

DAIRY PIPELINE

QUALITY, CONSISTENCY, AND INNOVATION: HOW CDR HELPED NASONVILLE DAIRY BECOME AN INDUSTRY LEADER

The Center for Dairy Research is passionate about providing support to the dairy industry. Whether it be through education (Short Courses and trainings), product development or technical troubleshooting, CDR staff are focused on helping the dairy industry produce high quality products.

CDR's work with Nasonville Dairy, a family-owned dairy processing plant located in Marshfield, Wisconsin, highlights some of the ways that CDR staff can assist a dairy processor in achieving success.

Nasonville Dairy has a long history in Wisconsin. Founded in 1885 in Wood County, it has evolved and changed hands over the years. In 1968, Arnold and Rena Mae Heiman arrived at the plant and joined the plant's Co-Op as managers. They brought with them their three sons Ken, Kim and Kelvin and daughter Kathy. In 1985, the Heimans purchased the plant and reinstated its original name – Nasonville Dairy.

Ken Heiman, who now owns the plant with his brothers, became a licensed cheesemaker at age 16 and is also a Wisconsin Master Cheesemaker. In recent years, the plant has continued to evolve and expand.

“When our father brought us here in the late 60s, this plant ran 7,500 pounds of milk a day,” Ken Heiman said. “Today, it runs 1.5 million a day. Things have changed immensely. We’re always looking for the next new market, the next new venture, the next new product that people are looking for.”



Nasonville Dairy has improved the efficiency of its Feta production with CDR's help.

Today, Nasonville Dairy produces about 46 million pounds of cheese a year and makes more than 40 flavors of cheese. A recent expansion has boosted its Feta production with a new brine system and packaging line.

CDR and Nasonville Dairy

CDR and Nasonville Dairy have worked together for so long that Heiman isn't exactly sure how or when it started but he assumes it was because of an issue in the plant. “I’m sure we reached out to CDR for a plant problem or some quality issue,” he says. “I would guess that 90% of the companies began their relationship with CDR over a problem.”

When asked how CDR has helped Nasonville Dairy over the years, Heiman lists off a number of cheese issues like consistency, color and quality (slits/cracks). CDR has also helped Heiman change the way his plant uses its equipment. For example, the company expanded its production of Feta cheese and has specialized equipment for Feta production, but Heiman wanted to know if they could make other cheeses with that same equipment. ➔



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“We have all this equipment for Feta,” he said. “Well, I want to know what else can I do with it? John Jaeggi (CDR Cheese Industry and Applications Coordinator) has worked with us in making fresh Mozzarella on there. We’ve made Cotija and Snow Feta on there. We have an idea and we ask, ‘How can I make this work?’ That’s where CDR has been extraordinarily helpful to us.”

By better utilizing equipment, Nasonville has been able to produce more cheese more consistently and efficiently. Producing consistent, high-quality cheese is essential for success. Heiman said CDR has helped Nasonville Dairy better understand acid development, which has helped produce more consistent cheese, “We have to understand how we get from point A to point B.”



Nasonville Dairy has been making Feta since 1986.

Another example, Nasonville Dairy ran into quality issues in its cheese. “We were getting these very large holes in the cheeses and it would cause all these inconsistencies. We had to figure out where this was coming from,” Heiman said. Eventually, with the help of CDR, it was discovered that there were some fermentation issues with corn silage that was carrying through the cow and negatively impacting the quality of the milk.

CDR also helped Nasonville Dairy develop its new brine system. This was a complicated project with a lot of moving parts. “We had to think about how much moisture are we adding to the product. How much more consistent can we be? How much better product can we produce more consistently for the customer?” Heiman said. “Do we want to UF the brine? What do we know that works? CDR helped us with all of that.”

New Products for Export

In addition to quality and consistency issues, Nasonville Dairy and CDR have worked together to develop new products for export.

“Our new products are all designated for China,” Heiman said. “One of our new products that we worked with CDR on was what we call Snow Feta. That has started out quite well over there.”

Heiman describes Snow Feta as more of a powdered Feta that is sprinkled as a topping on foods like pizzas. “We have been quizzed about other products that we’re making and the idea here is to advance on that,” he said. “We see growth in other parts of the world, like Southeast Asia, these are places that we need to go. We need to continue to evaluate how we’re going to get there.”

In addition, Nasonville Dairy sells Feta, Cheddar and other cheese varieties to China, Japan, Saudi Arabia and other markets. Exports is an area that Heiman is passionate about and he says that more U.S. cheesemakers need to get their products in foreign markets such as Southeast Asia and beyond.

Reverse Engineering Cheese

CDR and Nasonville Dairy have also worked closely together to develop cheeses that have traditionally been imported. “If someone in the U.S. has a cheese they import, we can send that cheese to CDR and get a breakdown of the cheese. CDR will tell us how to manufacture it.” Heiman said.

For instance, Heiman brings up his plant’s Feta production as an example, “Stop and think about how much Feta was coming into this country. Now, people who have Feta in the U.S. will travel to other parts of the world and they’ll go, ‘Nah, it isn’t as good as the Feta at home.’”

There are other examples, such as Queso Blanco. Heiman said there were quality concerns with Queso Blanco that was being imported, “CDR taught a lot of people how to make the product, make it right, and make it safe.”

Going back further in time, Heiman also mentions Blue Cheese. “Stop and think about Roquefort – it was the United States that, when put into a corner, came up with Blue cheese. Now, if you talk about Roquefort people look at you with eyes crossed because no, it’s Blue cheese. Now they’ve turned around and the people all over the world want to use the term Blue cheese.”

