THIOGUARD® TST

MAGNESIUM HYDROXIDE TECHNOLOGY AND APPLICATIONS IN WATER AND WASTEWATER

ANDREW RUPPRECHT, PREMIER MAGNESIA, LLC

MAGNESIUM HYDROXIDE-WHAT?

MAGNESIUM HYDROXIDE

MILK OF MAGNESIA

EARTH FRIENDLY PRODUCT

Produced from natural deposits or extracted from seawater, Thioguard® is $Mg(OH)_2$, milk of magnesia. problems facing wastewater professionals today.

It is an environmentally safe, less expensive replacement for lime, caustic and other provides many valuable benefits in wastewater collection and treatment.

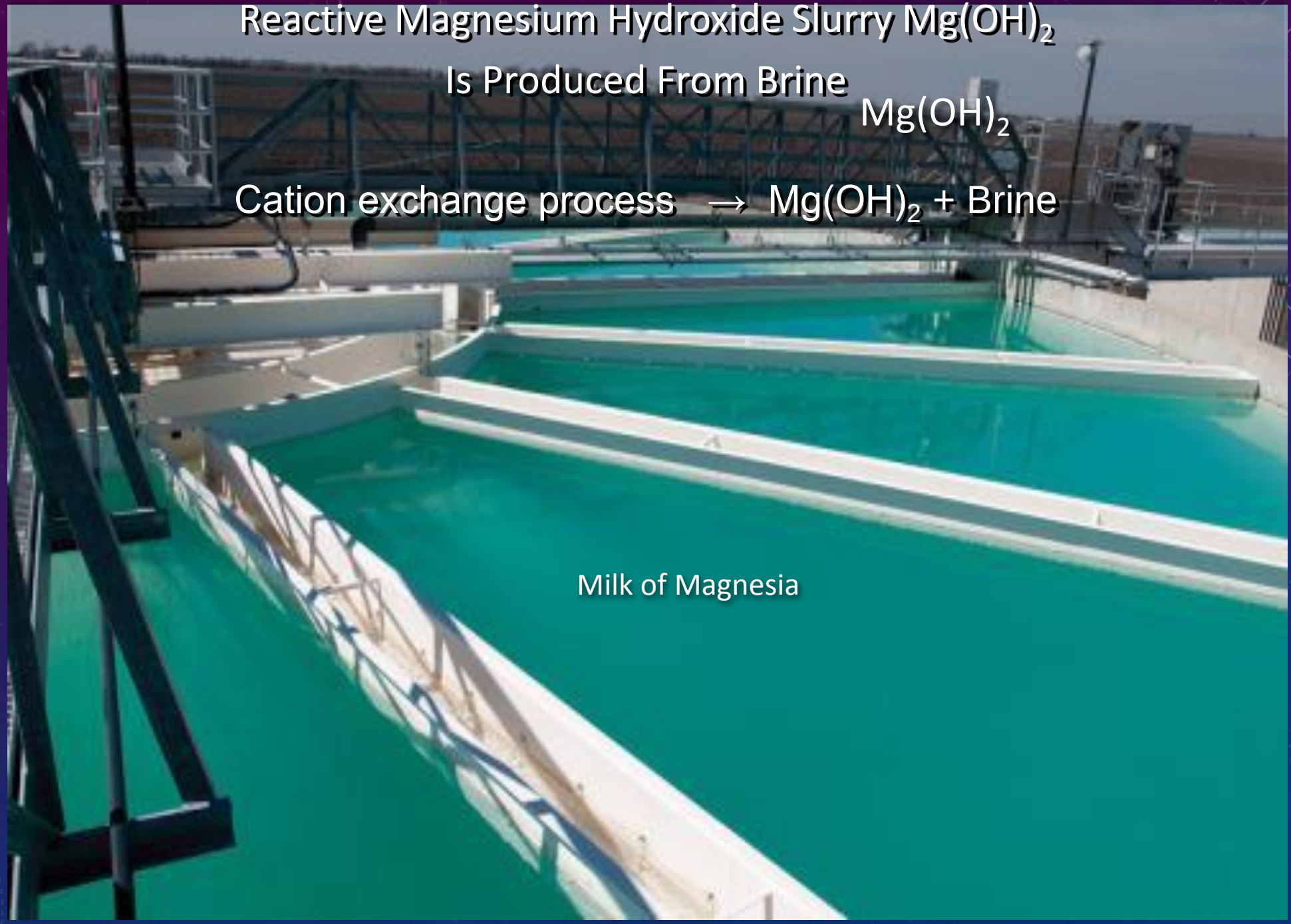
Thioguard is a registered trademark of Premier Chemicals and is patented for use in municipal collection systems under U.S. patent numbers:
5,718,944 - 5,833,864 - 5,554,355 - 5,834,075, 6,056,997

