Diving Deep Into Winery Water Usage & Treatment

Bob Coleman, Technical Winemaker

TREASURY WINE ESTATES

Start Upstream in the winery…

- Reduce process **water** by:
  - number of wine movements (tank to tank)
  - frequency and depth of cleaning
    - lessen deposits on tank surfaces
- Reduce waste going to treatment (**electricity**):
  - address winery process waste
- Smart cleaning **chemistry**:
  - inorganic chemistry
  - hydrogen peroxide

At the ponds…

- Smart **controls**:
  - dissolved oxygen and redox

Reduce Process Water

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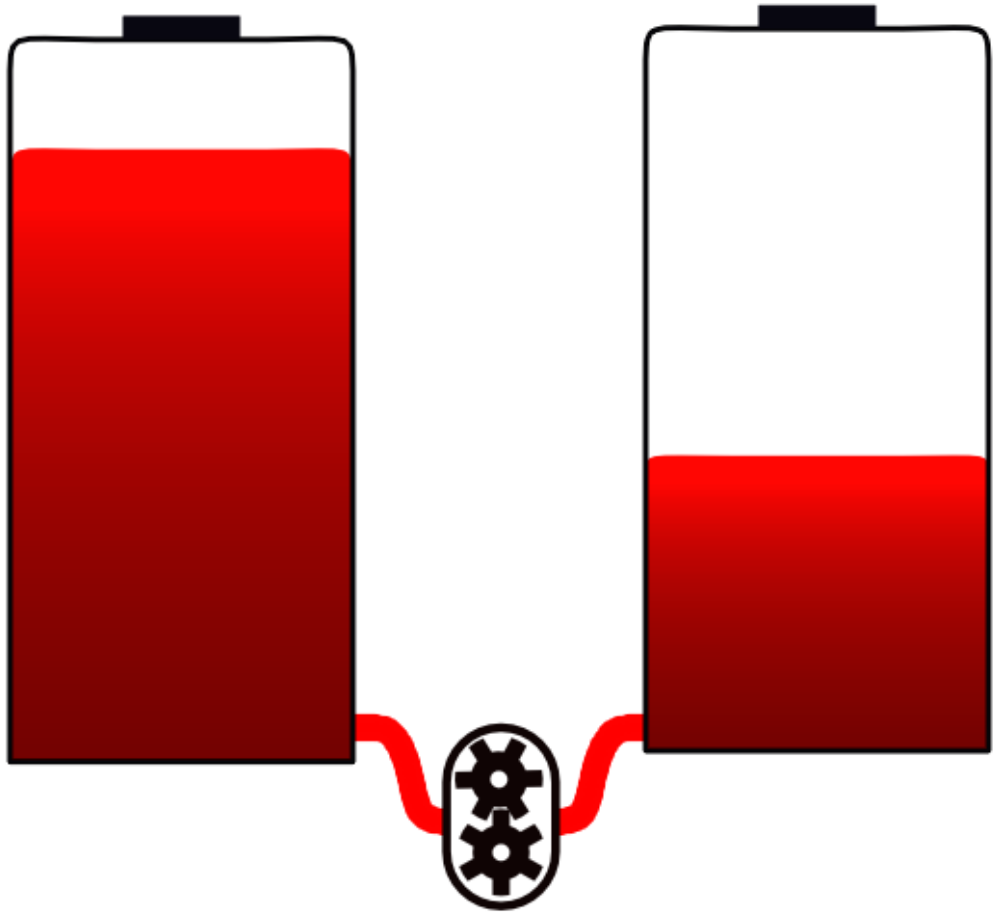
WINE ESTATES

OREGON WINE
SYMPOSIUM
FEBRUARY 15–17, 2022

Minimize Tank to Tank Movements

- Tank to tank movements



Potential items to wastewater:

- water
- cleaning chemicals
- lees
- bentonite
- potassium bitartrates
- wine

Need practices to minimize and reduce

Minimize Tank to Tank Movements

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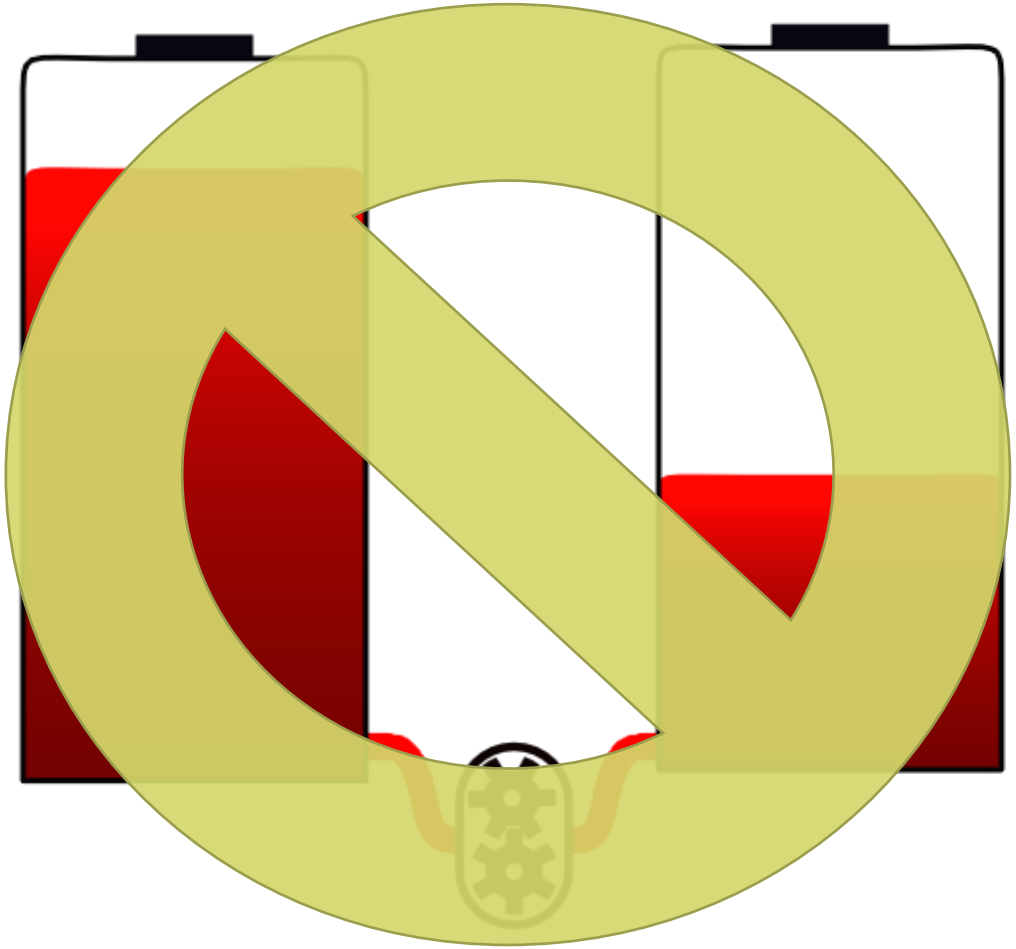

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Need practices to minimize and reduce

