



The Value of Standard Operating Procedures for Small Businesses

A Case Study with Purgatory Beer Company

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Abstract

The co-owners of Purgatory Beer Company, a local microbrewery, perform all of their cleaning and sanitation procedures themselves without any reliance on Standard Operating Procedures (SOPs). However, as the co-owners expand their business, SOPs will be crucial to ensure any new employees carry out sanitation procedures safely, correctly, and in compliance with food safety laws. By detailing my writing process as I compose SOPs for Purgatory Beer Company, I demonstrate the difficulty, and importance, of writing SOPs for small businesses.

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Chapter 1: Background

1.1) Introduction

Since the late 20th century, the microbrewery industry has seen exponential growth in the United States. In 1980, the United States only had 4 microbreweries (Weston et al., 1999). By the end of 2018 there were over 3,800 microbreweries (Brewers Association CITE). For my Professional Writing Major Qualifying Project, I am working with a local microbrewery called Purgatory Beer Company. Purgatory Beer Company was founded by two locals of Northbridge, MA who shared a passion for locally-brewed beer. The company is still in its first few years of existence, but business has been going well and the co-founders are now beginning plans to expand their brewing operation.

To learn more about running and expanding a successful microbrewery, the co-owners of Purgatory have attended various microbrewery conferences and seminars. They have also found that online microbrewery forums contain a wealth of knowledge about best practices and process improvement. The owners of Purgatory Beer have been looking to these forums as they plan to expand their business and add more crew members. Right now, the crew working at Purgatory is rather small, just the two co-owners and a handful of part-time bartenders. Therefore, all of the brewing process for the microbrewery is carried out by one of the co-owners. When researching the expansion of microbreweries, almost all online forums cited the importance of process documentation.

Purgatory Beer currently has three written procedures which can be found in Appendix B – two outlining steps for employees opening and closing the bar and one outlines the procedure for running the dishwasher. The rest of their procedures are communicated by word of mouth – including procedures for the entire brewing process, ringing a customer up, cleaning the floors of the brewer, and all equipment sanitation. However, verbal instructions can be unreliable since they allow the variability in procedures when performed by different operators, and this could lead to inaccurate, even dangerous work habits (Stainrod, 2016).

In order to ensure consistency, accuracy, and quality in a repetitive process, the vast majority of manufacturing processes, large or small, utilize some sort of Standard Operating Procedures (SOPs) (Barbe et al, 2016). SOPs are written step-by-step instructions outlining how to carry out procedures correctly. SOPs can be used in many different capacities within a microbrewery – the beer-making procedure, inventory checking procedures, customer service procedures, or sanitation procedures to name a few SOP-appropriate applications. Most importantly, SOPs can be used to prove compliance with laws when the facility is audited by federal, local, or state authorities (Weston et al., 1999). SOPs take into account current standards, codes, and regulations so that all procedures ensure the microbrewery is obeying all applicable laws.

Small microbrewery facilities, like Purgatory Beer Company, generally only get audited by their local Board of Health (Anonymous Craft Brewery, personal communication, January 13, 2019). These audits are usually visual checks of the cleanliness of the facility, without the in-depth evaluation of documentation. However, since the passing of the Food Safety Modernization Act in 2011, microbreweries are under the jurisdiction of both the FDA and the

Federal Bureau of Alcohol, Tobacco, and Firearms. Therefore, although craft breweries are rarely audited by federal organizations, it is possible that microbreweries can be randomly audited by the FDA – in early 2018, an unsuspecting Colorado craft brewery was audited by the FDA was cited with 13 different violations, including employees not washing their hands and an unclean ceiling above a food preparation area (Martinez, 2018). Audits from these organizations sometimes require proof that the facility is complying to the appropriate laws (Hinman, 2017).

Oftentimes, microbrewery owners are dealing with more immediate needs than writing documentation – in the case of Purgatory Beer, the co-owners are focused on brewing the best beer possible, growing their business, taking care of their respective families, and working full time elsewhere. The co-owners of Purgatory, along with owners of many other small businesses, lack the time and resources to write their own documentation. However, Purgatory’s co-owners recognize that documentation is essential when expanding their business. Purgatory’s co-owners want documentation for their sanitation and cleaning processes so that these processes can be delegated to new employees and they can focus on the brewing process. Therefore, I decided to focus my Professional Writing MQP on writing documentation for the sanitation and cleaning of their kettle, mash tun, and fermenter, which are the large, stainless steel apparatuses used for the brewing process. My goal for my MQP was to write standard operating procedures to ensure that sanitation processes are carried out safely and correctly, which will aid Purgatory in producing the best and highest quality product possible.

1.2) Project Approach

I wrote and edited a few SOPs during my time as a supply chain intern at Frito Lay in the summer of 2018. Through this experience, I gained a deep appreciation for all that SOPs can be used for in a large-scale manufacturing environment. However, during my time as an intern, I followed the Frito Lay template and layout, concentrating more on the content of the procedures than the actual structure of the SOP. To start work on this project, I knew I first needed to continue to research the structure and content of typical SOPs. I referenced a variety of peer-reviewed journal articles from different industries to create a genre analysis of SOPs.

After establishing a deep understanding of SOPs as a genre, I examined the current SOPs that the employees at Purgatory Beer Company have been using in their day to day operations. Generally, when creating or modifying a procedure, the SOP writer should watch a person perform the task and write down their observations (Bernick, 2013). After creating a draft of the SOP, the procedure should be approved with another person who often performs that same task (Bernick, 2013). Therefore, I interviewed Brian DiStefano, one of the co-owners of Purgatory. From my interview notes, I wrote a first draft of the kettle, mash tun, and fermenter cleaning SOPs. I then observed one of the co-owners carry out the fermenter cleaning procedures, then finalized the fermenter SOP for Purgatory.

Chapter 2: A Genre Analysis of Standard Operating Procedures

In order for me to write the best SOPs possible, I first had to identify the key features of SOPs as a genre. Genre is defined by John Bean as “recurring types of writing identifiable by distinctive features of structure, style, document design, approach to subject matter” (Bean, 2011). SOPs have distinctive features that make them similar to one another – they generally follow similar structures and serve similar functions within professional or manufacturing environments. But genres are not templates of documents to be mindlessly followed by writers. Genre should center around the action it is used to accomplish (Swales, 1990). Genre should provide some semblance of order and structure, but an author can manipulate a genre to fit the rhetorical situation (Bazerman, 1988).

In his article *Genre Analysis*, John Swales claims that a genre often cannot be defined by a single definition, but a different examples of a genre have a web overlapping similarities, like a “family” – related but not exactly the same (Swales, 1990). Texts in a genre generally share a similar communicative purpose. The constraining conventions of a genre may be used by writers without a second thought, but the underlying purpose of a genre is oftentimes more convoluted. What many genre users do not realize is the constraining conventions of a genres can shape the way a discourse community thinks (Bazerman, 1988). Experts in a discourse community recognize the purpose of a genre and understand what qualifies a piece to be part of a genre.

In order for me to fully qualify my use of SOPs for Purgatory Beer Company, I first must define what SOPs are and their overarching purpose based on what I have found in literature. Then, I look to exemplars in the SOP genre to establish general constraints that SOPs follow as a genre. Finally, I identify content that I will include in Purgatory’s SOPs and defend my reasoning for choosing the content.

2.1) Defining Standard Operating Procedures

Standard Operating Procedures are defined as “written step-by-step instructions on how to carry out procedures correctly” (Barbe et al., 2016). The word “standard” denotes that the documentation outlines the optimal possible steps for an “operating procedure” (Standard operating procedures, merriamwebster.com). SOPs are used to inform the reader; each procedural step in an SOP should be written in a manner that relieves any stress or uncertainty the reader may have had about the procedure. SOPs should help maintain and manage risk, make repetitive work consistent, and improve the efficiency of work (Bernick, 2013). SOPs should remind the employee of Good Manufacturing Practices, notifying the reader of any safety precautions that they should take before carrying out a procedure (Barbe et al. 2016)

SOPs can also point employees to resources they can use while carrying out certain procedures. For example, SOPs may reference a certain training they should have completed before carrying out the procedure. To be clear, SOPs are not to be used in place of any trainings employees should have – it is still important for new employees to be trained by a supervisor (Stainrod, 2016). SOPs can be used to aid in training new employees, and SOPs can serve as a refresher and a reference for these trainings (Barbe et al. 2016).

While writing SOPs, the writer inadvertently identifies jobs that are repetitive, which in turn helps the SOP writer identify which tasks can be delegated to newer employees. SOPs writers also aid the business overall by documenting these processes; thus, if anything were to happen to the employees who normally carry out the procedures, the knowledge about a certain process can still be passed on to other employees. Writing SOPs also allows the SOP writer to reflect on the process and evaluate how the process can be performed better (Bernick, 2013). Standard Operating Procedures can give both business owners and employees peace of mind because owners supervise repetitive processes less closely, and employees are less stressed about performing these procedures (Barros-Velázquez, 2016).

2.2) The Content of a Standard Operating Procedure for Microbreweries

SOPs in general should help ensure that the employee carrying out the procedure is doing so correctly, safely, and in compliance with the law (Hinman, 2017). In order to ensure a procedure is carried out correctly, SOPs should list the conditions that the SOP will be carried out under – the location of the SOP, the equipment required for the SOP, and the training required to carry out the SOP properly (Stainrod, 2016). The procedure itself should be written after shadowing an expert as they perform the SOP so that the most accurate procedure is documented (Bernick, 2013). To ensure the safety of a business's employees, SOPs should mention any safety precautions that need to be taken before performing the procedure in the document. A lot of the safety precautions that microbreweries will need to take into account will be outlined on the SOPs provided by the microbrewery's chemical supplier (Anonymous Craft Brewery, personal communication, January 13, 2019).

Additionally, the SOP should reiterate safety precautions before the steps that the safety precautions apply to. This not only ensures the safety of the person carrying out the procedure, but also ensure that the company will not be liable for any safety incidents that occur during these day-to-day operations (Barros-Velázquez, 2016).