Reactive Magnesium Hydroxide Slurry $Mg(OH)_2$

Is Produced From Brine

$Mg(OH)_2$

Cation exchange process $\rightarrow$ $Mg(OH)_2$ + Brine



Milk of Magnesia

QUALITY STANDARDS

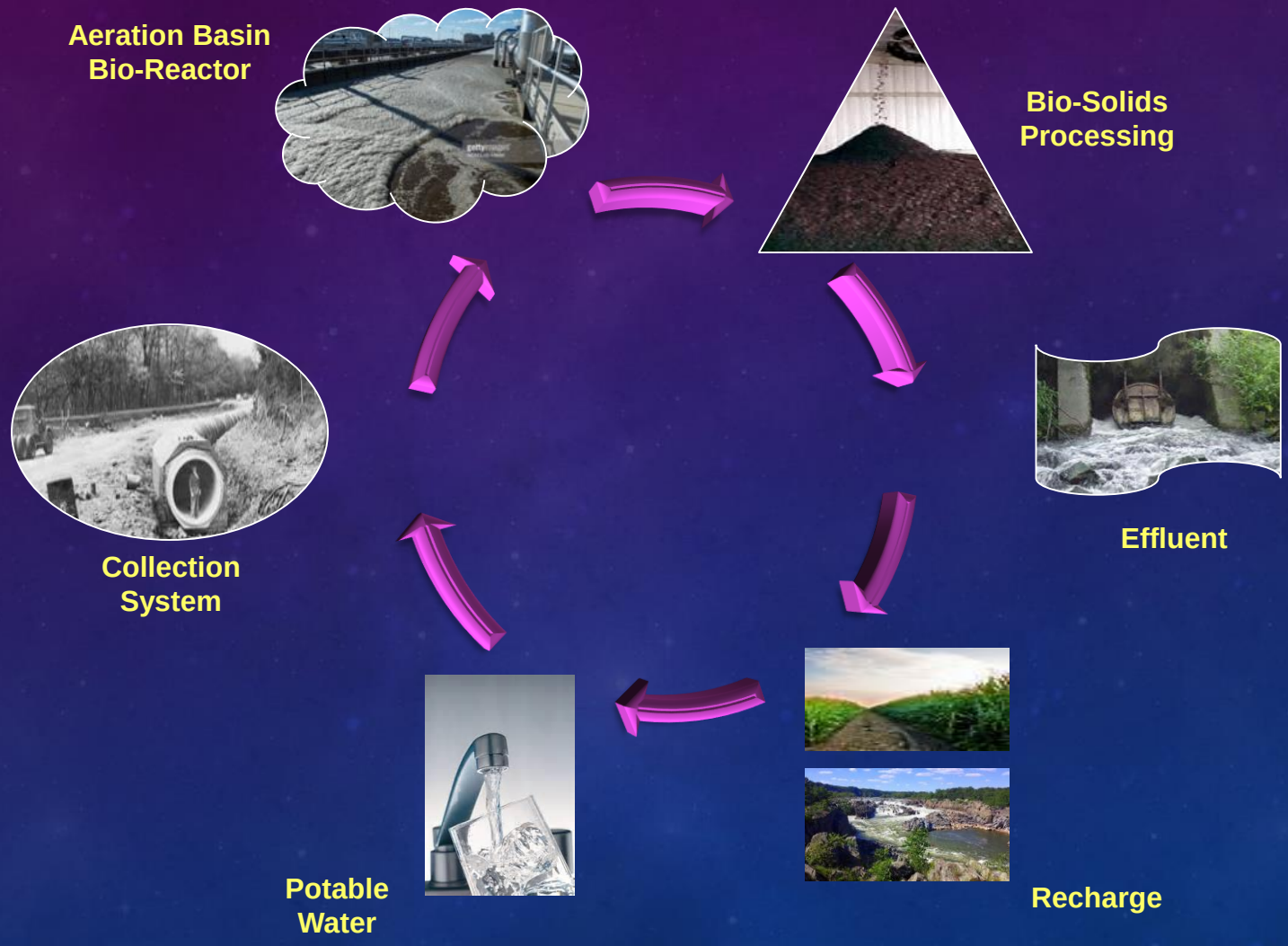
- The highest reactivity-CMA; Caustic Magnesia Activity
- The highest specific surface area (SSA)
- The greatest stability for transportation, storage and application
- The greatest dispersion and utile consumption rates

- Brucite, brucitic marble, and dolime are not the same nor equivalent to Premier magnesia and are not generally suitable for municipal, biological wastewater treatment

MAGNESIUM HYDROXIDE-HOW

TOTAL SYSTEM TREATMENT (TST)

THE MAGNESIUM CYCLE



Forging Partnerships in Water and Wastewater Treatment

Atlantic County Utilities Autho

MAGNESIA, LLC

cleanwaterbaltimore
www.cleanwaterbaltimore.org

IMPACT OF MAGNESIUM HYDROXIDE

CHEMICAL	% REDUCTION
Ferric Chloride $FeCl_3$	75-100%
Polymer	75-100%
Chlorine Cl_2	20-30%
Sulfur Dioxide SO_2	20-30%

FATS…OILS…GREASES

APPLICATION 1: FOG!