A Truly Innovative Cheese

One project that Heiman is especially proud of is “sliceable” Feta Cheese. Nasonville Dairy had a customer that requested a sliceable Feta cheese. At the time, there was a similar cheese available, but it contained additives and the customer wanted an all natural option. Heiman turned to CDR and, over the course of several years, CDR and Nasonville Dairy were able to develop an all natural Feta Cheese that can be sliced. Heiman laughs about the project because in the end, the customer decided they didn’t want the cheese, but Heiman is still proud of the collaborative, innovative work between Nasonville Dairy and CDR. ➔

CURD CLINIC – BUFFERING

Curd Clinic Doctors: Mark Johnson and Dean Sommer, CDR

Question: What could cause the pH of cheese to rise from when we tested it at milling to when an independent lab tested it several days later?

The rising of pH of a cheese soon after it is made is a very common occurrence especially in cheeses where the main starters are thermophiles. The rise in pH is due to the cessation of lactose fermentation and the kicking in of the buffering capacity of the cheese. Buffering that results in an increase in pH is the phenomenon where a weak acid, such as phosphoric acid, is picking up hydrogen ions. pH is a measurement of hydrogen ions bouncing around between water molecules. These hydrogen ions are not associated with anything other than water molecules. If, however, the hydrogen ions become attached to another substance such as phosphoric acid, they are not measured and do not contribute to the pH of the cheese.

To understand how buffering occurs in cheese, let's take a couple steps back in the cheesemaking process. During cheesemaking, lactic acid is formed. It releases hydrogen ions, and the pH decreases (cheesemakers also lower pH by direct acid addition to the vat). However, due to a quirk in the nature of things, some acids such as phosphoric acid can pick up these hydrogen ions especially as the pH decreases. Almost all the buffering capacity initially in cheese is actually bound to the casein as calcium phosphate. Some of the calcium phosphate is dissolved during lactose fermentation but there is much more that is not. Solubilization of calcium phosphate is a relatively slow process once the curd is formed even though there is considerable lactic acid formed and hydrogen ions released. Within a few hours to a few days, some of the remaining calcium phosphate begins to dissolve and this results in the buffering or increase in pH. Calcium phosphate dissolves because hydrogen ions replace the calcium. The hydrogen ions are now attached to the phosphate and calcium is not. The attached hydrogen ions are no longer associated with the water and can't contribute to pH. Consequently, the pH of the cheese increases.

For example, a Cheddar may hit its lowest pH point within 24 hours of being made and then the pH will slowly rise over the next couple of days. Typically, the pH can increase anywhere from a modest 0.05 pH unit (i.e. from 5.05 to 5.10) or a more dramatic 0.3 pH units (i.e. 5.05-5.35). Cheddar cheese typically undergoes a more modest rise, say 0.05-0.15 pH units. But with sweeter (less acidic) cheeses like Colby, Monterrey Jack, or Mozzarella there can be much more dramatic pH rises (or buffering), up to and even over 0.3 pH units. ➔

Heiman believes this project is also indicative of the increasingly important role of dairy as American consumers look for new flavor profiles and healthy food options. "This is where dairy comes in and CDR can help develop those products that will be usable by a restaurant, portion controlled and be good for you as well. That's where CDR absolutely shines."

Holding Up the Integrity of Dairy

"One thing that CDR has always done is that CDR has always protected the integrity of milk and the integrity of cheese. They don't try to cheat on it," Heiman said.

For example, as Heiman works with export markets across the globe, he said that they are



Kim, Kelvin and Ken Heiman

seeing some poor quality products produced in those foreign countries. These include cheeses where the milkfat is removed and replaced with vegetable oils. As Heiman said, "You get away with it, but the product is not real good."

Looking ahead, Heiman plans on continuing the collaboration with CDR as Nasonville Dairy is always trying to develop the next new product or interesting flavor profile.

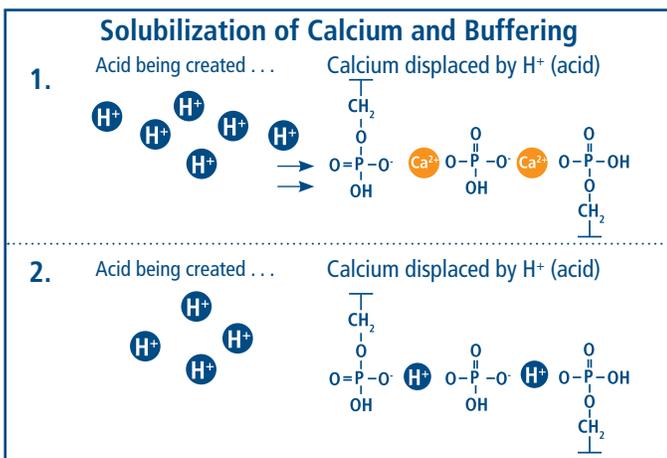
One exciting project that Heiman believes has a lot of potential is the ultrafiltration (UF) of milk. Nasonville Dairy has a new, large scale bottling line. They are working with CDR on using UF to develop and produce different lactose-free milks and beverages. In addition to reducing the natural sugars in milk, UF can help concentrate proteins and increase calcium content. The development of dairy beverages is an area with a lot of growth potential.

There are a lot of exciting projects and products being developed at Nasonville but Heiman said he misses working directly with CDR staff like Dean Sommer and John Jaeggi. Because of travel restrictions, CDR staff have been mostly working remotely or from the University of Wisconsin-Madison campus.

"What we miss tremendously in our industry right now is John and Dean running up and down the road," Heiman said. "They're welcome in every plant in the state of Wisconsin. 🌻"

The ability of a cheese to buffer or the buffering capacity of a cheese depends on the amount of calcium phosphate that is present in the cheese. The more calcium phosphate that is in the cheese, the more buffering capacity it has.

