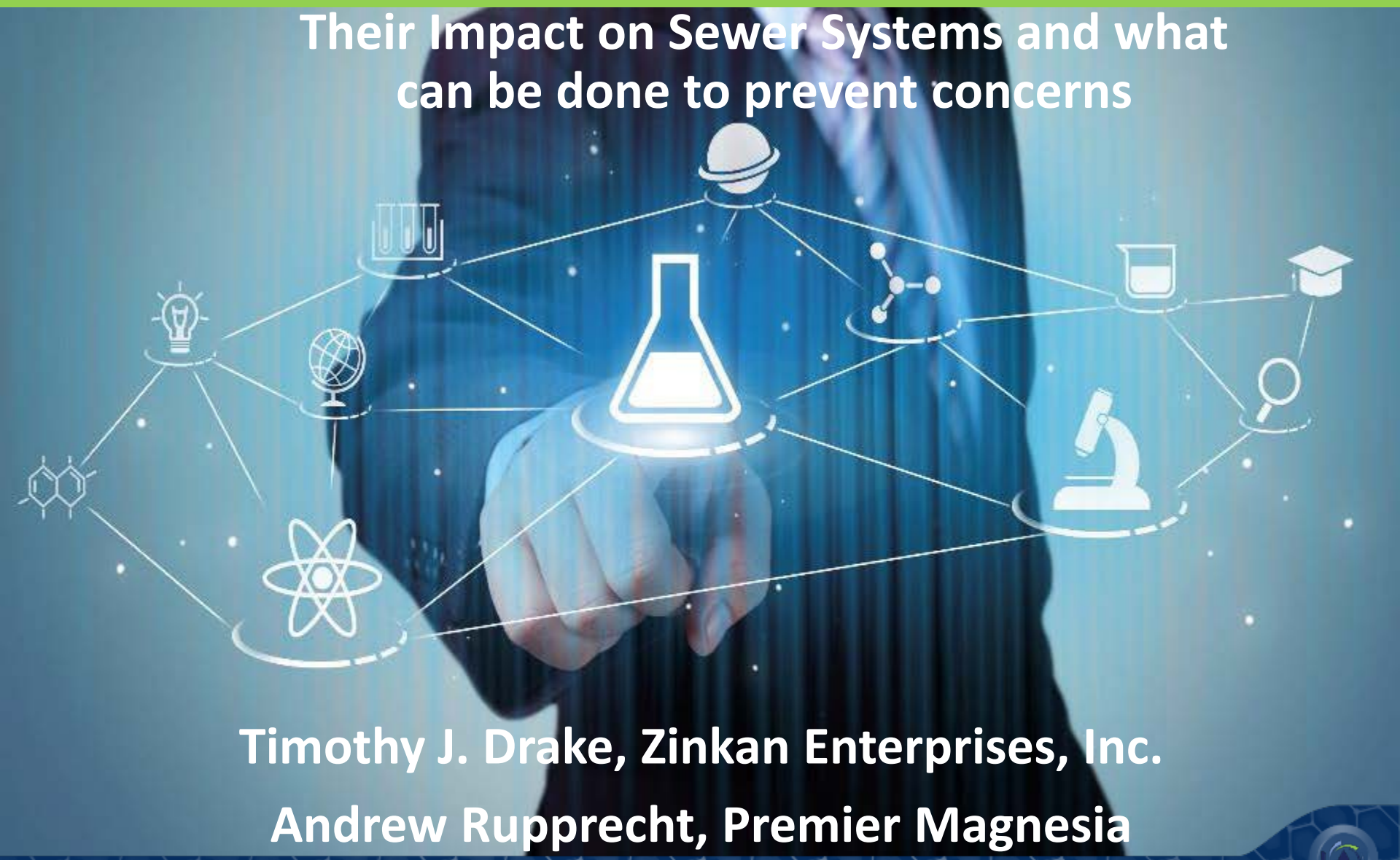
Fats, Oils & Grease (FOG) from Industrial and Commercial Sectors

Their Impact on Sewer Systems and what can be done to prevent concerns



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PAIN MANAGEMENT SOLUTIONS

Cascading System Control

- PAIN = FOG
- SOURCE CONTROL
- STANDARDS OF PRACTICE
- A MILD APPROACH
- EFFECTS ON WWTP

THE PAIN

- What does it cost you?