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

WHAT TO EXPECT

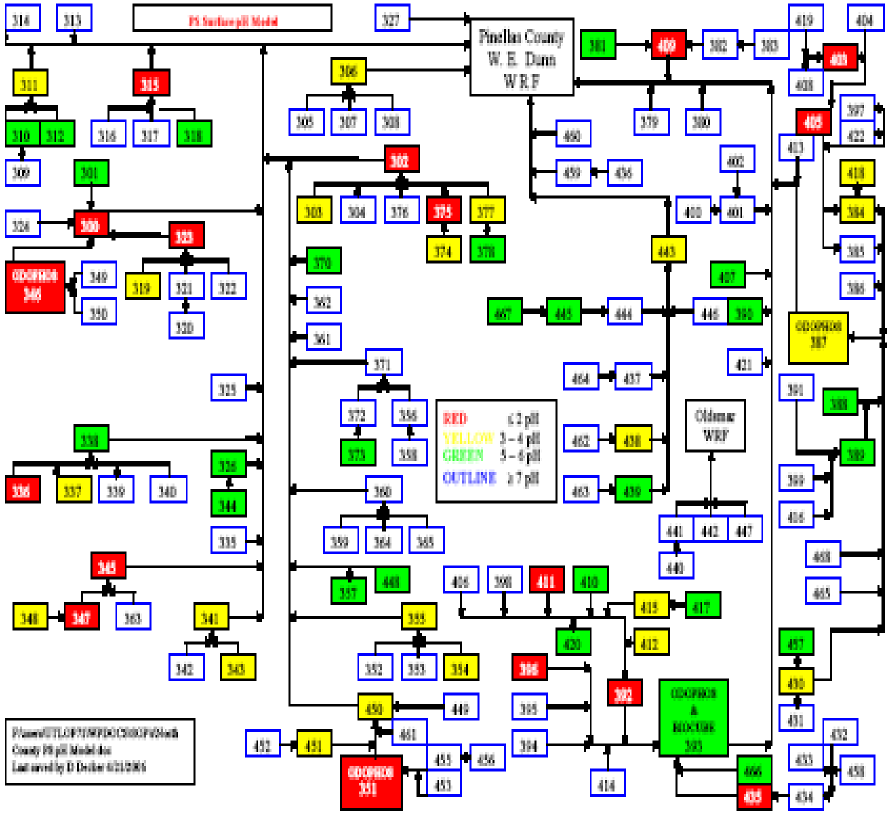
2 Weeks, **No** treatment

After 2 Weeks with Treatment

2 Weeks with Treatment, after rinse

ODOR AND CORROSION

APPLICATION 2: CONVEYANCE SYSTEMS
H2S - PH STUDY AND MODELING



39% of the pumping stations in the North Pinellas County Collection System has a surface pH below 4.

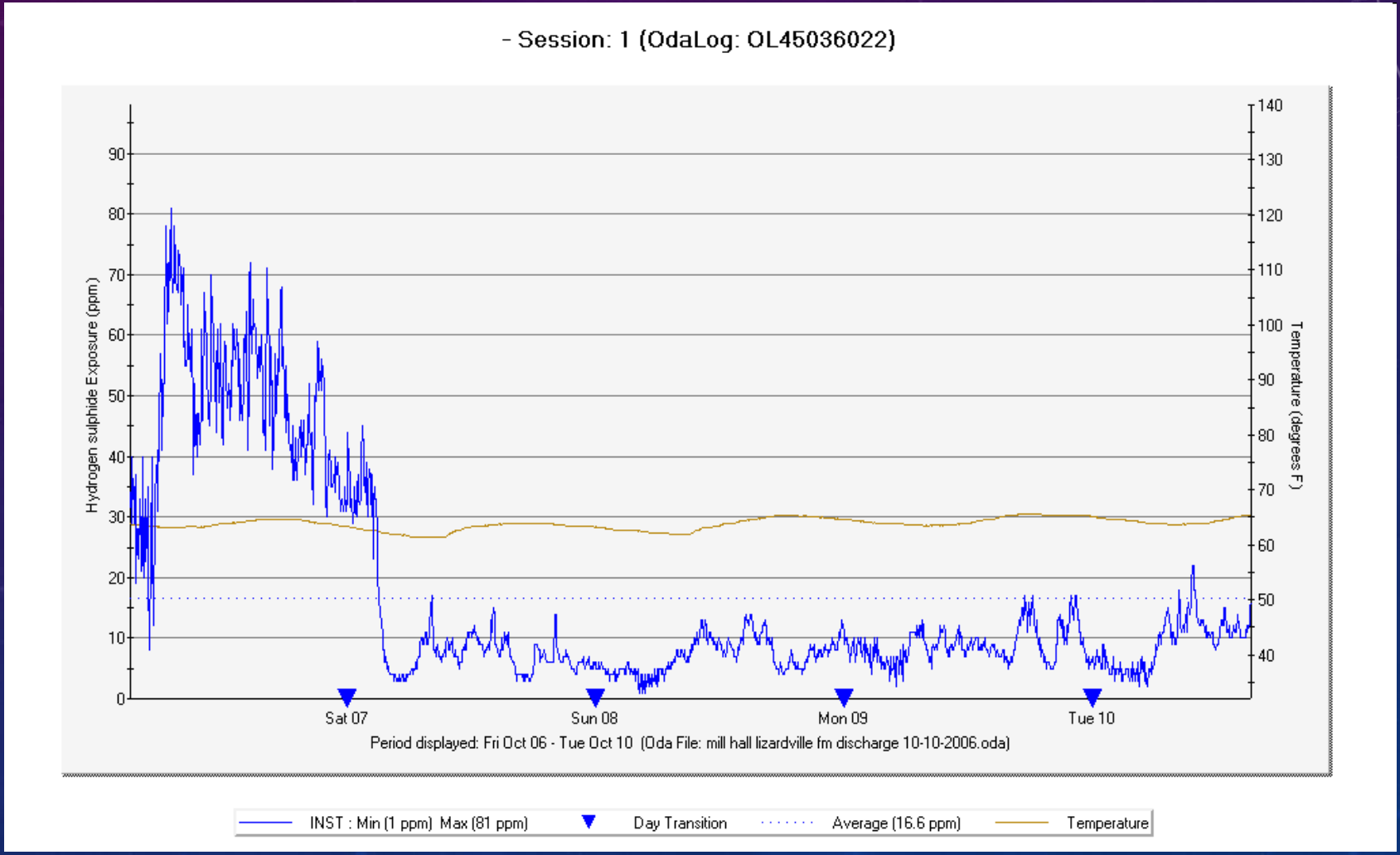
RED	≤ 2 pH
YELLOW	3 – 4 pH
GREEN	5 – 6 pH
OUTLINE	≥ 7 pH

