WORLD BREWING CONGRESS
August 13–17, 2016 • Denver, Colorado, U.S.A.
#ElevateBeer

Principals of Cleaning & Sanitizing In The Modern Brewery

Presenter: Jim Diamantis

ZEE COMPANY
A Member of The Vincit Group

Principles of Cleaning & Sanitizing

- Introduction
  - Purpose of cleaning and sanitizing – Why?
  - Monitoring microbes
  - Soils found in the brewery
  - Cleaning programs and product selection
  - Summary

Cleaning vs. Sanitizing

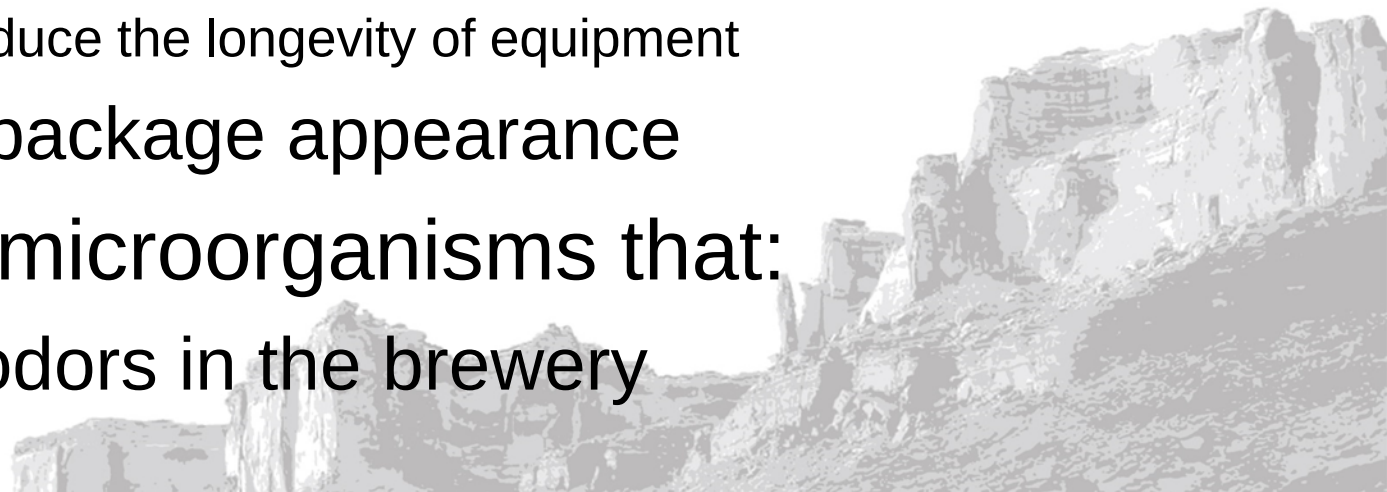
Cleaning vs. Sanitizing vs. Disinfecting

- Cleaning - removal of soil and debris from any given area
- Sanitizing – reducing microbes by 99.999% (five log reduction) on a clean surface
- However, 99.9999% log reduction, most effective
- Disinfecting – complete destruction of microbes. Microbe free.

  “ You cannot sanitize a dirty surface”

Why should we keep our processing equipment clean?

- Remove soils that can:
  - Product Contamination
    - Cause product spoilage/off flavors
  - Impact production efficiency
    - Employee safety
    - Increased wear and tear on equipment
      - Reduce the longevity of equipment
  - Impact package appearance
- Remove microorganisms that:
  - Impart odors in the brewery