THE PAIN

- Fatty organic materials from animals, vegetables, and petroleum are not quickly broken down by bacteria.
- This **Fat, Oil, and Grease** (FOG) can cause pollution in receiving environments.
- When large amounts of oils and greases are discharged to receiving waters from community systems, they increase **Biological Oxygen Demand** (BOD) and they may float to the surface and harden, causing aesthetically unpleasing conditions.

THE PAIN

- FOG also can trap trash, plants, and other materials, causing foul odors, attracting flies and mosquitoes and other disease vectors.
- In some cases, too much oil and grease causes septic conditions in ponds and lakes by preventing oxygen from the atmosphere from reaching the water.
- A large percentage of wastewater collection blockages (even in mains) can be traced to FOG.
- Blockages are serious, causing sewage spills, manhole overflows, or sewage backups in homes and businesses.

THE PAIN

- Example Study:
  - Grease skimmed off of the primary tank is collected into a 7,000 gallon grease pit. The grease pit has to be pumped out about four times a year to keep the grease pit effective.

Costs	Activity
$450 per Pump-out	To pump out the tank, a septage hauler would be used at $100 an hour
$4,500-6,200 per Disposal	The grease is then transferred to another treatment facility were it costs $345 per percentage of grease solid; in this case study, they would average between 12-17% of solids per transfer.
$19,800-26,600 per Year	4 Pump-outs and Disposal per Year

…Not to mention, the large amount of grease degrading in the grease pit resulting in noxious odors that were followed by complaints from the neighborhood.

INDUSTRY STANDARDS OF PRACTICE

- **Source control – Human Influencers**
- **DON'T**
  - Wash (solid or liquid) FOG material down the drain, dump them in the toilet, or grind them up in the disposal.
  - Wash contents of soaking parts or items down the drain.
  - Pour discharge used oil down the drain.
  - Pour discharge grease down the drain.
  - Pour discharge grease down the storm drain.
- **DO**
  - Use mesh drain strainers to catch solid FOG material for disposal
  - Use containers to collect FOG waste material for disposal where appropriate.
  - Pour used oil into a container with a top (the original if available) so it can be reused, recycled, or placed in the trash can for disposal.
  - Pour cooled grease into a grease can or other container for disposal and/or absorb with paper towels or newspaper.
  - Pour cooled grease into a container, seal it and place it in the trash.

