Brewing Safety: Ensuring a Secure Brewhouse Environment

Welcome to our comprehensive guide on brewhouse safety. In the bustling world of craft brewing, ensuring a secure environment is paramount. Not only are lives potentially at stake, but OSHA penalties and the financial impacts of accidents can be devastating for breweries of all sizes. Throughout this presentation, we'll explore the various hazards present in a brewhouse, from chemical risks to physical dangers, and provide essential strategies to mitigate these risks. Remember, a safe brewery is a productive brewery – so let's dive in and learn how to keep our passion for brewing both enjoyable and secure.

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Importance of Brewhouse Safety

1 **PEOPLE**

Yours or someone else's life is at risk

2 **EQUIPMENT**

Damage to expensive equipment, property

3 **$$$$**

Time offline, loss of product, potential work hazard lawsuits

4 **OSHA**

Fines, embarrassment

Case Studies: Learning from Past Incidents

1944: High Injury Rates

In 1944, the brewing industry saw approximately 1 disabling injury for every 10 workers. This alarming statistic highlights the dangerous conditions prevalent in early 20th-century breweries.

1

2001-2009: OSHA Reports

OSHA accident reports from this period reveal various incidents,

2

2023: Underreporting Concerns

Recent reports suggest that while official injury numbers in breweries appear low, there may be underreporting. This emphasizes the importance of creating a culture where all incidents, no matter how minor, are reported and addressed.

3

Future: Proactive Prevention

Looking ahead, the focus is on proactive safety measures, leveraging

4

Brewhouse Specific: MASH

Each Brewhouse is Different - Generally at Production scale..

Hot Liquor Introduced to System Under Pressure (HLT Pump, etc)

-In order to produce a desired flow rate at the hydrator, inlet water must be under a relative and proportional amount of pressure to do so - still burns but FASTER

-Potential for burns from piping, steam, unintended valve changes, automation (PID temperature/flow controllers etc)

Grain Introduced (auger, chain disk, manly muscles, etc)

-Dust, rotating (and moving) equipment, typically highly involved on labor

-Dust explosion risks, physical dangers of augers/pulling systems, the act of manual mixing or adding to vessel itself has risks

Rotating Equipment (Rakes, Mixer Paddles, etc)

-Catching on or jamming rakes, stress on vessel/mounting itself from mixing

-Don’t play tug of war with your rakes if it takes your paddle - E-Stop always Never, ever, under any circumstance be in a position to fall in

Brewhouse Specific: Boil

Each Brewhouse is Different - Generally at Production scale..

<u>Industrial Heating Elements (steam, direct/indirect fire, electric)</u>

-Hot

-Dry fires are dangerous, expensive, exhausting & humiliating

<u>Pumps (whirlpool, knockout, calandria)</u>

-Boiling hot sugar water living its best life at like 15gal/min

-Check your clamps and gaskets OVER and OVER, heating and cooling causes gaskets to flex and shrink, clamps to loosen

-KNOW BEFORE YOU GO - always check where the valve you're opening leads

-**<u>Boiling Wort</u>**

-Boiling hot grain water ain't so sweet - think about how you'd handle boiling water on a stove - understand the *gravity* of the situation

-If you're boiling before you turned your stack fan on, you waited too long - fermcap is your friend, keep the lid open if need be - Don't allow boil-overs to occur

Hot Liquid and Steam Safety

Hazard	Prevention Measure	PPE Required
Hot Liquid Splashes	Use splash guards when transferring hot liquids	Heat-resistant gloves, face shield
Steam Burns	Proper ventilation, clear steam release procedures	Heat-resistant clothing, face shield
Scalding from Pipes	Insulate hot pipes, use warning signs	Long-sleeved shirts, gloves
Tank Overflow	Monitor fill levels, use overflow alarms	Chemical-resistant boots, apron

Cellar Safety Overview

CO2 Hazards

CO2 buildup in cellars can be deadly. Always open your cellar door when first entering in the morning. Use and regularly calibrate CO2 meters. If you have a headache you communicate!