SOPs should also ensure that reader follows a replicable protocol that follows any legislative standards, which is the main concern of auditors and other government officials. (Barros-Velázquez, 2016). Under law, Breweries are classified as food establishments. Food establishments can be audited at any time by local health boards or the FDA, according to the Food Safety Modernization Act (Brewers Association & Master Brewers' Association of the Americas, n.d.). The FDA mandates that all food establishments comply to the Code of Massachusetts Regulations Title 105 section 590, abbreviated as 105 CMR 590.000. 105 CMR 590.000 sets minimum sanitation standards food establishments in the state of Massachusetts, standards that Purgatory has to comply to (Town of Northbridge Board of Health, n.d.). The 105 CMR 590.000 provides guidance with anything from preventing foodborne illness to food safety training to identifying the proper leader of an organization. 105 CMR 590.000 often refers to the 1999 food code as a reference. According to the FDA, the food code is a model that is used to assist and unify food regulations at a local, state, tribal, and federal level (FDA Food Code, 2018).

Adhering to food-industry related laws can prove challenging for breweries, since the majority of the laws are catered towards concerns facing food production and storage, not beverage. While the fundamental theme for the two industries is the same, food production

and storage often requires a lot of specific legislation; for example, the food code has a chapter dedicated specifically to food where only a few short sections pertain to issues of concern for microbreweries (FDA Food Code, 2018). According to the co-owners of Purgatory, the local Board of Health is generally very supportive of local microbreweries and can give the microbreweries an overview of what they will be looking for in their inspections before the microbrewery even opens (Brian DiStefano, co-owner of Purgatory Beer Company, personal communication, January 22, 2019). Additionally, being part of a local brewer's guild, an organization where microbreweries located in the same area come together, is very beneficial when trying to understand best practices when complying to local law (Anonymous Craft Brewery, personal communication, January 13, 2019). Similarly, microbreweries can apply for membership within the Brewer's Association, a national organization of microbrewery owners and experts with countless online resources, seminars, and conferences to help microbreweries start up and stay in business (Brewers Association, n.d.).

2.3) The Structure of Standard Operating Procedures

SOPs have a very similar framework throughout a variety of different industries. The Brewer's Association website provides a sample SOP specific for Microbreweries, available on the Hazard Assessment Principles web page, which I have included in Appendix A. While some elements of this sample SOP are slightly different, the Brewer's Association sample SOP follows a lot of structural elements that are seen in other example SOPs in other industries – most notably Bernick's (2013) and Stainrod's (2016) sample SOPs, which were written for the farming and petroleum industries, respectively.

Generally, SOPs have a header on the top of each page which includes a descriptive SOP title, the SOP number, the revision number, revision date, and page number. According to a representative from Anheuser-Busch, consistency in SOP headers helps keep SOPs organized and easy to find when a company has a lot of SOPs and SOP revisions to keep track of (Anonymous Anheuser-Busch Representative, personal communication, January 13, 2019). The header is followed by a short introduction that details who should use the SOP and when they should use it (Stainrod, 2016). SOPs typically list regulatory references, providing all of the legal reasons the SOP was written. The references can be specific, listing the names and clauses of the standards or laws that the SOP should comply to (Stainrod, 2016). The list of regulatory references works to establish a logical appeal with the reader – basing the SOP on laws appeals to the reader by bringing a higher regulatory power to mind and reminding the reader of the consequences to straying from these procedures.

After establishing legal credibility, SOPs generally outline any safety precautions and equipment required, then the procedure section details the actual instructions to be followed, typically in list form (Stainrod, 2016). The language of the procedure should be informal and precise (Bernick, 2013). Any warnings and precautions should precede the action needed to be taken, and any reasoning should follow the instructions. Any drawings or visual aids should be used next to corresponding text (Barbe et al., 2016).

The SOP should conclude with any follow-up procedures that need to be addressed – this includes corrective actions or preventative maintenances needed to ensure the quality of

the product and the safety of the equipment. Finally, the SOP lists any document control measures needed at the bottom of the last page, listing who controls the document, who approved the document, and the expiration date of the SOP and the date the SOP needs to be revised (Stainrod, 2016). SOPs should be sorted in a logical manner and stored where any employee who would need an SOP can access it. For example, Anheuser-Busch numbers their SOPs with codes, with letters used for which department the SOP is for followed by the SOP number (Anonymous Anheuser-Busch Representative, personal communication, January 13, 2019).

SOPs are typically structured to be consistent and easy for employees to read and reference. Example SOP structures are useful as guides, but each industry and company within that industry personalizes these general structures to fit their specific needs.

Chapter 3: Creating SOPs for Purgatory Beer Company

When I initially started work at Purgatory Beer Company, the co-owners immediately expressed interest in creating documentation for sanitation. The co-owners of Purgatory run this microbrewery operation while also both working full time in other positions. As they hire more employees, the co-owners want the responsibility of cleaning to fall to other employees, and they hope to continue taking charge of the brewing process for Purgatory. The co-owners have always done the cleaning themselves, and in the past they just used documentation for small portions of their cleaning process if there were any specifics that they need to keep in mind (i.e. temperature of the water, acids to use). The co-owners wanted to expand these SOPs to help train new employees on the cleaning process, using the SOPs as a reference to ensure that the new employees have the whole procedure written out and understand the reasoning behind each step. These more detailed SOPs can be used as a training aid or a reference point for new employees. This SOP would be stored in the bar area, an area that all employees have access to. The co-owners also wanted a shorter procedure in a checklist, which they could display in the fermenter area. This shortened procedure for employees to check off steps as they clean, mainly to ensure that experienced employees do not miss any steps and to help transition newer employees from the more detailed SOP. By studying the current documentation at Purgatory and the needs of the business, I constructed SOPs specifically for Purgatory's cleaning processes.

3.1) The Current SOPs at Purgatory Beer Company

Currently, Purgatory has a few written procedures, which I have included in Appendix B. These procedures outline the steps to setting up the basins of cleaner, running the dishwasher, cleaning the vessels post wash, opening the bar, and closing the bar. These procedures are very effective to remind current employees of their day-to-day processes. However, the procedures are not specific enough to be used by new employees without close supervision.

For example, one of the steps in the "Set Up Cleaner" procedure is shown below.

- Set Up Cleaner –

 - Make sure Vessels are both clean
 - Fill sanitize vessel (left)
 - Cold water and 1oz of Iodine per gallon (min of 7 gal fill)
 - Fill Wash Vessel (right)
 - Hot Water and 1 oz per gallon of Acid #5 and Acid #6 (Five Star)
 - Connect Hot Water to Rinse Valve "In Line"
 - Connect the Purge "Out Line" line to the drain or a bucket
 - Connect CO2 connection to tank (tight w a plastic washer)
 - Set CO2 to 12-15 psi
 - Hook up Electric

Figure 1: Original purgatory procedure for setting up the cleaner.

This procedure is a great example of an SOP that stands as a reminder for current employees, but this procedure does not have enough detail for a new employee to use. For example, when someone who is familiar with the cleaner sees the step “hook up electric”, they would know exactly where the electric system is on the cleaner and how to hook up the electric, so this step would serve as a reminder to them. Someone with no experience, like a new employee, would not be familiar with the setup of the cleaner. They would need to know what “electric” means, where on the cleaner the electric is, they might need to know what wires should be hooked up where, any safety hazards to avoid, and they should know why hooking up the electric is important.

The co-owners of Purgatory, who wrote these SOPs, are very familiar with the procedure to set up the cleaner. In reading the current SOPs, I learned how important it was for an untrained reader to review SOPs and ask these questions. By inquiring about the specifics of a procedure, the writer can make the procedure much more clear. Instead of revising these SOPs, the co-owners of Purgatory Beer company wanted me to write new procedures for the cleaning process they follow for cleaning their fermenter, mash tun, and kettle, which are all large, stainless steel apparatuses used for the brewing process. To write SOPs for these process, which were new to me, I first had to familiarize myself with the process.

3.2) First Draft of the SOPs from Verbal Instructions

For the first SOP draft, I met with one of the purgatory co-owners, Brian, to go over the cleaning process for their three main brewing apparatuses – the fermenter, the mash tun, and the kettle. Brian talked me through the cleaning process of all three vessels. I took notes by hand and transcribed the notes into a word document later that day. These notes can be found in Appendix C.

Learning the procedure verbally was a good way to get a preliminary procedure down, since I was writing these procedures from scratch. It was good to hear Brian’s train of thought – he provided a lot of information about safety precautions and pointed out variations between his cleaning preferences and the other co-owner’s preferences. Since Brian was not cleaning while he was talking me through the procedures, he was able to spend extra time pointing out and naming the parts of the vessels and making sure I understood the vocabulary they use at the brewery.

As I organized my notes into SOP drafts, which can be found in Appendix D, E, and F, I noticed a few problems with taking notes on a verbal procedure instead of observing the procedure itself. Brian is very accustomed to carrying out these procedures, and by now he has his own procedure where he does a lot of the steps concurrently. When he walked me through the procedures, he spoke about a lot of steps out of order and brought in supplemental information as he was reminded of it; so while I got a lot of the information I needed in my notes, I had to reorder everything when I turned my notes into a procedure. Additionally, since Brian was narrating the procedure from memory, he could not remember every step in the detail that an employee in training would need to carry out a procedure without supervision. To get that level of detail, I would have to shadow him actually cleaning the vessels.

3.3) Shadowing and Revising the Fermenter SOP

Using the first draft as a base and a template, I was able to make major revisions to the fermenter SOP by observing the procedure and making note of changes I needed to make. The final draft of the fermenter SOP, which can be found in Appendix G, has seven more steps than the first draft. The additional steps all came from additional tasks that Brian performed when cleaning the fermenter, which he did not mention when giving a verbal overview of the cleaning process. Step 11, which involves removing, cleaning, and sanitizing the racking arm at the bottom of the fermenter, is an extremely important step that was not touched upon at all during the verbal overview. Should I have skipped observing the procedure myself, I would have missed a major step in the process, which could have led to bacteria growth in the fermenter and violated the health code.

A lot of steps that were added after I shadowed the process were optional steps which would help the company save time or money. For example, I observed Brian removing the yeast from the liquid in the fermenter, and he mentioned that during this step, the person cleaning could attempt to save the yeast. Saving yeast for reuse in future saves Purgatory Beer Company a lot of money, since yeast is a very expensive commodity, and makes the company more sustainable. I also added a step which instructs the person cleaning to periodically spray the floor with a hose towards the drain so there is not any residual hops or grain on the floor. I added this step I noticed Brian spraying the floor so he would not have to scrub dried-up grain and hops from the floor at the end of the fermenter cleaning process. The addition of this step will save the person cleaning valuable time in what is already a very long cleaning process.

