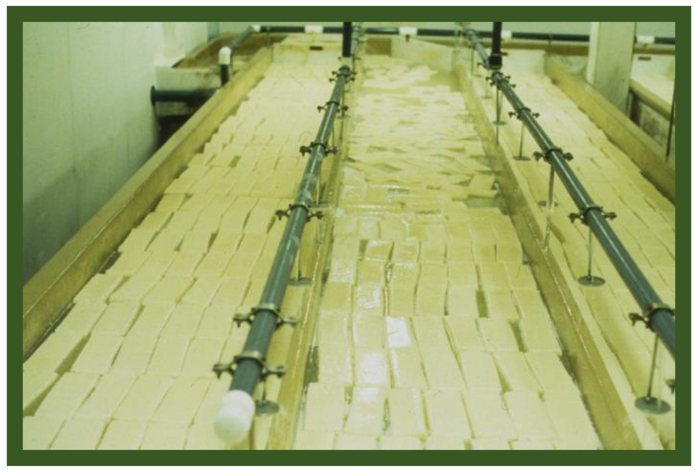
Dairy Brine Food Safety Best Practices

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SECTION 1: OVERVIEW

1.1 Scope and Purpose

Brines increase salt content, reduce moisture, help control cheese starter and non-starter microbiological growth, impart flavor, aid in cheese temperature control, and restrict the growth of salt-sensitive microorganisms in cheese. This document focuses on the FOOD SAFETY elements of brine system programs, with an emphasis on microbiological controls. Other important attributes are briefly covered as they relate to practices that support the food safety programs. Brine should be considered to be an ingredient, not just a processing aid, and must be sourced and handled accordingly.

1.2 Other Applicable References

The Best Practices for Cheese Brine Systems from Dairy Practices Council (DPC.org) is an additional resource for the construction, preparation, maintenance, and many other brine system considerations.

SECTION 2: BRINE MAKING AND STORAGE

2.1 Brine Definition

Brine is simply a salt solution in water that typically ranges from 21% - 23% salinity. Once the brine is mixed it is typically pH adjusted to a similar pH as the cheese being brined and cooled to 4°C to 20°C. Other important considerations are water and salt quality.

There are three general types of brine systems:
1. Static brine systems, where cheese is placed in pits or tanks with little or no brine circulation,
2. Classic brine systems, where brine is circulated around stationary cheese, and
3. Dynamic channeled systems, where both cheese and brine flow together through a channel system, are used to salt a variety of cheeses including mozzarella, provolone, Gouda, Munster, Feta, and parmesan (Johnson Industries).

2.2 Brine Water and Salt -- Quality and Food Safety Considerations

- Water Quality – Brine must be made only with potable water that meets all preventive controls requirements. Water quality expectations can be found in the Pasteurized Milk Ordinance (PMO) for water sourced from municipalities or wells.

- Salt (NaCl) Quality – Brine must be made with only food grade salt free of any chemical contaminants.
  - Sea Salt is not recommended for making brine due to a risk of chemical and pathogen contaminants.
    - If flow agents are utilized in the salt, this could become problematic in managing suspended solids in the brine without effective filtration.
    - Salt without flow agents will likely require some type of grinding or breaking step to become flowable for the process.

2.3 Brine Storage Considerations

- Operational Balance
  - Several factors can impact the volume of brine such as the amount of cheese in the system, losses, and evaporation. A balance needs to be maintained to account for this fluctuation in brine volume. It is important to monitor and manage balance tanks and ensure they are cleaned when the entire brine system is emptied and cleaned.

- Treatment of brine and cleaning of brine system
    - It is critical for brine quality and food safety to identify enough storage to allow for all the brine to be removed from the "flume" into tanks, silos, or other suitable storage locations. This complete removal of brine typically serves two purposes.
    - It allows the emptied flume and all adjacent equipment to be cleaned, inspected, and repaired.
    - It allows the brine to be pasteurized/treated and returned to the flume without recontamination of the brine and handling equipment. The frequency that the brine system is completely emptied and cleaned is driven either by time (annually, quarterly, etc.) or by quality indicators and action limits based on the facility's trending of the data.

