



Industrial Pretreatment

Best Management Practices (BMPs) for Microbreweries, Craft Beer Operations and Home Breweries

This guide is designed to inform local brewers of the environmental impact of Microbreweries, Craft Beer Operations and Home Breweries. JEA has full jurisdiction on what enters the sewers that are monitored, owned, and operated by JEA and seeks to provide guidance to industries that will embark the least amount of environmental impact.

Owners and operators of Microbreweries, Craft Beer Operations and Home Breweries

1. Shall consider the impact their operation has on the environment.
2. Shall implement Best Management Practices where a permit is not required.

Discharges from Microbreweries, Craft Beer Operations and Home Breweries can cause significant contamination and interfere with treatment plant operations which in turn will affect aquatic life.

These include but are not limited to

1. Off-spec discharges
2. Pre and post production cleaning water
3. Cleaning products
4. High solids
5. TOC (Total Organic Carbon)
6. COD (Chemical Oxygen Demand)
7. BOD (Biological Oxygen demand) levels released into the sewer
8. pH
9. Product spills
10. High temperatures

This Best Management Practice Guide contains requirements for keeping the environment protected as you brew your product. It is JEA's priority to protect the water system in its jurisdiction by providing the appropriate information, practices, permits, and BMP's that lay out the basic guidelines and regulatory requirements that govern discharges into JEA sewers. The brewing process generates large amounts of wastewater effluent and solid wastes that must be disposed of or treated to meet discharge regulations set by government entities. This guide will also provide vital information that makes good business sense, streamline environmental processes, as well as drive compliance. As Microbreweries, Craft Beer Operations and Home Breweries become more popular and operate in abundance, the more cautious the industry needs to be of its environmental impact. BMPs that prevent pollution and contamination of the waters in JEA's jurisdiction may exempt Microbreweries, Craft Beer Operations and Home Breweries from obtaining a permit, provided that other JEA requirements are followed and reported in a timely manner.



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Why should Microbreweries, Craft Beer Operations and Home Breweries reduce their environmental footprint?

1. It is required by the regulatory authority. Protecting the water and sewer is a top priority at JEA. These efforts help with preserving the integrity of the water and can help alleviate upsets at the wastewater plant due to unauthorized waste from Microbreweries, Craft Beer Operations and Home Breweries. Implementing environmentally friendly practices can attract more customers, increase marketing potential, and provide economic benefits from improved energy and water and waste efficiencies.
2. Energy efficiency
 - a. Energy incentives
 - b. Tax breaks
 - c. Leak repair
 - d. Insulation of steam pipes
 - e. Lighting retrofits
3. Water Consumption
 - a. Set goals to achieve 3.5:1 water to beer barrel ratio
 - b. Capture, recycle, or reuse water where feasible
4. Reducing Waste
 - a. Reuse and Recycle
 - i. Pallets
 - ii. Keg collars
 - iii. Shipping materials
 - iv. Buckets
 - v. Containers
 - b. Recycle materials
 - i. Spent grains
 - ii. Yeast
 - iii. Filtration media
 - iv. Compost organic wastes
5. Composting Organic Wastes
 - a. Use in gardens
 - b. Farms
 - c. Livestock feed
 - d. Hop fields



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The facility is required to implement and maintain the following practices to minimize COD, TSS, and wastewater discharged to the sanitary sewer system.

1. **Mash/Lauter Tun** – Spent grains from the mash/lauder tun are filtered, collected and sent offsite for agricultural re-use or disposed of as solid waste.
2. **Brew Kettle** – Trub is captured via filters and mixed with spent grains for offsite re-use and/or solid waste disposal.
3. **Fermentation Tank** – Yeast is drawn from the cone bottom fermentation tanks. Some yeast is recovered for re-use in the fermentation process and the remaining yeast is deactivated and mixed with spent grains for offsite re-use and/or solid waste disposal.
4. **Heat Exchanger** – Hot wort is cooled to room temperature via cool water heat exchanger. Heated water from the heat exchanger is then used in the hot liquor tank for subsequent brewing batches.
5. **Equipment Cleaning** – Wastewater minimization will be achieved by utilizing approximately 20 gallons of water per each process tank cleaned and 20 gallons of water per batch of kegs cleaned.
6. **Product Spills** – Introduction of spilled product into the sanitary sewer will be minimized by collecting product and adding it to spent grains for offsite re-use or solid waste disposal.



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Brewery Wastewater Characteristics

Generally speaking, brewery wastewater has a few common characteristics:

1. High in sugar
2. High in alcohol
3. Potentially high in solids
4. High temperature
5. Highly variable pH

The most cost-effective method for significantly reducing effluent load of brewery wastewater is to separate the solid wastes from the wastewater itself. Wastewater is one of the most significant waste products of brewery operations. Other materials make up only a small portion of wastewater, but can be present in large enough quantities that may require some pretreatment before discharging the wastewater into the JEA sewer system. The acidity or alkalinity of wastewater affects both wastewater treatment and the environment. The pH levels can range between 2 and 12 and are influenced by the amount and type of chemicals used in cleaning and sanitation (e.g., caustic soda, phosphoric acid, nitric acid, etc.). Low pH indicates increasing acidity while a high pH indicates increasing alkalinity (a pH of 7 is neutral). The pH of wastewater needs to be adjusted to a level between 6 and 9 before being released in to the sewer system to protect organisms, waterfowl, aquatic life, and other inhabitants of the waters.