The WW Treatment Management, able to identify a line segment within the north system to treat with Magnesium Hydroxide to curb the H2S gas and Reduce the corrosion at surface pH elevation.

The model, as shown here, was an eye opener insofar as the severity of corrosion rate within the system.

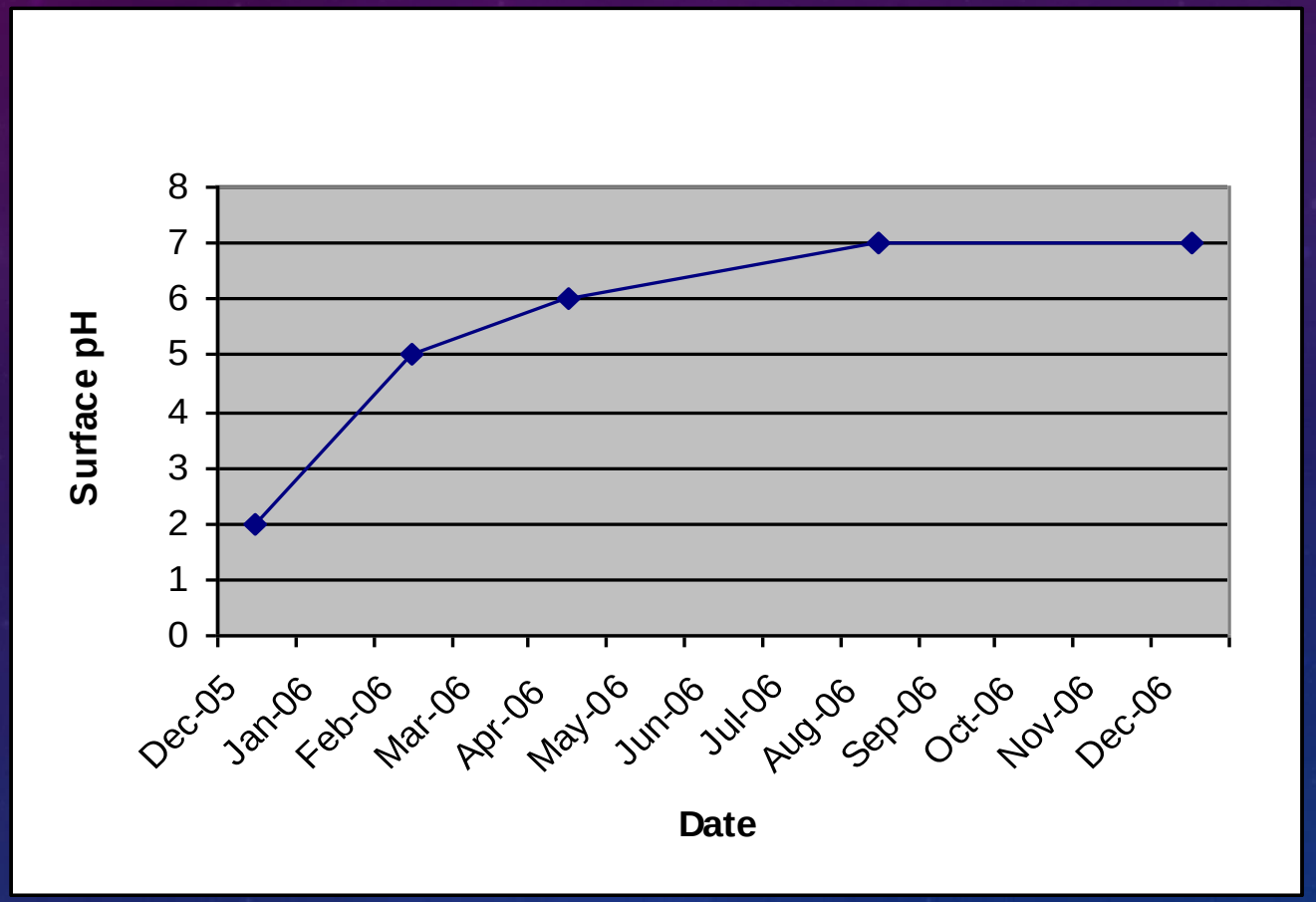
This collection system makes up ~35% of the flow received at the South Cross Bayou WRF with over 18 hr retention times