Note: When pasteurized/treated brine is put back into the system the temperature, salinity, and calcium levels should be monitored and adjusted to operational levels according to the facility's SOPs.

2.4 Brine Quantity

Brine volume should be 5 times the volume of cheese to ensure the uptake of salt. (Bintis, 2006, pg. 271). Note: Although Bintis references a 5 to 1 brine to cheese ratio, the ratio would require a huge volume of brine and space be allocated to salting when a large static or pick and pull brine system is considered. By having brine of a known and controlled concentration circulate around each cheese, less brine is required and the cheese to salt ratio may be less than 5 to 1.

2.5 Brine Circulation

Brine circulation is important in both the classic and dynamic brining systems because it minimizes salt striation and salt dilution at the cheese-brine interface as whey is expelled from the cheese. It also helps maintain a constant temperature throughout the brine in high-capacity brining operations. However, it is less important in classic pit brine systems where there may be little to no circulation.

2.6 Importance of Creating a "Clean Break"

For all types of brine systems, it is important to periodically create a "clean break" in which it can be convincingly demonstrated that the brine's impact on product quality or food safety is limited to a particular period of time or "lot". Steps used to create the clean break must be documented each time a clean break is created. A clean break may be created by:

1. Complete and permanent disposal of 100% of the brine followed by a complete cleaning of the brine making, storage, and handling systems (pipes, pumps, etc.)
2. Microbiological treatment (pasteurization or other) of the brine to achieve desired micro levels without possibility of recontamination of the brine or ancillary equipment.
3. A validated sanitation process and verification of the system cleanliness must be conducted prior to the reintroduction of treated or new brine solution.
4. Documentation of the brine plan with robust environmental monitoring plan which provides verification of the effectiveness of hygienic and sanitation programs.

SECTION 3: MONITORING BRINE QUALITY AND FOOD SAFETY

3.1 Visual Examination of Brine

Visual appearance is an important indicator of the quality of the brine. Brine should be clear with a light greenish color sheen. Brine that is discolored or contains a high amount of solids may be an indication of issues with brine quality.

3.2 Chemical and Physical Examination of Brine

A. **Salinity (NaCl)**

A typical brine will contain approximately 21-23% (w/w) food-grade salt and resulting in approximately 90% saturation (Kosikowski, 1997). The salt concentration should be monitored and maintained throughout the brining process by adding salt, as needed.

Testing salt content. A Baume hydrometer (salometer), pH meter with a sodium-sensitive electrode, or salt analyzer (platinum electrodes or flow-through style) may be used to monitor the salt concentration of brine. Hydrometers are easy to use but as dissolved solids from the cheese increase, their ability to accurately measure salt is reduced because the hydrometer cannot distinguish between dissolved salt and dissolved cheese solids. Therefore, a sodium-sensitive electrode or salt analyzer should be used to calibrate the hydrometer and confirm the sodium chloride content. Both the pH meter and a salt analyzer require additional training, but each will provide sodium ion readings that may be converted to % salt and neither are affected by dissolved cheese solids. (Wendorff, AOAC).

B. Calcium

The calcium content of the brine should be like that of the cheese to avoid leaching calcium from the cheese into the brine and producing cheese with soft rind. Unless calcium is added, calcium from the cheese will leach into the brine until an equilibrium is reached. Add between 0.1 % to 0.3% $CaCl_2$ to new brines (Kristensen, 1999, Kindstedt, 2005). (Kindstedt, 1991 recommends adding 0.06% $CaCl_2$ to Mozzarella brines). As whey is expelled from the cheese into the brine, the calcium content of the brine will be diluted so monitoring and adding calcium to maintain brine-calcium concentrations will be necessary. Because calcium helps firm up the cheese surface, the addition of too much calcium can make the cheese surface uncharacteristically firm (Wendorff, CDR).