The amount of calcium phosphate in cheese is directly related to the pH at which the milk is clotted and the pH at drain. The lower the pH at these points, the less calcium phosphate remains in the curd leading to less buffering in the cheese. So, when there is a drop in pH there is also a loss of calcium in the cheese. This demineralization of casein by removal of calcium is important for cheesemaking. Calcium phosphate serves as a crosslinking agent between caseins. Without this action (the binding together of caseins) it wouldn't be possible to make cheese. However, if there is too little acid development early in the cheesemaking process, too much calcium will remain bound to the proteins. This will produce cheese that doesn't stretch appropriately, or the curds won't knit together properly. Conversely, if too much calcium (pH drops too much) is lost there can be several negative consequences to the cheese like a soft or pasty, gummy body. Or the cheese body can become very short and brittle and will have splits if gas is formed. The cheese also may not stretch appropriately.



In addition, the effect of buffering on the pH of cheese also depends on how the cheese was made. For instance, in Low Moisture Part Skim Mozzarella, or washed curd cheeses, you'll see limited or even no acid developing after the cooking stretching step, or after the curd is hooped. The decrease in pH is a race between the amount of acid developed and the rate at which the buffer can pick up the hydrogen ions. In Mozzarella cheese, the race is won by a fast rate of acid development but is lost when no more acid is developed i.e. the cheese is cooled and the thermophilic cultures can't ferment lactose anymore and not produce more lactic acid. Consequently, the pH may decrease rapidly during cheesemaking only to increase later after brining and cooling when the calcium

phosphate buffering effect eventually kicks in and picks up hydrogen ions. Then we see a pH increase.

In Cheddar Cheese, where there is a considerable amount of acid formed during pressing and even during the first few days of storage, the amount of hydrogen ions released exceeds the amount that can be picked up by the calcium phosphate. Thus, the pH may decrease after hooping and block formation of the cheese. If the fermentation is slowed or stopped due to application of salt or cooling of the curd buffering will kick in and the pH will increase. If the fermentation continues buffering activity may be overwhelmed and the pH will decrease or at least not increase. If the fermentation stops because there is no more sugar to ferment the pH will increase when buffering kicks in. All cheeses have the built in buffering capacity but buffering may not be seen if there is continued lactose fermentation and will be seen if the fermentation has been stopped.

As cheeses age, there will be a tendency for the pH to increase slightly, depending on the amount of acid formed initially and the amount of calcium phosphate that is undissolved by the time fermentation has stopped. A large increase in pH during aging is due to several potential factors including microbial metabolism of lactic acid, release of ammonia by molds and in some cases release of ammonia as the result of amino acid metabolism by particular bacteria. The latter is currently being explored in detail as carbon dioxide is also formed and can lead to splits in cheese and loose packages in addition to the formation of unclean flavors in cheese. 🌟

Sources:

Johnson, M. 2002. *Cheese pH-What's Behind the rise and fall? Dairy Pipeline. Volume 14, Number 4. December 2002.*

Johnson, M. 2019. *Back to the Basics: The Role of pH in Cheesemaking Dairy Pipeline. Volume 31, Number 4. Spring 2019.*

CDR RESEARCH IS HELPING ADDRESS THE INCREASED PREVALENCE OF FOOD ALLERGIES

Recent and current research projects at the Center for Dairy Research are developing ways to help address the increasing rise in food allergies and asthma in children. Food allergies are potentially life threatening and affect more than 12-15 million Americans and 3-6 million children. In addition, the number of food allergies identified in Americans increased by 50% between 1997-2011. About 2% of children under 4 years old have cow's milk (milk protein) allergy. ➔

“Incidents of food allergies are steadily increasing and becoming a major problem,” said CDR Director John Lucey. “We want to be part of the solution and help figure this out.”

Modifying Whey Proteins

Lucey collaborated with Dr. Jim Gern, Principal Investigator for the University of Wisconsin Asthma and Allergic Diseases Clinical Research Center, to develop a method of modifying whey proteins to reduce their allergenicity.

To achieve this, CDR researchers tried a couple of different methods. First, they tried conjugating (attaching) the whey proteins with a sugar (polysaccharide). “This changes proteins in interesting ways,” Lucey said. “It makes it more soluble and more heat stable. We’re basically enhancing the functionality of whey proteins.”

Dr. Gern’s lab supplied CDR with blood samples of children with milk allergies. The conjugated whey proteins were tested against the blood samples to see if the modified whey proteins were less allergenic. The tests showed that this method reduced the allergic reaction about 20-30%. “We thought that was good, but wanted to try and reduce it further,” Lucey said.

To try to further reduce the allergenicity of the whey proteins, CDR hydrolyzed, or broke down, the whey proteins before conjugating them with a polysaccharide. Protein hydrolysis is one method used when making infant formula for infants with milk sensitivities. By combining these two strategies – protein hydrolysis and conjugation – CDR was able to create whey proteins with a much reduced allergenicity. “We got a large reduction in the IgE response when combining these two methods,” Lucey said.

The Wisconsin Alumni and Research Foundation (WARF) recognized Lucey and Dr. Gern for their work by awarding a patent for the technology. “This is a brand new technology,” Lucey said. “It’s very exciting and could help create new opportunities for dairy.”

Analyzing Cow’s Milk and Breast Milk

Numerous studies have found that children raised on farms are less likely to develop allergies and asthma. An ongoing study by the University of Wisconsin School of Medicine and Public Health is following children and families in the Marshfield, Wisconsin area. The study is researching children raised in an Amish community,

children growing up on farms and children growing up in urban or suburban settings. The study has found reduced allergies in farm children, and almost no incidents of allergies or asthma in Amish children. The question is why do children raised in a traditional farm setting have a greatly reduced chance of developing allergies or asthma?

One suggestion is that children on farms come into contact with a lot of bacteria, molds, etc. and their immune systems are essentially challenged and “learn” to distinguish various threats. It is also known that early exposure is important in reducing allergies and asthma

later in life. Children who are exposed to microbial diversity before age two are more protected against developing food allergies (see figure). Still, it isn’t known what specifically is helping build up the immune system. Could it be something in the milk or the environment?