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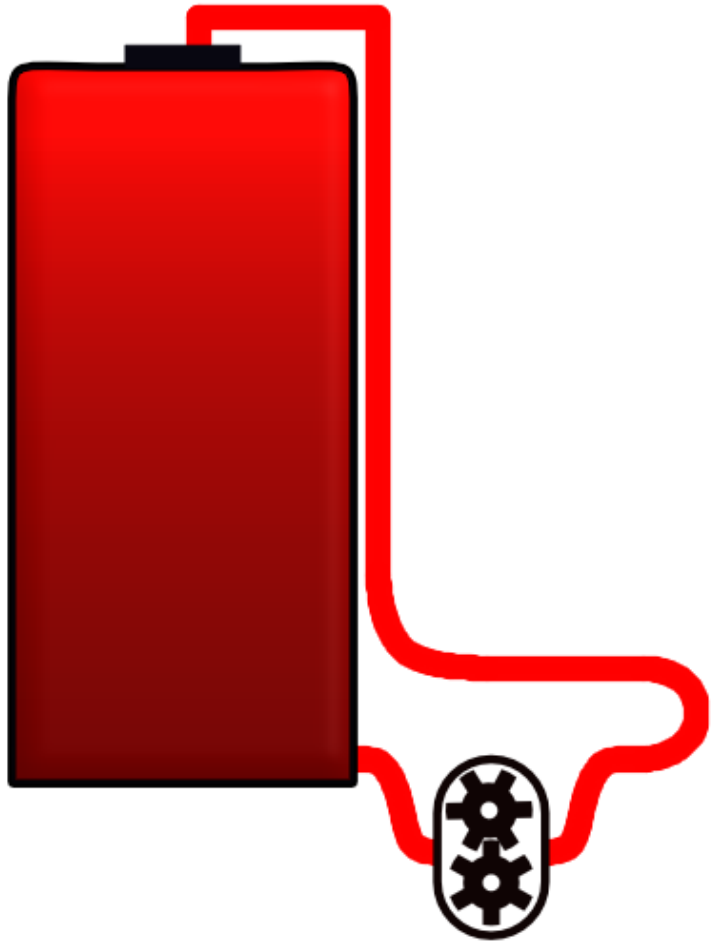
Minimize Tank to Tank Movements

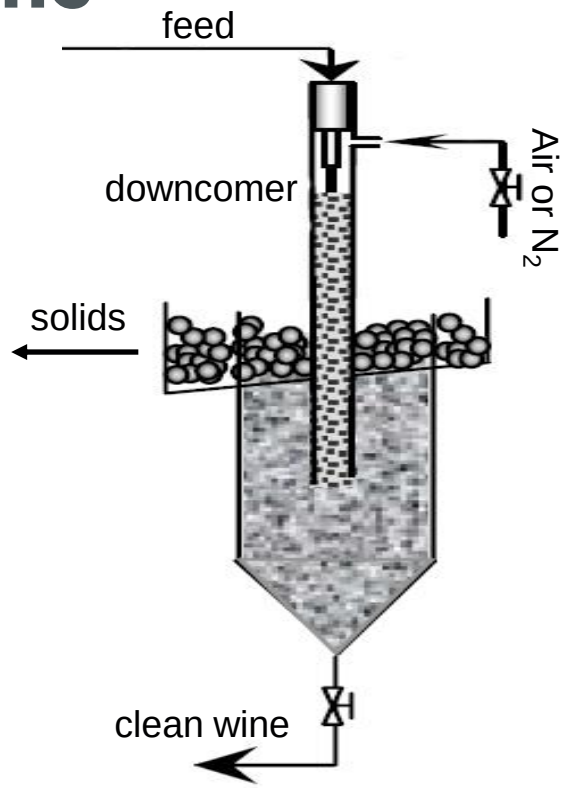
- In-place or in-line movements



- Reduce tank cleaning
  - minimize water and chemicals
  - minimize wine loss
- **Jameson cell**
  - collect solids in-line
- **Protein adsorption columns**
  - collect unstable heat proteins in-place
- **Fluidized bed cold stabilization**
  - cold stabilize wine in-place
  - collect and reuse potassium bitartrate

Minimize Tank to Tank Movements

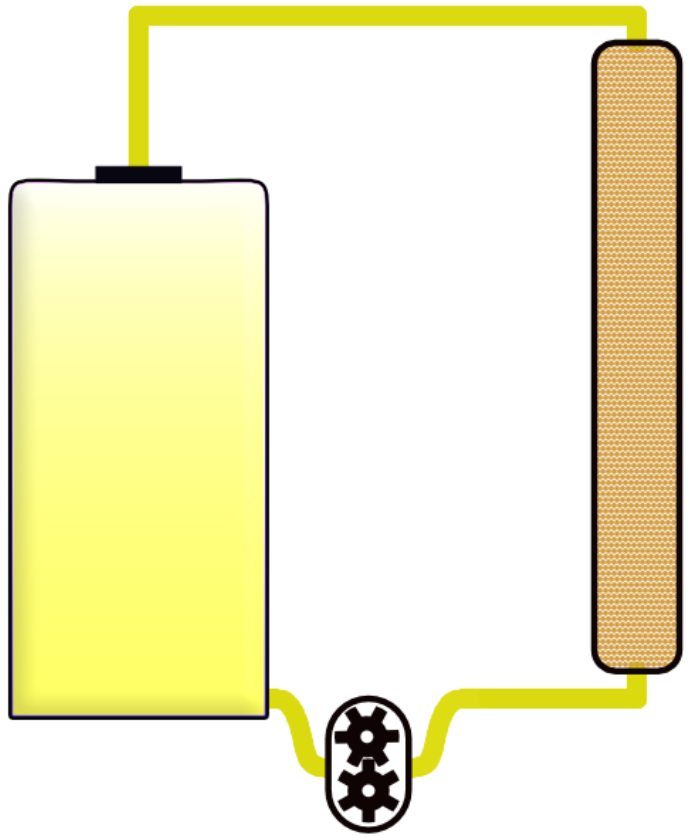
- Jameson Cell
  - In-line solid removal
  - Replaces more energy intensive removal
    - centrifugation
    - decanters
    - cold settling
  - Floatation cell