C. pH

It is recommended to keep brine pH below 5.4 as a food safety best practice. Ideally, brine pH should be the same as the cheese being brined, but when the cheese pH is higher than 5.4 it is still recommended to maintain the brine at 5.4. When brines are more alkaline than the cheese, they may cause the surface caseins to swell, retain moisture, and may cause the surface to become slimy. Adding acidulants such as lactic or acetic acid to new brines to lower the pH of the brine to that of the cheese helps eliminate this defect. In established brines, expelled whey should maintain the pH. However, the pH should be routinely monitored and adjusted with lactic acid, acetic acid, sodium hydroxide, or potassium hydroxide to maintain the target pH. If brines have pH values above 5.4, additional considerations will likely be necessary to control the outgrowth of undesirable microorganisms.

D. Temperature

Temperature is important as a pathogen and quality control tool. Brine temperatures may vary depending on the type of cheese being made and the function of the brine. When used for salt uptake and cooling the cheese, brine temperatures are likely held warmer, 7°C to 10°C (45°F to 50°F), than brines used primarily for cooling of the cheese, at 2°C to 7°C (35°F to 45°F). Low brine temperatures retard the growth of *Lactobacillus casei*, which can cause a soft surface in cheese (Wendorff). Optimally, brine should be maintained at 50° F or less.

During brining, sodium and calcium ions move from the brine into the cheese. At the same time, water, calcium ions, and phosphate ions move from the cheese into the brine (Geurts et. al., 1974). In general, water moves out of the cheese twice as fast as salt moves in. Warmer brine temperatures increase both the diffusion rate and the quantity of salt absorbed by the cheese (Turhan & Kaletune, 1992). Cheese can expand or contract if moved from a cold brine to warm brine or from a warm brine to a cold brine (McMahon et. al., 2009). Therefore, keeping the brine temperatures within narrow limits minimizes temperature-related structural changes.

3.3 Microbiological Examination of Brine

Microbiological control programs are critically important to manage quality and food safety of the brines. Often these programs focus on quality controls for yeast and mold with less emphasis of specific measures for control of pathogens.

If brine systems are poorly managed, they can harbor spoilage and/or pathogenic organisms. The quality of the cheese rinds may become contaminated microbiological organisms originating from the immersed cheese, water, salt, equipment, and plant environment. Undesirable organisms can include yeasts, molds, lactobacilli, micrococci, staphylococci, Enterobacteriaceae, and pathogenic bacteria such as *Listeria monocytogenes*, *Escherichia coli*, Salmonella, and *Staphylococcus aureus*. Therefore, it is imperative to have robust and documented monitoring programs to keep brines free of pathogens.

3.3.1 Minimum Monitoring Program Requirements

1. Selection of <u>indicator</u> organisms to be monitored to predict the presence of spoilage and the potential of pathogenic organisms.
2. Documented monitoring frequency and sampling locations.
3. Standards and action limits (upper/lower control limits) for monitored organisms.
4. Corrective and Preventive actions (CAPA) taken to ensure product safety when limits are exceeded.

A. <u>Indicator Organism Selection</u>

Indicator organism monitoring may include yeast, mold, coliforms, and/or Enterobacteriaceae (EB) to monitor the microbiological quality of brines. The monitoring of psychrotrophic bacteria may also be beneficial, especially if off-flavors are encountered in the cheese.

- When testing brine for *pathogen* indicators, it would be considered the equivalent to a Zone 1 sample and specific considerations must be made. Refer to the FDA's Control of Listeria monocytogenes in Ready-To-Eat Foods: Guidance for Industry, Draft Guidance 7 for additional information.
- Each company will need to design a plan appropriate for its own situation, based on the risks presented by its plant characteristics and processing conditions, to develop its Zone 1 testing program. More information on Zone 1 monitoring can be found in the FDA's Control of Listeria monocytogenes in Ready-To-Eat Foods: Guidance for Industry, Draft Guidance 7.
- It is strongly advised that you involve an internal or external Food Safety Expert to develop your Zone 1 monitoring program to determine which specific sites to sample and how product will be controlled pending sampling results from routine and non-routine sampling of Zone 1.
- As FDA Listeria control guidance describes, only test for Listeria *species* in Zone 1 (not Lm). Testing for and finding Listeria spp. on a product contact surface does not automatically mean that product is contaminated, but appropriate and aggressive corrective actions must be taken and documented.

