

MBAA Safety Toolbox Talk



Boil-Over Safety in the Brewery

Overview

Vigorous boils are a central component of wort production. By definition, there is a risk from burns from the highly viscous wort if the boil erupts from the kettle hatch. Burns from wort boil-overs are serious hazards and potentially life-threatening. The old adage that brewers should “never turn their back on a boil” still holds true, and there are ways to mitigate this risk.

Boil-overs are most likely to occur when kettles are overfilled and there is insufficient freeboard space to manage the boil. This mode of failure is entirely preventable. The typical mechanism behind boil-overs in a properly filled kettle is through thermal expansion of the wort as it heats up, then being exacerbated by stable foams developing, forming a cap, and climbing up the walls of the kettle during a vigorous boil. This is most frequent during the beginning of the boil, but can occur at any point.

Best practice is to conduct boils with the kettle hatch closed, but there are cases when the door has to be opened. Hops and other kettle additions create nucleation sites and can trigger boil-overs as they circulate, while some kettle designs require air to flow through an open hatch in order to provide adequate draw through the kettle vapor stack. Preventative controls should begin with managing the hazard risk by not overfilling the kettle, followed by other engineering controls, and supplemented with PPE measures.

Design & Engineering Considerations

- **Adequate freeboard space in the kettle:** Over-filling a kettle creates a significant risk for boil-overs. Kettles should be sized to have roughly 20-30% excess space to manage a vigorous boil.
- **Kettle stack sizing:** The stack must be appropriately sized to provide sufficient draw to maintain the balance of pressure.
 - Fan assistance: In certain cases, there isn't enough space for the target diameter stack, or the routing creates restriction that impedes the draw. Installation of a stack fan can improve the draw.
- **Safety equipment:** Devices such as boil-over sensors and remote steam cut-off valves need to be periodically challenge-tested to confirm that they are functioning as intended. These tests should be documented.
 - NOTE: If the sensor is being triggered frequently during the course of a brew week, it is an indication that the kettle is being routinely overfilled or that there is a problem with the kettle stack. Thoroughly document to track trends.
- **Vessel cleaning:** Soiled surfaces are more prone to trigger boil-overs as foam caps develop more quickly. Monitor kettle boils more carefully as the period between CIP cycles increases.
- **Workflow**
 - Brewing platforms, stairs, and ladders need to be designed appropriately and allow easy & rapid egress in the event of a boil-over. Steeply pitched stairs and cluttered spaces can create a tripping hazard that impedes emergency egress.
 - Block access to the workspace below the kettle door during a boil, especially with brewhouse platforms made from open-grate flooring.

Safety Equipment

- **Operator awareness:** There is no substitute for hazard awareness and safety training.
- **Boil-over sensors:** These are electroconductive devices that are triggered when foam or liquid comes into contact with 2-3 prongs, completing an electrical contact. These are easily installed when commissioning a new vessel or retrofitting onto an existing kettle
 - Best practice is to wire the sensor directly to a steam shut-off valve that will immediately close the steam supply and remove the heat flow, allowing foam to subside before resuming the boil.
 - Audio-visual alarms can provide advance warning to brewers and allow them time to spray down the rising foam, turn off the steam from the main control panel, or safely exit the brewing platform. This could be a simple alert light or a combination of a warning beacon and horn. A/V alarms can serve as a useful first step when retrofitting a boil-over sensor into an existing kettle.
 - Challenge testing and maintenance: Best practice is to follow manufacturer guidelines, but the basic principle is to immerse the sensor probes in liquid and confirm that the sensor is activated and triggers all of the connected controls.
- **Remote steam shut-off valve:** Having a remote valve located in an accessible area which is protected from boil-over flow allows operators to safely halt steam flow when not on the brew deck.
- **Food-grade defoamer:** A spray-bottle of defoaming agent next to the kettle can help to knock back rising foam before it can trigger a sensor or erupt from the kettle.
- **PPE**
 - Boots: Tall boots can fill with liquid if the pant legs are tucked into the boot and lead to serious burns
 - Aprons: Wearing an appropriate heat- and liquid-resistant apron can provide protection when adding hops or collecting wort samples.
- **Preventative maintenance programs**
- **Splash shields:** A removeable shield can be placed over a kettle hatch during boils to deflect liquid during a boil-over.

Learn more!

Resources and Regulatory References

- Master Brewers Podcast Series: Episode 49 “Breathe, Breathe, Breathe, Scream” July 28, 2019
- Master Brewers Practical Handbook for the Specialty Brewer, Volume 1: Raw Materials and Brewhouse Operations
- The Practical Brewer, Master Brewers Association of the Americas
- Master Brewers Tool Box Talks
 - Personal Protective Equipment
 - Walking-Working Surfaces

FOR MORE INFORMATION ON BREWERY SAFETY, PLEASE VISIT THE MBAA BREWERY SAFETY WEBSITE AT:
<http://www.mbaa.com/brewresources/brewsafety>