I also added sub-steps and reminders throughout the process. An example of a step from my first draft is shown below.

- Send PBW through the CIP ball at the top of the fermenter**

 - b. Reason: PBW combined with hot water is very effective in removing residue from the fermenter**
 - c. Procedure:**
 - i. Combine 4-6 ounces of PBW per 5 gallons of hot water**
 - ii. Hook up hose to the side port**
 - iii. Hook up hose to the pump**
 - iv. Pump all PBW and water through the CIP ball into the fermenter until there is no solution left**
 - v. Drain solution from fermenter**

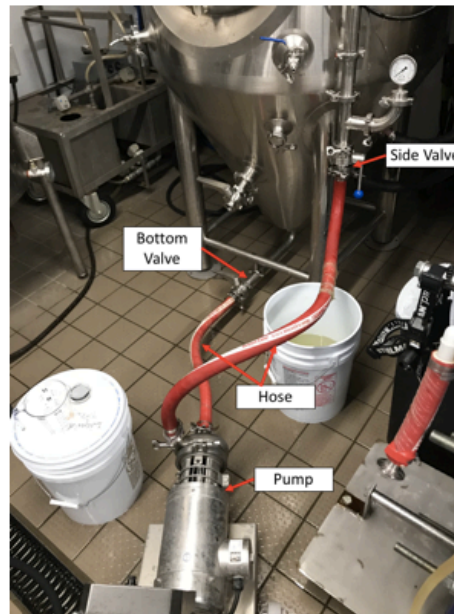
Figure 2: Procedure after Verbal Interview

And an example of the same step that I revised after shadowing the process is shown below:

Send PBW through the CIP ball at the top of the fermenter

a. **Equipment Needed:** Spray Hose, PBW, Two large hoses, pump, 5-gallon bucket

*The setup is shown in the picture to the right. Hook the bottom valve to the pump using a large hose and then hook the pump up to the side valve with another large hose. **Remember:** You can use dirty large hoses that have recently been used in other parts of the process, so they will be cleaned as they are used to clean the fermenter.*



Procedure:

- i. Combine 4-6 ounces of liquid PBW per 5 gallons of hot water inside the fermenter
 1. Measure the PBW with a measuring cup
 2. Pour PBW into the fermenter
 3. Put the water on the hottest setting, spray the hose until the water is very hot, then use that hot water to fill the 5-gallon bucket
 4. Pour the water into the fermenter
- ii. Hook up hose to the side port, connect the hose to the pump, and then open the side valve
- iii. Hook up hose to bottom port valve and connect to the pump
- iv. Open the spigot to release air
- v. Open bottom valve
- vi. Turn on the pump, and pump all of the PBW and water solution through the Cleaning in Place (CIP) ball for 10-15 minutes
- vii. After 10-15 minutes, turn off the pump
- viii. Drain the water and PBW solution from fermenter
 1. If the PBW solution draining from the fermenter has bung in it, do not send it through the chiller, just drain the solution. If the solution is just liquid, send it through the chiller using the procedure below.
- ix. Close the side valve
- x. Open manway and inspect the inside of the fermenter visually Very important to see its clean
- xi. Rinse out fermenter
- xii. Open side valve and drain the liquids into bucket
- xiii. Open bottom valve to let water drain
 1. If there's little pieces of bung coming out, rinse the fermenter again and then drain it again.

Figure 3: Revision after shadowing the cleaning process.

These additional steps contain shortcuts that can save time and, for lack of a better term, kill two birds with one stone. For example, using hoses that were recently used and dirtied in other parts of the process to send cleaner and sanitizer through the fermenter would clean and sanitize these hoses at the same time. Within the procedure, I added onto existing steps based on what I observed in the process. For example, in the first draft, I did not specify in that the PBW and the 5 gallons of hot water needed to be combined in the fermenter, a step that is crucial to the overall procedure. I also added steps that I observed that we did not touch upon in the verbal interview, for instance opening the spigot to release air. I also was sure to add steps that could be easily forgotten, like opening the manway and inspecting the inside of the fermenter visually, a step that should be done but is not always completed, as the co-owners explained. Adding reminders like this in the SOP serves as a reminder for tenured employees and helps form good habits for new employees. Without including these reminder steps, these steps may be neglected and the cleaning process will not be as thorough.

The addition of diagrams in this draft added a lot of clarity to the instructions. In the first draft, the sub steps detailing how to hook the pump up to the fermenter just instruct the person cleaning to hook the hose up to the side port and then hook the hose up to the pump. In reality, however, the pump hooks up to the bottom valve and the side port like in the figure shown below.

Shadowing the process also allowed me to gain a deeper understanding of safety precautions that operators need to take to carry out these procedures. For example, the first draft's procedure reads: "Open manway to vent out CO₂". After shadowing the fermenter cleaning procedure, I expanded the single step of venting the carbon dioxide out of the manway into four separate steps, detailing the precautions that need to be taken to carry out this process safely, shown in the image below.

- Set thermostat to 75°F or higher
 - *This will ensure that no glycol is flowing through the system and glycol is not wasted*
- Vent CO₂ out the side from the arm valve on the side of the fermenter until the pressure gauge reads about 5 psi
- Use the extra pressure (5 psi) to help drain the bung (excess pieces of grain) from the bottom of the fermenter with the hose into the drain
- *If the hose gets clogged, you can put the air compressor into the end which will send whatever is clogging the hose back into the fermenter or you can spray the end of the hose that is in the fermenter to try to push whatever is clogging the hose directly into the drain*
- Open the valve on the side to release the pressure until the pressure gauge reaches zero psi
 - *The fermenter will be safe to open once the pressure is at zero psi, which means the fermenter is completely depressurized.*
- Open the manway door and vent the rest of the CO₂ out of the fermenter for at least 15 minutes
 - *It is important to keep the manway door open for at least 15 minutes to ensure the inside of the fermenter is safe before cleaning the inside of the fermenter – if you inhale a lot of CO₂ you could become unconscious or face brain damage due to oxygen deprivation to the brain.*

Figure 4: Revision, emphasizing the hazards of CO₂ inhalation

Some of these new steps make the cleaning process more efficient, but more importantly they address the necessary safety precautions that were not addressed in my first draft. The pressurized carbon dioxide in the fermenter can create a dangerous environment for an operator, and opening the manway door without first relieving the pressure in the fermenter could cause the door to fly open, causing harm to the operator. Additionally, the new procedure highlights importance of venting the manway for 10-15 minutes so the operator is not deprived of oxygen while cleaning. Without this new emphasis on safety, employees may be tempted to skip steps they deem unnecessary, unaware of the potential safety hazards they may impose on themselves.

After shadowing the fermenter cleaning process and subsequently revising the SOP, I found that shadowing the procedure is essential for documenting the most accurate and efficient procedure possible. Observing the procedure reveals details about the procedure that a writer simply cannot learn from a verbal interview. Watching someone perform the procedure also allows the SOP writer to ask questions about steps that are unclear. SOP writers can also photograph the process and create informative diagrams that can aid an operator in the future. For my SOP writing experience, observing the fermenter cleaning procedure was critical to producing the best possible documentation for Purgatory.

Chapter 4: Conclusions and Recommendations

The importance of SOPs in expanding businesses cannot be underestimated. SOPs can help train new employees, they can serve as a guide for new employees when their employers are not present they are a record of the most effective and efficient way to carry out a procedure, and they can help ensure that employees carry out procedures correctly, safely, and in compliance with legal regulations.

While small businesses may feel that they do not have the time or resources to write their own SOPs, SOPs can aid small businesses, especially as they look to take on new employees or expand their business. My experience writing SOPs does confirm that SOP writing can be time consuming and could benefit from an outside writer, like myself. However, I outline steps below that small businesses owners can use to write SOPs with limited time and resources.

4.1) A Standard Operating Procedure for Writing SOPs in Small Businesses

If a small business recognizes repetitive processes in their operation, SOPs may be useful to help ensure safety, accuracy, and legal compliance as employees carry out these repetitive procedures. The following procedure can be used to produce accurate SOPs.

Note: When selecting an SOP writer, try to select an employee who is unfamiliar with the procedure you are trying to write an SOP for. However, if all employees are familiar with the procedure, these steps can still be followed.

- 1) An employee who is familiar with the procedure verbally outlines the procedure for the SOP writer. The SOP writer takes detailed notes (for an example of notes taken during an SOP shadowing process, see Appendix C, D, or E).
- 2) The SOP writer drafts an SOP from these notes.
 - a. *If your business already has an SOP format, the first draft should follow the same format.*
 - b. *If this is the first time your business is using SOPs, the first draft can use a generic SOP format, like the Brewer's Association format in Appendix A.*
- 3) The SOP writer shadows an employee who is familiar with the procedure as he or she performs the procedure. The SOP writer takes notes on their observations.
 - a. *Taking these notes on the first draft the SOP writer has already written can help streamline the SOP editing process.*
- 4) The SOP writer rewrites the SOP with the notes from the process shadowing.
- 5) The SOP writer observes an employee who is unfamiliar with the procedure as he or she performs the procedure using this final draft of the SOP.
 - a. *If the employee has any trouble or questions while performing the procedure, identify which step this occurs in the SOP and make the appropriate edits to answer these questions.*
- 6) Choose a "expiration" date when the SOP must be revised.

4.2) Recommendations for Purgatory Beer Company

Through my work on my Major Qualifying Project, I finalized a draft of the fermenter cleaning SOP, wrote preliminary drafts for the kettle and the mash tun SOPs, and created an SOP writing procedure for small businesses. The kettle and mash tun cleaning processes are still preliminary drafts. To finalize these drafts, the SOP writers should shadow the cleaning processes for the kettle and the mash tun, take notes while shadowing the process, and revise the SOP draft based on these notes. There are also a lot of other repetitive processes that can be made into SOPs at Purgatory Beer Company – for example, SOPs can be written for removing yeast from the fermenter, cleaning the floors, and the even brewing process itself. Additionally, Purgatory’s SOPs can be “tested” by any new employee who is unfamiliar with the process. Having a new employee carry out the SOP can help pinpoint which steps are difficult to understand, which can be very valuable to the SOP revision process. Finally, all of Purgatory’s SOPs should all have an “expiration” date, a date where they must be looked at and revised, but SOPs can be continuously revised whenever the employees see fit.