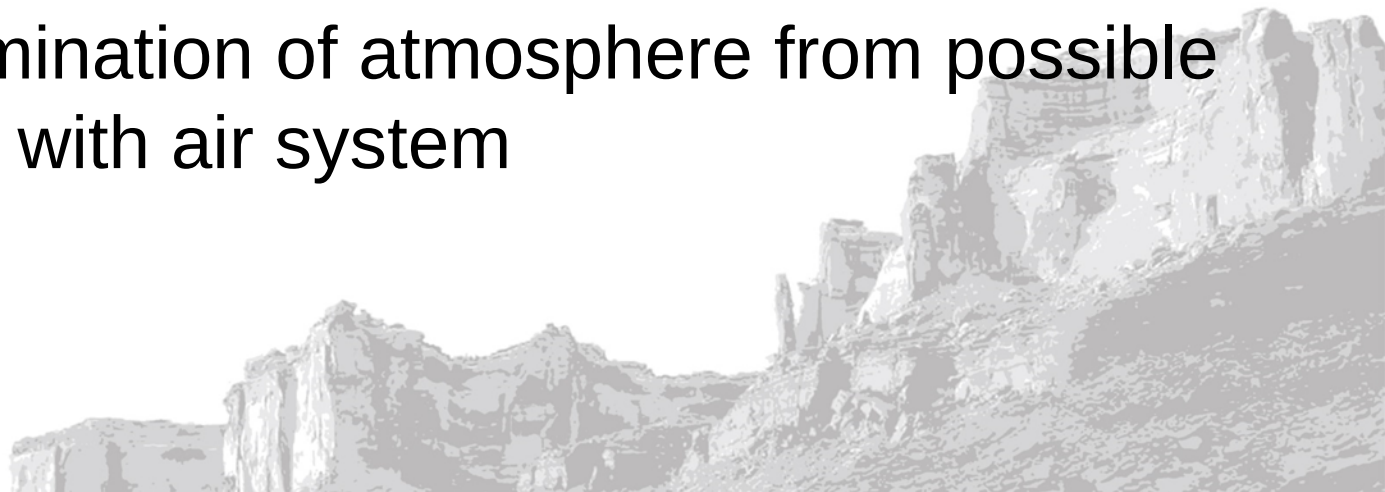


Microbial Monitoring in the Brewery

Air Monitoring

Air Monitoring

- Monitoring Plant Supply
  - Removal of moisture in air supply
  - Contamination of air operated devices
  - Eliminate
    - Reduce the chance for microbial growth in plant supplied air lines
    - Contamination of atmosphere from possible growth with air system



ATP Swabbing

- Adenosine Triphosphate (ATP)
  - Transports chemical energy within cells for metabolism.
  - Indicator if any organic cells (alive or dead) are present on the surface of equipment.
  - Used as a “go/no go” for sanitation
  - Quick way to check level of cleanliness
  - Always test prior to sanitizing

Soils in the Brewery

Principles of Cleaning and Sanitizing Microbial Monitoring

- Sources of contamination
  - Beer spillage
    - Carbohydrates, proteins, yeast
  - Environmental soils
    - Dust
    - Grease/oils
  - Floor Drains
  - Air Flow
  - Personnel
    - Hands, foot ware

Soil Identification Chart

Film/Deposit	Description Identification	Cause	Removal	Prevention
Protein	Blue-rainbow hue varnish-like "apple-sauce"	1. Using non chlorinated cleaner 2. Inadequate pre-rinse 3. Improper (sporadic or periodic) cleaning	Chlorinated Alkaline Detergent	1. Adequate pre-rinse 2. Proper cleaning with proper use dilution after each usage 3. Chlorinated alkaline detergent
Beerstone	White to yellow	1. Minerals from beer	Acid Wash	Regular and proper cleaning procedures coupled with acidified rinse
Fat/Grease	Hanging water droplets. Greasy white appearance	1. Low temperature 2. Improper detergent concentration 3. Regular use of acids in place of alkaline detergent	1. Proper temperature 2. Correct concentration of alkaline detergent	Regular and proper cleaning procedures coupled with acidified rinse
Mineral (Calcium, Magnesium)	White (waterstone) Chalky to gray	1. Rinse too hot, drop-off of minerals from water supply 2. Failure to use acid detergents 3. No acidified rinse 4. Alkaline detergent used cannot handle hard water at present concentration	Acid Wash	1. Acid wash 2. Alkaline detergent used has good water conditioning 3. Water softener or treatment
Iron	Red to brown/black	1. Water Supply 2. Using chlorine with high iron water	Acid Wash	1. Regular effective acid rinse 2. Water treatment 3. Proper selection of sanitizers