B. <u>Monitoring Frequency and Sampling Locations</u>

Monitoring must be done on a set, documented schedule at a frequency that demonstrates control (i.e., weekly) and include enough brine samples to be representative of the system. Ensure samples are taken from all tanks in a multi-tank system or at various points throughout a channeled system.

As brine actively or passively circulates around the cheese, cheese solids from the surface and interior of the cheese become incorporated into the brine. Some cheese solids dissolve, but others do not and either settle to the bottom of the tank as a sludge or remain suspended provided that the brine circulation is sufficient to do so. Milkfat that has been released from the cheese surface or expelled from the interior of the cheese floats to the top of the brine and can create a foam consisting of milkfat, cheese protein, and salt. Therefore, it is possible to have three very different Zones or micro-environments within the tank or channels i.e., brine, cheese, and brine surface.

Routine sampling from each micro-environment may not be practical on a weekly basis but as brine tanks are emptied for cleaning, maintenance, or as other opportunities arise, they should be tested for a facility's documented indicator organisms. In addition, indicator testing before and after filtration systems, heat-treating units, and high-count areas of the brine system will provide valuable information about the quality of the brine.

C. Microbiological Standards and Action Limits

Determining Standards and Limits: Specific specifications, action limits, and corrective actions must be devised and documented for each organism in your plan. Since the goal is to have as few problematic organisms in the brine as possible, an "Ideal" or target level for coliform, yeast, and mold should be established (Table 1). Microbial limits will differ depending on the cheese, brining system, and cheese production process. If SPC were included in a monitoring program, a target of ≤ 2500 cfu/ml could be used for cultured cheeses. However, this value may be significantly less for non-cultured cheeses or significantly higher for cheeses that are salted in brines to which cultures have been added to enhance cheese flavor. Therefore, limits should be customized to meet the needs of the brine system with consideration to the cheese culturing systems. Consult your internal or external food safety experts to determine targets, alert limits, and action limits, as well as appropriate actions for your particular situation. Below is a recommended *starting point* for microbiological limits. Microbiological standards should be established for each brine system and cheese type being brined (Table 1).

Table 1. Microbiological limits for cheese brine

	Target	Alert Limit	Action Limit
Microorganism	cfu/ml	cfu/ml	cfu/ml
Coliform	≤ 10	> 10	> 100
Yeast	≤ 100	> 100	> 1000
Mold	≤ 100	> 100	> 1000
Enterobacteriaceae (EB)	≤ 10	> 10	> 100

In addition to a low ideal target value, an *Alert Limit* and an *Action Limit* should be established. Exceeding an alert limit should cause concern unless, for example, there was a known event which would cause a drift in the process or product. An action is not necessarily required, but it is a flag to pay attention to and monitor this specific process or parameter. Whenever a process or product exceeds the Action Limit, immediate action is required. Corrections and/or corrective actions must be implemented. For events or trends in which action limits are exceeded, an investigation should be done with root cause analysis and corrective and preventive actions identified and documented.

D. Responses and Corrective Actions:

When microbiological counts exceed the Alert Limits (Table 1), intervention may be warranted. However, action is necessary when counts exceed the Action Limit thresholds as these values represent the highest allowed limits for your brine system. Actions would include verifying that brine pH, calcium, and salinity levels are within your established ranges. It may be necessary to drain and clean tanks and clean suspect areas of a channel system. Consult with your sanitation specialist for proper cleaning chemicals and methods. Heat treating the brine from a drained tank before it is reintroduced into the cleaned tank or increasing the heat-treatment frequency of the brine may be warranted. Additional monitoring will be needed after corrective actions to ensure the system is under control.

Environmental Monitoring Recommendations

In addition to pathogen indicator testing, it is recommended that air quality and contact surfaces be swabbed and tested for other microbiological organisms.