I recognize that Purgatory is a small business, and Purgatory’s operations cannot all be halted to write and edit all of my recommended SOPs. However, as Purgatory expands, writing at least the kettle, mash tun, and fermenter cleaning SOPs will allow the co-owners of Purgatory to delegate these cleaning tasks to new employees. By doing this, the co-owners will be free to fulfill more pressing needs within the company.

SOPs can be seen as a hassle to create and maintain, but their benefit to growing small businesses cannot be overlooked. Up-to-date, accurate SOPs can help ensure that employees are carrying out procedures in a safe, precise manner that complies with food safety rules and regulations. By working with Purgatory Beer Company, I was able to gain a deep understanding of the the challenges that small businesses face when composing SOPs, but I also saw that the benefits of SOPs outweigh any struggles a company may have with SOP writing. SOPs are one of the best tools a company can use to take its business to the next level, and I am glad that I had the opportunity to aid Purgatory Beer Company as they expand.

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Appendix A: Brewers Association's Example SOP

SOP FORM

TASK: _____	SOP NO: ____ REVISION DATE: _____
DEPT: _____	INITIALS: ____

1) Purpose

This SOP describes Brewery _____'s procedure for safe and effective _____.

2) Scope

This SOP is limited to _____.

3) Responsibilities

It is the responsibility of every Brewery _____ employee to maintain the highest standards of safety, quality, and sustainability. Any Brewery _____ employee who performs the task described herein will be first trained and approved for the use of the equipment and materials specified, according to this SOP. Any changes to this procedure shall be first approved by _____.

4) Equipment and Materials

5) Procedure

- 1) _____
 - a. _____
 - b. _____
- 2) _____
- 3) _____
 - a. _____

6) Related Documents

Appendix B: Original SOPs at Purgatory Beer Company

Keg Cleaning Protocol

Use Eyewear Always!!!!

Set Up Cleaner –

- Make sure Vessels are both clean
- Fill sanitize vessel (left)
 - Cold water and 1oz of Iodine per gallon (min of 7 gal fill)
- Fill Wash Vessel (right)
 - Hot Water and 1 oz. per gallon of Acid #5 and Acid #6 (Five Star)
- Connect Hot Water to Rinse Valve “In Line”
- Connect the Purge “Out Line” line to the drain or a bucket
- Connect CO2 connection to tank (tight w a plastic washer)
 - Set CO2 to 12-15 psi
- Hook up Electric

Running Washer –

- Make sure CO2 and Hot Water is open
- Switch on power behind Box
- Set dials, higher the number higher the cycles (min of 30)
- Press button to start cycle (sometimes you need to switch off and on multiple times to start)
- Lights
 - White (hot water rinse)
 - Green (acid wash)
 - Blue (sani)
- Cycle is over when all lights flash at the same time and pressure goes back to set level
- Remove keg, sani spray head of keg and cap (there should be zero water in keg)
- Between cycles, replace sani or wash water if no longer clear
- If cleaner is working properly, the sani and wash vessels should maintain same water levels
- When done, disconnect lines

Post Wash Clean –

- Open vessel valves at bottom
- Scrub inside vessel, rinse

Opening

- 1) Turn on dishwasher and run it 3 times (**this is for Board of health compliance to get the dishwasher up to the proper temperature)
- 2) Turn on bathroom fan switch (in the office, top of two switches, the one on the right)
- 3) Fill three-bay sink (left bay tiny bit of bleach and water, middle bay soap and water, right bay water), test bleach bay
- 4) All glasses clean (no lipstick marks!) and put away
- 5) Floors swept, mopped, rubber mats behind bar
- 6) All trash brought out
- 7) Hand soaps and TP in bathroom full, trash out
- 8) Red bucket filled with water and ½ cap of bleach, place rag in bucket. Test water with litmus paper
- 9) Put crate next to taps, fill growler tube jug with water and a cap full of star san. Make sure cleaner is mixed in.
- 10) All surfaces cleaned with bleach and water (in red bucket) and dried with clean towel
- 11) Laminate menus and distribute throughout PBC
- 12) Snacks filled, 4 of each mustard filled, 4 pretzels ready, salt, butter spray, plates and napkins (use food handling gloves)
- 13) Tap lines clear and ready
- 14) Tables laid out, make sure they aren't wobbly (if they are, adjust one of the feet on bottom) and three stools under each
- 15) Turn on CO2/Nitro valves (12-15 psi CO2, 20 psi nitro)

Closing

- 1) All glasses, flight trays cleaned and put away
- 2) Stack stools and move stacks and tables toward the bar
- 3) Sweep floors
- 4) Bathrooms cleaned, soap checked, toilet paper checked
- 5) All trash brought out
- 6) All surfaces wiped with fresh bleach and water (red bucket) and dried with towel
- 7) Clean up pretzel area
- 8) Clean tap grate, tray under taps, dump bleach water down tap drains
- 9) Put dirty white towels in bucket and make sure taken home to be washed
- 10) Set up new flight trays on top of tap system and cover
- 11) Remove floor mats from behind bar and hose off both sides in the brew area
- 12) Shut off dishwasher
- 13) Turn off CO2 and Nitro tanks (lights out in cooler)

Appendix C: Notes on Verbal Instructions for all three procedures

Sanitation of fermenters

- Brewing seminar PowerPoint
- Uses 5 senses all the time (except taste)
- Yeast and hops settles at the bottom
- Harvest yeast, try to save it for later slash same brews
- Dispose of hops and leftover beer
- Look inside but wait until CO₂ is ventilated (should be fine after the things are opened for cleaning)
- There's always a dry rim of gunk where the top of the beer used to be
- Use headlamp and glasses
- Rinse with hot water to loosen stuff up
- Remove hardware (yeast inside all of them)
- Scrub rim with caked on stuff with a brush (~15 min)
- Put all hardware in bucket w/ iodine and starsan
- Leave hardware levers open before taking them off because they are really hard to open when they aren't on the fermenter
- Rinse hardware with water before sanitation
- Spray before reassembly
- Quality will suffer without this diligence
- Put fittings back on (maybe not spigots) before the final sanitation
- PBW – 4/6 oz. per 5 gal
- Hook up hoses to side port; pump sanitizer through CIP ball (like a sprinkler) CIP stands for Clean in Place
- Hose out fermenter after CIP (THAT'S STEP 1!!!). Hot water important to PBW step
- Acid- step 2, cleaner not sanitizer
- 5-10 gal of water – 1 oz. acid (~15 minutes), lukewarm water
- send through side port and CIP again
- empty out again rinse again with water **THAT'S STEP 2!!!
- 1 oz. to 5 gallons of iodine
- same steps ~15 min
- empty and hose out
- take hardware out and check to make sure there's no other stuff
- close valve on side port
- empty out over bucket
- thermostat should be set to 75°F or higher (This is probably step 1)
- wont heat up just wont cool and waste glycol
- manway (Giant Hole in center) has a giant rubber gasket, needs to be cleaned really thoroughly before too
- small fermenter, open and is well vented will be CO₂ free
- triclamps on gaskets

- eye goggles, maybe gloves? (gloves are inconvenient and its not unsafe without them but it dried out Brian's hands really bad)
- Could have to repeat steps if stuff isn't clean enough
- SOPs will be good for new hires
- Could have a check-off list that uses a dry erase marker
- Plate chiller is the hardest thing to clean – SOPs would be wicked useful for that purpose
- T-shirt inventory uses dry-erase a lot they like that a lot

