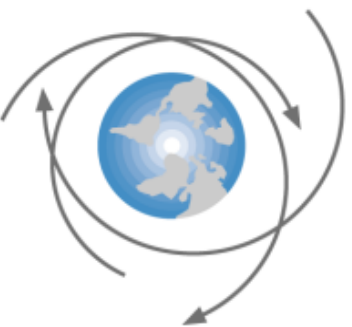


pH Alternatives and Applications



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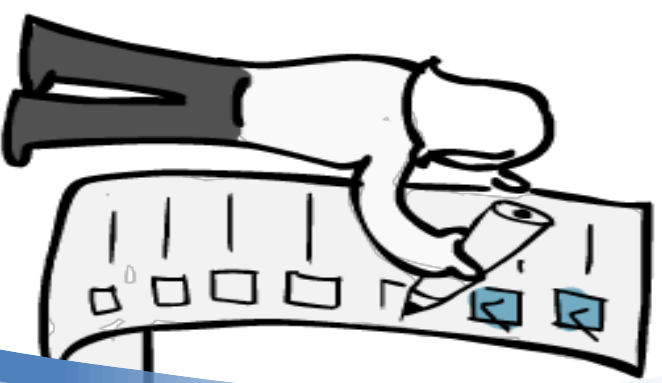


Responsible Care[®]
Our commitment to sustainability.



Agenda

- pH alternatives
- Water treatment applications
- Wastewater treatment applications
- Closing





Section 1

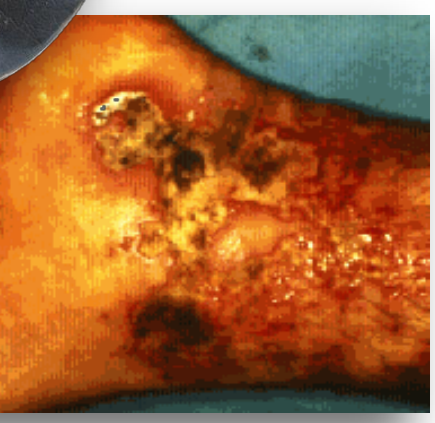
**ALTERNATIVES IN PH
ADJUSTMENT**

Alkali Choices

- Liquid Caustic
- Liquid Mag Hydroxide
- Dry Soda Ash
- Liquid Potassium Hydroxide
- Dry Lime
- Premium Liquid Calcium Hydroxide (PLCH)

Liquid Caustic

- NaOH
- Used in both WTP's and WWTP's
- Usually purchased in liquid (25-50%)
- Multiple raw chemical sources
- Variety of uses



Liquid Caustic

Disadvantages

- Hazardous chemical
- Gels in pumps/feed lines below
- Weak buffering (little affect on alkalinity)
- Offers no calcium hardness
- **Expensive** and suffers from price fluctuations
- Adds additional sodium to the water

Advantages

- Strong Base
- Accurate dosing
- Consistent product

Magnesium Hydroxide

- $\text{Mg}(\text{OH})_2$
- Milk-like appearance
- Has lower solubility in water
- Non-hazardous alkali
- Primarily found in waste water plants

Magnesium Hydroxide

Disadvantages

- Slower reaction time
- Lower maximum pH (weaker base)
- Less abundant natural resource (expensive)
- Can contribute to struvite formation
- Limited to wastewater treatment

Advantages

- Nonhazardous
- Paired with monitored equipment
- High concentration of slurry (58-65%)

Sodium Carbonate (Soda Ash)

- Na_2CO_3
- Used as a water softener during laundry
- Contributes no hardness to water.
- When added to water 50% of molecule is alkalinity
- Small contribution to pH

Sodium Carbonate (Soda Ash)

Disadvantages

- Dry bags are hygroscopic
- Difficult long term storage
- Expensive as a pH supplement
- Adds more sodium to water

Advantages

- Adds alkalinity

Potassium Hydroxide

- KOH
- Colorless solid is a prototypical strong base
- Approximately 100 times more NaOH than KOH is produced annually



Potassium Hydroxide

Disadvantages

- Very expensive
- Hazardous chemical
- Less raw material supply
- Adds no calcium to water

Advantages

- Strong base
- Accurate feed rate

Dry Lime

- Large natural resource
- Mined in 30 states
- Strong alkali



Calcium Carbonate



Quicklime



Hydrated Lime

Manufacturing Process



CaCO₃
PCC
Precipitated calcium carbonate

RECARBON

+ CO₂

CaO
lime
calcium c



Properties of Lime



Types of Feed Eq.



