break down the oils and grease to serve as "food' for the bacteria culture established in the grease trap. The additional digestion of the fatty acids by the bacteria in the grease trap is considered to be a treatment. The digestion of the fatty acids by the bacteria will further break them down into CO_2 and H_2O.

Potential limiting factors of biological treatment include retention time, temperature variations, maintenance and monitoring issues. Biological exposure to oil and grease require retention times that may not be achieved in the grease trap. Surges in flow volumes will further decrease the retention time of the wastewater. Elevated temperature readings above 120□ F potentially destroy the bacterial cultures. Conversely, temperature readings below 40□ F inhibit the effectiveness of the bacterial culture in the grease trap. A grease trap utilizing biological treatment requires continual monitoring and maintenance. Inoculation, maintenance of the bacterial cultures and the cleaning of the grease trap is necessary.

Alternative Treatment Technologies

Other technologies are available for Oil and Grease treatment. Among these are dissolved air flotation, chemical treatment, centrifugation, heating, filtration, and electrical methods. Of these methods, filtration and dissolved air flotation are the only treatments that can be utilized alone. The dissolved air flotation treatment is an actual physical separation of the oil and grease from the water with the use of injected air. The air is added to the waste stream under pressure by a pump and then discharged to atmospheric pressure in a tank. The oil and grease and small particles of solids cling to the surface of the minute air bubbles and float to the surface where they are skimmed off. Filtration methods utilize a variety of media such as sand and diatomaceous earth to filter the oil and grease from the waste stream. The addition of coagulating chemicals is necessary to create larger particles for more effective filtration.

The other methods of treatment, centrifugation and the chemical, heating, electrical methods, are utilized to de-emulsify the oil and grease prior to the physical separation from the water. Centrifugation treatment de-emulsifies the oil and grease by separating it from water with the use of centrifugal force. The chemical treatment either destabilizes the dispersed oil or destroys the emulsification agents present in the waste stream. The electrical treatment is performed by the passing of an electrical current through the wastewater as it flows through a series of pipes. The oil separates and collects at the anodes.

All of these treatments identified have limiting factors relating to their efficiency. Some treatment methods such as dissolved air flotation and electrical are not cost effective for a small volume discharger. Other treatment methods such as centrifugation and filtration are best utilized for a specific type of oil and grease.

Best Management Practices

An important concept in treating Oils and Greases is that pretreatment begins in the kitchen. The smaller the amount of oil and grease put down the drain, the easier it is to treat the remaining oil and grease in the interceptor. Good kitchen cleanup practices are the most efficient methods of oil and grease removal. A study conducted in Austin in 1982 on kitchen cleanup practices determined that a major portion of oil and grease discharged down the drain can be removed during kitchen cleanup. These practices listed can be used to decrease the point source discharge of oil and grease.

Do not use a garbage disposal.

Scrape food from plates into a garbage can.

Prewash plates by spraying them off with cold water over a small mesh catch basin positioned over a drain. This catch basin should be cleaned into a garbage can as needed.

Pour all liquid grease and oil from pots and pans into a waste grease bucket stored at the pot washing sink. Heavy solid buildup of oil and grease on pots and pans should be scraped off into a waste grease bucket.

Discussion

The most cost efficient treatment technology available to most dischargers of animal\vegetable oil and grease is the use of a grease trap. As previously stated, the automatic oil and grease removal units can approach 98% treatment efficiency. Most industries have passive grease traps on line. Efficiency of these units range from 20% to 95% depending on the volume of oil and grease retained in the separator. Average treatment efficiencies of 70-80% for grease traps can be attained in the service area of L\E WWTP, provided, that the grease trap is cleaned at proper intervals. The Littleton/Englewood POTW will request all utility departments in the service area adopt minimum cleaning intervals for on-line grease traps to attain these treatment efficiencies.
A sampling study conducted in St. Louis for oil and grease dischargers found that among animal\ vegetable dischargers, the food industry discharges the highest concentration of oil and grease. All samples were taken of untreated wastewater. Of the 660 samples taken for oil and grease from 88 food establishments, 32% of these samples were in concentrations less than 200mg\L, 29% of the sample concentrations were between 200 - 500mg\L, 21% of the samples concentrations were in the range of 500-1000mg\L and 18% of the samples recorded values above 1000mg\L.
If we can assume that this data is similar to what we can expect in the service area of the Littleton/Englewood WWTP, then 21% of all restaurants discharge untreated wastewater in concentrations of 500- 1000 mg\L and 18% of all restaurants discharge in concentrations above 1000mg\L. Taking this data and multiplying it by the treatment efficiencies of grease traps, we can expect effluent concentrations from the grease traps from 125 - 250mg\L for the restaurants that discharge in concentrations of 500 - 1000mg\L. For the industries that discharge above 1000mg\L we may expect effluent concentrations above 250mg\L.(Table 1)

