Why?
Then and Now versus Now and Then
THEN:

chemical
physical
some definitions:
What’s Wrong with Spoilage?

- Spoilage lacks consistency—clientele become confused
- Spoilage doesn’t allow the wine’s *typicité* to show through:
  - Grape variety
  - Terroir
  - Viticultural practices
  - Winemaker’s style
Some definitions:

- **Cleaning**: an attempt to physically and chemically remove food for microorganisms and to eliminate hospitable environments for their growth.

- **Sanitation**: (=disinfection): an attempt to reduce the number of spoilage microorganisms on equipment surfaces.
Sterilization: an attempt to kill 100% of a population of spoilage microorganisms

(statistically to reduce the probability of contamination)
What things need to be cleaned and sanitized?

- Surfaces of “winery”
  - Tanks
  - Barrels
  - “Bottling equipment”
CLEANING
Cleaning of surfaces

Cleaning **before** other “sanitizations”

Another definition: removal of soil deposits from a surface

Pre-rinse; wash; post rinse

*Brettanomyces*: South African Experiences

Characteristics of water:

- softness; temperature
What about difficult surfaces?

- Barrels?
- Biofilms?
- “Bottling equipment”? 
Cleaning Agents

- Alkalis; caustic soda; soda ash; TSP
- Phosphate; pyrophosphates, tripolyphosphates, hexametaphosphate
- Surfactants (has both water and oil soluble properties)
- Acids: phosphoric acid
- Chelating compounds: EDTA
SANITIZING AGENTS

Requirements:
– Reduce concentration of living organisms (not necessarily a cleaner)
– To be effective, it must be easy to remove and have no influence on odor or flavor

Chlorinated compounds?
– Chlorine gas; hypochlorite; chloramine; chlorine dioxide; Quaternary ammonium compounds
  no no no no no no no
Chemical Stabilizations of WINE!

- **Sulfur Dioxide**
  - Broad spectrum
  - Antioxidant
  - Bound and free
  - Never an effect stabilizing agent
  - pH dependent what about (0.8 mM SO2?)

- **Sorbate**
  - Yeast “inhibitor”
  - Zygosaccharomyces resistant (G T)
Chemical Stabilizations of WINE (con’t)

- Fumaric acid
  - Malolactic bacteria
  - Limited solubility

- Lysozyme
  - Against lactic acid bacteria—in wine
  - Adds some protein

- DMPC (dimethyl pyrocarbonate)
  - “Velcorin”
    - Methanol endproduct (OK)
    - Quickly dissipated: needs metering
Chemical Stabilizations of WINE (con’t)

- Benzoic acid esters (parabens)
- Delle Units
  - Sugar stabilization of yeast:
    - If % sugar + 4.5 x % ethanol = 76
Sterilization of Wine

**Chemical**
- $\text{SO}_2$? NO!!
- Velcorin

**Physical**
- Heat? Hi Temp Short Time (HTST)
- Hot bottle?
- Steam tunnel, 350 mL bottles (this works!!)

**Removal of organisms (see next slide!)**
Cold Sterile Bottling

sterilized by steam or hot water (20 min)
  – Membrane filter and housing
  – All surfaces: lines & filler

Bottles! Generally lacking wine microbes

Corks?

Corker Jaws!!

Q C
now
ozone

- Colorless toxic gas
- Very powerful oxidizing agent
- Irritant via inhalation and to skin/eyes
- Odor threshold 0.02 – 0.1 pm
- Vapor density: 1-6 = heavier than air
- Solubility in water: 10 mg/L @ 0°C
- Half life: “20 min” only in water, but 3 days in air
However

- Terms such as “energized oxygen” or “fresh air smell” suggest that ozone is a healthy kind of oxygen.
- Ozone is a TOXIC gas with vastly different chemical and toxicological properties than oxygen.
Recommended: respirator

When working with this chemical, wear a approved full face positive pressure supplied-air respirator or a self contained breathing apparatus.

Upper limit of 0.1 ppm not to be exceeded at any time
Materials damaged by ozone:
- Rubber
- Cotton
- Nylon
- Dyes & paint
But it works!

Preliminary evidence:

effective in destroying

*Brettanomyces*

In or on wood: uprights

BBLL
Peroxides; Peracetates

Also called: per(oxy)carbonates

NaO-O-COONa

Europeans have phased out chlorinated compounds---

Years ago!!
ProxyClean™

Sodium Carbonate Peroxyhydrate
2 Na₂CO₃•H₂O

Common component of laundry bleaches

Provides over 13% available oxygen
Peracetates Activity

- Release of oxygen radicals via $\text{H}_2\text{O}_2$
- Effective over wide pH range (1-8)
- Degradation to soda ash, water, $\text{O}_2$
Radiation Treatments

- **Sanitation**
  - UV light
    - Lignin degradation → volatile phenols?
    - Light-struck wine residues
    - No surface penetration
  - Accelerated Electron Beam
    - Penetration: 4 cm
    - Sterilization? Spores?
Barrel Sanitation

- Steam/hot & cold water
- Soda ash; percarbonates
- Surfactants; SO$_2$
- DMDC; UV light
- Accelerated electron beam
- Chlorine; ozone
Acknowledgements

- Dr. C. E. Butzke, Rhode Island
- Fritz Neradt, Bad Kreuznach
- R E Kunkee, VEN 126 (né 217) Wine Microbiology notes
- Peter Fisher, Barrel Builders, Inc
- Trevor Phister, VEN UCD