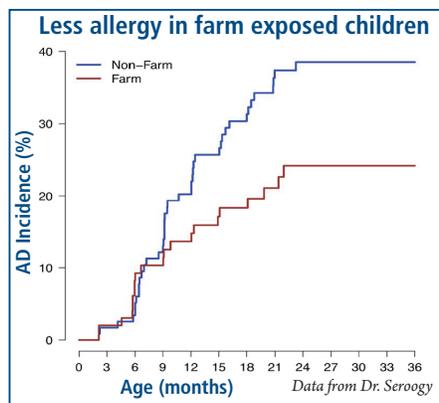
To help shed some light on this area, CDR is collaborating with Dr. Anne Marie Singh, Director of the Food Allergy Research and Education Clinical Research, Center of Distinction at the University of Wisconsin-Madison

School of Medicine and Public Health. Dr. Singh is part of a study that is trying to find why some populations of children are less susceptible to food allergies. As part of this study, Dr. Singh is collecting cow’s milk and human breast milk samples from different populations. Dr. Singh has turned to CDR to help analyze these samples to try and identify components within the milk samples that are potentially protective. Lucey and Dr. Singh received a Hatch Grant through CALS at University of Wisconsin-Madison that will provide four years of funding for the project.

“We’re trying to figure out if there is something different in these milk samples – either the breast milk or the cow’s milk – that we could point to and say it’s this that could be potentially protecting against allergies,” Lucey said.

CDR is analyzing the milk samples and examining the different proteins and components of the milks. For the human breast milk samples, CDR is particularly interested in the human milk oligosaccharides. Lucey said these human milk oligosaccharides are very complex sugars that are like a “universe all of their own.” One interesting aspect of these sugars is that they are not digested by the baby. Instead they appear to help promote the growth of probiotic bacteria in the baby’s gut. The question is do these human milk oligosaccharides change based on the microbial diversity that the mother is exposed to?

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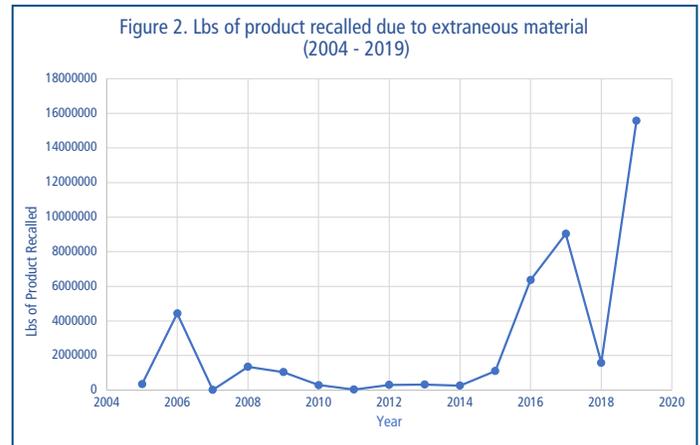
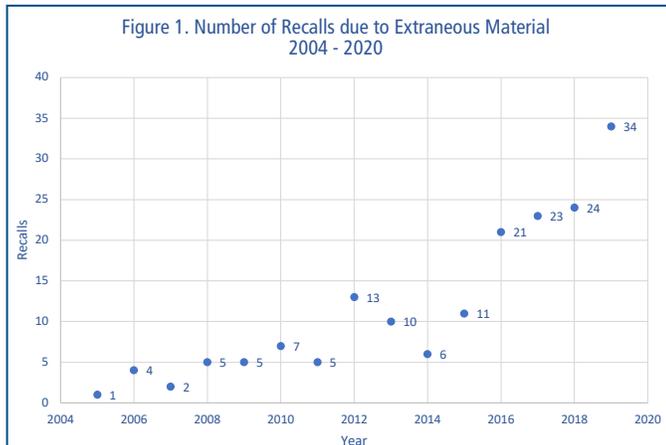


FOREIGN MATERIAL PREVENTION

Technical Contributor: Alex O'Brien, CDR

Foreign material comes in many shapes and forms, whether it be gasket material, a piece of plastic broken from a gauge, sampling utensil, or metal shards from a piece of equipment that has broken down. All these items, as we know, fall under the physical hazard category. The U.S. Food and Drug Administration (FDA) guidance on “hard and sharp objects” defines that foreign material becomes a food safety concern in the range of 7-25 mm. This guidance also discusses the hazards of items less than 7 mm being a potential danger for infants.

Over the past 5 years, the industry has been moving toward rejecting material that is less than 7 mm, even if it is compliant with the FDA minimum. The amount of recalls due to extraneous material has been trending up over the past 15 years (Figure 1 and Figure 2).



This has prompted suppliers and manufacturers to take a long and hard look on how to prevent foreign material from appearing in product to avoid a voluntary recall or a serious customer complaint that leads to loss of business.

There are several factors and ways to improve your foreign material program and awareness to avoid costly finds of foreign material.

The 3 categorical pillars that hold up the foreign material prevention program are:

- P: People | P: Programs**
- D: Detecting and Separating Equipment**

P: People

People are the foundation to having any successful operation and are key to ensuring your customers do not receive product with foreign material. A company can implement the best programs and have state of the art equipment, but these will fail if the individuals you employ do not enforce them.

An anti-foreign material culture starts from the top. If employees bring concerns of foreign material to the attention of a supervisor, manager, CEO or owner, and this concern appears to be downplayed by management, this will discourage future reporting of issues of foreign

material. Treat every report of foreign material as serious; let the employee know that you will investigate the cause, and thank the employee for being vigilant. If you deem their concern as low risk, explain your thought process to the employee and thank them for their effort. Secondly, if part of your company’s core mottos isn’t already stated in a short memorable quip on remembering food safety, quality and foreign material, it may a good thing to implement. One quip that is used and that has been successful is, “If you see something, say something.”