Table 1
Untreated Effluent Concentrations from Restaurants X Grease Trap Treatment Efficiency

Percentage of	Untreated Effluent	Average Grease Trap	Expected Grease

Restaurants in service area	Concentrations	Treatment Efficiency	Trap Effluent Concentrations
32%	0 - 200mg\L	75%	0 - 50mg\L
29%	200 - 500mg\L	75%	50 - 125mg\L
21%	500 - 1000mg\L	75%	125 - 250mg\L
18%	above 1000mg\L	75%	above 250mg\L

*Untreated effluent concentration data taken from a St. Louis study on restaurants in the service area.
A local limit of 200mg\L for animal fat/vegetable oil and grease is proposed. As demonstrated in Table 1, we feel that 200mg\L is an attainable limit. Industries that cannot meet this local limit may have to utilize the Best Management Practices outlined in this document or clean the grease traps on a more frequent basis. It is recommended that minimum pumping intervals are adopted to meet the average treatment efficiencies for grease traps.

Oil and Grease Local Limits

by
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As defined by the U.S. E.P.A., Oil and Grease is considered in the class with other conventional pollutants such as BOD, TSS, and pH. (**Ref:** Standard Methods; 14th Edition) "Standard Methods" defines oil and grease as groups of substances with similar physical characteristics that are determined quantitatively on the basis of their common solubility in Freon. These include fatty acids, fats, waxes, hydrocarbons, oils, soaps and any other material that can be extracted by Freon during the analysis. The Oils and Greases present in the wastestream can be classified as polar or nonpolar. Polar oils and greases, usually biodegradable, originate from animals or vegetables and may include waxes, fatty acids, fats, oils, and soaps. Nonpolar oils and greases, less readily biodegradable, usually come from petroleum products and may include light hydrocarbons such as gasoline and jet fuels or heavy hydrocarbons such as crude oils, diesel fuel, asphalt, lubricants and cutting fluids. (**Ref:** "Pretreatment of Industrial Wastes" Manual of Practice No. 3 Water Poll. Control Fed. 1975) The sources of animal fat oils and greases are primarily from the food preparation industry The sources of petroleum-based oils and greases includes the automotive repair industry, metal finishers, industrial laundries and other manufacturing industries.

The presence of Oils and Greases in the wastewater presents a myriad of problems for divisions within the service area of the Littleton\Englewood Wastewater Treatment Plant. The oils and greases may impact the collection system and the treatment plant by coating, congealing, and accumulating on sewer pipes, pumps and equipment to the extent that obstructions occur. They may also impact worker health and safety by increasing the potential for hazardous atmospheres within the collection system.

This executive summary details the study conducted by the pretreatment staff to determine the feasibility of developing new local limits for Oils and Greases. This study involved the collection of documentation data relating to problems from oil and grease for the divisions within the treatment

plant and the collection system. Interviews were conducted with personnel from the operations, maintenance, and laboratory divisions at the Littleton\Englewood WWTP and the utility departments from Littleton, Englewood and the Southgate Sanitation District. A phone survey was conducted for the utility departments in the contracted wastewater districts of Littleton and Englewood. A literature review was performed for sources of best available treatment technologies, point sources, and any relevant data of how other POTWs developed Oil and Grease local limits.

Littleton/Englewood Wastewater Treatment Plant
Maintenance Division

The maintenance division has experienced problems in the Dissolved Air Flotation Thickeners (DAFTs), specifically, the thickened sludge pumps P7312 and 7313. These pumps pump the thickened sludge produced in the DAFT process to the digesters. Thickened sludge pump # P7312 contained hard scum throughout the intake valve and piping. The six (6) inch glass-lined pipe had been reduced to a one and a half inch opening. A small amount of rags clogged the intake to the pump causing the stator to burn up. Approximately 35 gallons of scum was removed from the intake line and valve. Replacement cost was $2,054.00. The other scum pumps in the area were disassembled to check for and to remove scum in the lines. The six (6) inch glass-lined pipe in thickened sludge pump P7313 intake line was reduced to a two (2) inch opening Approximately 35 gallons of grease was removed. The scum removal and pump repair took 86 maintenance man-hours.