Chemical parameters associated with the organic content of waste-water include biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), and total oxygen demand; all of which can be in the brewery waste stream. Biological Oxygen Demand (BOD) is a measure of how much oxygen it takes microorganisms to break down soluble organic material in water. More BOD equals less oxygen in water for plants and animals and more work for city wastewater systems. Total Suspended Solids (TSS) is the total amount of solids in water. Excessive amounts of BOD, COD, and/or TOC can result in surcharges to the brewery. Brewery wastewater typically has a high biochemical oxygen demand (BOD) from all the organic components (sugars, soluble starch, ethanol, volatile fatty acids, etc.). None of it is toxic, but in high concentrations, it can play havoc with the microbes used by sewage treatment plants to break down organic waste. Pouring too much of the stuff into the waste stream can wind up overfeeding the bacteria, causing them to suck all the oxygen out of the water and killing the microbes. It is not uncommon for a brewery's wastewater to contain a concentration of BOD₅ more than 20 times stronger than wastewater from a home. Phosphorus concentrations can be 5 to 10 times more than wastewater from a home. At these concentrations, the wastewater can contain a large portion of a treatment plant's organic load. Smaller wastewater treatment plants may have trouble dealing with the high strength wastewater, potentially causing plant upsets and possible permit violations. Brewery wastewater usually has temperatures ranging from 25°C to 38°C.



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Brewery Cleaning and Sanitation

Nearly all brewery equipment including tanks, fermenters, brew kettles, and lauter tuns contain product residue that must be removed between batches or at routine intervals in continuous operations.

Manually cleaning is the use soft-bristled brushes, non-abrasive pads, cloths, and handheld spray hoses for cleaning. When cleaning manually, great care must be taken to assure that brushes and equipment are cleaned very well to avoid cross-contamination. Clean-in-place systems were developed by the dairy industry as a means of reducing the amount of labor needed for cleaning and sanitizing operations such as those in the brewing industry. One big advantage of clean-in-place systems is that they can recirculate and allow the reuse of chemicals and rinse water, reducing consumption by as much as 50%. This also results in fewer discharges to the sewer system.

Detergents must contain sequestering power to keep calcium and magnesium salts (beerstone) in solution. Nitrogen and phosphorus levels are mainly dependent on the raw material and the amount of yeast present in the effluent. This can be avoided by treating for these components before releasing the wastewater to the sewer. One of the best cleaning agents for the brewery tanks is sodium hydroxide and it is the most used in breweries worldwide. It effectively dissolves proteinaceous soils and fatty oils. Sodium hydroxide is a great choice for cleaning sludge off the bottoms of boilers and for cleaning beer kegs. It is the best solution for dissolving protein and organic matter when combined with chlorine, surfactants, and chelating agents in the brewery tank cleaning process. These caustic/hypochlorite mixtures are particularly effective in removing tannin deposits, as well as be used for occasional purge treatments or to brighten stainless steel.

Acid detergents are often used to help remove and prevent the build-up of beerstone, water scale (calcium and magnesium carbonates), and aluminum oxide. Acid detergents also kill an abundance of bacteria. This also explains the importance of neutralizing the wastewater before releasing it to the

Phosphoric acid is used in the removal of beerstone and similar deposits on surfaces such as protein material resins and yeasts. Acid-stable surfactant are used with phosphoric acid in order to penetrate surface deposits and provides better rinsing at the end of the cleaning process. Nitric acid is used to remove beerstone and other inorganic deposits, and protein.

Sanitizing agents or disinfectants are used to reduce the number of microorganisms to acceptable levels in brewing. Sanitizing may include the use of either hot water or steam to kill bacteria or chemical sanitizing which involves immersing the object in a sanitizing solution for a specific amount of time or spraying/wiping the object with the solution and allowing it to air-dry. Concentration, temperature and contact time are key factors required to kill bacteria. Common chemical sanitizers include chlorine compounds, hydrogen peroxide, peroxyacetic acid, anionic acids, and iodophores. Some brewers prefer steam or hot water for brewery sanitation because chemical sanitizers can taint the beer with objectionable odors. Steam must be wet (not superheated) and free from air.



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Chlorine based sanitizers are widely used in the beer brewing industry. Chlorine has activity at low temperature, is relatively inexpensive, and leaves minimal residue or film on surfaces. In properly blended products, chlorine based sanitizers are relatively non-toxic, colorless, non-staining, and easy to prepare and apply. Quaternary ammonium compounds, are used in breweries because they are for the most part non-corrosive. They are also very effective against yeast and mold. Peroxyacetic acid or PAA is often used because there are no vapor issues as with chlorine-based compounds. Its other advantages include the absence of phosphates and foam, and its biodegradability.

Avoid using oxidizing acids such as nitric and sulfuric or non-oxidizing acid solutions that have oxygen dissolved in them when cleaning copper. This may cause copper to solubilize and end up in brewery effluent. Copper is usually resistant to non-oxidizing acids such as acetic, hydrochloric, and phosphoric. Also, avoid using caustic cleaners with aluminum, as it actually dissolves the metal and pits the surface. The reaction between caustic cleaners and aluminum can produce flammable hydrogen gas.

Protecting the environment and creating a green environment can be advantageous. Responsible stewardship can help keep the high quality of process water used in current processes. Encourage others in the industry to help protect the water through BMPs and awareness. Below is a summary of BMPs, tips, and other tidbits to help microbrewers protect the environment:

1. Prevent spent yeast, grains, hops, and trub from entering the sewer; settle strain or filter them out.
2. Dewater solids and consider beneficial reuse as compost, fertilizer, animal feed, or convert to energy.
3. Train employees on solids management practices.
4. Install pH control equipment in treatment system.
5. Reuse and recycle whenever possible.
6. Minimize the amount of unused and off-spec product from entering the sewer.
7. Neutralize bad batches as much as possible before dismissing them into the sewer.
8. Provide secondary containment for chemical storages to prevent accidental spills into the sewer.