Beer Spillage

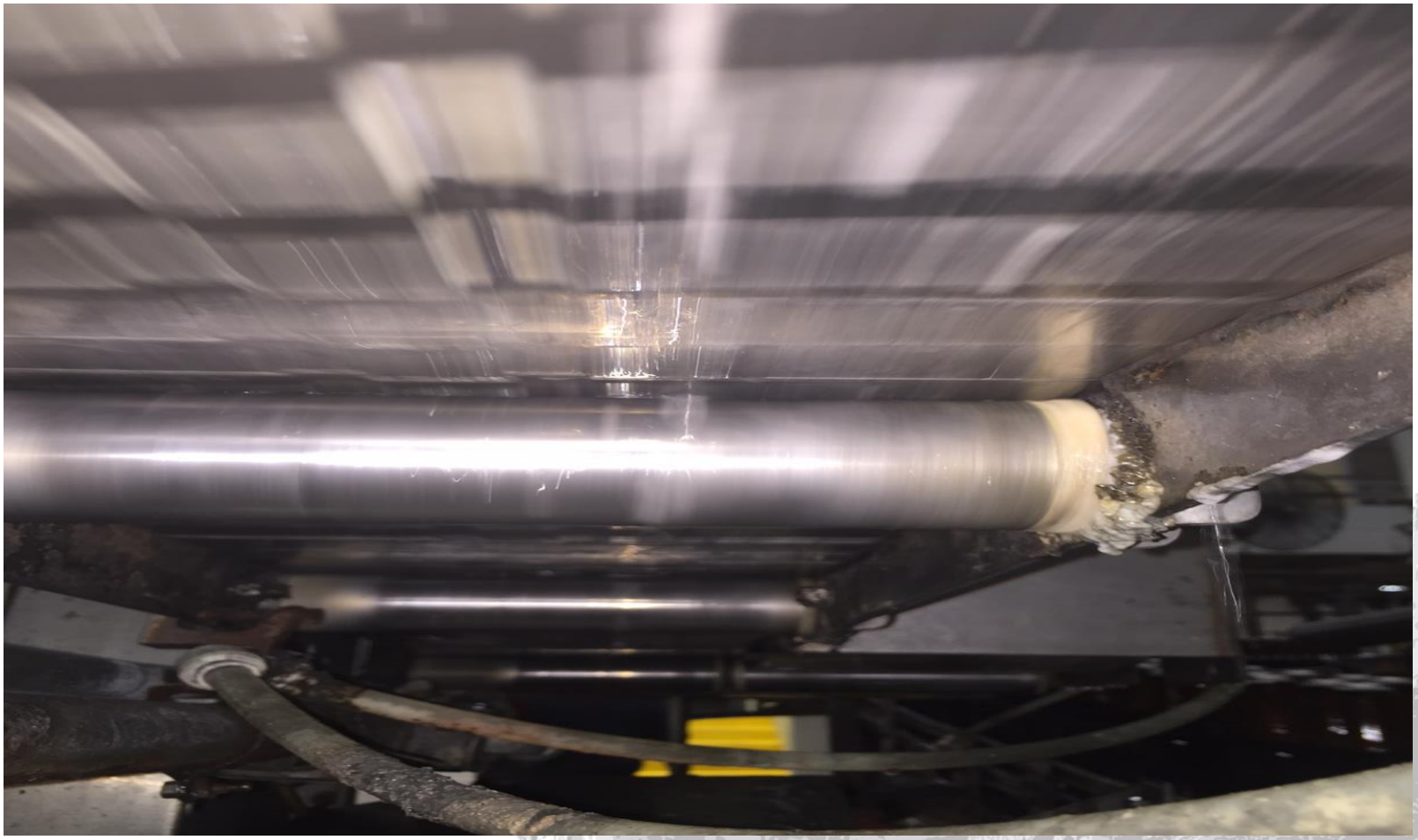
- Beer soils build up on the floor
  - Create slippery surface
    - Employee safety risk
  - Provide medium for mold growth
  - Floor discoloration

Microbial Contamination- Conveyors

Slime on conveyors

Microbial Contamination - Conveyors

Soils/Grease/Slime under conveyors



Microbial Contamination-Conveyors

Carton Dust – Dry Cleaning

Microbial Contamination

Glue on labeling equipment

Components of Cleaning

“TACT WINS”