Pressure Safety

Ensure pressure relief valves (PRVs) are working correctly and tanks aren't overfilled.
When dry hopping or venting tanks with dissolved CO2, be aware of potential ‘geysers’.
Vent tanks properly, if rousing check that exhaust pressure is not building

Confined Spaces

Valves, sample ports, stainless all potential hazards for blunt contact
Wet floors (water and/or cleaning/sanitizing solutions, glycol drip, etc) pose slip and injury risks

Chemical Safety

Handle cleaning and sanitizing agents with care. Use appropriate PPE and ensure proper storage and labeling.

The Physics and Chemistry

‘Geysers / Volcanoes’ - Pressurized Tanks and Equilibrium

Cellar WIP’s can have high levels of dissolved CO2 both early and late into fermentation/conditioning - a geyser occurs due to the liberation of said CO2 from solution within a vessel not capable of handling said expansion

CO2 does not want to stay in solution more than it has to - equilibrium will dictate where it wants to go - a wide open dry hop port (atmospheric pressure) offers a new equilibrium - and hops are the ticket to get there fast

Hops serve as a ‘nucleation point’ - a disturbance or impurity - that serves as a point for our solution to ‘reorganize’ spontaneously - resulting in CO2 erupting out of solution and taking beer with it

The Physics and Chemistry

‘Geysers / Volcanoes’ - Pressurized Tanks and Equilibrium

Tips on how to avoid:
-Headspace - Can additional headspace result in your beer absorbing more CO2? - Technically YES

However for dry-hopping purposes, additional headspace also provides increased volume for expansion - meaning the pressure building within the tank as CO2 is liberated will not outcompete the exhaust pressure

-Take your time, add hops slowly, add 1 bag at a time. Giving CO2 a additional time to leave the vessel will prevent pressure buildup

-Know Your Cellar - tanks that have built up or have been left under pressure will have picked up more dissolved CO2 than one left to a blow-off bucket (with a few exceptions)

The Physics and Chemistry

Pressure in the Cellar

- Fermenters/Brites are designed to handle positive pressure within the vessel - if said vessel is brought to negative pressure (vacuum), it can cause your tank to ‘soda-can’ or implode

Things to avoid:

- Introducing Caustic soda (NaOH) to a confined vessel full of CO2 - There’s a chain reaction produced in which CO2 is rapidly absorbed - sudden and rapid absorption of gas can create a vacuum within your tank

- Transfer to/from a vessel without appropriate pressure considerations taken; Both CO2 head pressure and Pump xfer’s will need to equilibrate or compensate for vacuum on your sending tank.

The Physics and Chemistry

Pressure in the Cellar

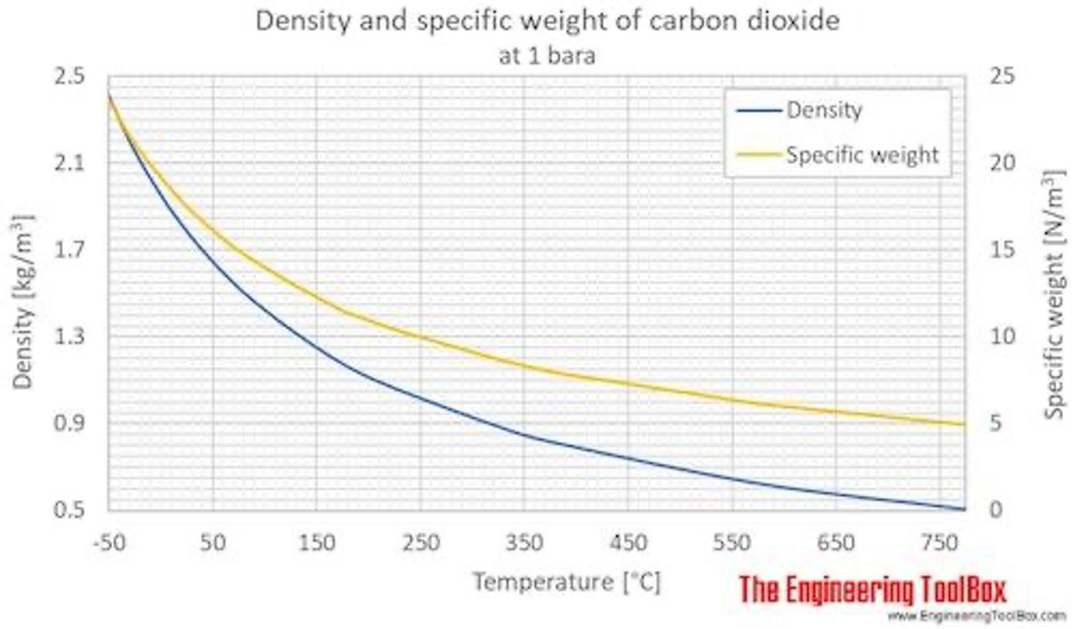
Things to avoid (cont'd):