Modified from: Taşdemir, T.; Tasdemir, A.; Oteyaka, B., Gas entrainment rate and flow characterization in downcomer of a Jameson cell. *Physicochemical Problems of Mineral Processing* **2011,** *47*, 61-78.

Minimize Tank to Tank Movements

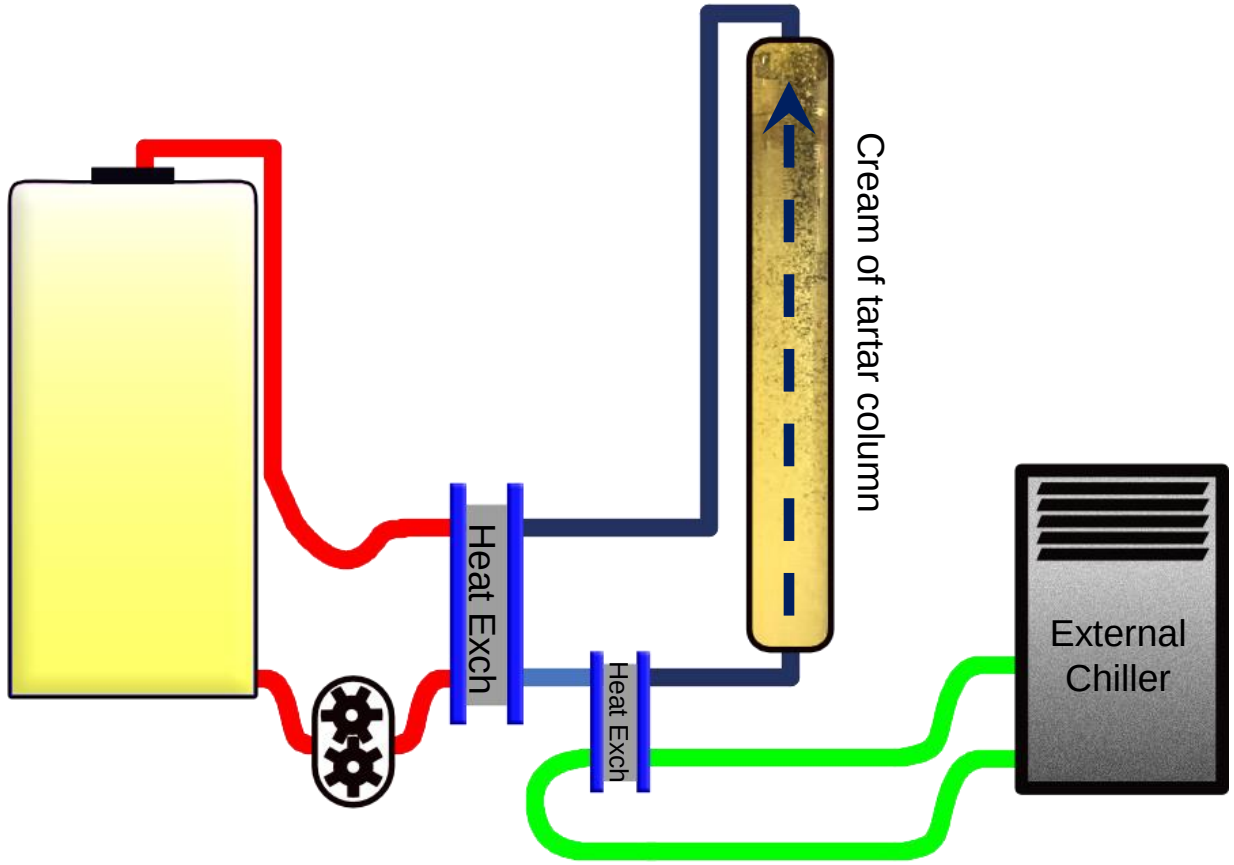
- Protein adsorption columns



- In-place protein removal
- Protein / heat protein adsorption material
  - Macroprep
- Regeneration / reuse column
- Eliminate the need for bentonite

Minimize Tank to Tank Movements

- Fluidized Bed Cold Stabilization



- In-place cold stabilization
- Recoup refrigeration energy
- Reduce energy
- Collect and reuse KHT crystal
- Reduce wine loss
- Minimal water