- Cleaned equipment ATP and TPC – Non-pathogenic specific ATP, Total Plate Count, and coliform swabs taken on equipment after cleaning and prior to use are helpful in determining the effectiveness of sanitation protocols in Zone 1 (food contact surfaces).

- Air plates (yeast and mold) are useful in evaluating the cleanliness of the air that circulates in the brining room. Air plates should be placed at representative locations throughout the processing area and the inside of air ducts going to and from the brine room. Room air quality, like any other test, must have action limits. It might also be important to note that you may want to be looking at the air data with respect to a baseline value of performance as opposed to just the action limits. The baseline value may indicate a shift in air quality over time that wouldn't reach the action limit until it become too late and at that point you are likely to not be able to react in time to avoid defects and or/product loss due to spoilage.
    - Room fogging with approved, non-residual sanitizers may be considered if yeast and mold (Y&M) counts exceed action limits. This should be part of a routine MSS program as well as a reaction to AAL air counts at high enough levels so long as you can cover the brine system to protect it from the sanitizer.
    - Note: If you cannot cover the brine tank/system, it is not suggested to fog due to risk of contamination of the brine with the fogging chemical.
- Refer to FDA's Listeria Guidance Document, Section VIII, for additional monitoring guidance.

HVAC System and Filters

HVAC systems containing high efficiency (HEPA) filters are critically important in providing and maintaining adequate room air quality. The HVAC filters must be monitored for effectiveness as part of the facility PM program and replaced on a routine basis. Change frequency is determined by their effectiveness as measured by an increase in back pressure, or other operational methods.

SECTION 4: PATHOGEN ENVIRONMENTAL MONITORING OF THE CHEESE MANUFACTURING FACILITY

4.1 Industry and Regulatory Guidance

Information on *environmental* monitoring programs is provided in The Innovation Center for US Dairy "**Controlling Pathogen in Dairy Processing Environments – Guidance for the Us Dairy: Principle #5: Pathogen Environmental Monitoring"**

Typically, routine environmental monitoring for pathogen species is focused in Zone 2 and Zone 3 of a facility, and not in Zone 1 areas due to potential product implications in the event of unfavorable results. Aggressive monitoring and corrective actions in Zone 2 and Zone 3 will help to reduce the risk of pathogens in Zone 1.

4.2 Pathogenic Organisms of Concern

Of primary concern are pathogens such as *Listeria monocytogenes, and Salmonella spp.*

- *Listeria monocytogenes* grows or survives in cool moist environments and can tolerate high salt levels (Dongyou et. al, 2005). Areas where condensation occurs such as drip pans or troughs, pipes near the ceiling, areas where moisture collects such as floor drains, and damp corners are all locations of concern. Testing for *Listeria* species, rather than specifically for *L. monocytogenes*, increases the sensitivity of an environmental monitoring program because *Listeria* species will be found more frequently. In addition, test results for *Listeria* species will generally be available faster than for *L. monocytogenes* allowing more rapid intervention. Detection of any Listeria species in the environment should be cause for concern and requires aggressive, and immediate corrective action.

- *Salmonella* can grow in moist areas, but are less tolerant to salt than *Listeria* spp., and can grow in many dryer conditions (Aw < 0.85). As with *Listeria*, the presence of *Salmonella* is determined by testing for general *Salmonella* species rather than for a specific *Salmonella* species. Detection in the environment requires corrective action.

4.3 Corrective Actions

Immediate and effective corrective actions must be taken when positive environmental monitoring results are received and documented. This may range from increased cleaning to capital projects to correct identified issues.

SECTION 5: CLEANING AND MAINTAINING THE BRINE SYSTEM

5.1 Cleaning Brine Handling Systems

A. <u>Open Systems -- Aboveground Flume/Pit Cleaning</u>

Storage capacity is critical to move the brine from the "flume" into tanks/silos to enable both heat pasteurization of the brine and the full cleaning of the empty "flume" on some regular frequency. This is recommended to avoid poor quality of the brine, a product quality event, or a pathogen being found in the brine. The frequency requirements to do this pasteurization and cleaning of the flume will be driven by microbiological data, visual observation, flume design, filtration capability, and cheese capacity.