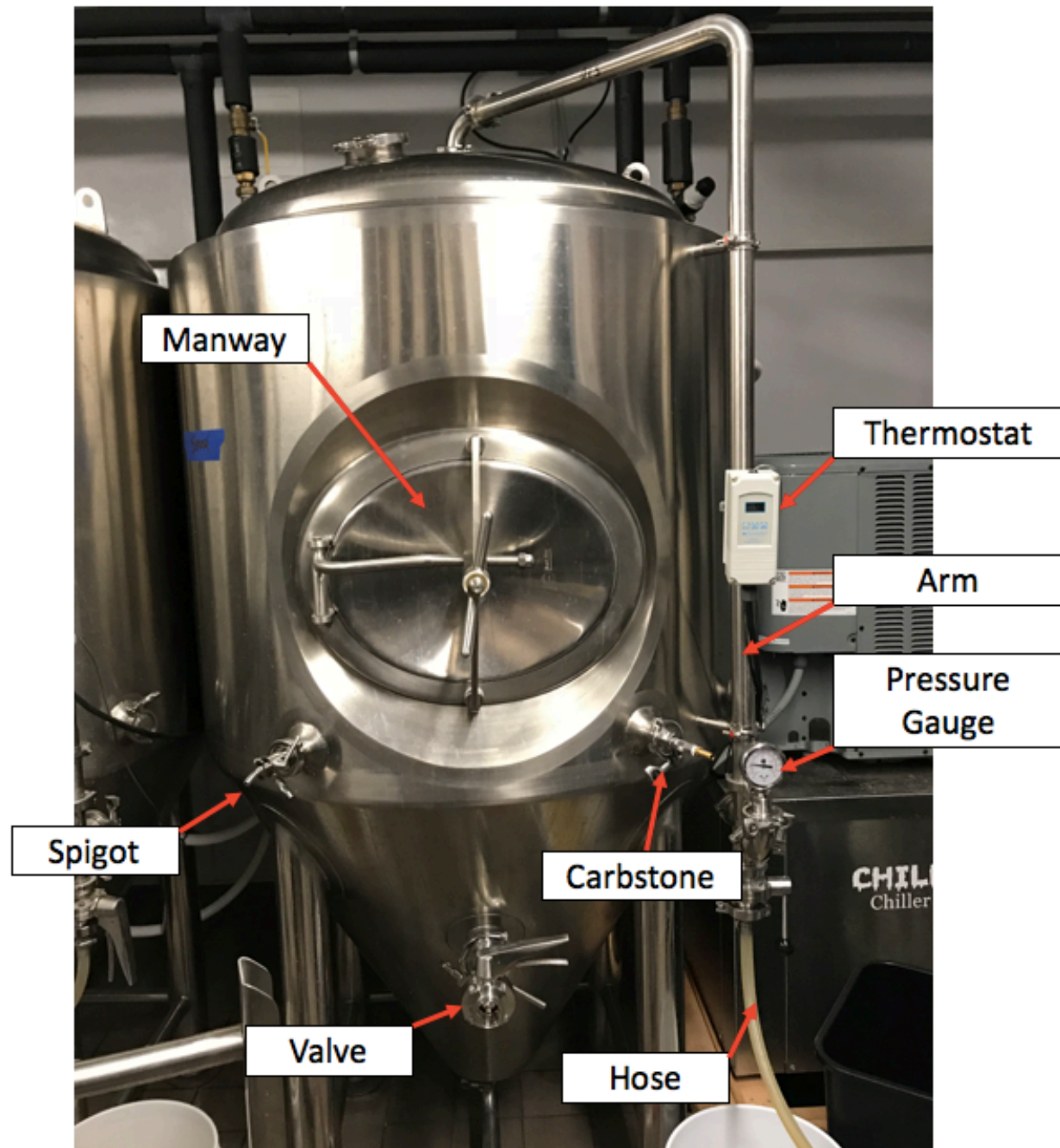
Sanitation of Mash Tun

- Once you are finished making the mash, open manway
- Put bucket under manway before you open it, grain will fall out into the bucket
- Take of gasket, rinse off, put in bucket of starsan
- Shovel out grain
- remove bear trap (aka the strainer at the bottom of the mash tun)
- remove gasket from bear trap, spray with starsan and clean out slit really thoroughly
- scrape excess grain from the bear trap into the garbage without having the bear trap touch the garbage
 - o excess grain will go to a farm! Reduce reuse recycle!
- Put bear trap off to the side, make sure every piece of grain is taken out of the bear trap, using a toothpick and a hose
- Spray out from top down
- Spray out whirlpool port
- Make sure all surfaces are clean
- Open up valves, take off, rinse, and put in a bucket of sanitizer
- Get surface all wet, get sanitized scrub brush and scrub the whole thing, start at top with the lid, rinse, spray along the way, go into manway with headlamp, scrub around
- Pipe cleaner to clean whirlpool port
- Clean outside, surface of door inside and outside
- Spray inside with iodine, let it sit until dry, rinse really well with hot water
- Once everything is dry, set up mash tun again, you can store stuff inside too to save space

Sanitation of Kettle

- Purgatory kettles are different than a lot of other kettles
- Drain kettle of any excess hops or wort, there should be about 4 gallons of stuff, hook up hose to bottom valve and drain stuff right into the drain
- Take out coils, fittings, thermometer, float switch
- Soak coils in water and acid solution
- Take coils out of the sides (box with hose on sides)
- Can clean inside with power washer, but every 3 brews or so you need to do a deep cleaning
- Lay kettle on top of drain for deep cleaning
- Use coarse plastic brush, no metal because it damages the top kettle
- Kettle is slanted, it would be good to have a check of the integrity of the equipment

Appendix D: First Draft of Fermenter SOP from Verbal Procedure



PURPOSE:

This SOP describes Purgatory Beer Company's procedure for safe and effective cleaning and sanitation of the fermenter.

SCOPE:

This SOP is limited to the fermenters in the back room only.

RESPONSIBILITIES:

It is the responsibility of every Purgatory Beer Company employee to maintain the highest standards of safety, quality, and sustainability. Any Purgatory Beer Company employee who performs the task described herein will be first trained and approved for the use of the equipment and materials specified, according to this SOP. Any changes to this procedure shall be first approved by Brian.

SAFETY:

Use smell, touch, and sight at all times – stay engaged

Safety glasses: reason – iodine, acid, and starsan are all corrosive to the eyes

Safety gloves: iodine, acid, and starsan are all corrosive to the skin

Surgical mask maybe??!!?

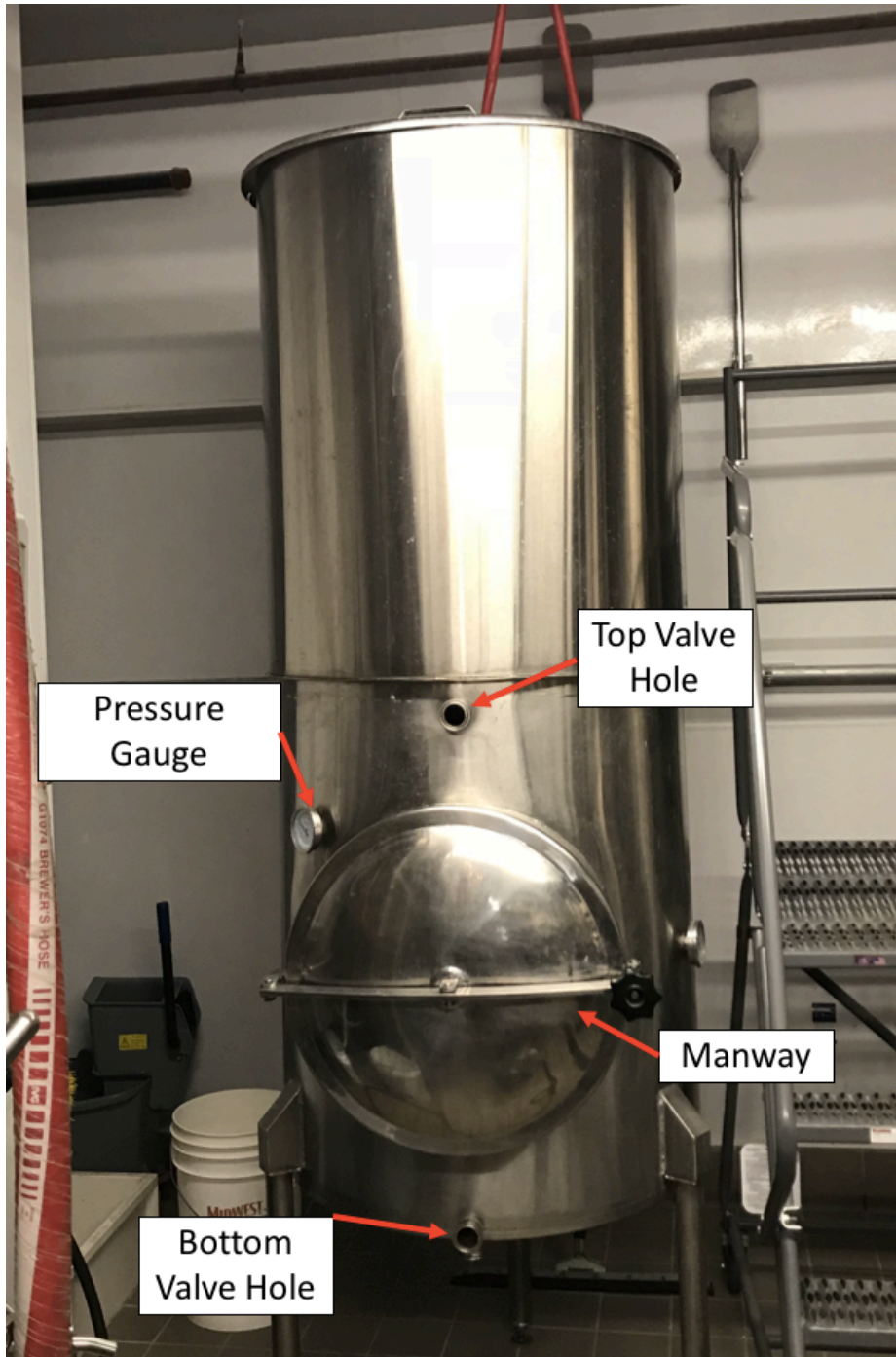
Fermenter cleaning procedure (for training):

- 1) Set thermostat to 75°F or higher
 - a. Reason: this will ensure that no glycol is flowing through the system and glycol is not wasted
- 2) Open manway to vent out CO₂
 - a. Reason: it is unsafe to inhale air that has an oxygen deficiency
 - b. Wait at least 15 minutes before cleaning the inside of the fermenter
- 3) Manually clean the inside of the fermenter
 - a. Reason: there is a lot of buildup within the fermenter that needs to be removed by hand
 - b. Procedure:
 - i. Use a headlamp and safety glasses
- 4) Remove spigot, curbstone, and valve for cleaning
 - a. Reason: these smaller pieces of hardware are difficult to clean and must be cleaned thoroughly and replaced before the fermenter is cleaned and sanitized
 - b. Procedure:
 - i. Open hardware levers (the levers are very hard to open when the hardware is off the fermenter)
 - ii. Remove spigot, curbstone, and valve
 - iii. Soak in 5-gallon bucket with PBW and warm water first
 - iv. Scrub with brush
 - v. Rinse with water
 - vi. Rinse with acid and lukewarm water
 - vii. Rinse with iodine and lukewarm water
 - viii. Rinse with water

- 5) Dispose of hops and leftover beer
 - a. Reason:
- 6) Clean rubber gasket that seals the manway
 - a. Reason: the manway needs to be sealed during the entire cleaning process, so the manway needs to be cleaned thoroughly before anything else
 - b. Procedure:
 - i. Remove Rubber Gasket
 - ii. Soak in 5-gallon bucket with PBW and warm water first
 - iii. Scrub with brush
 - iv. Rinse with acid and lukewarm water
 - v. Rinse with iodine and lukewarm water
- 7) Replace rubber gasket and re-seal manway
 - a. Reason: this is so no PBW and water solution leaks out of the
- 8) Send PBW through the CIP ball at the top of the fermenter
 - a. Reason: PBW combined with hot water is very effective in removing residue from the fermenter
 - b. Procedure:
 - i. Combine 4-6 ounces of PBW per 5 gallons of hot water
 - ii. Hook up hose to the side port
 - iii. Hook up hose to the pump
 - iv. Pump all PBW and water through the CIP ball into the fermenter until there is no solution left
 - v. Drain solution from fermenter
- 9) Send Acid solution through the CIP ball at the top of the fermenter
 - a. Reason: this is a cleaner that will clean the surfaces of the fermenter so that the fermenter can be properly sanitized
 - b. Procedure:
 - i. Combine 1 oz. of acid per 5-10 gallons of lukewarm water
 - ii. Hook up hose to the side port
 - iii. Hook up hose to the pump
 - iv. Pump all acid solution through the CIP ball into the fermenter until there is no solution left
 - v. Drain solution from fermenter
- 10) Replace curbstones before final sanitation
 - a. Reason: This will ensure the entire fermenter and curbstones are bacteria free.
 - b. Procedure:
 - i. Spray each piece of hardware with water
 - ii. Put the fittings back on
 - iii. Ensure curbstone is closed
- 11) Send iodine sanitizer solution through the CIP ball into the fermenter
 - a. Reason: this is the sanitizer that will remove all the bacteria from the fermenter
 - b. Procedure:
 - i. Combine 1 oz. of iodine to 5 gallons of room temperature water
 - ii. Hook up hose to the side port

- iii. Hook up hose to pump
 - iv. Pump all iodine solution through the CIP ball into the fermenter until there is no solution left
 - v. Drain solution from fermenter
- 12) Drain entire fermenter and rinse with water one more time
- a. Reason: to ensure there is no iodine remaining in the fermenter so the fermenter is ready to hold beer again
 - b. Procedure:
 - i. Empty contents of the fermenter through the through the bottom valve into a bucket
 - ii. Close the side port
 - iii. Spray the inside of the fermenter with the hose
 - iv. Empty the contents of the fermenter through the bottom valve
 - v. Repeat
- 13) Visually inspect the fermenter to ensure cleanliness
- a. Reason: the fermenter should be ready for use, so it should look, feel, and smell clean

Appendix E: First Draft of Mash tun SOP from Verbal Procedure



PURPOSE:

This SOP describes Purgatory Beer Company's procedure for safe and effective cleaning and sanitation of the mash tun.