Minimize Frequency and Depth of Cleaning

- *In-place movements*
- **Electropolish**

Reduce Waste Going to Treatment

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Winery Wastewater

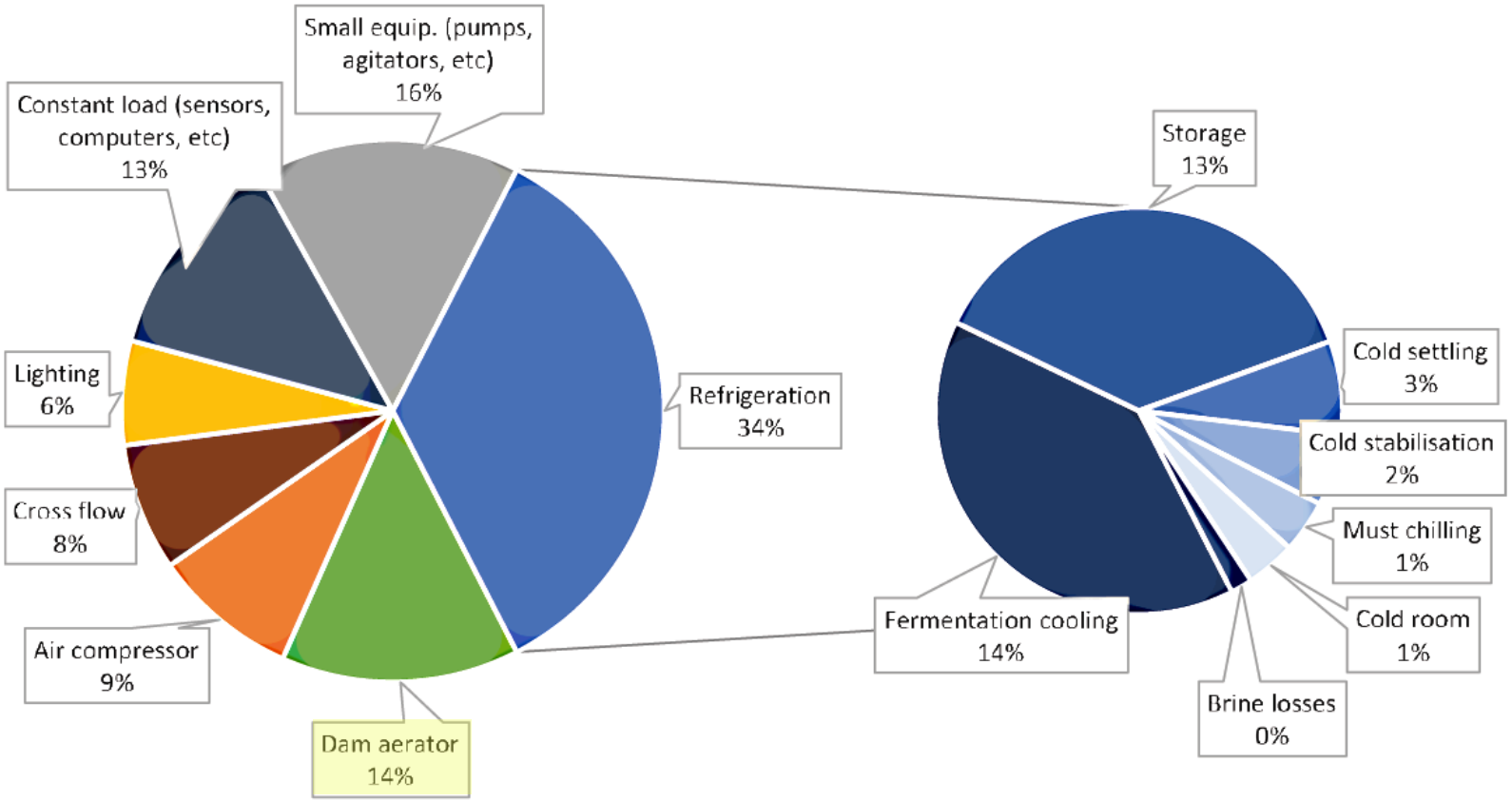

Figure 1. Breakdown of winery electricity use identified during the energy audit, with a further breakdown of the electricity used for refrigeration

AWRI Technical Review No. 235, August 2018

Winery Process Waste

- Lees removal services
  - high proof recovery
  - bulk wine
  - solids to compost
- Screens
- *Jameson Cell*

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Smart Cleaning Chemistry

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Inorganic Cleaning Chemistry

- Current cleaning chemistry considerations:
  - Organic acids for sanitation – adds COD, BOD, and electrical input for treatment
    - citric acid
    - paracetic acid
  - Na, PO_4, NO_3, Cl_2, ClO_2, O_3 - soil, water, safety, and/or environmental persistence