- Manual "flume" cleaning and sanitizing involves the 7-step cleaning process which would involve foaming and significant hand brush scrubbing which is well documented in the FDA's Listeria Guidance document, Section VII-A-1.

- When the flume is completely empty of brine it is an excellent time to do a thorough environmental room foaming/cleaning and sanitizing of the walls, floors and ceilings where mold/yeast and even pathogens can persist for the many months of running without the ability to do this cleaning. An effective means to cover open flume systems (i.e., flume covers) may be considered when conducting environmental cleaning near the open portions of the system and when sufficient storage capacity is not available.

- Master Sanitation Schedule (MSS) and Preventative (PM) work should also be scheduled and completed at this time when the brine is not in the "flume".

B. <u>Closed Systems – Storage Vessels/Silo Tanks/Cooling Presses/Systems</u>

Brine storage tanks and cooling systems shall be cleaned via CIP (clean-in-place) system and reference this sanitation section in the FDA's Listeria Guidance Document for more information on CIP cleaning and sanitizing requirements, Section VII-A-3. CIP cleaning of these "in the pipe" equipment is the most efficient and effective way to achieve good cleaning of these components.

C. <u>Brine Racks / Ripening Racks / Cheese Molds</u>

Racking and molds can be cleaned and sanitized via one of two methods: Manual 7-step cleaning in a dedicated sanitation room with foam and manual scrubbing refer to related sections in The Innovation Center for US Dairy **"Controlling Pathogen in Dairy Processing Environments – Guidance for the Us Dairy: Principle #4: Effective Cleaning and Sanitation Procedures and Controls,"** or

Using the preferred method an automated Automatic Cleaning System "ACS" very much like a dishwasher in your home. For cheese molds it's typically a long tunnel washer that automatically cleans and sanitizes the molds or for the racking it typically looks like a small chamber or the carwash you drive through where the racks are pushed in and cleaned and sanitized. Both of these ACS processes meet the four parameters in cleaning, requires attention to automation detail, must be maintained, validated and you can reference in the FDA's Listeria Guidance Document, Section VII-A-3 for more details on this technology.

5.2. Solids Removal / Brine Cleaning

A constant challenge with brine solutions is keeping them free of unwanted solids and microbial contaminants. Interventions are often used, depending on the size and scale of the brine system, to remove these unwanted solids. At minimum, brine solutions should be skimmed regularly or continuously to not allow the solids to build up. Advanced filtering systems such as Microfiltration (MF) and Ultrafiltration (UF) are very effective at removing the unwanted solids and microbial contaminates.

A. Brine Filtering Methods – Microfiltration (MF) and Ultrafiltration (UF)

- Microfiltration (MF) has proven to be superior technology for sanitation purification of the cheese brine as it's a clean process which removes the microorganisms, dead cells and physical contaminates from the brine and without any significant change to the chemical composition of the brine. This technology allows the cheese proteins to pass through the filters and eliminates > 99.5% of the microorganisms.

- Ultrafiltration (UF) filters down to an even greater level than does MF, but also removes the cheese proteins and other chemicals components that may be beneficial to cheese making.

Either filter system must be correctly sized to allow the total volume of the brine in the system to be completely filtered in a reasonable timeframe. This is necessary to shorten the growth log cycle of the quality microorganism of concern, which is typically yeast.

MF/UF filter systems consist of a series or bank of filter canister containing spiral filter material which are fibrous making them a challenge to clean. They must be cleaned at a frequency necessary to maintain good brine flow through them during production. If not cleaned correctly or regularly they become plugged creating low flow brine efficiency through them not maintaining good quality brine. The frequency of cleaning for a given facility should be based on microbiological and operational data.