Prioritize foreign material in your employee training and lay out the consequences for not complying with procedures. Include pictures of what your expectations are regarding: what your tools and equipment should look like and examples of when to report a problem. Do not be afraid to hold individuals accountable for not following foreign material processes. It is imperative that employees running preventive controls are properly trained and that anyone not capable of the responsibility is relieved of those duties.

If there is not already a good reporting culture in your company, you can develop an incentive program. For instance, you can reward individuals who reports the most foreign material near misses over a certain time span. For this type of program to work, you must know ➔

the demographic of your workforce and what will motivate employees. Also, encourage employees to suggest ideas on how to make a process more foreign material free or ask them to identify items along a production line that could potentially fall into or contaminate the product stream.

For items that are reported, create a way to track the amount, production line, employees who reported it and type of material found. Some organizations call this a “near miss” or “near hit” and create a log of all the relevant information. Although this terminology has mostly been used in a safety context, it can be used to apply to foreign material. If an employee points out a piece of equipment that was about to be damaged and become a foreign material concern or notices something in a raw ingredient, this can all be documented and used for data analysis.

Lastly, supervisor and managers should be consistently walking the floor, asking questions and investigating if there are any new potential sources of foreign material contamination. Have a management team member be the point person to lead foreign material mitigation strategies. Once a month, post what your employees have found and prevented from getting to your customers. Try to assign a dollar value for cost savings. Report the near misses/hits, customer complaints and pictures of items found. This will help improve foreign material communication throughout the plant.

P: Program – Pre-Operational Inspections Program

The modern food industry has certainly moved toward more documentation over the last few years, partially due to the Food Safety and Modernization Act. However, while adding yet another checklist seems to be futile, with foreign material prevention, you must create a comprehensive pre-operational checklist.

Before creating a foreign material pre-operational checklist, the management team must complete a foreign material assessment. There are three main categories that must be considered when completing this assessment:

- 1.** Evaluate customer foreign material complaint trends. Determine your plant’s biggest concern. Are you seeing a large amount of metal reported? Are they all the same type of metal? Are they coming from the same line? Are they coming from the same product? Do finished products that have foreign material share a common raw ingredient?
- 2.** Evaluate the process. Gather a cross-functional team and walk through your process. Search for potential sources of foreign material and analyze the probability of occurrence.

- 3.** Evaluate behaviors. Are there habits, tendencies, or processes that employees or management have that would lead to higher foreign material risk? Also question your operators to find out what items they believe are the highest risks.

Once you have completed these items, evaluate the data. If there are possible adjustments to daily processes or how equipment is engineered, tackle the changes that give you the most reward. This includes tools or utensils located in production that easily could fall into product.

After these steps, you are ready to develop your foreign material pre-operational inspections checklist.

For the tools that are necessary to the process but have a high risk of entering the product stream, check them on a daily/per shift basis. For instance, you can create an intentional time before each shift for employees to check that all high-risk items are accounted for. This will help avoid having your customer find the problem before you do.

P: Program – Preventive Maintenance Program

Preventive maintenance, when done correctly, will save downtime in any operation. It is also imperative in foreign material control. Evaluate the items that are in your near miss log, foreign material assessment, and items reported on the pre-operational inspections.

Are you receiving complaints with gasket pieces, cheese cloth, etc.? Replacing or repairing these items before they break and cause customer complaints is the objective of the preventive maintenance program for foreign material prevention.

When purchasing replacement gaskets, check to see if there are any color variants. If you replace certain gaskets on a quarterly basis, a color-coding scheme may help in your investigation process as well as provide a visual prompt for your maintenance/production crews and alert them that they need to change the gasket. Other considerations for gaskets, if cost effective, would be to purchase metal detectable gaskets. In addition to gaskets, plastic utensils such as shovels, forks and hoes (used in cheese vats), cheese forms, and buckets should all be inspected regularly and either taken out of service or repaired. Having an intentional check interval paired with empowering your employees to remove any items in circulation they deem as a foreign material risk is a winning combination.

P: Program – Approved Supplier Program

Utilize your critical approved supplier program, not only to maintain food safety and quality, but as an ➔

important means to control potential foreign material. When evaluating your suppliers, make sure they have documented foreign material controls in place, such as sieves, x-ray detection, metal detection, or magnets. Buyers can mandate foreign material control measures for their suppliers and these requirements should be written in the specifications of the particular product you purchase.

P: Program – Pallet Management Program

In most plants, pallets are the only potential source of wood foreign material. You should have in place pallet specifications, storage standards and an inspection program. When pallets arrive at your facility, they should be checked for cleanliness and structural integrity. Check for boards that might have loose nails, which can be a biological contaminant as well as a foreign material contamination if it punctures your packaging.

P: Program – Good Manufacturing Practices

Good Manufacturing Practices are foundational in any Food Safety Program but are also essential to foreign material reduction. Jewelry control and making sure your employees abide by the jewelry policy is one of the biggest concerns when thinking about GMP policies. Uniforms must be clean before work and torn clothing is prohibited. Uniforms should not have pockets above the waist, should be made of materials that will not fray or shed, nor have buttons. Hair restraints worn in the plant must be distributed by the plant and not brought in from the outside. Hair nets must cover all hair on the head, including the ears, and any facial hair must be covered by a beard net. You might want to consider having arm coverings or uniform vacuums at the entrance of the plant to remove any loose hair or other foreign material. When wearing gloves, change them frequently and immediately report when there missing pieces. Ear plugs should be harnessed together and verified by lot that they are metal detectable.