  - Steam - safety and high gas or electrical input

Ideally avoid or minimize the practices above

Inorganic Cleaning Chemistry

Paired Potassium-Based Buffers for Sanitizing Winery Equipment and the Carbon, Nitrogen, Sodium, and Phosphorus Footprints of Winery Cleaning Practices

Roger Boulton

Advances in Wine Research. January 1, 2015 , 379-387

DOI:10.1021/bk-2015-1203.ch024

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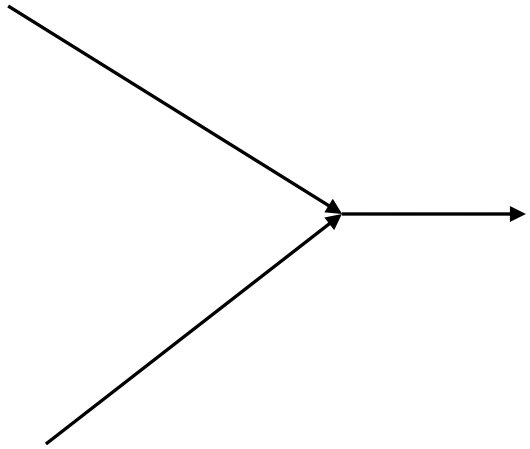
Inorganic Cleaning Chemistry

- Basic Wash
  - 20 mM KOH (1.1g/L), pH=11.5
  - potassium based caustic
- Acid Wash
  - 20 mM $KHSO_4$, (2.7g/L), pH=2.5
  - cake mixes, adjust pH in food
  - sulfate concentration less than soil concentration



Neutralizes to:

- 20 mM K_2SO_4
- pH=7.0
- Appropriate pH for wastewater ponds
- No COD and BOD

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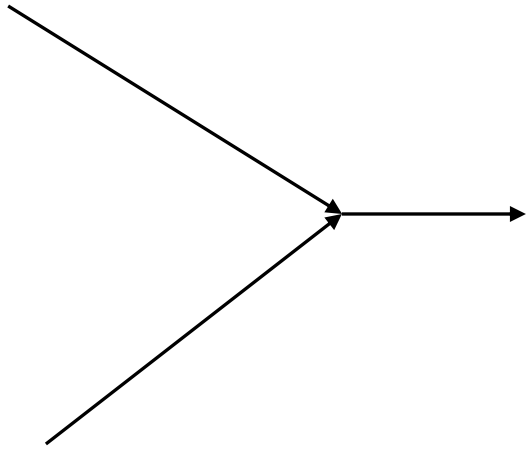