Spiral filters due to their sensitive fibrous like paper materials have to be CIP cleaned (refer to Listeria Guidance Document page 43-51 for CIP information) and cleaned at a much lower temperature (< 120°F) with specialized caustic/surfactant enzymatic cleaners. Work closely with your chemical vendor in selecting the right series of cleaning products with their recommended cleaning CIP sequence for cleaning membranes optimize daily run times and overall operational life.

B. Brine Treatment Methods

Facilities may utilize various treatments for food safety and quality purposes, including:

1. Pasteurization
2. Anti-microbial agents / Bio-preservatives
3. Oxidizing agents – Chlorine/Hydrogen Peroxide
4. Other Treatment Methods

Note: If an oxidizing agent is utilized, such as chlorine or hydrogen peroxide, shelf life studies should be conducted on cheese styles and brine times to ensure product quality and functionality are not impacted.

Pasteurization:

Brine may be pasteurized through a unit that is timed and sealed by the appropriate regulatory authority. To determine if your brine should be pasteurized and at what frequency, the facility should conduct a risk assessment and consider all environmental monitoring, in-process, finished product testing relevant to brine quality and safety as well as the ability to create a clean break.

Pasteurization Steps:

The first step in pasteurizing brine is to remove the brine from your various tanks or pits into a clean storage silo or vessel. The storage vessel (s) should have the capacity to accommodate your brine volume. The brine system and/or any racking associated with your system should also be cleaned, reference the **7 Steps of Cleaning listed in the Pathogen Guidance Document.**

1. For the most efficient and effective pasteurization, solids should be clarified from the brine solution with mechanical clarification (if available), fat removed from the solution with mechanical separation (if available), and clarified, separated liquid pasteurized. The cooled, pasteurized brine should be pumped via clean piping or sanitary hoses into a clean intermediate storage tank or directly back into a clean and sanitized brine storage system. Once pasteurized brine is put back into the system, temperature, salinity, and calcium levels should be monitored and adjusted per the facility's SOPs.
2. Maintenance considerations:
    i. Brine HTST systems require a PM program to monitor plate and gasket integrity. It is recommended that plates, plate gaskets, and o-rings be inspected for pitting and integrity on a quarterly basis. Dye checks on plates for pin hole leaks should be conducted at least annually.
    ii. Because of the abrasive nature of brine, it is recommended that other brine storage and handling equipment be included in a PM program with an inspection and service frequency based on wear history.

Anti-Microbial Agents /Bio-Preservatives:

In the US, preservatives such as benzoic acid, sodium benzoate, sorbic acid, potassium sorbate, and calcium and sodium propionate may be added to brine to inhibit the growth of undesirable yeast, mold, or bacteria (Bintsis, 2006). Although each has GRAS status and are safe from a consumer point of view, the FDA has established upper limits for their use presence in the food (21 CFR, Part 133). For example, sorbic acid and potassium sorbate may be used at levels not to exceed 0.2% and 0.3%, respectfully, while benzoic acid and sodium benzoate may be used at levels not to exceed 0.1%. International regulations may differ from those in the US and specific customers may have additional restrictions on the use of "approved" preservatives. Therefore, understanding their requirements is important.

Natamycin may be utilized to control yeasts, molds, and other indicator organisms that are not desirable, thus improving the quality of brine systems. If anti-mycotics are employed, consider a testing regimen of your product to insure regulatory compliance per the appropriate CFR:

https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=172.155.

Oxidizing Agents – Chlorine/Hydrogen Peroxide:

Hydrogen Peroxide is an emerging treatment for controlling pathogens in cheese and/or other brines. Current studies in-process show promise in the efficacy of Listeria monocytogenes in brine. Consult the appropriate code of federal regulations (CFR) for current approvals of this chemical.

Other Treatment Methods:

Ozone injected directly into the brine circulation stream (2ppm max).

Regulatory Compliance Note: The treatment options offered in this document have been used successfully to maintain the quality and food safety. When considering ANY type of brine treatment method always consult the appropriate code of federal regulations (CFR) for the latest, current approvals of the material (s) to be utilized.

https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=178.1005

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