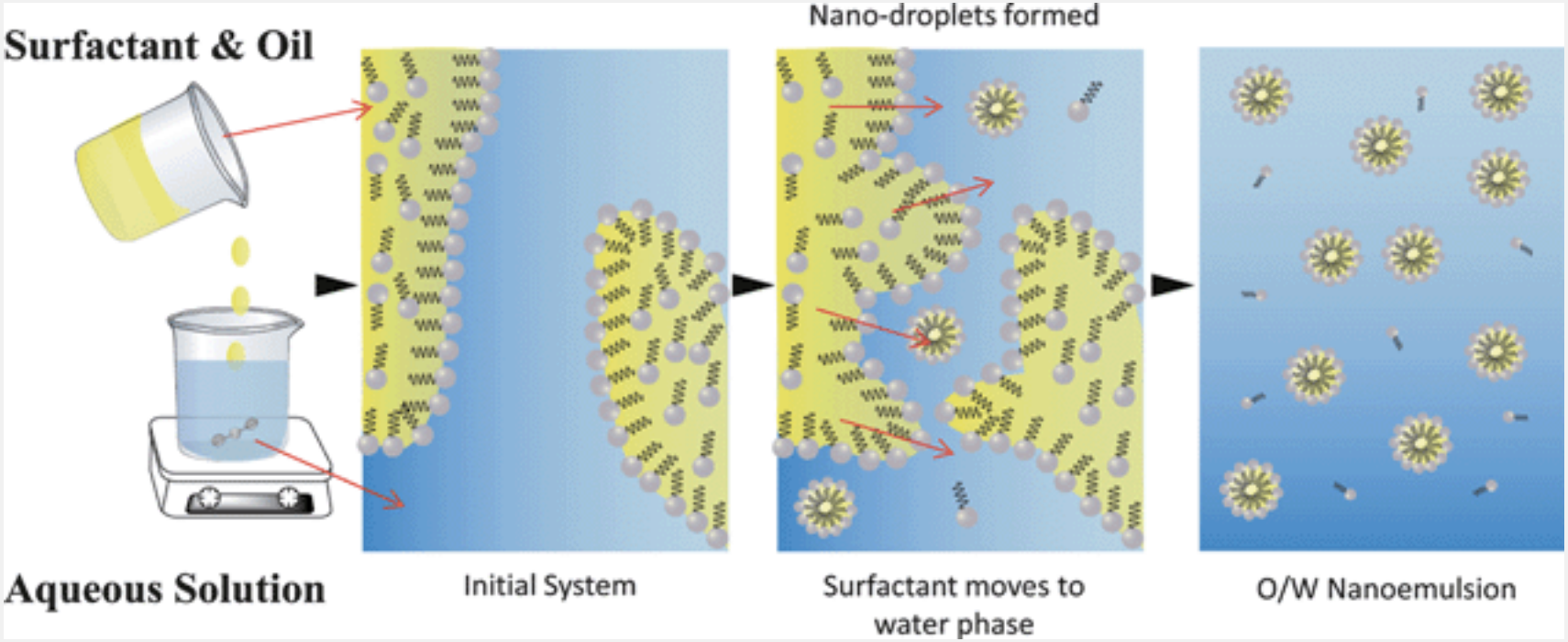
INDUSTRY STANDARDS OF PRACTICE

- Mechanical
  - Grease Traps at the source, requires disposal
  - Time-honored mechanical solutions for FOG problems include jetters and rodders using a variety of attachments designed to remove FOG buildup.
  - Pigging — sending a scrubbing device through a force main — can also offer relief. Ice pigging, a newer technology, employs a saltwater ice slurry to scour the inside of FOG-coated force mains.

INDUSTRY STANDARDS OF PRACTICE

- Chemical/Biological
  - You can disperse/emulsify to **BREAK UP** the grease (which may coagulate later)
  - **ENZYMATIC** alterations change the character of the grease into water-soluble components, which will never reform as grease anywhere downstream.
    - Surfactants can be beneficial in that they help enzymes work.
    - Enzymes and bacteria only work on the surface of a substance. When a surfactant is used, more surface area is exposed.
    - A surfactant will turn a chunk of grease floating in water into many droplets.
    - This gives the enzymes and bacteria more surface area to attack and digest the grease.
    - Residence TIME Required!!!
  - **BREAK DOWN** by saponification to eliminate downstream FOG blockages and odor
    - The Trick is to do it mildly, so that the WWTP is not 'upset'.

DISPERSE/EMULSIFY……BREAK UP



SAPONIFICATION- BREAK DOWN

- By raising the pH of the wastewater to 8 or higher, hydroxides break fats (FOG) down into a mild soap and glycerol. Glycerol is then consumed at the plant or in the collection system by the biology.

FATTY ACID

GLYCEROL

CARBOXYLATE SALTS - SOAP

SAPONIFICATION-DETAILS

Hydroxide releases hydroxyl ions which breakdown low-density, large-chain fatty acids (FOG) into glycerol (carbon source) and various types of soap, both of which are more readily digested by bacteria in wastewater.

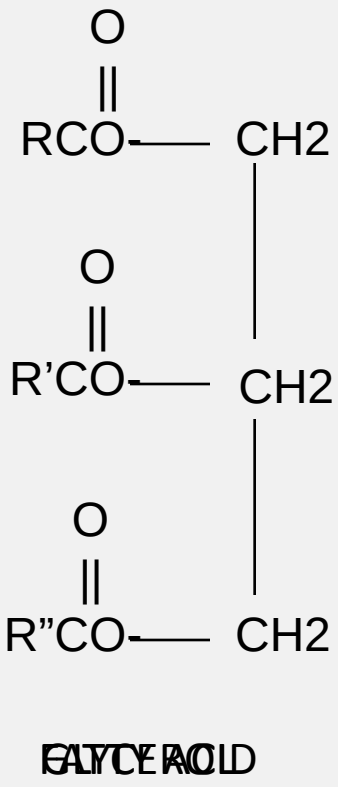
The soaps that are produced further facilitate the breakdown of accumulated blankets by solubilizing FOG's.