- Height / volume differential can cause your sending tank to vacuum rapidly due to gravity, static pressure head, etc - either increase your back pressure (constrict flow) or compensate your head pressure (be sure your gauge can keep up) in order to insure

- Introducing Hot or Cold water to any tank without at least 1 additional (non-flow) valve(s) open for pressure fluctuations - i.e. Cip arm, drain, + at least (1) additional port
  - Never remove clamps from a vessel body before insuring atmospheric pressure has been reached; Spray balls clog, drain valves clog, a lack of exhaust from either does not insure the tank as been vented properly - don't be the one to unclamp a bullet

The Physics and Chemistry

Gas & Thermo Laws



Basic ‘Ideal Gas Law’

$$PV=nRT$$

Thermodynamics of a contained system (energy conservation) suggest changes on one side will result in changes to another;

Given our tank volume (V) and is constant we’ll typically see changes with Pressure relating to Temperature directly - Sudden changes in one will produce sudden changes to the other - until new equilibrium is reached

Temperature ↑ = Pressure ↑

Pressure ↓ = Temperature ↓

The Physics and Chemistry

Flow Systems / Joule-Thomson Effect

Joule -Thomson

'At room temperature, all gases except hydrogen, helium, and neon cool upon expansion by the Joule–Thomson process when being throttled through an orifice'

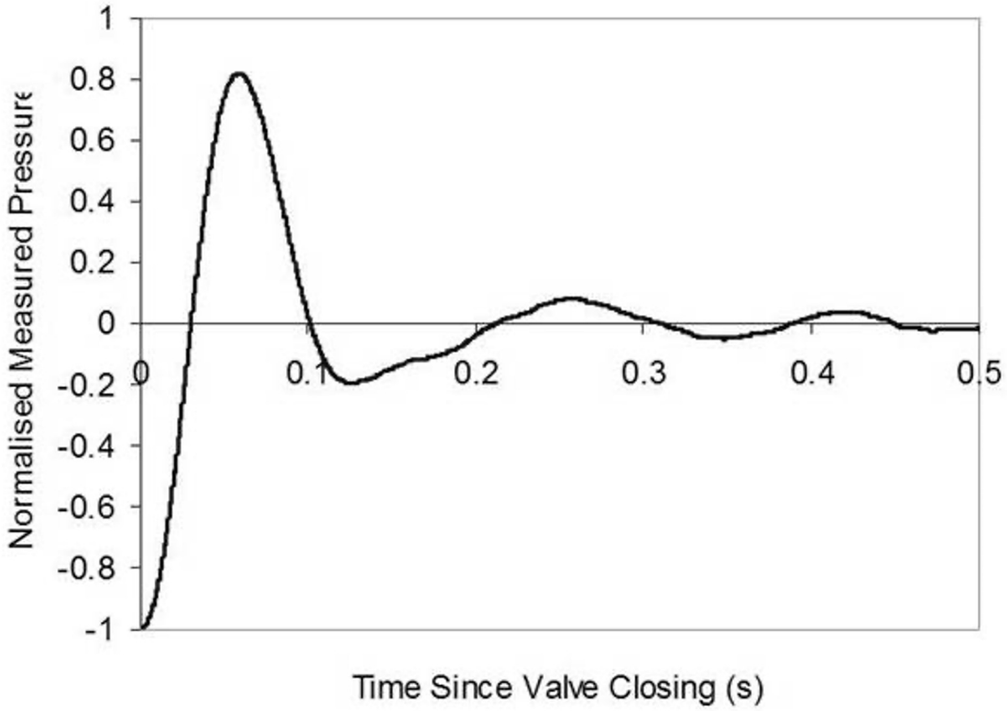
i.e. A tank being vented rapidly will cool rapidly