APPLICATION 2: CONVEYANCE SYSTEMS
NITTANY VALLEY- 5 MILES TREATED FROM ONE LOCATION



APPLICATION 2: CONVEYANCE SYSTEMS

NO OTHER TREATMENT TECHNOLOGIES HAS BEEN SEEN YET TO IMPROVE SURFACE PH

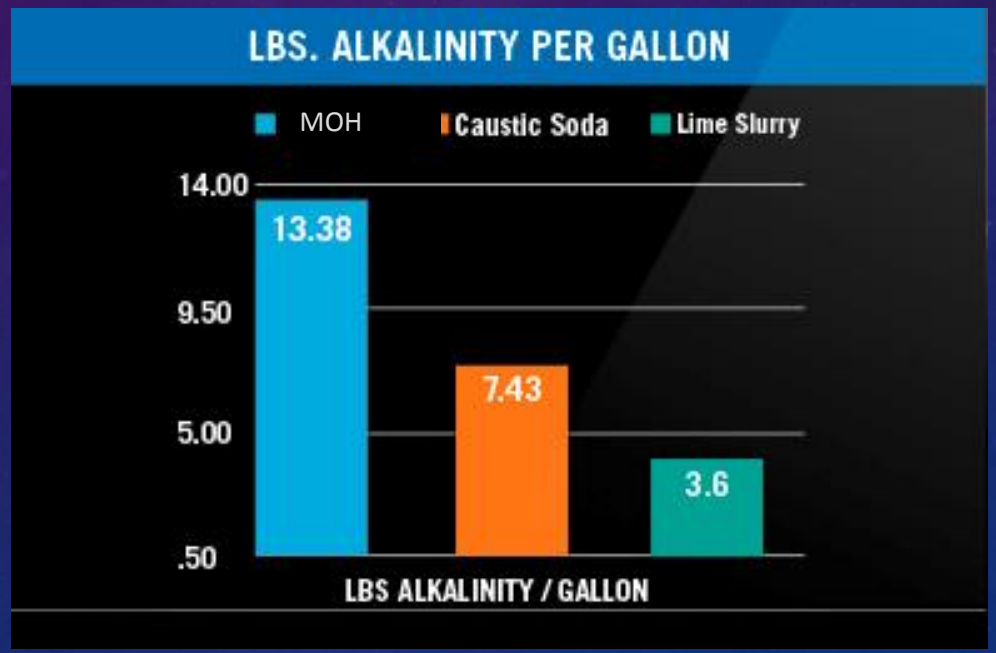


WILLIAMSPORT, PA -ACIDIC @ BELOW FREEZING

ALKALINITY

ALKALINITY

- 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.