OH-

Low-density, long-chain fatty acids accumulate on the water surface of low-velocity structures and can build up on pipe walls causing occlusion and eventually SSOs.

OH-

OH-



FATTY ACID

CARBOXYLATE SALTS

GLYCEROL

SOAP

COMMON HYDROXIDES

- This section will discuss the three common sources of hydroxide chemistry encountered in the wastewater industry, their relative strength, handling/safety, quality and application
  - Lime – Calcium Hydroxide – Ca(OH)2
  - Caustic – Sodium Hydroxide – NaOH
  - Milk of Magnesia – Magnesium Hydroxide –Mg(OH)2

LIME –CALCIUM HYDROXIDE

Lime can be obtained in the powder or slurry form. If **sludge disposal and scaling are not a concern**, it can be cheap chemical for controlling pH (alkalinity). Within a few feet of the addition point, it can raise the pH anywhere to 12- 14 standard units (s.u.).

- Slurry concentrations up to 40%.
- EPA states that lime addition in some cases can add as much a 50% more sludge for disposal.
- Certain dosages can kill treatment plant bacteria and form sludge through water softening.

CAUSTIC SODA –SODIUM HYDROXIDE

Caustic soda is general supplied in the liquid form with a freezing point of 50° at 50% concentration by weight. If storage can be maintained **above freezing and scaling is not a concern**, it can be an alternative for controlling pH (alkalinity). Within a few feet of the addition point, it can raise the pH anywhere to 12- 14 standard units (s.u.) and the concentrated liquid can cause sever burns.

- Increased single charged ions, like sodium, can cause problems with pin floc, dispersion, and settling.
- Accidental overdose will almost certainly kill treatment plant bacteria.

MILK OF MAGNESIA–MAGNESIUM HYDROXIDE

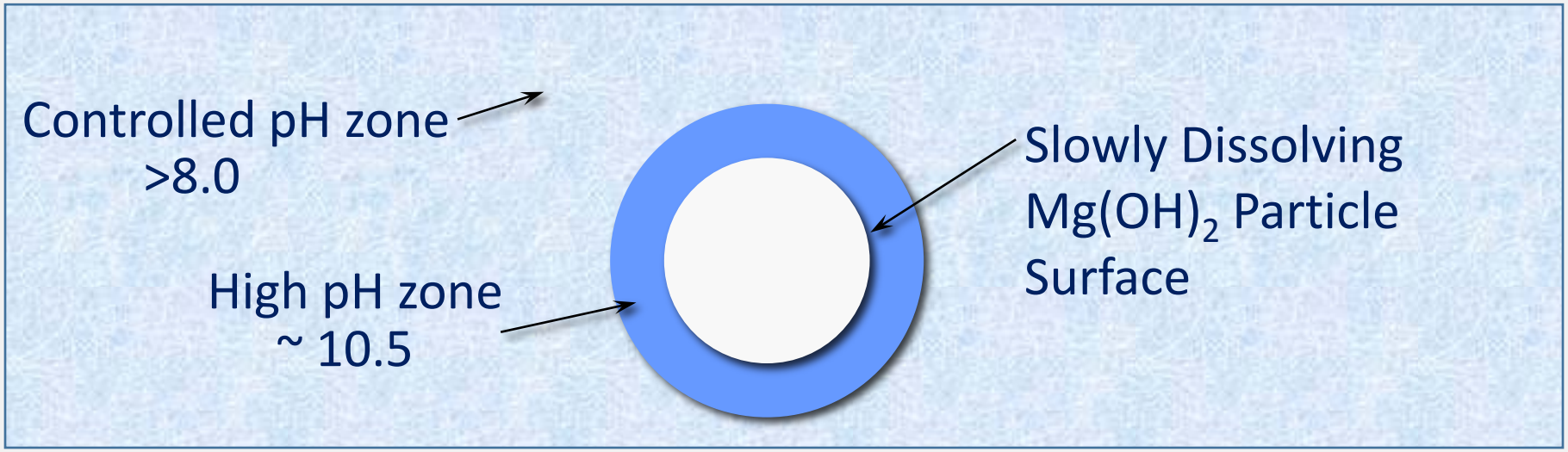
Magnesium Hydroxide can provide alkalinity as a slurried hydroxide ranging 58-59% by dry solids weight or as a Magnesium Oxide powder. Arctic blends have a freezing point around -20° Overdosing of the slurry will have little impact on the biology or effluent discharge limits.