If beer is forced from high pressure to low pressure abruptly, can result in a phenomena called 'flashing' - as the liquid (beer) exits our high pressure vessel to atmospheric pressure across a throttle (restriction) - it will partially vaporize; given our liquid of concern is carbonated, that CO_2 will also liberate from solution, rapidly dropping the temperature

i.e. A 'wrong clamp' mishap can be extremely dangerous to handle

The Physics and Chemistry

Water Hammer



The ‘pressure surge or wave caused when a fluid in motion is forced to stop or change direction suddenly’

Closing/slamming valves suddenly never a good idea

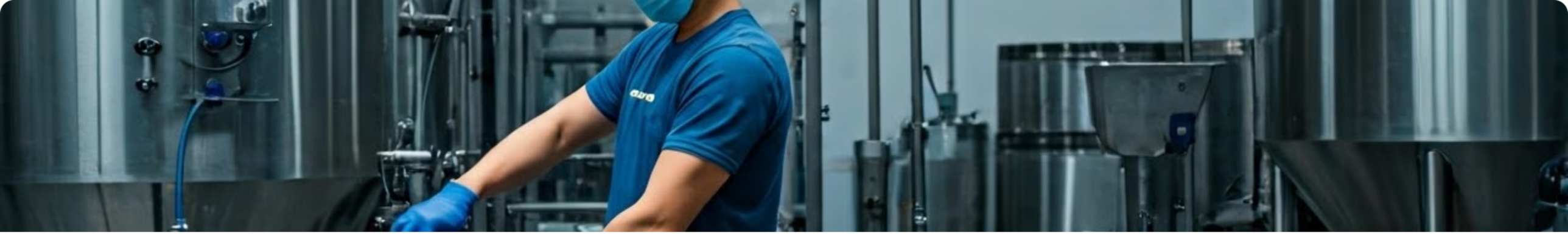
Sudden opening and closing mechanisms within a brewery need special considerations for firmly tightened clamps

i.e. Brewhouse - Water Lines rapidly closing, either by team members or automation (ex Hot liquor flow control blenders)

Cellar - Block & Bleed / Xfer Transitions

Canning Lines - the hose jolt you’ll often see visibly as fill heads open / close

Any time a clamp unintentionally comes loose is a bad time



Packaging and Bottling Safety

Mechanical Safety

Automated rotating equipment should not be accessed at any point during operation i.e. seamers, fillers, depalletizers, labelers etc

PPE Usage

Enforce the use of appropriate PPE

Eyewear, gloves, closed-toed shoes, pants

1

2

3

4

Proper Training

Thoroughly train all staff on equipment operation and safety procedures. What to do, where to go, where not to go. Know where your E-

Ergonomics

Implement ergonomic practices to prevent repetitive strain injuries.

Common Chemical Hazards in the Brewhouse

1 **Cleaning and Sanitizing Agents**

Caustic cleaners like sodium hydroxide and acidic cleaners such as phosphoric acid can cause severe skin irritation and burns. Always wear proper protective equipment when handling these substances.

2 **Brewing Process Chemicals**

Silicone dioxide, lactic acid, and phosphoric acid as well as brewing minerals pose their own respective burn or inhalation risks

3 **Compressed Gases**

Carbon dioxide (CO_2) and nitrogen (N_2) pose suffocation risks in poorly ventilated areas. Proper ventilation and gas monitoring systems are crucial.

4 **Chemical Storage**

Improper storage can lead to spills or leaks. Follow manufacturer recommendations and use appropriate personal protective equipment (PPE) when handling chemicals.

Preventing Chemical Exposure and Contamination

1

Proper Handling and Storage

Store chemicals according to manufacturer guidelines. Use appropriate PPE such as gloves, goggles, and protective clothing when handling. Never leave chemical containers unattended or unlabeled.