P: Program – Glass, Brittle Plastic, and Ceramics Program

A good glass, brittle plastic and ceramics program is crucial to controlling potential foreign material risks. Eliminating any unnecessary glass and plastic reduces the risk of these materials shattering or breaking and finding its way into product. Having a current comprehensive glass and brittle plastic register with a manageable and reasonable check frequency will ensure a lower risk of seeing foreign material complaints. You can



Foreign material in Cheddar cheese.

make verification of the register easier to check by creating maps of where these items are, as well as pictures of what the items look like.

P: Program – Sanitation Program

A good sanitation program is effective at removing foreign material contaminants after equipment maintenance. Implementing a triple wash after invasive maintenance with a lot of grinding as well as messy routine maintenance will greatly reduce the risk of foreign material contamination. Recording these actions to ensure they happen is equally integral.

D: Detecting and Separation Equipment – Separating Equipment

Screen and filters are a good way to mitigate foreign material in the fluid milk stages of the process. However, once there are too many solids, filters and screens will be more of a hindrance than advantageous.

Magnets can be a useful tool help remove metallic material from a product stream. There are two main types: Ferrous and Rare earth magnets, with rare earth being the superior option of the two. There are several different applications of magnets such as tube, liquid line, pneumatic, chute, drum, or plate magnets. These magnets can be validated by a pull test or a gauss meter.

Pros | Magnets will actively remove foreign material from the product stream.

Pros | Magnets will also remove small ferrous and non-ferrous materials that may be below the level of detection of a metal detector or X-ray machine (example fine metal dust or abraded stainless steel).

Pros | Magnets can last a very long time if handled carefully (dropping magnets will cause their shelf life to be reduced).

Cons | Magnets do not have alarms to notify you when items are collected.

Cons | Magnets are not useful for detecting material embedded deep within a solid product.

Cons | There are also some safety issues to consider with using magnets. Proper engineering for the magnet holder and proper ways to inspect, handle, and clean the instrument is very important. Magnets if carried improperly will be attracted to any metal close to it and may lead to appendages being caught between metal and magnet.

D: Detecting and Separation Equipment – Detecting Equipment

Detecting equipment can be a very helpful tool in the fight to prevent foreign material from leaving the plant in your product. Properly trained personnel and maintaining proper settings for all equipment is imperative for success. In addition, detection equipment like metal detectors and x-ray detection equipment should be calibrated or validated by a 3rd party at minimum once per year. ➔

Metal detectors are a good tool for detecting many types of metal including ferrous, non-ferrous and stainless steel. Once the metal detector is programmed and calibrated to find what it needs to, it works well. Metal detectors have either a reject mechanism or a conveyor that stops upon alarm. There are some pros and cons to metal detection.

Pros | Metal Detectors are capable of detecting ferrous, non-ferrous, and stainless-steel objects in dairy products. All metal alloys are either magnetic, conductive, or both. Metal detectors work on these parameters, allowing them to detect metal with great accuracy, even lighter metals such as aluminum (lower in density) which are more difficult to detect using x-ray.

Pros | Metal detectors work well with bulk conveyed and gravity flow products. Metal detectors trigger based on interference with their electromagnetic field. The density and consistency of the shape of the product does not impact the ability of a metal detector to work as much as it would impact an x-ray machine.

Cons | Metal detectors can be influenced by iron, salt and moisture content of the product it is detecting. This can cause false positives.

Cons | Metal detectors are limited to detecting metal and are not designed to detect rubber, plastic, or glass.

Cons | Metal detectors can also miss objects based on how those objects are oriented. For example, if there is a .25 mm diameter wire, but it is 3 inches in length, a metal detector will only be able to detect this item if it goes through a certain way. Since the metal detector triggers based on interference with its electromagnetic field, the product will only be caught if it triggers the interference. So, if the orientation of the material is just right, it can slip past the metal detector.

X-ray detection equipment works by sending x-rays through the product and creating an image. What the x-ray detection equipment is trying to evaluate are changes in product density. It looks at the density of the package, learns the density and then rejects items that exhibit drastic changes. The larger the size of product, the larger the x-ray generator that is necessary. This in turn will mean more additional shrouding is needed to protect from X-ray leakage.

When verifying the X-ray detector is working, standard cards are available for checking objects such as quartz, rubber, ceramic, and other items. There are some pros and cons with using X-ray detection equipment.

Pro | X-ray equipment can be made to detect all types of foreign material including, glass, plastic, rock, and other high-density materials, especially items of non-magnetic or non-conductive nature.

Cons | Contaminants such as paper, hair or other less dense materials will not trigger the unit. No technology on the market is capable of this task.

Cons | The temperature and size of the product can cause false positives.

Cons | Products with high densities and random textures may be difficult for the x-ray machine to effectively detect.

Cons | It is an expensive technology. For instance, a metal detector capable of detecting foreign materials in 1lb blocks of cheese would cost approximately \$10,000 dollars, whereas an x-ray detector could cost approximately \$100,000.

Cons | There are also safety concerns. This piece of equipment can emit radiation. It requires more regulations to operate and service the machines, which means more safety devices to service on a regular basis.

Finding the Origin is Key

It may be very difficult to pinpoint an exact origin of foreign material when you have multiple potential sources of metal contamination. If you have a customer complaint that gives you metal shavings, with nothing wholly intact, one viable option is metallurgy testing. Submitting samples of metal from various equipment around your plant and comparing them to the material found from a customer for metallurgy testing will help confirm where the source of your problems may be coming. It can also confirm where they aren't coming from!

Other Things to Consider

There may be other tools you can try out or purchase. For instance, there are metal detectable pens, gaskets, and other items. Work with suppliers to get samples to test out the product and see if it is detectable on your equipment.

Overall, foreign material prevention is pivotal in maintaining food safety and reducing customer complaints. There are several different factors that lead to a successful foreign material program including people, programs, and detecting equipment. Company culture and employee participation are the foundation to successful foreign material prevention measures.

