CO2 Reduction in the Brewery

Purpose: The purpose of this document is to provide best practices and guidelines to the members of the Vermont Brewers Association to limit Co2 usage in the brewery. A reduction in overall CO2 use will reduce costs, emissions, and reduce the potential for unsafe working conditions.

Summary: Co2 is impossible to avoid in the brewery but reducing overall usage can be achieved by following some simple guidelines. Many practices are easily achievable by a brewery of any size, while some practices and equipment may be inaccessible to some brewers. The goal of this document is to equip every brewery with a toolkit of options and guidelines to lower overall Co2 usage. The main goal of this document is to reduce Co2 usage, but this inherently means a reduction to employee Co2 exposure thus creating a safer work environment.

Safety Considerations:

Never exceed the operating pressure of any brewery vessel. Ensure that pressure and vacuum relief valves are properly installed, but do not rely on these valves to maintain safe operating pressures.

Practices:

1. **Install a Co2 meter.** These can be relatively expensive, but they are extremely useful for keeping brewery employees safe. Knowing the Co2 levels in the brewery is the most important factor in reducing Co2 build up in your workspace. If you don't know that the co2 levels are high, you can't take actions to reduce your exposure. Co2 meters can also give you an indication of leaks in your system.

2. **Check for leaks in your Co2 system often.**
    a. Use a spray bottle with soapy water to easily detect leaks at connections.
    b. A leak in the system can also be detected by inspecting your co2 tank at the beginning of every day. If there is consistent icing (even when not in use) you likely have a leak somewhere in the system.
    c. Install an inline leak detector.
    d. Rent, buy, or borrow an ultrasonic leak detector to find small leaks in your system.
    e. Hire a third party company to inspect your Co2 system. Some utilities may offset some of the costs associated with such audits.

3. **Carbonate Colder.** When carbonating in a brite tank, get the beer as cold as possible. Co2 is more easily absorbed by the beer as temperature decreases. Use a carbonation chart to set your pressure and temperature to the precise levels to increase solubility and decrease Co2 lost to the headspace or atmosphere.

4. **Purge secondary conditioning tanks and lines slow and low**. Turbulent flow can cause gases to mix, inhibiting the purging of a vessel or line. Purging slow reduces the

overall time to purge a tank to the proper levels and uses significantly less Co2. A general rule of thumb is 1.5 hrs per barrel @ ~2 psi. A DO meter is however necessary to accurately measure the oxygen concentration of the gas exiting the tank. Smaller breweries may also be able to fill their tank with deaerated water and drain tanks with Co2.

5. **Clean brite tanks under pressure**. By using acid which does not interact with co2, you are able to clean a brite tank under pressure thus conserving co2. See CUP SOP from the Colorado Brewers guild for more info.
   https://coloradobeer.org/tech-safety-post/cleaning-under-pressure/

6. **Use Nitrogen where possible.** Nitrogen can be used in many processes in the brewery where Co2 would normally be used. Just like bulk Co2, source your nitrogen from a reputable source and ensure it is free of contaminants. You may also install a nitrogen generator, which pulls nitrogen from the air and has a purity of 99.8+%. Some uses for Nitrogen or a mix of nitrogen and Co2 include but are not limited to:
   a. Conditioning and brite tank purging
   b. Transfer line purging
   c. Keg cleaning
   d. Pre-Package Purge
   e. Serving draught beer

7. **Capture Co2 and reuse.** Investing in a carbon capture system can be very costly, and does not make sense for every brewery, but there are other ways to reuse naturally occurring Co2.
   a. Utilize Co2 that is naturally produced during fermentation to partially or fully carbonate your beer. Conduct a Forced Fermentation test at beginning of fermentation to determine final gravity of the beer. Depending on how carbonated you want your final product to be (or the pressure limitations of your equipment), seal the FV with 1-1.5 degrees plato left to ferment. 1°P of fermentation is approximately equivalent to 2.0 Volumes of Co2. Spunding valves can also be utilized for this process.
   b. Purge conditioning or brite tanks by transferring co2 from active fermentation. There are potential contamination utilizing this process, so take any steps necessary to reduce those contamination risks.
   c. Implement bottle/package conditioning to naturally carbonate packaged products.

Refer to the Brewers Association's "Guidelines for Economical Use of Carbon Dioxide in the Brewery" for more information on Co2 reduction and safety considerations.
https://www.brewersassociation.org/brewing-industry-updates/guidelines-for-economical-use-of-carbon-dioxide-in-the-brewery/

Revision History Log:

Version	Reason For Change	Date	Initial
1.0	First Draft of Document – Work in Progress	03/08/21	DS
1.1	Finished first draft from Process number 4 onward	3/18/21	DS
1.2	Document Complete	5/13/21	DS