SCOPE:

This SOP is limited to the mash tun in the back room only.

RESPONSIBILITIES:

It is the responsibility of every Purgatory Beer Company employee to maintain the highest standards of safety, quality, and sustainability. Any Purgatory Beer Company employee who performs the task described herein will be first trained and approved for the use of the equipment and materials specified, according to this SOP. Any changes to this procedure shall be first approved by Brian.

SAFETY:

Use smell, touch, and sight at all times – stay engaged

Safety glasses: iodine, acid, and starsan are all corrosive to the eyes

Safety gloves: iodine, acid, and starsan are all corrosive to the skin

Surgical mask

- 1) Put bucket under manway and open manway.
 - a. *Bucket will catch any grain from the mash tun that would fall out onto the floor. The excess grain will go to a farm to be used as feed or fertilizer.*
- 2) Remove, clean, and sanitize manway gasket
 - a. *Manway needs to be sealed during the final rinse process, so the gasket needs to be cleaned and sanitized first.*
 - b. Procedure:
 - i. Remove Gasket
 - ii. Rinse with hose
 - iii. Inspect slit to ensure there is no grain left in the slit
 - iv. Place gasket in a bucket with Starsan solution
- 3) Shovel out grain
 - a. *This is done to ensure that no large clumps of grain are left in the mash tun*
- 4) Remove and clean bear trap
 - a. *The bear trap is the mesh fitting that strains out the wort at the bottom of the mash tun. The bear trap will have a lot of excess grain caught in its holes. The bear trap needs to be thoroughly cleaned out so liquid can flow through and grain can be filtered out when making the next mash.*
 - b. Procedure:
 - i. Remove gasket
 - ii. Rinse with hose
 - iii. Inspect slit of gasket to ensure there is no grain left in the slit
 - iv. Place gasket into a bucket with Starsan solution
 - v. Remove bear trap from mash tun and scrape excess grain from bear trap without allowing the bear trap to touch the garbage can

- vi. Ensure each piece of grain is removed from the bear trap – use a toothpick to remove stubborn pieces of grain
 - vii. Spray bear trap with hose and set it aside
- 5) Spray from top down with hose
 - a. *This initial spray is to ensure that there are no residual pieces of grain on the inner surfaces of the mash tun.*
- 6) Spray out whirlpool port with hose
 - a. *The whirlpool valve will not be cleaned by the initial spray from top down, so the port must be sprayed with the hose.*
- 7) Make sure all surfaces are clean visually and to the touch
 - a. *Ensure there is no residual grain throughout the entire mash tun*
- 8) Open up valves, take off, rinse, put in a bucket of sanitizer
 - a. *These smaller pieces of hardware are difficult to remove from the mash tun when closed, opening the valves allows for a better grip when removing the valves. Valves must be cleaned thoroughly and replaced before the mash tun is cleaned and sanitized.*
 - b. Procedure:
 - i. Open hardware levers
 - ii. Remove valves
 - iii. Soak in 5-gallon bucket with PBW and warm water first
 - iv. Scrub with brush
 - v. Rinse with water
 - vi. Rinse with acid and lukewarm water
 - vii. Rinse with iodine and lukewarm water
 - viii. Rinse with water
- 9) Get surface all wet, scrub whole mash tun from top to bottom with a sanitized brush
 - a. *The mash tun needs to be completely scrubbed so it is free of any mash residue that may have been left behind. Use a headlamp for this step so that it is easy to visually see when the mash tun is clean*
 - b. Procedure:
 - i. Sanitize a plastic brush (do not use metal brush because that will damage the mash tun).
 - ii. From the top of the mash tun: scrub the lid of the mash tun and the inside walls of the mash tun, ensure there is no residue on the sides of the mash tun.
 - iii. From the manway: scrub the inside walls of the
- 10) Clean the whirlpool port with a pipe cleaner
 - a. *The whirlpool port will not get cleaned by scrubbing the inside of the mash tun, so it needs to be separately cleaned with a pipe cleaner.*
- 11) Clean outside of mash tun
- 12) Clean inside and outside of manway door
- 13) Replace manway gasket
 - a. *Gasket must be replaced so that the mash tun can be sealed off when sanitizing*
- 14) Close manway door and spray inside with iodine, let dry

- a. Iodine is the sanitizer that will remove all the bacteria from the mash tun*
- 15) Once everything is dry, set up mash tun again
 - a. Wait until everything is dry so that residual liquid iodine does not get into the mash of the next beer*
 - b. Procedure:
 - i. Put gasket back on bear trap
 - ii. Replace bear trap
 - iii. Shut manway door

Appendix F: First Draft of Kettle SOP from Verbal Procedure



PURPOSE:

This SOP describes Purgatory Beer Company's procedure for safe and effective cleaning and sanitation of the kettle.

SCOPE:

This SOP is limited to the kettle in the back room only.

RESPONSIBILITIES:

It is the responsibility of every Purgatory Beer Company employee to maintain the highest standards of safety, quality, and sustainability. Any Purgatory Beer Company employee who performs the task described herein will be first trained and approved for the use of the equipment and materials specified, according to this SOP. Any changes to this procedure shall be first approved by Brian.

SAFETY:

Use smell, touch, and sight at all times – stay engaged

Safety glasses: reason – iodine, acid, and starsan are all corrosive to the eyes

Safety gloves: iodine, acid, and starsan are all corrosive to the skin

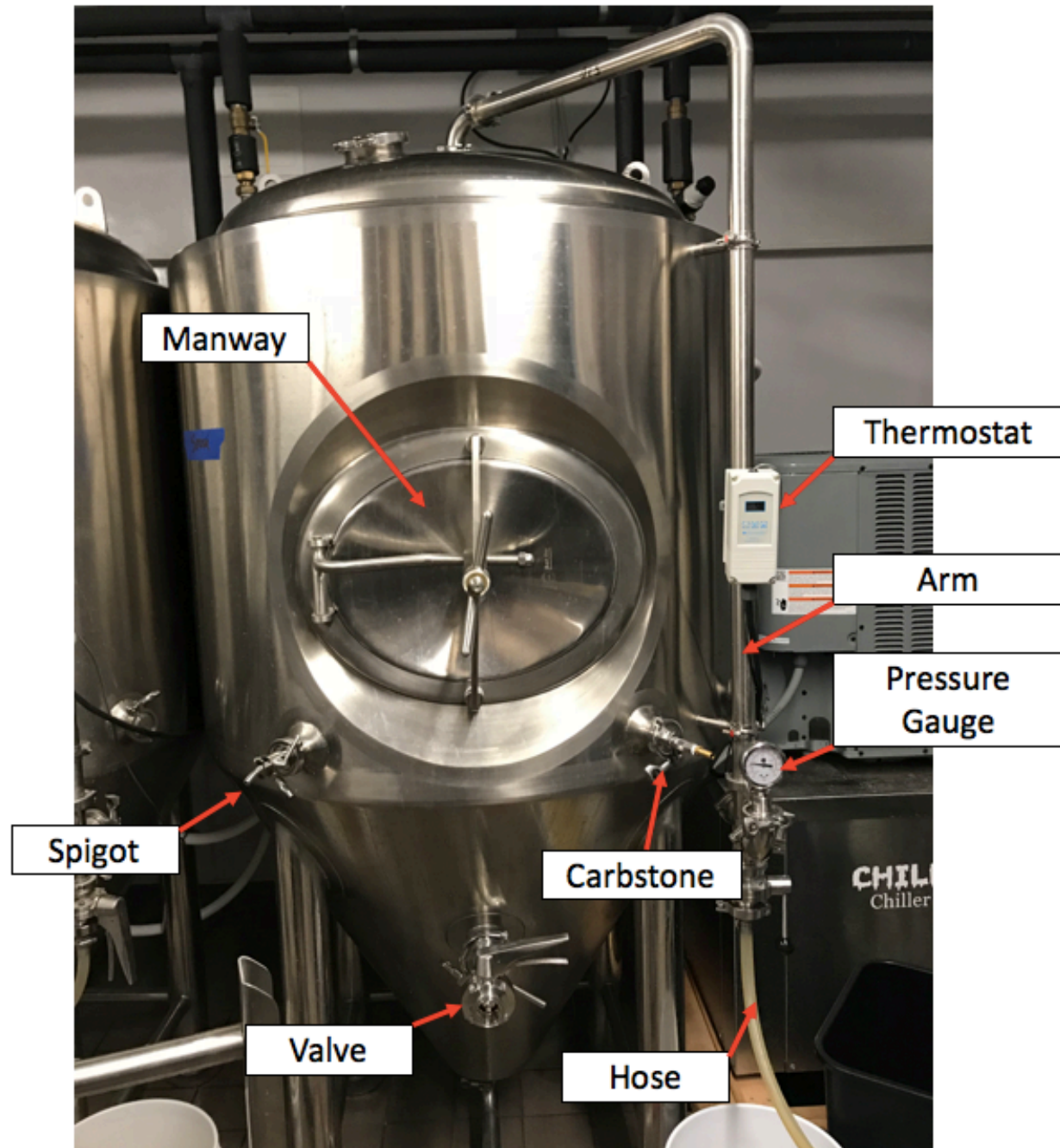
Surgical mask

Regular cleaning

- 1) Drain any excess hops or wort from the kettle from the bottom valve
 - a. *Ensure the kettle is completely empty before cleaning, there should be about 4 gallons of excess hops or wort in the kettle.*
 - b. Procedure
 - i. Hook a hose up to the bottom valve
 - ii. Drain excess hops and wort directly into the drain on the floor
- 2) Remove coils from the front and side of the kettle, and remove fittings, thermometer, and float switch
- 3) Soak coils in a water and acid solution
 - a. *Acid is a cleaner that will help remove residual hops or wort from the coils*
- 4) Power wash the inside of the kettle
 - a. *Ensure that the kettle is completely free of any hops or wort residue*
- 5) Check the integrity of the equipment
 - a. *The kettle is slanted towards the back wall, make sure the structure still looks sound*

Every three brews, the kettle needs to be deeply cleaned

Appendix G: Final Draft of Fermenter SOP



PURPOSE:

This SOP describes Purgatory Beer Company's procedure for safe and effective cleaning and sanitation of the fermenter.

