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Automated Process Equipment Corporation

FOOD MANUFACTURER'S GUIDE TO SAFE, EFFICIENT AND ACCURATE SYSTEMS

PROCESSING THE INGREDIENTS FOR YOUR SUCCESS

FOOD MANUFACTURER'S GUIDE TO SAFE, EFFICIENT AND ACCURATE SYSTEMS

Safe food and a safe food processing supply chain is essential for humans, livestock, and pets. The Food Safety and Modernization Act (FSMA) introduced stricter tracking, cleanliness and hazard prevention requirements for food processors, with the goal of reducing the spread of foodborne illnesses and the possibility of adulteration across the supply chain. Many of these regulations start with carefully designed processes and systems. With the right system implemented from the start, expensive losses, recalls and product defects can be prevented, and audits and inspections can be much easier.

In this guide, we'll discuss some of the most prominent points in FSMA as they apply to food processing, including good manufacturing practices (GMP), hazard analysis and critical control points (HACCP), traceability, and recipe consistency. We'll explore errors that food processors have encountered and how these can be prevented with thoughtful system design.

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GOOD MANUFACTURING PRACTICES (GMP) AND SYSTEM DESIGN

Good manufacturing practices (GMP) in food safety applies to a wide range of activities, some of which we will discuss in more detail later in the document. GMP in food safety starts with systems that are designed to complement safe practices, not combat them. This means using equipment that is easy to clean, resists corrosion, prevents injuries, and fits logically with the process from start to finish. When constructing or improving your facilities, consider the following:

System materials: are the machines that you're using made from metals that resist corrosion? Stainless steel is generally a good choice. However, you'll want to consider the ingredients that you're working with (for example, acidic ingredients like citrus juice or very sticky substances like agave sweetener), as well as the cleaning agents you'll need, as some cleaning agents will corrode stainless steel.

Welded joints: If two dissimilar metals are welded together, or the wrong filler metal used, a galvanic reaction occurs, which will cause the metals to corrode prematurely. Corroded points can then harbor bacteria, or introduce metal fragments into the mix. This might occur in machines made from low-quality metals or inexperienced labor.

Welding quality: The wrong welding technique on stainless steel can compromise the oxide layer that keeps it from rusting, or create tiny fractures that will ultimately cause the metal to rust or corrode. Skilled welding work can help to prevent the machine from breaking down prematurely.

CASE STUDY ANALYSIS: METAL FRAGMENTS

Unfortunately, it's not uncommon for metal fragments to find their way into foods. Usually, this is due to faulty or broken manufacturing components or machines. Every major food processor has issued recalls in the past due to metal fragments from food processing and manufacturing systems. After recalling 12 million pounds of chicken, one processor introduced corrective and preventative measures, discontinuing the broken machinery and adding metal detecting machines to ensure it did not happen again.

HAZARD ANALYSIS AND CRITICAL CONTROL POINTS (HACCP)

Hazard Analysis and Critical Control Points help to control potentially dangerous threats and reduce their impact. A good HACCP plan is essentially comprised of two parts: an assessment of what could go wrong in your operation and how to prevent this from happening, as well as how to reduce the effects if something does go wrong. It is important to document your HACCP plan, implement it, and take steps to ensure that it is being followed properly. The following are a few examples of HACCP protocols which are essential to food processing system design.

Temperature alarms: Proper heating and cooling is one of the best ways to kill bacteria. If food is not properly cooked or refrigerated, dangerous bacteria can grow. Temperature alarms will alert plant managers when temperatures in an oven or refrigerator become too low or too high.

Adulteration: For obvious reasons, it should not be easy for any products or ingredients to be accidentally or deliberately contaminated. Hazardous items like pesticides, machine fuel and lubricants, and cleaning solutions should be stored at a safe distance.

Quality control procedures: To make sure you produce a high-quality finished product, you need to start with quality ingredients. Quality control procedures should be in place to ensure that your ingredients are pure from the start.