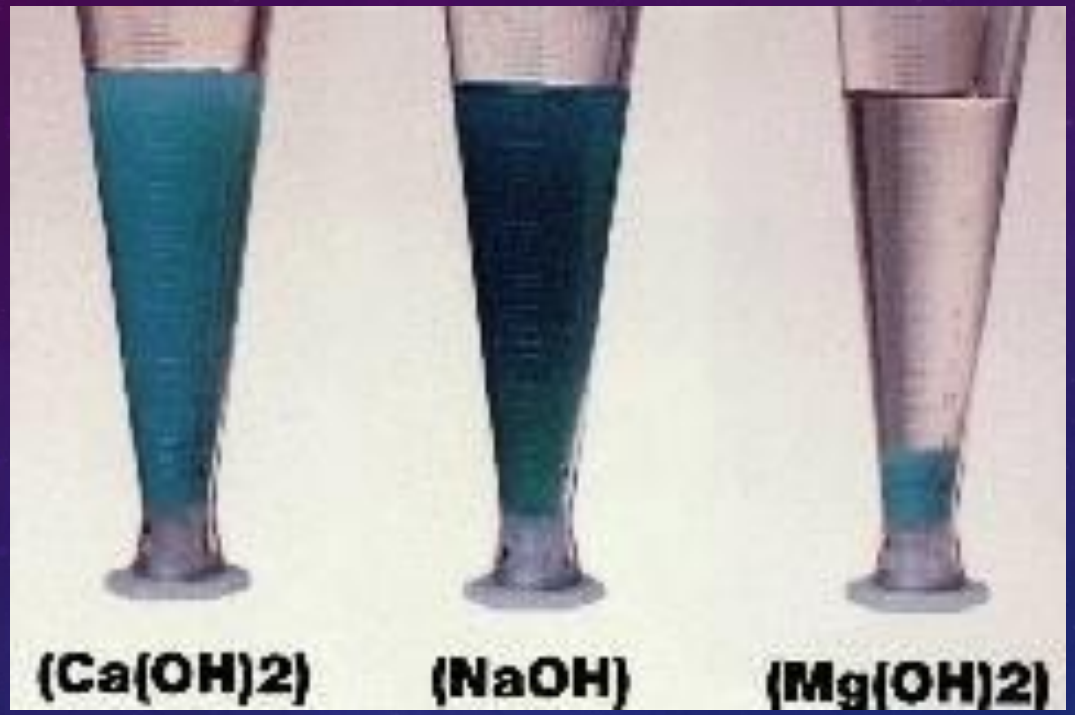


GROWS LANDFILL, PA-CONSIDER TOTAL OPERATIONAL COST

Product	Hydrated Lime	MgO	Thioguard Difference	Notes
Safety				
Chemical Formula	$Ca(OH)^2$	MgO		
MW	74	40.3		
Alk Equivalence	74	40.3	46%	
Typical Product Concentration	90%	93%	3%	
lbs of Alkalinity per dry lb	1.25	2.25	80%	
Annual Dry Tons used at GROWS	2,212	1,166		based on equivalence at typical product concentrations
Annual Truckloads Delivered	92	49	-47%	based on 24 ton deliveries
Cost Per Dry Ton	$ 190.00	$ 523.06		
Cost Per Dry Pound	$ 0.10	$ 0.26		
Cost Per Lbs of Alkalinity	$ 0.08	$ 0.11		based on equivalence at typical product concentrations
Annual Cost of pH/Alkalinity Product	$ 420,280.00	$ 609,773.49	45%	
Annual gallons of flash mix dilution water	6,630,695	1,165,784	-82%	based on 8 wt % soln of Lime and 3 lbs MgO per gallon
Annual Centrate Recycle (Inert Sludge), gal	25,461,871	2,012,864	-92%	this only examines the cost related to lime softening sludge and/or unreacted product components
Annual Water Treatment Chemical Costs	$ 254,618.71	$ 31,786.48	-88%	Based on $0.01 treatment chemical cost per gallon of water through the treatment system
Annual Tons of Inert Sludge	4,424	350	-92%	sludge related to lime softening (based on EPA estimates of maximum 3 lbs per gallon for every lb of lime added) and/or unreactive product components
Inert Sludge Dewatering Costs	$ 300,898.14	$205,920.40	-32%	Based on the "EPA Handbook for Estimating Sludge Management Costs" circa 1985
Total Annual Cost of Product	$975,797	$847,480	-$128,316	