The sources of sludge pumped to the DAFT units are the scum pits, the waste activated sludge, and the primary clarifier sludge. The waste produced from the scum pits is the major contributor to the clogging problems in the thickener pumps. The waste from the scum pits is generated by the skimming and collection of the free floating oils and greases from the primary clarifiers. The scum pits are then pumped at certain intervals to the DAFT system, typically 2 times a day.

Process and mechanical changes, such as engineering a looping system from the DAFTs to the digesters to recirculate warm digested sludge and retrofitting glass-lined piping in the thickened sludge line, were implemented during the recent expansion of the treatment plant to help alleviate the clogging problems of the thickened sludge lines and equipment. However, since the expansion implementations in 1992 problems with the thickened sludge line constricting because of the scum still occur. The line is on a preventative maintenance "pigging" schedule to help minimize the buildup of scum on the lines.

Operations Division

The operations division has experienced oil and grease problems primarily in the headworks and the primary clarifiers areas. One problem has been with the Hycor rotary screen used for dewatering rags in headworks. The rags that are mechanically scraped off the bar screen in the headworks area are sent through a sluiceway to the rotary screen for dewatering and to volatilize organics prior to the collection and disposal. The rotary screen has a self-cleaning water spray that should theoretically keep the pores of the screen clear of greases and debris. The pores, however, have been "blinded" by grease and scum and the operations staff have needed to clean them. The water spray used during the operational cleaning has been a hot water spray instead of cold water as originally planned to help alleviate the grease buildup. In 1993 and the first two months of 1994 there have been eleven (11) instances of grease buildup in the Hycor rotary screen which required operational intervention to clean and the grease buildup of the primary clarifiers and associated pumps and lines.

Another problem with oil and grease includes the grease or scum buildup in the primary clarifiers and the associated equipment. In 1993-4, there have been thirteen (13) instances of grease or scum buildup in the primary clarifiers, primary clarifier grinders and scum pits documented in the operations logsheets. Finally, there were six (6) instances of petroleum or solvent odors at headworks and/or "oily colored" influents which may be a result of petroleum-based oils and greases.

It has been suggested that oils and greases may be contributing factors to the promotion of *Nocardia* growth and the foaming in the aeration basins (**Ref**: Operation of Municipal Wastewater Treatment Plants; Vol.1,p.580-582.)and to the foaming problems in the digesters.

Pretreatment Division

The current Oil and Grease limit for the service area of the L/E WWTP is a total oil and grease limit that encompasses both the polar (animal fat) and non-polar (petroleum-based) oils and greases. The pretreatment division enforces the current Total Oil and Grease limit of 75.0 mg/L to its current SIU permits. The difficulty of enforcing this limit arises in instances of industries that may discharge both polar (animal fat) and non-polar (petroleum-based) oils and greases. Industries that discharge only petroleum-based oils and greases usually are in compliance with the total oil and grease limit while industries that discharge animal fat oil and grease have a greater potential for discharging in concentrations over the current limit. However, the current total oil and grease limit may not be applicable for animal fat oil and grease. The pretreatment division is reviewing the development of separate limits for petroleum-based and the animal fat oils and greases.

Laboratory Division

There has been no evidence of the pass-through of oil and grease at the Littleton/Englewood WWTP. All oil and grease analyses in the past five (5) years have been below the permit limitations of 10 mg/L. The analytical methods used by the laboratory at L/E WWTP is to look for a visual sheen in the chlorine bottles sampled by the operations division. If a visual sheen is recorded, the analysis protocol calls for the E.P.A.-approved gravimetric method to be conducted for oil and grease. This analysis protocol has been accepted by the state and is in the NPDES permit.

Cities of Littleton and Englewood Utilities

The utilities departments of the cities of Littleton and Englewood both have had a history of problems related to the animal fat oils and greases. They have periodic problems with clogged or constricted lines and coated equipment. Toxic atmospheres due to petroleum-based oils and greases are not a concern because the utilities departments from both cities have limited the entry of manholes and sewer lines by their personnel. Also, gas monitoring and ventilation is a requirement when a confined space entry is necessary. The city of Englewood reported that a hazardous atmosphere has not been detected in two-three years by the utility personnel.