It is also essential to analyze the greatest risks of foreign material contamination and then implement sustainable pre-operational inspections programs as well as performing preventive maintenance on equipment before it becomes a problem. Removal and detecting equipment like filters, magnets, metal detectors, and x-ray detection equipment can also help reduce the risk of foreign material. A successful foreign material control program can prevent recalls and maintain customer relationships. 🌟

Sources:

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United State Department of Agriculture, Food and Safety Inspection Service. Summary of Recall Cases in Calendar Year 2015. www.fsis.usda.gov/wps/portal/fgis/topics/recalls-and-public-health-alerts/recall-summaries/recall-summaries-2015

CHEESE EXPO

GLOBAL ONLINE

April 6-8, 2021

North America's largest Cheese, Butter and Whey Processing Expo hosted by WCMA and CDR is moving online as CheeseExpo Global Online, April 6-8, 2021. You'll find the same dynamic resources — industry innovation, world-class technical and marketing seminars, and key connections between suppliers and dairy processors — remain at the core of CheeseExpo GO. There will be three days of valuable programming, networking, and online exhibits including live Idea Showcases.

Be sure to attend the CDR technical seminars that are focused on those topics you said are important to you! We've also included times for you to meet with our Experts on Call. Read on to learn more about what's been developed for you, and then be sure to register today. For more information, including registration, visit <https://cheeseexpogo.org>

2021 CDR CheeseExpo GO Technical Sessions

Tuesday, April 6

CDR Experts on Call: Private Consultations with CDR Staff (by appointment) | 10:00 – Noon

CDR staff invite attendees to sign up for private online meetings. CDR teams will be ready to discuss dairy production, safety issues, product yield, quality defects, brining, and curing, just to name a few. It's your chance for one-on-one time to discuss challenges important to you.

Optimizing Cheese Yield at the Vat and with the Right Formula | 1:30 – 2:15

Where Efficiency Meets Excellence: Maintaining Quality in Modern Manufacture

Moderator: Dean Sommer, Cheese & Food Technologist, CDR

- Maximizing Cheese Yield Efficiency at the Vat
John Jaeggi, Cheese Industry & Applications Coord., CDR
- Developing your Formula to Optimize Cheese Yield
Mark Johnson, PhD, Distinguished Scientist, CDR

Wednesday, April 7

CDR Experts on Call: Private Consultations with CDR Staff (by appointment) | 10:00 – Noon

CDR staff invite attendees to sign up for private online meetings. CDR teams will be ready to discuss dairy production, safety issues, product yield, quality defects, brining, and curing, just to name a few. It's your chance for one-on-one time to discuss challenges important to you. ➔

Practical Applications of Process Data in Dairy Plants, Moderator: Dean Sommer, Cheese & Food Technologist, CDR | 1:30 – 2:15

- Steve Ejnik, Relco
- Larry Harris, Meister Cheese
- Joe Gardner, Wondware.

Artisan Focus: Cave – Aged Cheeses | 1:30 – 2:15

- Surface Microflora in Cave-Aged Cheeses, Ben Wolfe, Associate Professor, Biology, Tufts University
- A Look at CDR's New Affinage Capabilities
Andy Johnson, Assistant Coordinator, Cheese & Industry Applications, CDR.

Thursday, April 8

CDR Experts on Call: Private Consultations with CDR Staff (by appointment) | 10:00 – Noon

CDR staff invite attendees to sign up for private online meetings. CDR teams will be ready to discuss dairy production, safety issues, product yield, quality defects, brining, and curing, just to name a few. It's your chance for one-on-one time to discuss challenges important to you.

Microbes that Negatively Impact Cheese Quality and Advances in their Identification | 1:30 – 2:15

Moderator: Dean Sommer, Cheese & Food Technologist, CDR

- Identifying New Sources of Gas Formation in Cheese,
Rodrigo Ibanez, Scientist, CDR 🌟

CDR RECOGNIZES BURREINGTON FOR HER DISTINGUISHED CAREER

K.J. Burrington, CDR's long-time Dairy Ingredients, Beverages & Cultured Products Coordinator, has retired from CDR. She has joined the American Dairy Products Institute (ADPI) staff as director – training, education and technical development.

“K.J. started at CDR 23 years ago and, in that time, has made a significant contribution to the industry,” said CDR Director John Lucey. “She has worked with many companies and personnel from around the globe and made many friends along the way. K.J.'s list of achievements is lengthy and includes developing the CDR dairy ingredient applications program from its beginning, formulating many new products and supporting export growth.”



K.J. Burrington

At CDR, Burrington provided technical support for U.S. dairy processors and end users on dairy ingredient functionality and applications, yogurt, and beverages. She also provided technical support for food companies internationally through visits and seminars provided by ➔

the U.S. Dairy Export Council to Mexico, Latin America, China, South Korea, Japan, Vietnam, and Southeast Asia.

Among other accomplishments, Burrington established the dairy ingredient applications program at CDR in 1997. The program has had many successes and milestones.

CDR Dairy Ingredient Applications Program Milestones

The Whey Applications Program was established at CDR in 1997. It was the first such program at a University and is the longest active Dairy Ingredients program in the U.S. at a University.

In 2005, the program was expanded to include all dairy ingredients (milk powders, MPC, MPI, buttermilk powders, and fluid ingredients) and the name was changed to the Dairy Ingredient Applications Program to reflect its support across all dairy ingredients made in the U.S.

In 2011, the Beverages and Cultured Products Program was launched.

The Dairy Ingredient Applications Program started several short courses including, in 2017, the Dairy Protein Beverage Applications Short Course, which was the first of its kind in the U.S.

In 2008, Burrington started working with USDEC on “in country” trainings for food and beverage companies. Countries visited: Mexico, Guatemala, Honduras, Panama, Costa Rica, China, South Korea, Japan, Singapore, Thailand, Philippines, Indonesia, and Vietnam.