2

Chemical Spill Response

Clean up spills immediately. Avoid aggressive spraying to prevent splashing. Never assume a liquid is water – proper identification is crucial. Remember, PAA (peracetic acid) can cause severe harm if inhaled.

3

Controlling Exposure in the Brewhouse

Set up valves to prevent chemicals from intersecting with beer lines. Always ensure all manways and appropriate valves are closed before turning on pumps. Walk through your flow path to ensure safe CIP (Clean-in-Place) procedures.

4

Regular Training and Audits

Conduct regular safety training sessions and perform audits to ensure all staff are following proper chemical handling procedures. Stay updated on the latest

Physical Hazards in the Brewery

EVILLLLLL ------->

Heavy Lifting and Manual Handling

Lifting heavy objects like grain bags and kegs can lead to musculoskeletal injuries. Implement proper lifting techniques and use mechanical aids when possible. Train staff on ergonomic practices to reduce the risk of strains and sprains.

Slips, Trips, and Falls

Wet floors and obstacles like hoses create hazards. Maintain clean, dry floors and clear walkways. Use non-slip mats and proper footwear. Mark potential hazards clearly and immediately address spills.

High Temperatures and Burns

Hot liquids during mashing, boiling, and cleaning pose burn risks. Use proper insulation on hot surfaces, provide heat-resistant gloves, and install warning signs. Train staff on safe handling of hot liquids and steam management.

Equipment and Electrical Safety

Mechanical Equipment Hazards

Pumps, mixers, bottling lines, and forklifts can cause crush injuries or entanglement. Ensure all equipment has proper guarding and safety interlocks. Provide comprehensive training on equipment operation and maintenance.

Electrical Hazards

Risk of electric shock, arc flashes, and fires from electrical systems. Regularly inspect and maintain all electrical equipment. Only qualified personnel should perform electrical work. Use proper lockout/tagout procedures during maintenance.

Confined Spaces

Fermentation tanks, grain silos, and storage vessels pose risks of asphyxiation or toxic gas exposure. Implement a confined space entry program with proper ventilation, gas monitoring, and entry permits. Never enter confined spaces without a trained observer present.

Pressure Systems

Overpressurization in tanks or lines can lead to explosions or ruptures. Regularly inspect and maintain pressure relief valves. Train staff on proper pressure management and the risks associated with pressurized systems.

Electrical Safety in the Brewery

Hazard	Prevention Measure
Electrical Shock	Use Ground Fault Circuit Interrupters (GFCIs)
Equipment Malfunction	Regular Inspection and Maintenance
Fire Risk	Proper Wiring and Circuit Protection
Wet Environment Dangers	Waterproof Electrical Components