CASE STUDY ANALYSIS: MELAMINE IN PET FOOD

In 2007, an unknown number of dogs and cats in multiple countries sickened and died after consuming adulterated pet food. Widespread recalls followed, including 14 major suppliers and dozens of brands. An investigation traced the source of the illnesses back to melamine in wheat gluten imported from China. It's unclear how melamine, which is used in manufacturing some plastics, inks, and disinfectants, ended up in the raw ingredients, but the incident emphasizes the importance of preventative and reactive measures working in tandem. Though it would have been difficult for pet food suppliers to test for melamine, which mimics protein and would not have appeared on a test, recall measures stopped the spread of the tainted ingredients when the cause of the illnesses became known.

TRACEABILITY

Increased traceability requirements was one of the most important additions to FSMA. Tracking and tracing allows any product or ingredient to be tracked across the supply chain. This is an important reactive measure if preventative measures fail. Track and trace measures make it possible to recall any products or ingredients that have been adulterated. Without these measures, it is difficult to stop the spread of foodborne illness.

Lot tracing: Proper lot tracing shows what ingredients were used in the finished product, and what lots these ingredients came from. With proper labeling, you can limit any recalls to only the adulterated products or ingredients. Automating this process through the use of RF tags or bar codes allows you to save time and reduce error commonly found in manual inputs.

Accurate ingredient weights: It is not uncommon for ingredient suppliers to overfill bags and containers. While underfilling will upset customers and can result in legal action, overfilling is generally preferred. However, this can upset track and trace operations that depend on weight. Measure ingredient weights yourself to prevent overfilled lots from making their way into the next batch.

FIFO: First-in-first-out systems are relatively simple and prevent ingredients from sitting for long periods and accumulating bacteria. However, storage tanks, hoppers, silos and other vessels must be properly designed. Batches should be stored separately, as they can easily mix if one is poured into a tank after another. Keep in mind that ingredients seldom move through a vessel evenly. A seperator or an opportunity tank can prevent batches from mixing during storage.

Dispose of excess: If you receive more than the expected amount of an ingredient, do not mix it into the next batch unless you plan to label the finished products with both batch numbers. In many cases, it is better to discard the excess. If batches continually mix, there is no reliable way to trace contamination (see case study).

CASE STUDY ANALYSIS: MIXING BATCHES

In 1997, an E. coli outbreak that could have been contained to one bad batch ended up bankrupting Hudson Foods, which did not properly separate batches. Extra meat from one batch continuously made its way into the next during processing, which then made it impossible to isolate the contaminants. 25 million pounds of beef were recalled—the largest recall in U.S. history—and Hudson Foods was unable to recover.

RECIPE CONSISTENCY

Recipe inconsistency and accuracy can result in product losses and increased waste. Proper system and equipment design can help to increase consistency, especially when working with highly concentrated ingredients. This means not only measuring the right ingredients in the right amounts, but also ensuring that the ingredients mix properly.

Batch mixing: The wrong mixer, feeder, or hopper can cause ingredients to mix and dispense unevenly, creating batches with high concentrations of an ingredient, and other batches with low concentrations. For example, if the mixer is not filled to the correct capacity or given enough mixing time, the recipe will be unevenly mixed.

Material segregation: Material segregation problems can occur in many ways, and this will also cause recipe inconsistency. During processing, movement and vibration will cause particles with differences in size and weight to separate. Place the mixer as close to the end of the process as possible to eliminate segregation due to conveyance or other means.

Weighing: Getting the right amount of ingredients is the first step to getting the right mix. Finding the right load cell capacity, accuracy and type for your ingredients will help to ensure accuracy from the start.

CASE STUDY ANALYSIS: SELENIUM

Selenium is a vital nutrient for animals and people in small amounts, but too much can be toxic. Selenium is also commonly shipped in high concentrations to reduce costs. Measuring the wrong amount of highly-concentrated selenium can mean ruining a batch of animal feed or finished products for humans, such as nutritional supplements or nutrition bars. This process will likely require a more finely-tuned scale and load cell compared to other base ingredients.