- Magnesium is a big part of the energy production in biology.
- For batch systems visited once or twice a week, a couple days worth of chemical can be added all at once.
- No reportable spill amounts or fish kills.

MILD SAPONIFICATION

- Undissolved Magnesium Hydroxide particles react directly with FOG converting to GLYCEROL and CARBOXYLATE SALTS .

- These particles dissolve as they travel through the collection system allowing for just a few addition points AND mild, self-buffering treatments.



QUALITY PITFALLS, THINGS TO WATCH OUT FOR

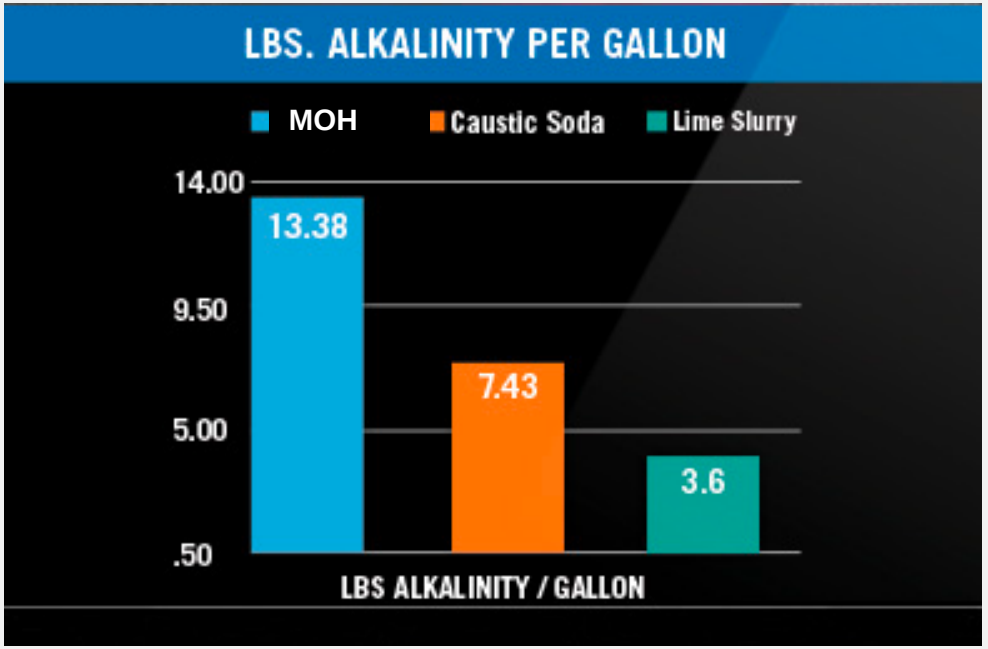
- Caustic – hard water used to dilute to lower percentages
- Lime – Sea Shell lime
- Milk of Magnesia – Brucite (Magnesium Hydroxide Marble).

GREATEST ADVANTAGE/CAUTION

- Caution
  - Caustic – chemical burn risk
  - Lime – softening/scaling/sludge costs
  - Milk of Magnesia – Brucite (Mag Hydroxide Marble)
- Advantage
  - Caustic - completely soluble
  - Lime - get it anywhere
  - Milk of Magnesia - doesn’t drive pH above 9 S.U.

COMMON CHEMISTRIES

- When comparing unit cost of chemical some chemistries may appear much cheaper than others, the chemical potency and impact on the overall system operational cost should also be taken into consideration.



COMMON CHEMISTRIES

- Magnesium Hydroxide is a environmentally responsible chemical strategy that can prolong infrastructure life, control collection system FOG and odor, prevent plant upsets, improves treatment and enhances biosolids quality.