Biological Hazards in Brewing

Microbial Contamination

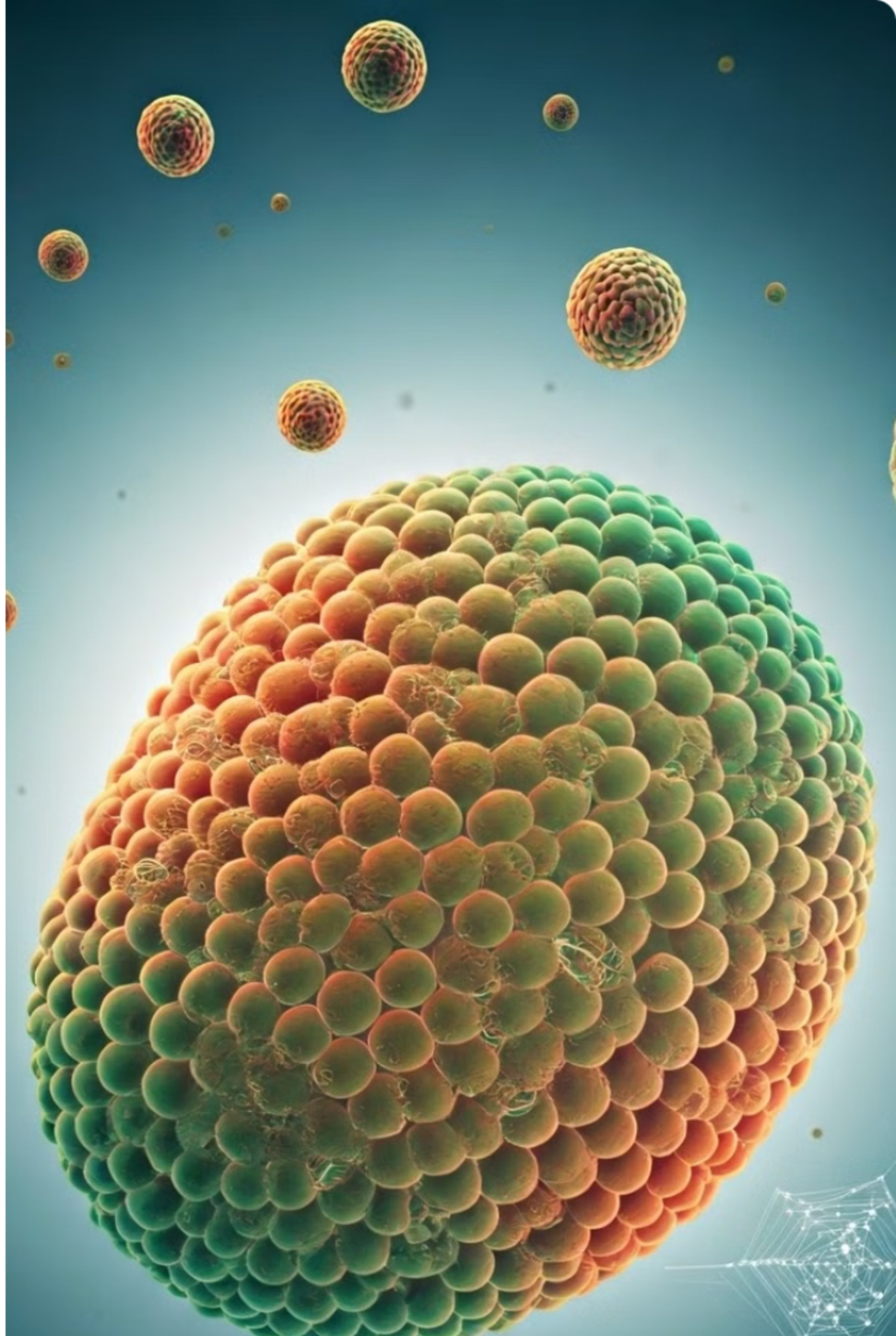
While many microorganisms are essential for brewing, others like E. coli or Listeria can cause foodborne illnesses. Implement rigorous sanitation protocols and regular microbial testing to ensure product safety.

Allergens

Common brewing ingredients like barley and wheat are allergens. Clearly label products and implement strict cleaning procedures to prevent cross-contamination. Provide allergen awareness training to all staff.

Mold and Fungi

Moist environments in breweries can promote mold growth. Regularly inspect and clean areas prone to moisture accumulation. Use proper ventilation systems and consider using mold-resistant materials where applicable.



Physiological Considerations in Brewery Safety

1

Proper Rest and Attentiveness

Ensure workers are well-rested and alert. Implement policies that promote adequate sleep and breaks. Consider rotating shifts to prevent fatigue-related accidents.

2

Mental Health Awareness

Promote a psychologically sound work environment. Offer resources for stress management and mental health support. Encourage open communication about mental health concerns.

3

Substance Use Policy

Strictly enforce a no-substance use policy while on duty. This includes alcohol consumption, even in a brewery setting. Implement random testing procedures if necessary.

4

Noise Exposure Management

Monitor and control noise levels from machinery. Provide appropriate hearing protection and conduct regular hearing tests for employees exposed to high noise levels.