SCOPE:

This SOP is limited to the fermenters in the back room only.

RESPONSIBILITIES:

It is the responsibility of every Purgatory Beer Company employee to maintain the highest standards of safety, quality, and sustainability. Any Purgatory Beer Company employee who performs the task described herein will be first trained and approved for the use of the equipment and materials specified, according to this SOP. Any changes to this procedure shall be first approved by Brian DiStefano or Kevin Mulvehill.

SAFETY:

Use smell, touch, and sight at all times – stay engaged

Use safety glasses: iodine, acid, and starsan are all corrosive to the eyes

Use safety gloves: iodine, acid, and starsan are all corrosive to the skin

Use a surgical Mask: iodine, acid, and starsan can cause slight respiratory damage

EQUIPMENT AND MATERIALS:

To carry out this procedure, you will need:

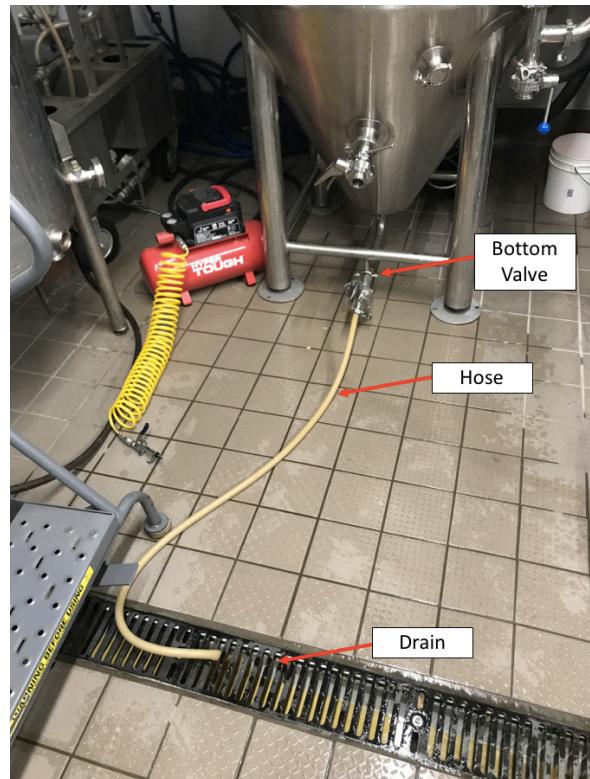
- Safety Glasses
- Safety Gloves
- Surgical Mask
- Two 5-gallon buckets
- Scrubbing brush
- PBW (Five Star Chemicals brand)
- Acid (Five Star Chemicals brand)
- Iodine (Five Star Chemicals brand)
- Small Hose (fits onto the bottom valve)
- Two Large Hoses (fits onto the pump)
- Headlamp
- Pump
- Chiller
- Air compressor (optional)
- Spray Hose
- Scooper
- Yeast Container
- Screwdriver
- Wrench

Fermenter cleaning procedure (for training):

- 1) Set thermostat to 75°F or higher
 - a. *This will ensure that no glycol is flowing through the system and glycol is not wasted*

- 2) Vent CO₂ out the side from the arm valve on the side of the fermenter until the pressure gauge reads about 5 psi
- 3) Use the extra pressure (5 psi) to help drain the bung (excess pieces of grain) from the bottom of the fermenter with the hose into the drain
 - a. **Equipment Needed:** Small Hose, Air compressor (optional)

The setup for Step 3 is shown in the figure to the right. If the hose gets clogged, connect the air compressor to the end of the hose, which will pump whatever is clogging the hose back into the fermenter.



- 4) Open the valve on the side to release the pressure until the pressure gauge reaches zero psi
 - a. *The fermenter will be safe to open once the pressure is at zero psi, which means the fermenter is completely depressurized.*
- 5) Open the manway door and vent the rest of the CO₂ out of the fermenter for at least 15 minutes
 - a. *It is important to keep the manway door open for at least 15 minutes to ensure the inside of the fermenter is safe for cleaning – if you inhale a lot of CO₂ you could become unconscious or face brain damage due to oxygen deprivation to the brain.*
- 6) Scoop out yeast to be reused if there is minimal liquid in the fermenter
 - a. **Equipment Needed:** Scooper, small container to store yeast, headlamp
 - b. *If there is too much liquid, ask one of the co-owners to remove the yeast*
- 7) Rinse the manway door with hot water from the hose
 - a. **Equipment Needed:** Spray Hose, Scrubber brush (optional)

After Step 7, the door should be look clean and feel clean to the touch after this step. If the door does not look and feel clean after rinsing, you can scrub the manway door with the back of the scrubbing brush, shown right.



- 8) Remove the gasket from the manway door, rinse it with hot water, and clean it
 - a. **Equipment Needed:** Hose, Acid, 5-gallon bucket
 - b. *The manway needs to be sealed during the entire cleaning process, so the manway gasket needs to be cleaned thoroughly before anything else*
 - c. Procedure:
 - i. Remove Rubber Gasket
 - ii. Soak in 5-gallon bucket with acid and warm water solution (6 oz. of acid per 5 gallons of water)
 - iii. Scrub with the back of the scrubbing brush
 - iv. Rinse with lukewarm water
- 9) Once the bung and liquid have drained, open the fittings and remove the fittings from the fermenter.
 - a. **Equipment Needed:** Spray Hose, Screwdriver, Wrench, 5-gallon bucket, PBW, Acid, Iodine, Scrubbing brush
 - b. *These smaller pieces of hardware are difficult to remove from the fermenter when they are closed. Opening the valves allows for a better grip when removing the valves. These smaller pieces of hardware are difficult to clean and must be cleaned thoroughly. The fittings can be cleaned while the fermenter is going through its sanitizer cycles, as long as a flat fitting is placed over each fitting hole.*
 - c. Procedure:
 - i. Remove carbstone hose using orange screwdriver and wrench
 - ii. Rinse hose with warm water and hang up to dry
 - iii. Open carbstone and remove carbstone, place in a 5-gallon bucket filled with lukewarm water and PBW (4-6 oz. PBW per 5 gallons of water)
 - iv. Open spigot and remove spigot and place in the same 5-gallon bucket
 - v. Open bottom and arm valves and remove the valves and place in the same 5-gallon bucket

- vi. Clean the holes for the carbstone, spigot, and valves with a paper towel to get bung out
- vii. Spray the fitting holes on the fermenter with water to get the rest of the bung out
- viii. Replace all fitting holes with flat fittings for cleaning and sanitation

NOTE: At this point in the procedure, let the fittings sit in the PBW and water solution and continue cleaning the fermenter at Step 10.

- ix. Scrub all fittings with a brush
- x. Rinse with water
- xi. Dump out the PBW solution and fill the 5-gallon bucket with an acid cleaner and water solution (6 oz. acid per 5 gallons of water)
- xii. Place fittings in acid and water solution

NOTE: At this point in the procedure, let the fittings sit in acid and water solution and continue cleaning the fermenter at Step 16.

- xiii. Rinse fittings with water
- xiv. Dump out the acid solution and fill the 5-gallon bucket with an iodine cleaner and water solution (1 oz. iodine per 5 gallons of water)
- xv. Place fittings in iodine and water solution
- xvi. Rinse with water before replacing onto fermenter

10) Manually clean the inside of the fermenter

- a. **Equipment Needed:** Headlamp, Safety glasses, Spray Hose, Scrubbing brush
- b. *The majority of the buildup within the fermenter needs to be removed by hand*
- c. Procedure:
 - i. Wear a headlamp and safety glasses
 - ii. Power spray the big ring of gunk at the top of the fermenter
 - 1. **Remember:** spray above the manway opening, which is difficult to see and reach
 - iii. Scrub the gunk off with the backside of the bristled brush
 - 1. **Remember:** scrub above the manway opening, which is difficult to see and reach
 - iv. Inspect thoroughly with the 5 senses to make sure the inside of the fermenter's surface is clean before sanitizing

11) Open bottom valve and gasket, remove racking arm, clean and sanitize racking arm

- a. **Equipment Needed:** Spray hose, Scrubbing brush, 5-gallon bucket, PBW, Acid, Iodine
- b. Procedure:

NOTE: This will follow a similar procedure to Step 9 and can be completed while cleaning the fermenter.

- i. Spray fitting hole in fermenter with water to get the rest of the bung out
- ii. Spray racking arm to get the rest of the bung out
- iii. Place in 5-gallon bucket with the fittings in the PBW and water solution

NOTE: At this point in the procedure, let the racking arm sit in the PBW and water solution with the rest of the fittings and continue cleaning the fermenter at Step 13.

- iv. Scrub fittings with brush
- v. Rinse with water
- vi. Place in a bucket with an acid cleaner and water solution

NOTE: At this point in the procedure, let the racking arm sit in the acid and water solution with the rest of the fittings and continue cleaning the fermenter at Step 16.