CLOSING

Designing the right food processing system from the start can prevent the need for costly changes or mistakes later on. There are many factors to consider, and your products, ingredients, and individual processes will determine the safest, most efficient, and most effective design. We work with food processors of all types, working with a wide array of products and ingredients. If you have questions about system design for FSMA regulations, we can help.

Let's get started on your equipment or system design

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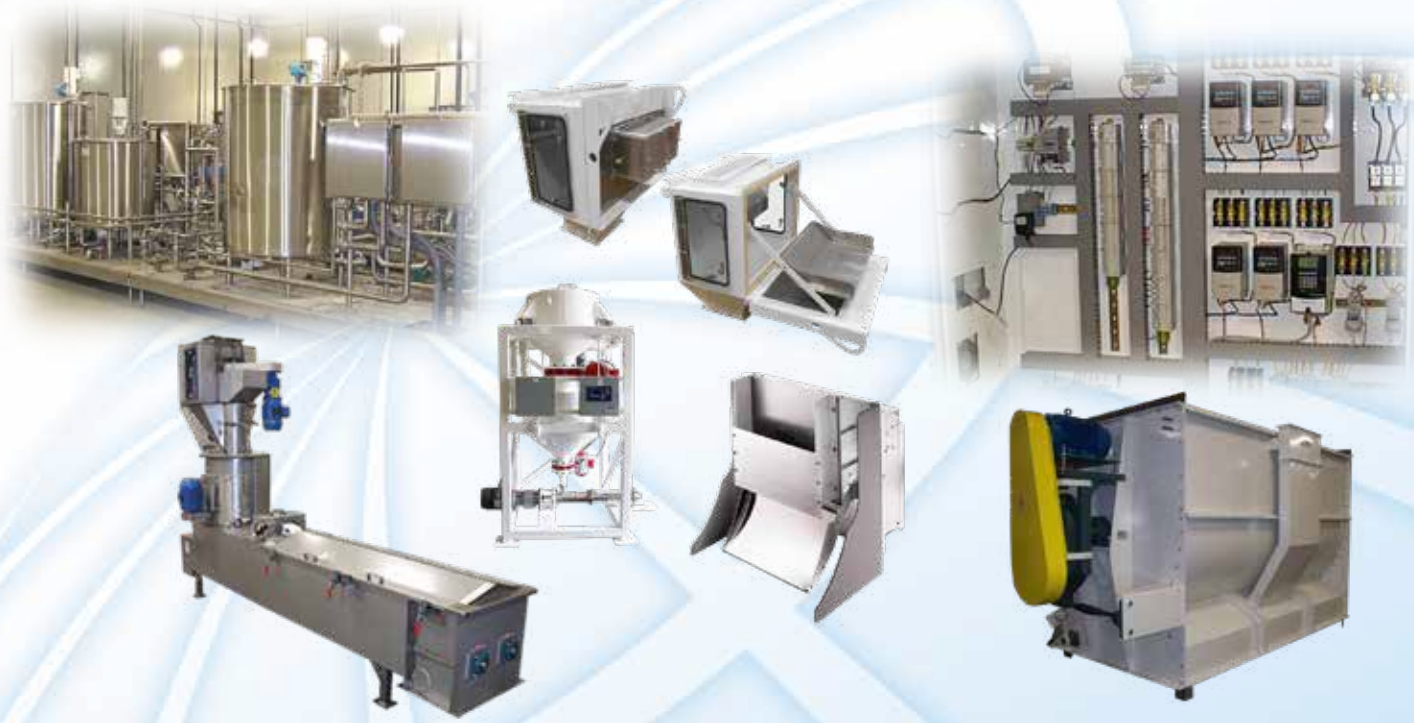

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