Both cities have similar policies regarding the requirement for point sources to install oil and grease treatment technologies. They both require some form of on line technology for new sources however, the type of technology (grease traps, under the sink separators, oil and sand interceptors, etc.) in some cases may be a subjective decision by the utility inspector. Existing point sources are not required to install treatment technology unless an inspection relating to an oil and grease problem in the collection system is conducted and the conclusions dictate a need for treatment to be put on line.

The utilities departments of Littleton and Englewood have both expressed frustrations on the lack of reference material and rationale available to them for determining the correct type of treatment technology and the correct size to adequately separate oil and grease. Presently, the cities determine the treatment technology based on experience and the Uniform Plumbing Code however, there have been instances where the treatment technology installed had not been adequate. Also an inspection protocol is not in place to ensure that the traps or interceptors are pumped at the proper time intervals.

Literature Review

The literature reviewed and cited in this section came from a variety of sources. The sources included Manuals of Practice from the Water Pollution Control Federation, sales brochures from grease trap pumping and grease bacterial companies, the Uniform Plumbing Code, articles in utility trade journals, policies from the Utility departments in the service area and data gathered from the phone survey of the contracted sanitation districts in the service area of the L|E WWTP. The topics discussed in the literature included the effects of oil and grease on the collection system, grease traps sizing criteria, and alternative treatment technologies.

The major problem of animal fat (polar) oil and grease on the collection system is the coating, congealing, and accumulation on sewer pipes and pumps to the extent that obstructions occur. The problems of oil and grease in the treatment plant have been discussed. The potential for toxic atmospheres is attributed to the release of petroleum (non-polar) oil and greases.

According to the Uniform Plumbing Code (U.P.C.), Section 711.(a), "When, in the judgment of the Administrative Authority, (underlined by author) waste pretreatment is required, an approved type grease trap complying with the provisions of this section shall be installed in the waste line leading from sinks, drains, and other fixtures or equipment in establishments such as restaurants, cafes, lunch counters, cafeterias, bars, and clubs, hotel, hospital, sanitarium, factory, or school kitchens, or other establishments where grease may be introduced into the drainage or sewage system in quantities that can effect line stoppage or hinder sewage treatment or private sewage disposal. A grease trap is not required for individual dwelling units or for any private living quarters." The U.P.C. also states in Section 711. (b), "No grease trap shall be installed which has an approved flow rate of more than fifty-five (55) gallons per minute, nor less than twenty (20) gallons per minute, except when specially approved by the Administrative Authority, and in Section 711, (f) it states that " Grease traps shall be maintained in efficient operating condition by periodic removal of the accumulated grease. No such collected grease shall be introduced into any drainage piping, or public or private sewer. The U.P.C. recommends this equation to determine the correct interceptor size:

number of meals/peak hour X waste flow rate X retention time X storage factor = interceptor size (liquid capacity).

Recommended retention times for commercial kitchen waste are 2.5 hours and the storage factor for 16 hour operation is two (2). Once the waste flow rate and the peak meal rate is known, the optimum interceptor size can be calculated.

The Utility departments in the service area of the Littleton\Englewood WWTP are similar in their policies regarding the installation of grease interceptors. All sanitation districts within the service area contacted in the phone survey, with the exception of Ken Caryl sanitation, do not inspect

existing sources for grease trap to install grease interceptors unless a need for one is documented (i.e.; a clogged sewer line due to oil and grease). Ken Caryl is requiring all their existing sources to install grease interceptors on-line, based on inspections. All sanitation districts require new sources to install grease interceptors before they open for business. The sizing criteria of these interceptors, however , differ for each utility department. Some departments follow the U.P.C. guidelines for their sizing criteria, while others have found that the recommendation does not work for them and they use their experience to determine the proper sizing for the installed interceptors.

Once the interceptor is sized and installed, it is important to maintain the interceptor by cleaning or pumping the interceptor on a regular interval so that grease will not escape. In practice, cleaning should be done when 75 % of the retention capacity of the unit is filled with accumulated grease. (**Ref:** "Pretreatment of Industrial Wastes" Manual of Practice No. 3 Water Poll. Control Fed. 1975) The most common method of cleaning a grease interceptor is to contract with a pumping company to pump out the trap on a regular interval.