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Before final neutralization:
nanofiller or semi-permeable filter separately to reuse the chemistry

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Hydrogen Peroxide

- Clean chemistry
  - hydrogen peroxide effective at pH 2.5 and 11.5
  - disinfection at 0.5% (lower percentage than supermarket hydrogen peroxide)
  - breaks down to water and oxygen

- On-site generation
  - transportation safety – avoid hauling 30%
  - generate at or slightly above using percentage (0.5%)

Smart Controls

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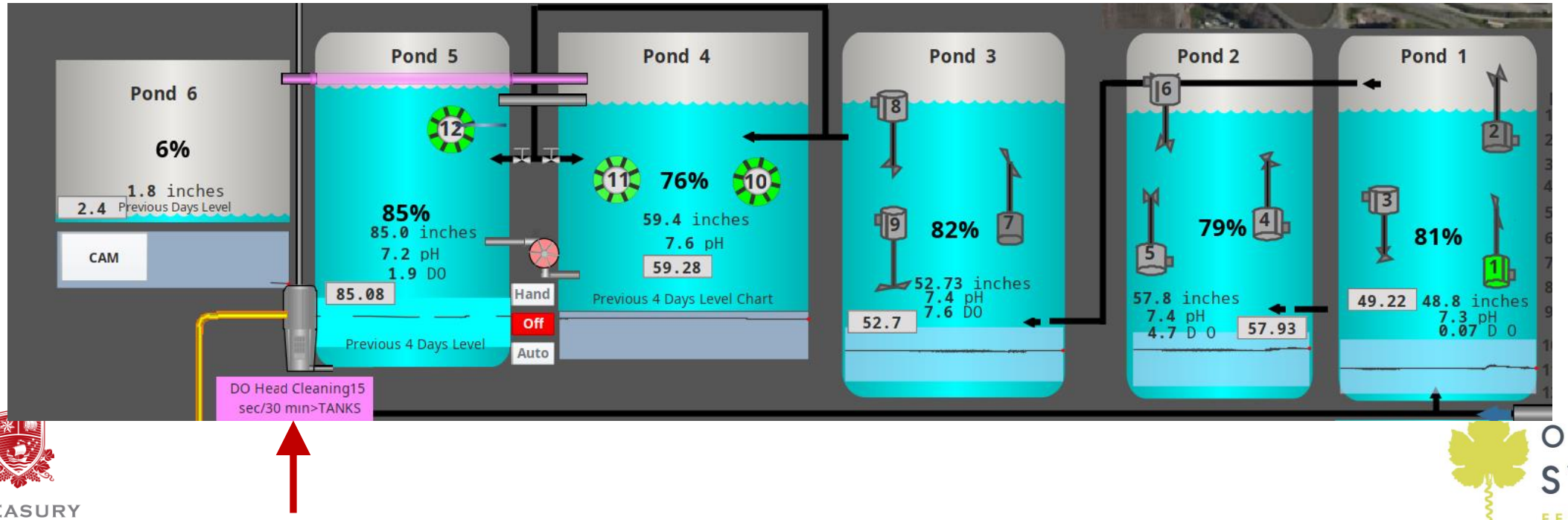
Dissolved Oxygen

- Smart **controls**:
  - dissolved oxygen probes tied into PLC / SCADA
  - DO probe cleaning – compressed air