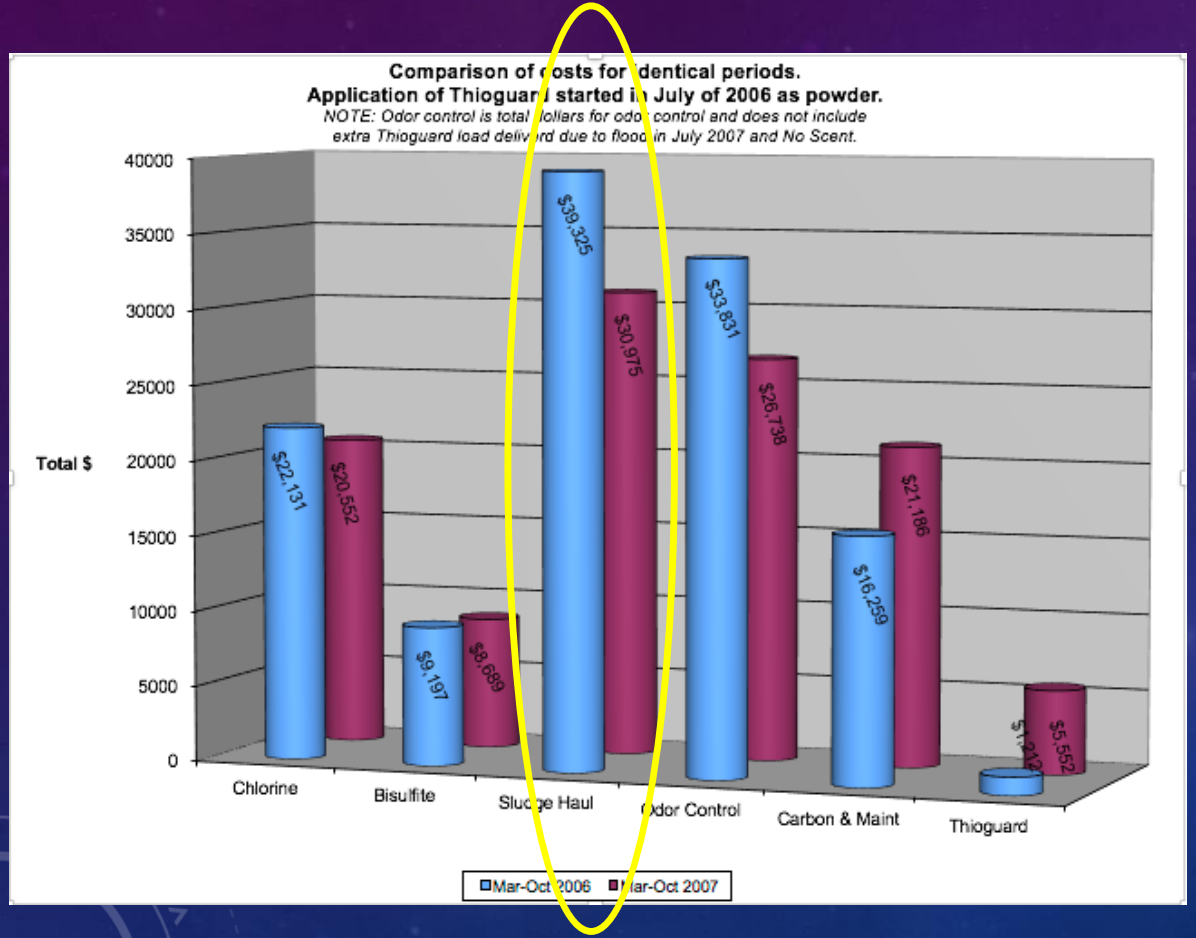
BIOSOLIDS

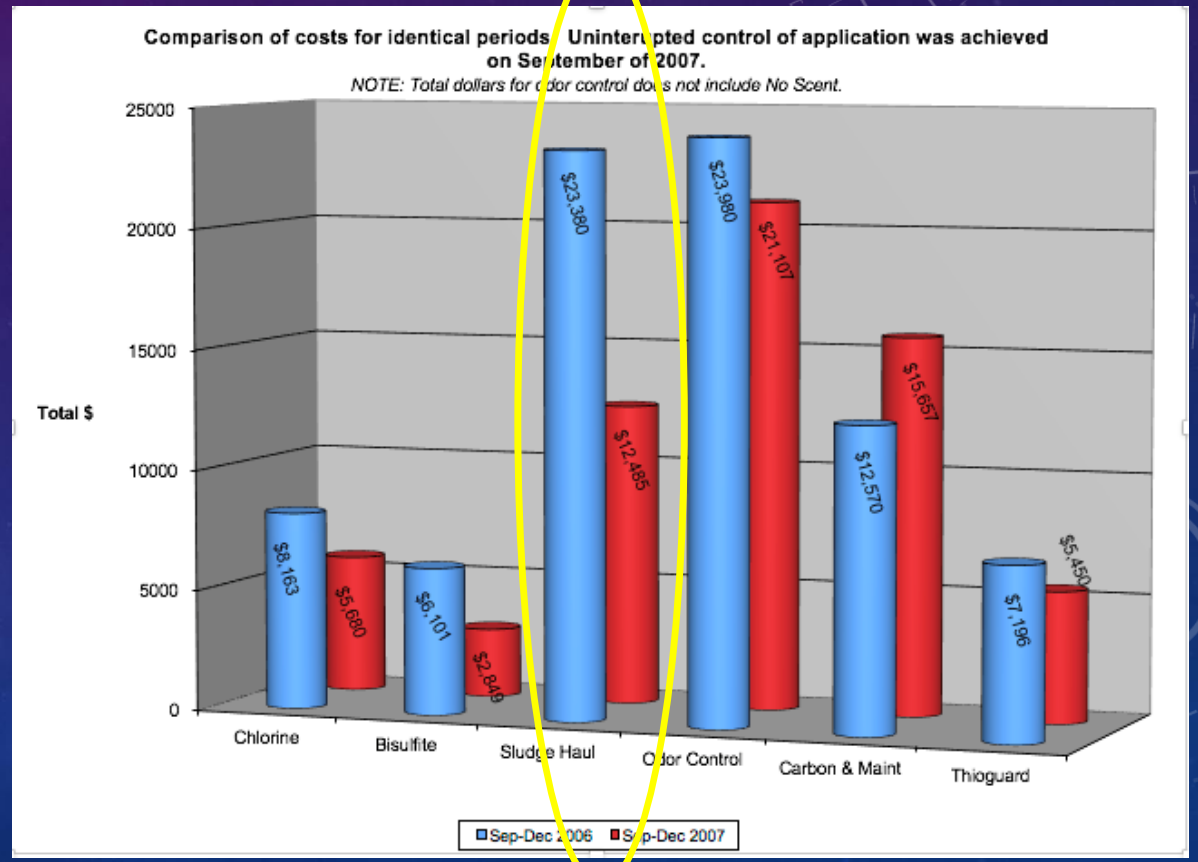
MAGNESIUM HYDROXIDE CAN IMPROVE SLUDGE DEWATERING



When compared to calcium hydroxide (far left) and sodium hydroxide, magnesium hydroxide (far right) substantially reduces sludge volume as shown in this laboratory acid neutralization test.