FOG - ODOR AND CORROSION

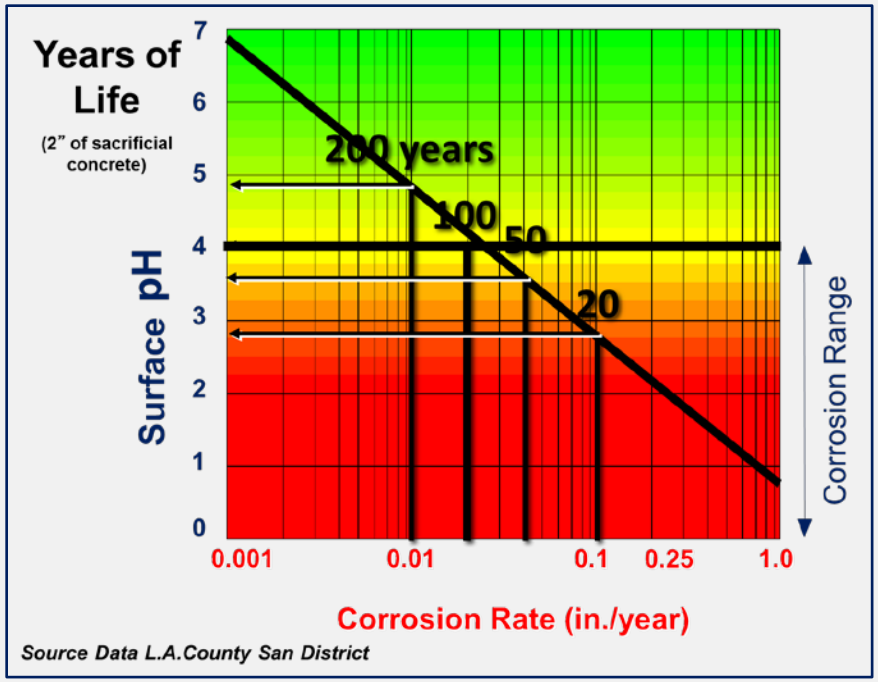
The hidden problem-coincidental solution

- The layer where grease and surface of the waste water meet or where grease/slime layer and the wall of the pipe meet are low oxygen (even septic) environments.
- This is where bugs are starving for oxygen.
- Sources of Oxygen:
  - Nitrogen sources can lead to methane buildup and ammonia odors
  - Sulfates contributes to H2S gas formation and even corrosion.

FOG – ODOR AND CORROSION

- Raising wastewater pH from 7 to 8 eliminates hydrogen sulfide gas and extends the useful life of infrastructure subject to corrosion by over 80%.

- NOTE: PHs of 8.0-8.2 decompose FOG



CALCULATING/ESTIMATING DOSAGE

The best way to get a good approximation of how much magnesium hydroxide you will need for odor control is to do a jar test to an endpoint of 8.2 su with a wastewater sample from the point where the odor is a problem.

- **For FOG control:** estimated 100 – 20 PPM (or 100-20 Gal/Million Gal)
- **For alkalinity supplementation**: 1 gallon of slurry provides approximately 13 lbs of alkalinity as Calcium Carbonate (that's about 5 lbs of MgO powder). So you get about 1.5 ppm carbonate alkalinity for every gallon (or 5 lbs of MgO) into 1 MGD of wastewater. Every ppm of Ammonia then requires about 7.14 ppm of alkalinity as Calcium Carbonate.
- **For odor control**: the rule of general thumb dosage for gravity or force-main odor control is 50-60 gallons of slurry per MGD. (Full range is 30-100 gallons per MGD). If using MgO powder, that is 30 dry lbs per 100,000 gallons of waste water.

WHAT TO EXPECT

2 Weeks, **No** treatment

After 2 Weeks with Treatment (40 PPM)