Necessary Components of any Cleaning Operation

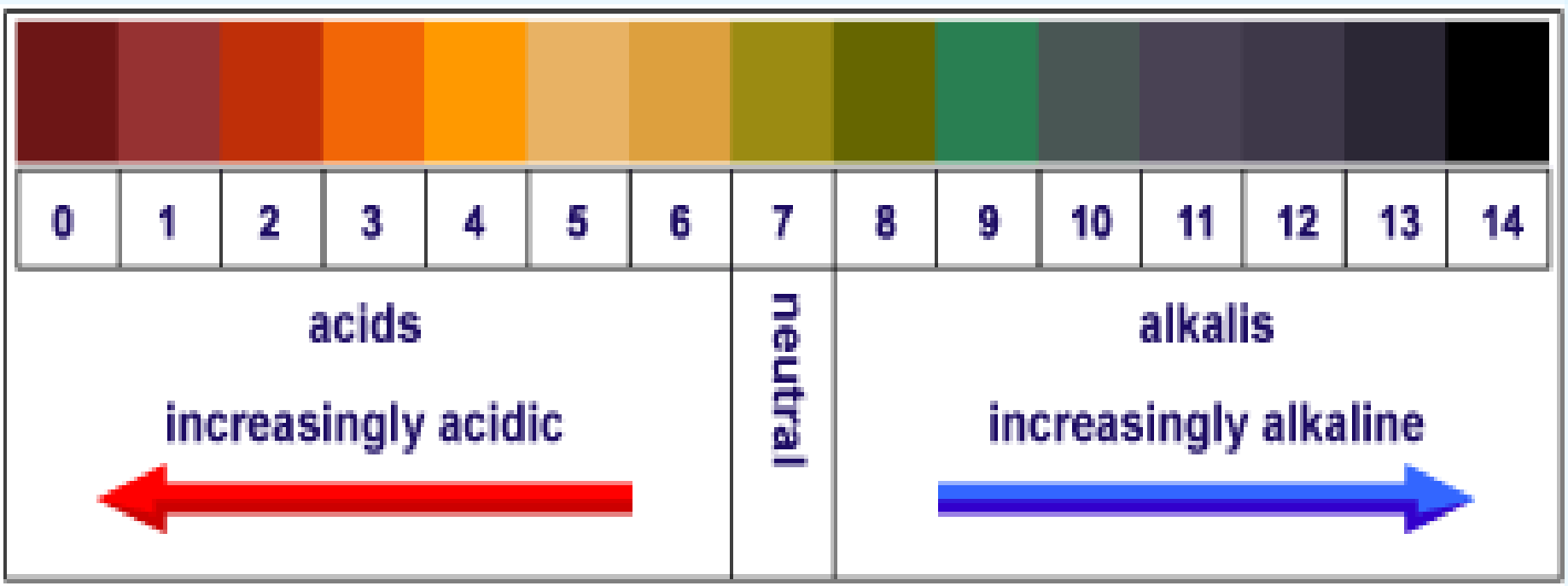
Time:	Contact time on the surface being cleaned; time required for the complete cleaning job.
Action:	Physical force exerted onto the surface. (In CIP systems: Velocity, or Flow)
Concentration:	Amount of detergent or cleaner used.
Temperature:	Amount of energy (as heat) used in the cleaning solution.
Water:	Used to prepare cleaning solution.
Individual:	Worker performing clean-up operation.
Nature:	Composition of the soil.
Surface:	What material is being cleaned.

Any of the above components may be varied, within specific constraints. Put them together and "**TACT WINS**."

Cleaning Modalities

- CIP – Clean In Place
  - Brew House
  - Brew Cellar
  - Packaging
    - Filler
    - Kegs
- COP – Clean Out of Place
  - Parts
- Manual Cleaning
- Foam Cleaning