LAMBERTVILLE, NJ
ROLL-OFFS CUT IN HALF



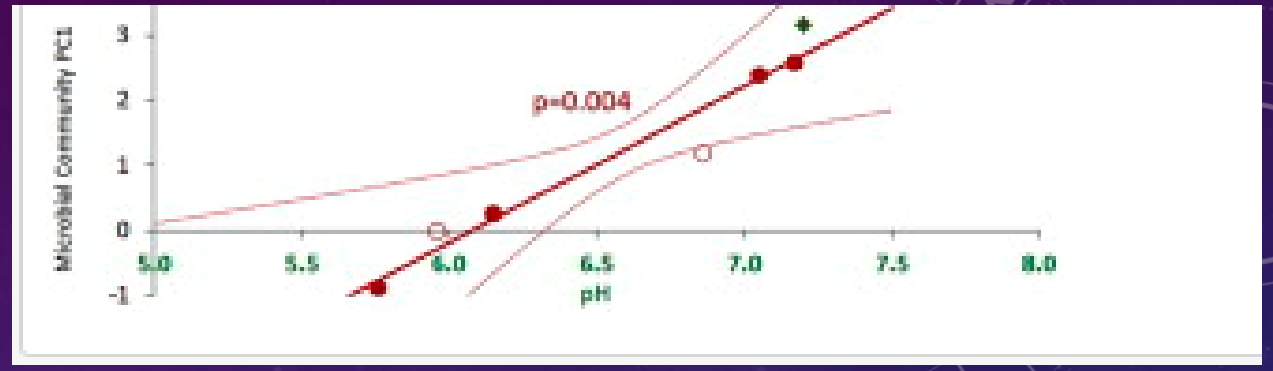


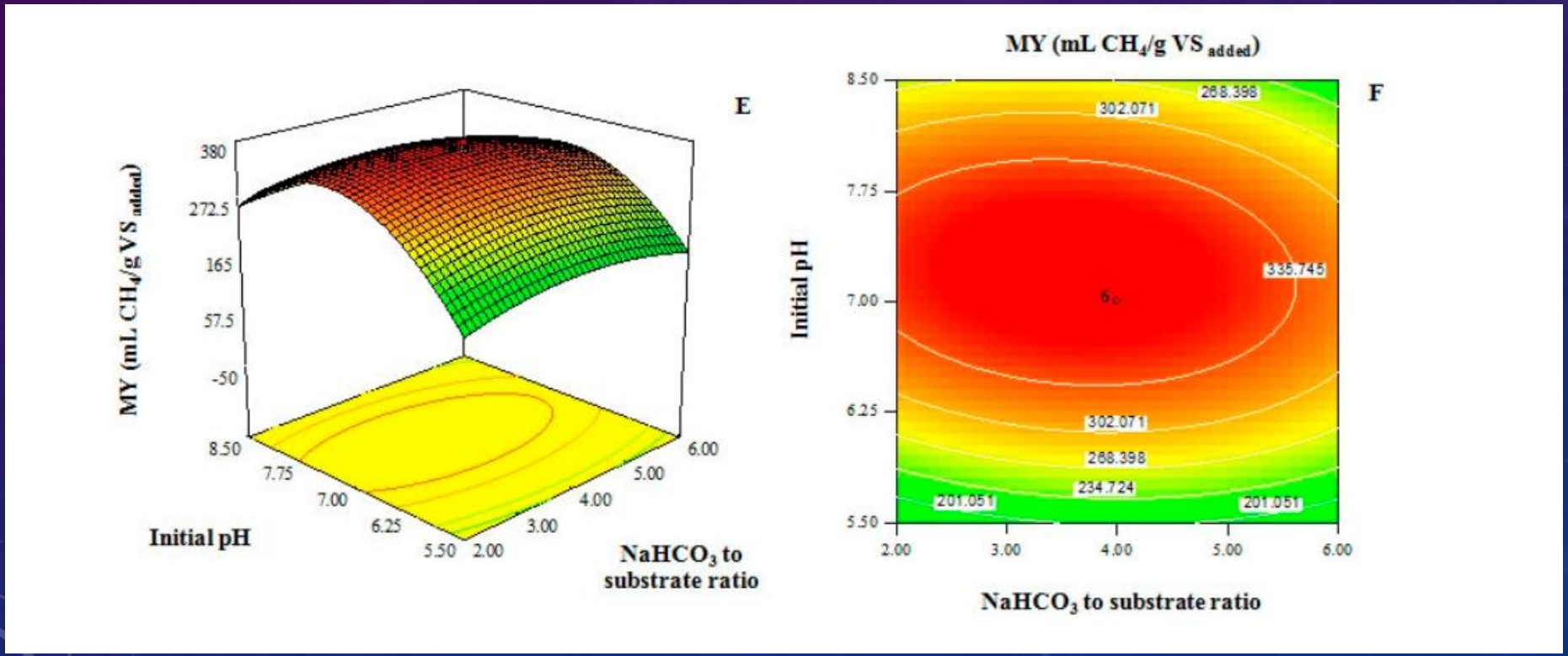
DIGESTION-BIOGAS

SOUTH MONMOUTH- IMPROVED DIGESTION AND BIOGAS

- **Methane is nearly insoluble in water. (GAS VOLUME DROP)**
- **Increasing water pH drives CO2 and H2S into solution. Ideal pH for methanogenisis as high as 8.2 standard units. [SPEECE 1996] (GREASE)**
- **Alkalinity to Volatile Acid ratios of 10-20 :1 are ideal for biogas digesters. (ALKALINITY)**

PROOF


Microbial Community PC1
p=0.004
pH
5.0
5.5
6.0
6.5
7.0
7.5
8.0
3
2
1
0
-1


E
MY (mL CH4/g VS added)
380
272.5
165
57.5
-50
Initial pH
8.50
7.75
7.00
6.25
5.50
NaHCO3 to substrate ratio
2.00
3.00
4.00
5.00
6.00
F
MY (mL CH4/g VS added)
Initial pH
NaHCO3 to substrate ratio
302.071
288.398
335.745
234.724
201.051

SUMMARY

IMPACT OF MAGNESIUM HYDROXIDE

CHEMICAL	% REDUCTION
Ferric Chloride $FeCl_3$	75-100%
Polymer	75-100%
Chlorine Cl_2	20-30%
Sulfur Dioxide SO_2	20-30%

NOTE: Bioxide users see a 30-50% reduction in costs for odor control and complete elimination of grease management cost.

TOTAL SYSTEM TREATMENT (TST)

THE MAGNESIUM CYCLE