Burrington was instrumental in helping to get permeate approval for food use in China in May 2020. She did several trainings in China and the U.S. for Chinese regulatory, academic, and government organizations over a five-year period.

Other accomplishments include numerous research proposals funding by Dairy Management, Inc. and many successful product development, functionality and/or applications projects with companies and start-ups located in Wisconsin and across the U.S.

CDR congratulates K.J. on her new role at ADPI and recognizes the many impressive accomplishments during her career at CDR and their positive impact on the dairy industry. 🌟

Food Allergies article, continued from page 5

CDR is about to start taking a deep dive into analyzing these milk samples. Lucey said it was an accomplishment simply to develop the complex analytical tests that identify the different types of human milk oligosaccharides and he credits Emily Caruso, CDR Research Specialist, with developing those tests.

Ultimately Lucey and Dr. Singh hope to understand if there something protective in cow’s milk or breastmilk that could help reduce the incidence of allergenicity. This would be a momentous finding for the dairy industry. Lucey said perhaps the component could be fortified into infant formulas to help reduce allergies in children. 🌟

DBIA UPDATES: BALDWIN, CONGRESS ALLOCATE \$22 MILLION FOR DAIRY BUSINESS INNOVATION INITIATIVES

The Dairy Business Innovation Alliance (DBIA), a partnership between the Center for Dairy Research (CDR) and Wisconsin Cheese Makers Association (WCMA), was pleased to learn that U.S. Senator Tammy Baldwin (D-Wisconsin) helped pass a spending package in Congress that allocates \$22 million in funding for the Dairy Business Innovation Initiatives in 2021.



DBIA is one of three centers that are funded by the Dairy Business Innovation Initiatives. DBIA will be submitting a proposal in 2021 to secure additional funding as a result of this latest budget allocation.

“In these challenging times, we must continue to focus on innovation and assist the growth of artisan dairy products, as they will add-value that can be returned back to our dairy farmers,” said John Lucey, CDR Director.

The Dairy Business Innovation Alliance supports dairy farmers and processors interested in developing value-added dairy products, farm diversification projects, and/or developing an export program. DBIA provides grants to dairy farmers and processors in Illinois, Iowa, Minnesota, South Dakota and Wisconsin, and offers free workshops (webinars) and resources to help grow the dairy industry.

“This is great news for the dairy industry in the region,” said Tom Guerin, CDR Research Program Manager. “The initiative provides a much-needed boost for dairy businesses and farmers seeking to add value to their milk. Working with our collaborators across the 5 states as well as the other centers in Tennessee and Vermont, we are able to share experiences, ideas and learnings for everyone’s benefit.”

Webinar Series Wraps Up

DBIA staff recently finished its “Let’s Get Started” webinar series. The series of eight webinars covered a variety of topics such as setting up a business, developing a marketing plan, understanding regulatory issues, assisting with economic development financing, and other topics. The recorded webinars can be viewed on the DBIA website: www.cdr.wisc.edu/dbia-webinars.

Grant Program to Open Soon

DBIA will begin accepting applications for the second round of its grant program in the spring. For the latest updates, visit: www.cdr.wisc.edu/grant-program. 🌟

Center for Dairy Research

University of Wisconsin-Madison
1605 Linden Drive
Madison, Wisconsin 53706-1565

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UPCOMING ONLINE CDR SHORT COURSES

The Center for Dairy Research is here to help you with dairy product training for your employees. With today's changing environment, investment in employee training is as important as ever.

Below is a listing of upcoming CDR short courses. Please note that some dates may change. For the latest information or to register visit www.cdr.wisc.edu/short-courses

Cheesemaking 101

- February 16-17 (Course will be live. Registration closes February 8.)
- March 2 (Course will be available on demand. Registration closes February 19.)
- March 30 (Course will be available on demand. Registration closes March 19.)

Certificate in Dairy Processing

- Begins March 17 (This is a blended online course. There will be live sessions and on-demand sessions.)

Process Cheese

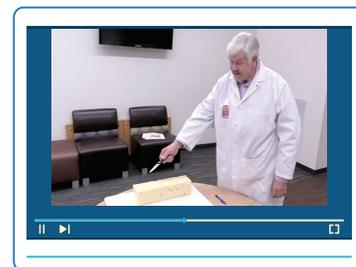
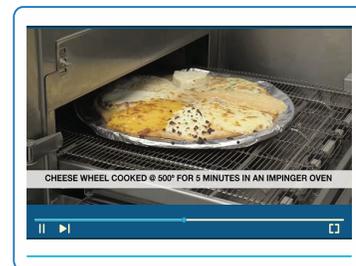
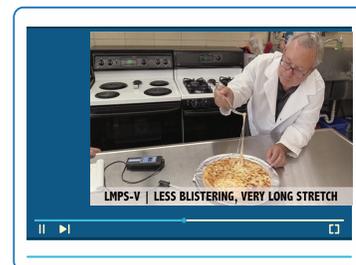
- February 23 (Course will be available on-demand. Registration closes February 11.)
- March 9 (Course will be available on-demand. Registration closes February 26.)
- March 23 (Course will be available on-demand. Registration closes March 12.)

Advanced Cheese Technology

- May 10-14 (This course will take place live online.)

Food Safety

- May 5-6 (This course will take place live online.)



DAIRY PIPELINE

Center for Dairy Research
1605 Linden Drive
Madison, WI 53706
www.cdr.wisc.edu

☎ 608-262-5970 📠 fax 608-262-1578

Editor: *Shelby Anderson* | sanderson@cdr.wisc.edu | 608-692-7125
We welcome your questions and comments.

Technical Reviewers: *Mark Johnson, John Lucey, Alex O'Brien, Dean Sommer, and Tom Szalkucki*

Newsletter Design: *Tim Hogensen*

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