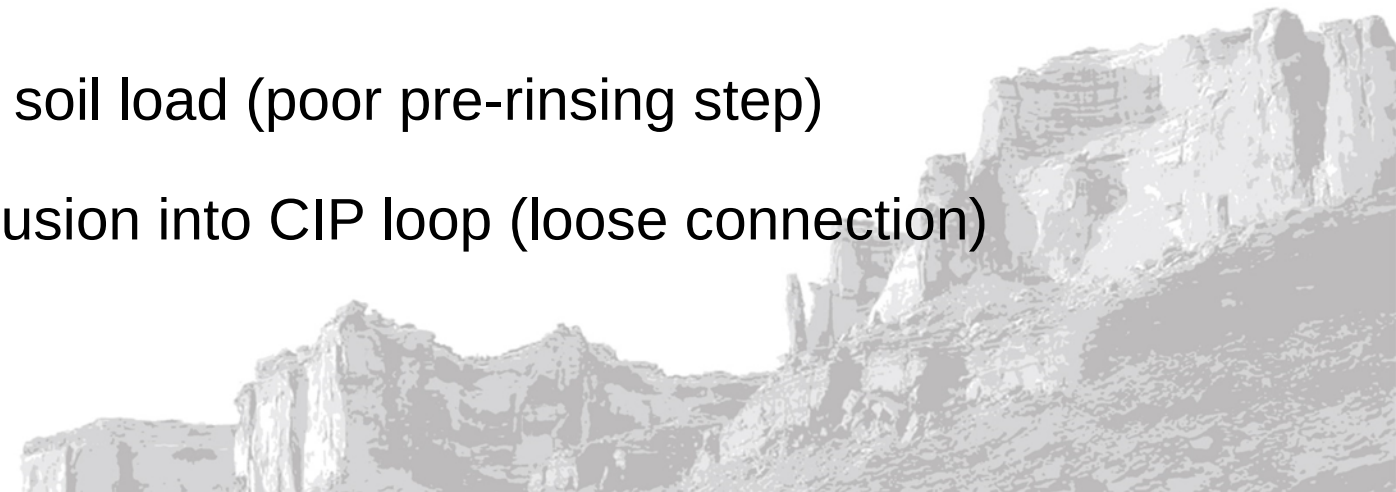
Basic Detergent Chemistry



Traditional CIP Product Selection

Select a non-foaming caustic or alkaline cleaner

- Most CIP products do not have a de-foamer in the formulation
- What happens if I have excessive foaming when CIPing ?
  - Heavy soil load (poor pre-rinsing step)
  - Air intrusion into CIP loop (loose connection)

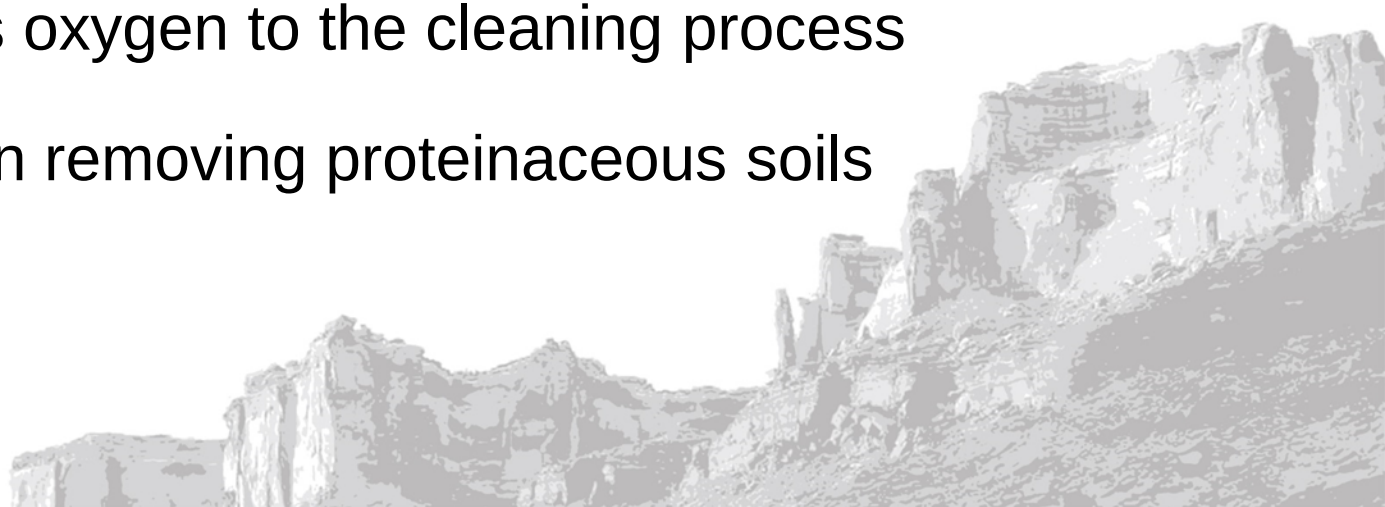


CIP Cleaning – Product Selection

- Caustic Cleaners
  - NaOH or KOH in the formulation
  - Chelants or surfactants in formulation
  - Blended formulation using NaOH and KOH
    - KOH tends to provide better rinseability than NaOH
- What is the difference between alkaline cleaners and caustic cleaners?
  - Alkaline cleaners tend to have 5-15% NaOH or KOH or a blend. With and without chlorine.
  - Caustic cleaners have 25-48% NaOH or KOH

CIP Cleaning–Product Selection

- Additives
  - Hydrogen Peroxide
    - Non-corrosive to metal
    - Will not react with CO2
    - Provides oxygen to the cleaning process
    - Assists in removing proteinaceous soils



Acid Cleaning – A New Trend

- Advantages of cleaning with Acid Detergents
  - CO_2 does not have to be evacuated from lines or filler bowl
  - Specialty built acid detergent cleaners remove carbohydrates, proteins and minerals found in beer soils
  - Free rinsing
  - Time, water, utilities savings