Alternative technologies to clean interceptors are bioremediation and bioaugmentation using extracted enzymes and/or bacteria cultures. The use of enzymes, either extracted or in bacterial cultures, emulsifies the free, floating oils and greases into a liquid or semi-solid state. This is accomplished by breaking the glycerol-fatty acid bonds. The end products in this reaction are fatty acids and glycerol. The companies that use the bacteria as an additional treatment step claim that the bacteria used will consume the fatty acids and the end products of this digestion is carbon dioxide and water.

Discussion

Southgate sanitation has acknowledged some problems downstream in the sewer lines from sources that use enzymes in lieu of pumping out the grease interceptor on a regular interval. The use of the enzymes alone as a treatment method effectively emulsifies the free oils and greases so that the greases flow out of the interceptor. However, the oils and greases may go back into a free state downstream and clog up sewer lines or coat equipment in the collection system. This bypasses the purpose of the grease interceptor and passes the responsibility of treatment and maintenance of oils and greases to the collection system departments. The additional use of bacteria should theoretically consume the emulsified form (fatty acid components) of the oils and greases. However, detention time in the interceptor to allow the digestion of the fatty acids by the bacteria is important. This time is not always sufficient in the interceptor and the result is an incomplete digestion of the fatty acids. Insufficient detention time will allow emulsified oils and greases to enter the collection system.

Telephone survey

As part of the Oil and Grease research, phone surveys were conducted of sanitation districts within the Littleton\Englewood service area. The purpose of this survey was to first; establish what problems were encountered with Oil and Grease, and second; establish what types of Oil and Grease were causing the problems. If the sanitation district experienced any problems with Oil and grease, then other associated questions were asked.

Many of the sanitation districts contract service on their sewer lines. Those contractors were called but none returned the phone call. Of the sanitation districts that were contacted, valuable information was obtained.

The results of the phone survey are as follows:

(1). Problems with petroleum-based Oil and Grease ?

Of the sanitation districts contacted, none experienced problems with petroleum-based oils and greases. No problems with vapors, toxicity, increased Lower Explosive Limit readings or other worker health and safety issues in the collection system were reported.

(2). Problems with animal fat Oil and Grease ?

Of the sanitation districts contacted, most experienced problems with animal fat oil and grease. The common problem being the clogging of the sewer lines. Other problems encountered were clogging of lift stations and pumps and the general reduction of flow throughout the collection system. No worker health and safety problems related to animal fat oil and grease were reported.

(3). Inspection and service of the sewer lines and point sources?

Of the sanitation districts contacted, all discovered oil and grease problems through complaints of a clogged line. Inspections and servicing were scheduled after the initial call. Some of the sanitation districts routinely inspect restaurant grease traps and require they be skimmed and pumped at least every six months. Some districts require more frequent cleaning if the restaurant exhibits high volumes of oil and grease.

As stated previously, policies of grease installation vary within the sanitation districts. Some of the districts require grease traps in all restaurants within their service area and other districts require grease traps for new sources only.

Conclusion

Based on the information gathered in this research project, separate limits for animal fat and petroleum-based oil and grease is a necessity. The problems relating to animal fat oil and grease in the treatment plant and the collection system are documented. Although there were no reported problems relating to petroleum-based oil and grease, the potential for worker health and safety hazards due to these types of oils and grease is significant.

Data gathered during the POTW survey conducted in the summer of 1994 determined that only two POTWs had separate limits for animal fat and petroleum oils and greases. The limits for the animal fat oil and grease is 100 mg\L for both POTWs and 25-50 mg\L for the petroleum oil and grease. A study conducted by the city of Austin in 1982 to determine the effectiveness of grease interceptors in their service area concluded that a limit of 200 mg\L for animal fat oil and grease was acceptable. They considered this limit to be based on Best Available Technology. There were no other reference material found that mentioned Best Available Technology (BAT) information for oils and greases. The development of separate local limits for animal fat and petroleum oils and greases based on the BAT will be determined by the pretreatment division in the near future.

It is recommended that the utility departments in the service area of L\E WWTP develop requirements for all oil and grease point sources to install appropriate treatment technology. It is also recommended that the utility departments develop minimum grease trap pumping intervals for point sources in their service area. The alternative treatment technologies available, extracted enzymes and bacterial cultures, are not always effective.