- vii. Rinse with water
- viii. Place in another bucket with an iodine and water solution
- ix. Rinse with water before replacing into fermenter

12) Replace rubber gasket and re-seal manway.

a. Procedure:

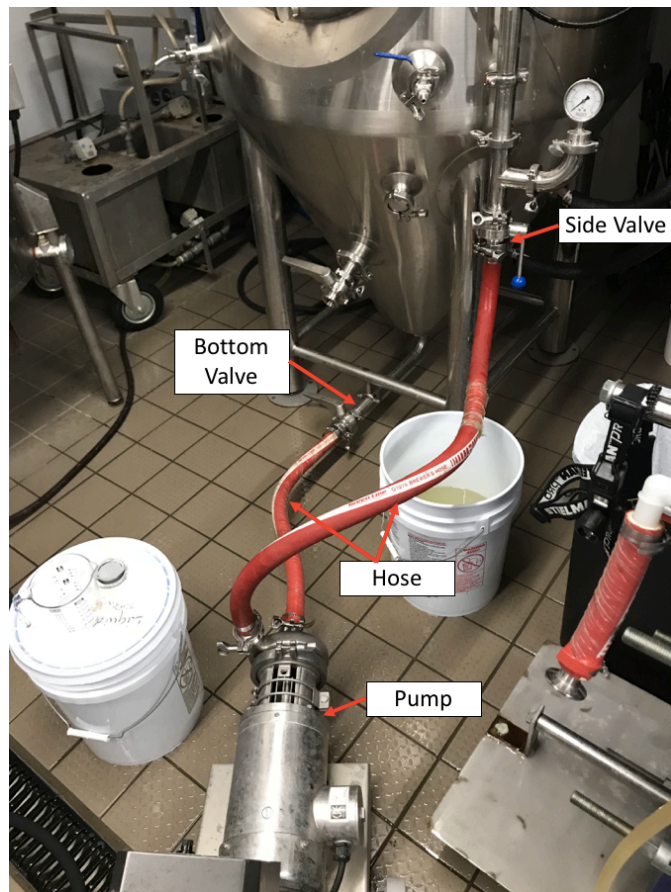
- i. Sanitize ports with iodine spray bottle before replacing the parts to ensure that there is no remaining organic matter
- ii. Replace parts so they get sanitized again when the fermenter gets sanitized

13) Spray floor towards the drain so that there isn't bung on the floor

14) Send PBW through the CIP ball at the top of the fermenter

a. **Equipment Needed:** Spray Hose, PBW, Two large hoses, pump, 5-gallon bucket

*The setup is shown in the picture to the right. Hook the bottom valve to the pump using a large hose and then hook the pump up to the side valve with another large hose. **Remember:** You can use dirty large hoses that have recently been used in other parts of the process, so they will be cleaned as they are used to clean the fermenter.*



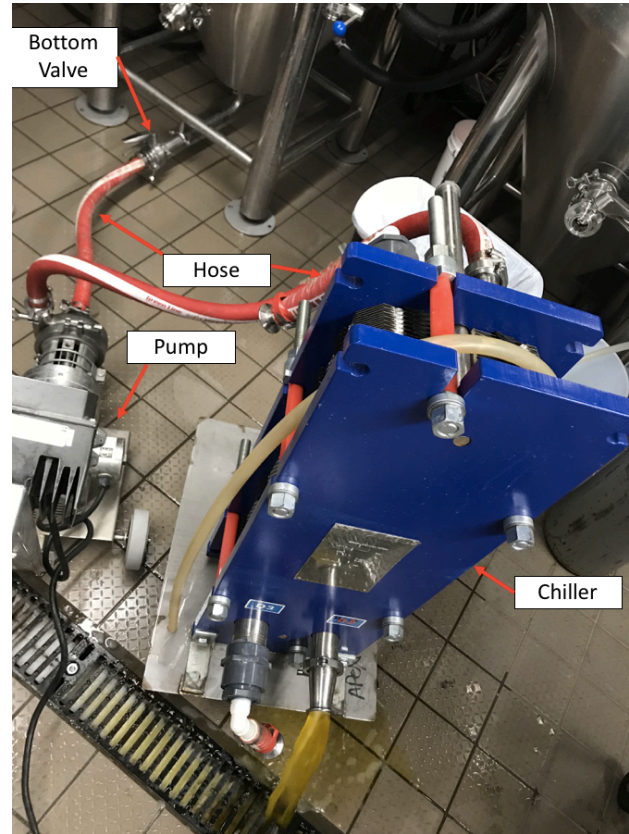
b. Procedure:

- i. Combine 4-6 ounces of liquid PBW per 5 gallons of hot water inside the fermenter
 1. Measure the PBW with a measuring cup
 2. Pour PBW into the fermenter
 3. Put the water on the hottest setting, spray the hose until the water is very hot, then use that hot water to fill the 5-gallon bucket
 4. Pour the water into the fermenter
- ii. Hook up hose to the side port, connect the hose to the pump, and then open the side valve
- iii. Hook up hose to bottom port valve and connect to the pump
- iv. Open the spigot to release air
- v. Open bottom valve
- vi. Turn on the pump, and pump all of the PBW and water solution through the Cleaning in Place (CIP) ball for 10-15 minutes
- vii. After 10-15 minutes, turn off the pump
- viii. Drain the water and PBW solution from fermenter
 1. If the PBW solution draining from the fermenter has bung in it, do not send it through the chiller, just drain the solution. If the solution is just liquid, send it through the chiller using the procedure below.
- ix. Close the side valve
- x. Open manway and inspect the inside of the fermenter visually Very important to see its clean
- xi. Rinse out fermenter
- xii. Open side valve and drain the liquids into bucket
- xiii. Open bottom valve to let water drain
 1. If there's little pieces of bung coming out, rinse the fermenter again and then drain it again.

15) Clean the chiller with the PBW solution from the fermenter

- c. **Equipment Needed:** Two large hoses, Pump, Chiller

The setup for sending PBW through the chiller from the fermenter is shown to the right.



- d. *PBW is yellow when it reacts with water, as seen in the liquids draining from the chiller*
- e. Procedure:
 - i. Hook up bottom valve to pump with a hose
 - ii. Hook up pump to chiller with hose
 - iii. Pump the PBW from the fermenter through the chiller into the drain on the floor

16) Send Acid solution through the CIP ball at the top of the fermenter

- a. **Equipment Needed:** Spray Hose, PBW, Two large hoses, pump, 5-gallon bucket

NOTE: These steps are similar to the steps taken in step 14.

- b. *Acid cleaner will clean the surfaces of the fermenter so that the fermenter can be properly sanitized*
- c. Procedure:
 - i. Combine 6 oz. of acid per 5-10 gallons of cool water in the fermenter
 - ii. Hook up hose to the side port, connect the hose to the pump, and then open the side valve
 - iii. Hook up hose to bottom port valve and connect to the pump
 - iv. Pump all acid solution through the CIP ball into the fermenter for 10-15 minutes
 - v. Drain solution from fermenter
 - vi. Rinse through the fermenter

- 17) Clean the chiller with the acid solution from the fermenter, using the same procedure as Step 15.
- 18) Replace carbstones before final sanitation if you haven't replaced them already
 - a. *This will ensure the entire fermenter and carbstones are all bacteria free.*
 - b. Procedure:
 - i. Spray each piece of hardware with water
 - ii. Put the fittings back on
 - iii. Ensure carbstone is closed
- 19) Send iodine sanitizer solution through the CIP ball into the fermenter
 - a. *The iodine sanitizer will remove all the bacteria from the fermenter*
 - b. Procedure:
 - i. Combine 1 oz. of iodine to 5 gallons of room temperature water in the fermenter
 - ii. Hook up hose to the side port, connect the hose to the pump, and then open the side valve
 - iii. Hook up hose to bottom port valve and connect to the pump
 - iv. Pump all iodine solution through the CIP ball into the fermenter for 10-15 minutes
 - v. Drain solution from fermenter
- 20) Rinse with water and ensure entire fermenter has drained
 - a. *Ensure there is no iodine remaining in the fermenter so the fermenter is ready to hold beer again*
 - b. Procedure:
 - i. Empty contents of the fermenter through the through the bottom valve into a bucket
 - ii. Close the side port
 - iii. Spray the inside of the fermenter with the hose
 - iv. Empty the contents of the fermenter through the bottom valve
 - v. Repeat steps iii and iv until the fermenter appears clean to all 5 senses
 - vi. Open all of the valves and drain any left over iodine, acid, or PBW solution
 - vii. Soak all fittings in sanitizer
 - viii. Detach hoses
 - ix. Hang hoses up to dry
- 21) Visually inspect the fermenter to ensure cleanliness
 - a. *The fermenter should be ready for use, so it should look, feel, and smell clean*

Appendix H: Final Fermenter Cleaning Checklist

Fermenter Cleaning Checklist:

- Set thermostat to 75°F or higher
- Vent CO₂ out the side from the arm valve on the side of the fermenter until the pressure gauge reads about 5 psi
- Use the extra pressure (5 psi) to help drain the bung (excess pieces of grain) from the bottom of the fermenter with the hose into the drain
- Open the valve on the side to release the pressure until the pressure gauge reaches zero psi
- Open the manway door and vent the rest of the CO₂ out of the fermenter for at least 15 minutes
- Scoop out yeast to be reused if there is minimal liquid in the fermenter
 - *If there is too much liquid, ask one of the co-owners to remove the yeast*
- Rinse the manway door with hot water from the hose
- Remove the gasket from the manway door, rinse it with hot water, and clean it
- Once the bung and liquid have drained past the level that the fittings are attached to the fermenter, open the fittings and remove the fittings from the fermenter.
 - *Remember: Replace fittings with flat fittings before sending anything through the CIP ball*
- Manually clean the inside of the fermenter
 - *Remember: spray and scrub above the manway opening*
- Open bottom valve and gasket, remove racking arm, clean and sanitize racking arm
- Replace rubber gasket and re-seal manway.
 - Spray floor towards the drain so that there isn't bung on the floor

- Send PBW through the CIP ball at the top of the fermenter
- Clean the chiller with the PBW solution from the fermenter
- Send Acid solution through the CIP ball at the top of the fermenter
- Clean the chiller with the acid solution from the fermenter, using the same procedure as Step 15.
- Replace carbstones before final sanitation if you haven't replaced them already
- Send iodine sanitizer solution through the CIP ball into the fermenter
- Rinse with water and ensure entire fermenter has drained
- Visually inspect the fermenter to ensure cleanliness (use all five senses too)
 - *Remember: the fermenter should be ready for use, so it should look, feel, and smell clean*