Sanitizer Selection

Brewery Sanitizers- Product Selection

Good | Limited | Poor

General Guidelines on Sanitizer Application

Application	Chlorine	Chlorine Dioxide	Iodine	Peracitic Acid	Quatenary Ammonium
Used for CIP sanitizing					
Used in acid environment					
Conductivity Control					
Corrrosive to soft metals					
Active against spoilage bacteria					
Active against bacterial spores					
Active against yeast					

Sanitizer Selection

- Paracetic Acid – highly effective CIP sanitizer
  - 5.7 % - 73 ppm – 230 pp (1-3 oz. per 6 gallons)
  - 15 % - 93 ppm – 260 ppm .7-2 oz. per 10 gallons)

Advantages

- Broad spectrum sanitizer
- Combination of acid rinse and sanitizer
- Safe on stainless steel
- Non-foaming
- Can sanitize under CO2 conditions
- Does not impart off flavor in beer

Disadvantages

- Can be corrosive to soft metals
- Strong odor in concentrate form

Sanitizer Selection

- Chlorine
  - Typically not used in the brewing industry
- Quaternary Ammonium
  - Should not be used in CIP system due to the foaming characteristics
- Iodophor
  - Broad based sanitizer; 12-25 ppm
  - Easily stains soiled equipment and porous surfaces
  - Can impart an off flavor in beer

Sanitizer Selection

- Chlorine Dioxide – effective sanitizer
  - CLO2 gas dissolved in water
  - Generated via electrical generation or chemical reaction
  - CLO2 will gas off with agitation
  - CLO2 will gas off in warm water
- Ozone
  - On-site generation; @ .5 – 1.0 ppm
  - Concentration loss during CIP circulation; up to 50%
  - Can impart an off flavor in beer
- Acid Sanitizer – not effective with brewing and beverage spoilage micros

CIP Cleaning

CIP Cleaning

CIP Cleaning Recommendations

- Turn off CO2 before cleaning interior of tank
  - CO2 in water becomes carbonic acid
  - By evacuating the CO2 you avoid a chemical reaction between caustic/alkaline cleaner and thus CO2 creating carbonate
  - NaOH Carbonate has a pH of @ 12 and is poor cleaner vs. NaOH
  - If the CIP cleaner has chlorine in the formulation as an oxidizer, it will create chlorine gas.
    - Chlorine gas is corrosive to all metals
    - Chlorine gas (mustard gas) is harmful to employees

CIP – Cleaning Program

- Pre-rinse
  - Make sure all CO2 is evacuated
- CIP Wash (alkaline/caustic)
  - 140F to 155F
  - 10 to 15 minutes at temperature
- Rinse
- Sanitize
  - Do not rinse if sanitizer concentration is within your chemical suppliers recommendation.

CIP – Cleaning Program

- Pre-rinse
- CIP Wash (acid detergent)
  - 120F to 140F
    - In some cases, ambient temperature wash water can be used
  - 20 to 30 minutes
- Rinse
- Sanitize
  - Non-rinse if sanitizer concentration is within recommended range provided by your chemical supplier

Environmental Cleaning & Sanitizing

Exterior Cleaning of the Equipment

- Foam clean the exterior of the equipment
  - Chlorinated alkaline foam cleaner (organic soils)
    - Allow for 10-15 minute contact time
    - Do not allow foam to dry on surface
  - Enzyme foam cleaners
    - Safe on all metals
    - Longer contact time allows for more effective cleaning
    - Extremely effective against biofilms
  - Foaming Acid Cleaner
    - Remove minerals (inorganic soils)
    - Schedule based on local water hardness

Environmental Sanitizing

- Sanitizer Selection
  - Quaternary Ammonium
    - Effective against yeast and mold
    - Safe on all metals
    - Self foaming through foaming units
    - Non-rinse – food contact
      - 200 to 400 ppm
    - Walls, floors, non-food contact equipment
      - 800 to 1000 ppm
      - 7 to 10 day residual effect

Environmental Sanitizing

- Paracetic Acid 15%
  - Broad spectrum sanitizer
  - Corrosive to soft metals
  - Non-foaming
    - Must add a food grade foam additive to generate foam
  - Non-rinse – food contact
    - 93 to 260 ppm
  - Spray sanitize
    - Atomized solution can create irritation to employees in close proximity

Foaming Equipment

Portable Foamer

Wall Mounted Foamer

Foaming Equipment

Fixed Foaming System

Benefits of a Good Sanitation Program

- Maintain superior quality
- Maintain shelf life
- Reduce maintenance costs
- Employee safety and pride in facility
- Cost avoidance
- Regulatory compliance

Thank You!

Any Questions?

ZEE COMPANY
A Member of The Vincit Group