2 Weeks with Treatment, after water rinse

WHAT TO EXPECT

COLLECTION SYSTEM BENEFITS

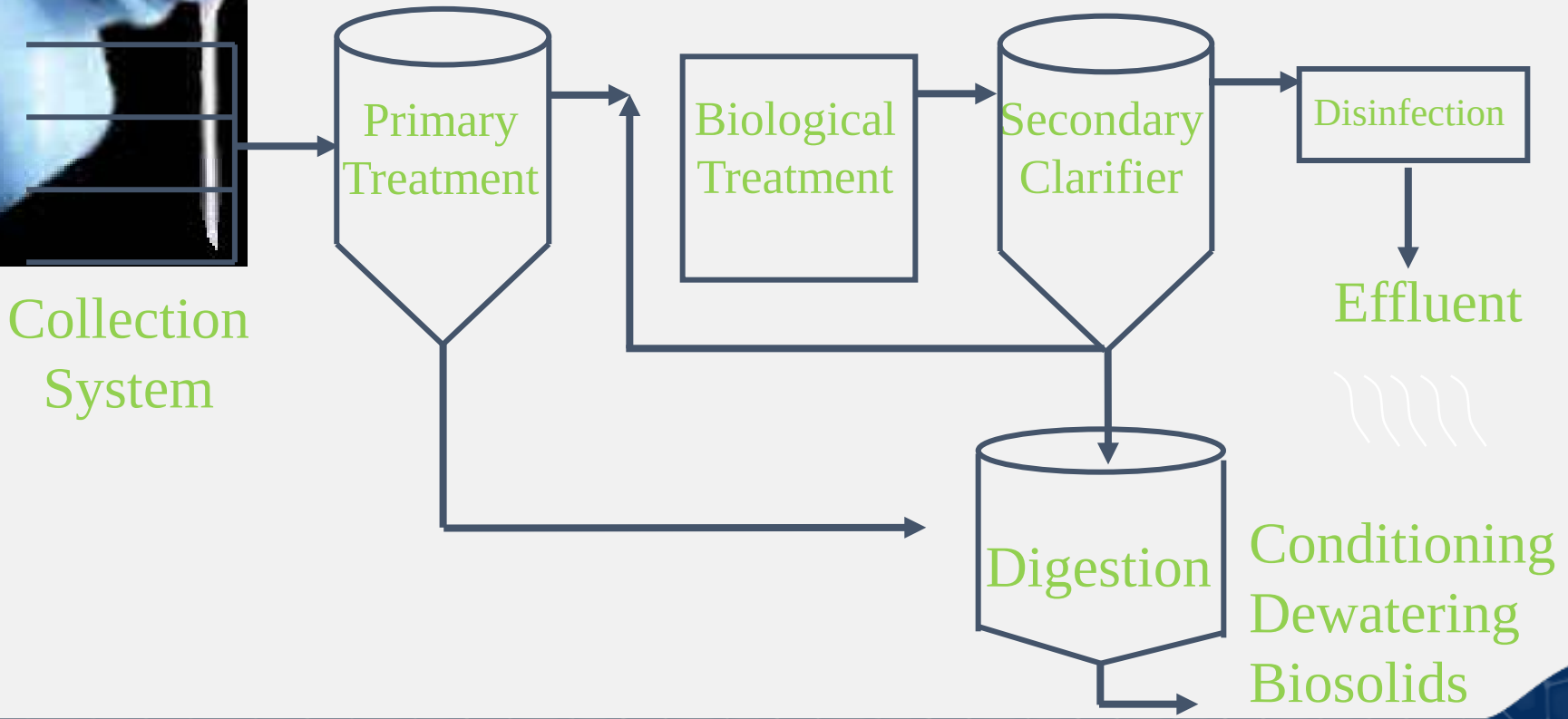
- Non-Hazardous/G.R.A.S.
- One dosing point gives pH and Odor control for miles
- Provides corrosion protect when doing odor control.
- Reduces FOG
- Least Expensive to the Total WW Treatment System