Dry Lime

Disadvantages

- Dust, handling, mixing
- Clogged feed lines (maintenance)
- High capital cost
- Limited equipment life
- Control, accuracy, and precision
- Raw product quality variations

Advantages

- Nonhazardous
- Least expensive alkali
- Adds hardness, alkalinity and pH



The PLCH Solution

Problem:



Solution:

PLCH/Custom Feed System – Offers

extremely accurate liquid calcium hydroxide dosing,
automated control, and a **functional guarantee**

Available Technology

PLCH offers...

- Feed rate reduction
- Stable pricing
- Operator friendly



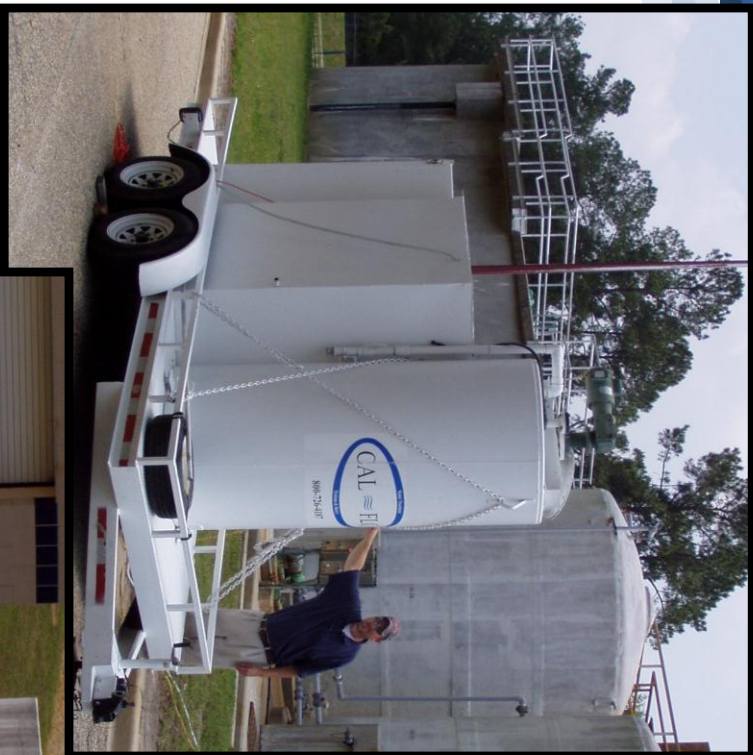
- Plant customization
 - Automated slurry dilution
 - Automated flushing system
 - Electronic pump controls
- ## *Equipment offers...*

Equipment Features

- **Safe** operation (equipment and chemical)
- Feed **accuracy** and precision
- **Low maintenance**
- Functional **guarantee**
- Numerous system indicators
- Remote monitoring (SCADA)



Test Units





'98 5 25







Section 2

PLANT APPLICATIONS

In Practice

Water Treatment

- Flocculation/Softening
- Distribution

Wastewater Treatment

- Collection
- Nutrient Removal



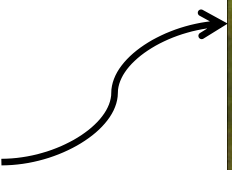
Plant Applications WTPP



Conventional Plants:

- Pre/Post Treatment for pH, alkalinity, and hardness

Includes Ultra filtration, nano, and RO membranes



Includes Actiflo & Enhanced Coagulation



Membrane Plants:

- Post Treatment for pH, alkalinity, and hardness

Plant Applications WTPP

Lime Softening Plants:

- Pre Treatment for pH



Example: Stabilization Technology

Problem:

1. Post membrane permeate water is too aggressive
2. Raw surface water experiences significant variations

Dry Lime – Permeate dosing impossible
without raising turbidity over 1 NTU

Liquid Caustic – Permeate addition lacked
true carbonate/bicarbonate alkalinity, also
expensive

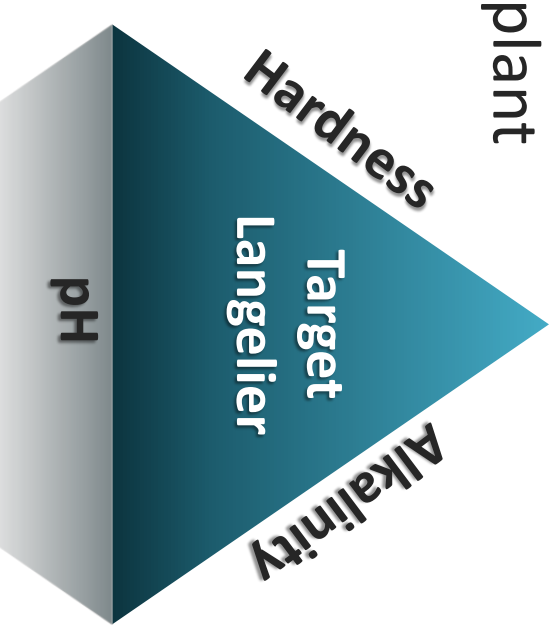
Stabilization Capability

Post-treatment:

- Ability to dial in hardness, alkalinity, and pH
- Scalable process (1 MGD to 200 MGD)
- Cost effect alternative

Pre-treatment:

- Offers conventional WTP's the ability to balance raw water
- Ability to dial in alkalinity, boost floc and plant performance
- Cost effect alternative



Cost Analysis



- Approximately \$3600/dry ton
- Does not affect LSI



- Approximately \$550/dry ton
- Only pH adjustment, little buffering



- Approximately \$450/dry ton
- Ca+ Hardness, Alkalinity, and pH



- Approximately \$110/dry ton
- Boosts $Ca(CO_3)_2$

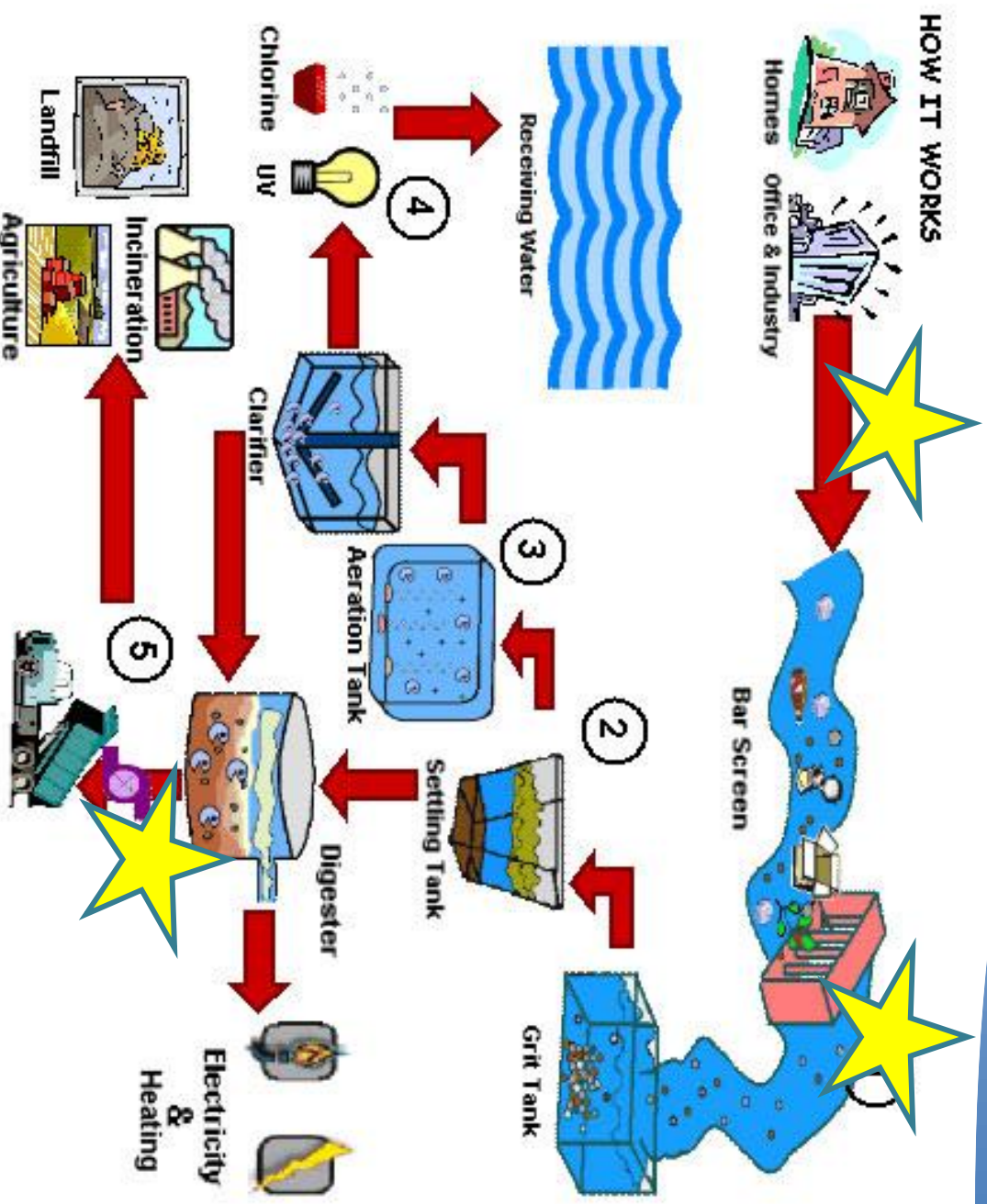


Plant Applications WWTP

Wastewater

Treatment Plants:

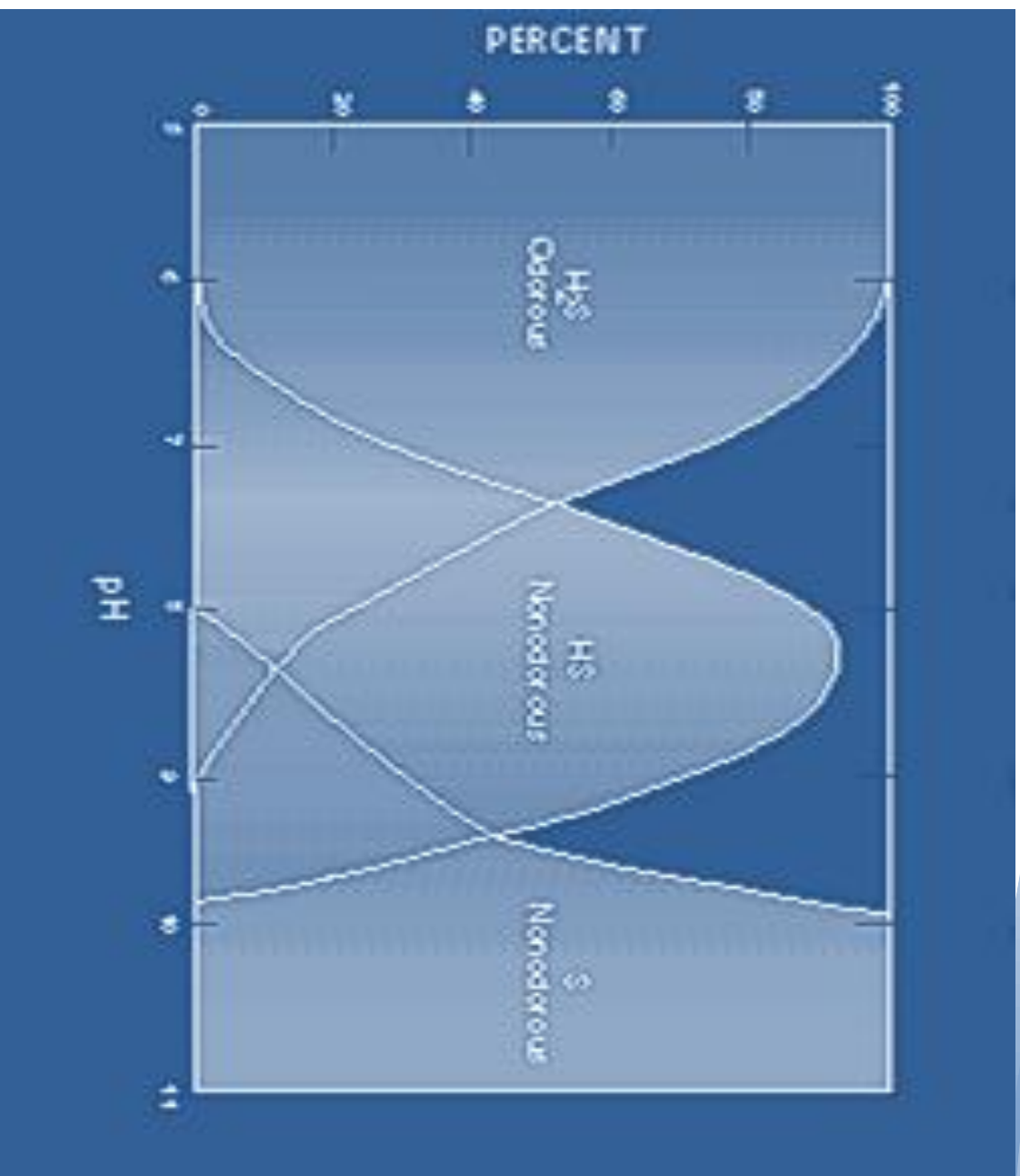
- Odor control in collection
- Influent supplemental alkalinity
- sludge stabilization



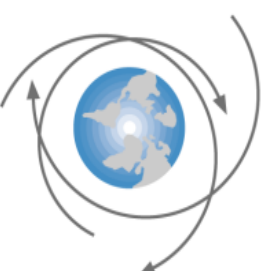
Example : Wastewater Collection

- Indirect treatment of hydrogen sulfide (H_2S)
- Mechanism - H_2S suppression by pH elevation
- Biological pH range considerations
- H_2S measurement – liquid, gas, continuous
- Control point
- Treatment Target (% H_2S Removal Needed)

Odor Properties



Questions / Comments



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