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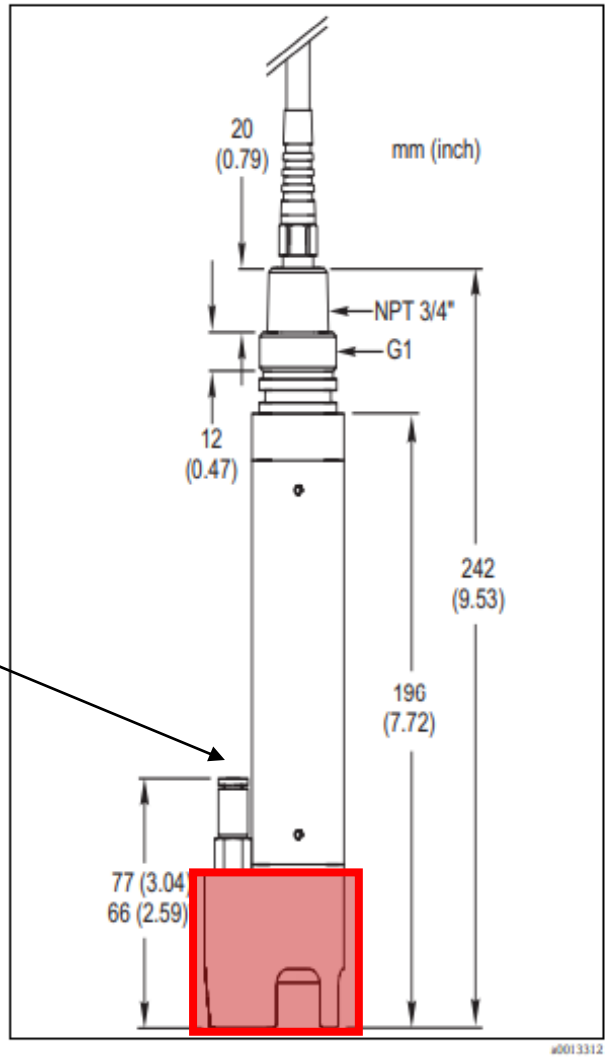
compressed air fitting



With optional cleaning unit

* depending on cleaning unit version

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Redox

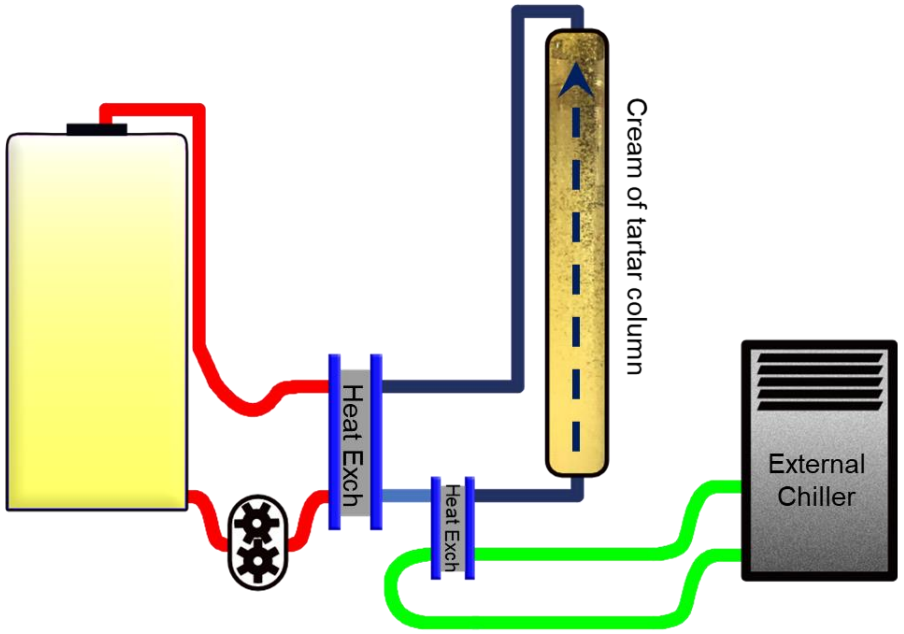
- Smart **controls**:
  - Redox probes
  - Origin of hydrogen sulfide (H_2S)
    - microbes
    - low redox potential of solution generated by microbes
  - Modify redox with small injections of air

TREASURY WINE ESTATES

More readings:
Killeen, D. J., Boulton, R., & Knoesen, A. (2018). Advanced monitoring and control of redox potential in wine fermentation. *American Journal of Enology and Viticulture, 69*(4), 394-399.

Conclusion

- In-place movements
  - Jameson Cell - future
  - Protein adsorption columns – in progress
  - Fluidized bed cold stabilization – in progress
- Electroplating - now
- Collection and off-site lees treatment - now
- Smart cleaning chemistry – now
- Smart wastewater treatment controls - now



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