Creating a Culture of Safety

Element	Description	Implementation
Leadership Commitment	Management actively promotes safety	Regular safety meetings, visible participation in safety initiatives
Employee Involvement	Workers contribute to safety programs	Safety committees, suggestion boxes, hazard reporting systems
Continuous Training	Ongoing education on safety practices	Regular workshops, online courses, hands-on training sessions
Clear Communication	Open dialogue about safety concerns	Safety boards, newsletters, daily briefings
Recognition and Rewards	Incentivize safe behaviors	Safety performance bonuses, public recognition for safety achievements

Risk Assessment and Management

1

Identify Hazards

Conduct a thorough assessment of the brewery premises, equipment, and processes. Use OSHA's Hazard Identification Training Tool and the Brewer's Association Safety Best Practices Guide to ensure comprehensive coverage.

2

Mitigate Risks

Develop protocols to address identified risks. Implement engineering controls, provide adequate PPE, and establish safe work practices for handling chemicals and operating machinery.

3

Train and Educate

Provide comprehensive safety training for all staff, covering hazard recognition, safe work practices, emergency procedures, and proper use of equipment and PPE. Conduct regular refresher sessions and safety drills.

Personal Protective Equipment (PPE)

Eye Protection

Safety glasses or goggles with side shields protect against chemical splashes, flying debris, and potential eye injuries from machinery. Remember, your eyes are irreplaceable – don't let your vision of success become blurry!

Hand Protection

Heavy-duty gloves made of nitrile or other suitable materials shield against cuts, burns, and chemical exposure. Keep your hands safe – they're your most valuable brewing tools (next to your taste buds, of course)!

Foot Protection

Steel-toed boots or shoes with slip-resistant soles protect against heavy objects, hot liquids, and slippery surfaces. Don't let a foot injury be the reason you're hopping mad!

Equipment Maintenance and Inspection

1

Regular Inspections

Conduct daily, weekly, and monthly inspections of all brewing equipment. Look for signs of wear, damage, or malfunction. Remember, a stitch in time saves nine – or in this case, a check in time saves your brew!

2

Preventive Maintenance

Implement a preventive maintenance schedule for all equipment. This includes cleaning, lubricating, and replacing parts as needed. Don't wait for something to break – be proactive and keep your equipment in tip-top shape!

3

Safety Equipment Checks

Regularly test and maintain safety equipment such as eyewash stations, safety showers, and CO2 meters. Ensure that emergency stop buttons are functioning and easily accessible. Your safety equipment should be as reliable as your favorite recipe!

4

Documentation

Keep detailed records of all inspections, maintenance, and repairs. This not only helps track the history of your equipment but also proves your commitment to safety in case of an audit. Remember, if it's not documented, it didn't happen!

Emergency Response Planning

1

Identify Potential Emergencies

Assess all possible emergency scenarios specific to your brewery, such as fires, chemical spills, equipment malfunctions, or injuries. Remember, it's better to be over-prepared than under-prepared!

2

Develop Response Procedures

Create detailed, step-by-step procedures for each identified emergency. Include evacuation routes, assembly points, and specific roles for team members. Your emergency plan should be as clear as your finest lager!

3

Train and Practice

Conduct regular training sessions and drills to ensure all employees are familiar with emergency procedures.

4

Review and Update

Regularly review and update your emergency response plan. As your brewery evolves, so should your safety procedures.

Cultivating a Safety Culture

Lead by Example

Leadership must consistently demonstrate commitment to safety. When managers prioritize safety, employees follow suit. Remember, actions speak louder than words – especially when it

Continuous Education

Provide regular, engaging safety training sessions. Use a mix of traditional methods and modern technology to keep it interesting. Knowledge is your best defense against accidents!

Recognize and Reward

Implement a system to recognize and reward safe practices. Positive reinforcement goes a long way in creating a safety-minded culture. Make safety success as celebrated as your

Conclusion: Brewing a Safer Future

Equipment Safety

Invest in modern, well-maintained equipment with proper safety features. Regular inspections and upgrades are key to preventing accidents and ensuring efficient operations.

Ergonomic Practices

Implement and regularly reinforce proper ergonomic practices. This not only prevents injuries but also improves overall worker health and productivity in the long run.

Technology Integration

Embrace technology for safety management. Use digital tools for real-time monitoring, incident reporting, and safety training to create a more responsive and proactive safety environment.

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