WASTE WATER TREATMENT PLANT EFFECTS

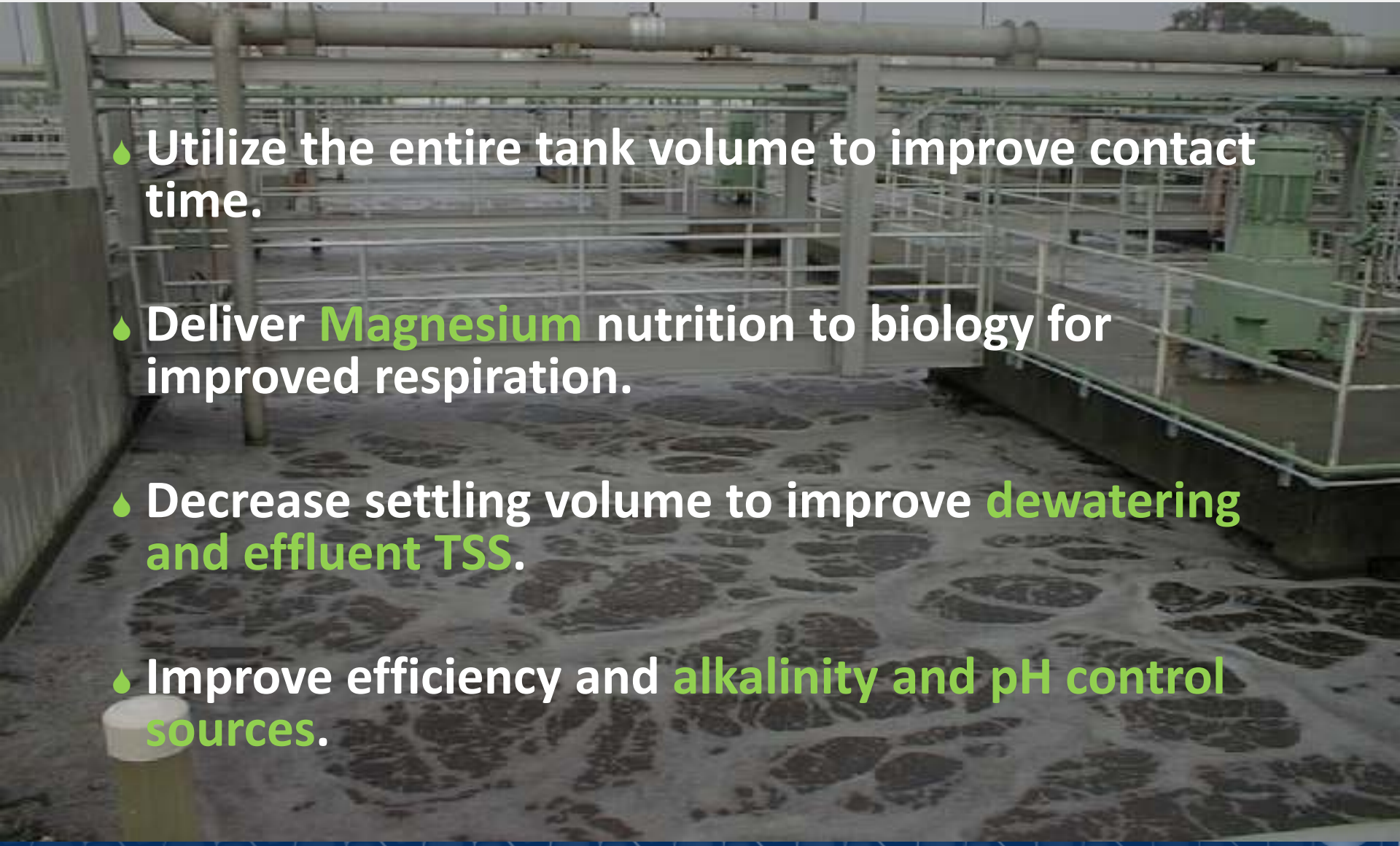
- Maintaining Control and Achieving Compliance
- Biological treatment plants and collection systems operate better with wastewater that has proper, stable pH, lower acidity and higher available alkalinity.

MAGNESIUM HYDROXIDE

- A More Natural Approach to Wastewater
- Total System Treatment.



TAKE FULL ADVANTAGE OF YOUR PLANT DESIGN CAPACITY



- Utilize the entire tank volume to improve contact time.
- Deliver Magnesium nutrition to biology for improved respiration.
- Decrease settling volume to improve dewatering and effluent TSS.
- Improve efficiency and alkalinity and pH control sources.

AVOIDING THE PAIN AND HELPING THE WWTP

The difference between a Good Day and Bad Day

- Treatment Enhancement
  Effluent Quality and Plant Capacity - BOD, COD, SVI, TSS, MLSS, MLVSS, RAS, DOC
- Odor Control
  Headworks, RBCs, Digesters, Sludge Holding, and Dewatering
- Better Bio-solids Volume and Disposal
- Improved Safety and Environmental Compliance

PAIN MANAGEMENT

- **Choose the Right Tool**
- There are many methods and many products for dealing with FOG; each used in the right conditions can do the job but limitations exist.
- Most wastewater treatment plants use some form of biological treatment to clean the water of organic material, including FOG.
- Chemistry can present a simple and easy method and be a very effective ally in the war against grease – especially when down stream impacts are considered.