Master of Public Health

Integrative Learning Experience Report

UNDERSTANDING AND APPLYING FOOD SAFETY PROCEDURES IN RURAL CHEESE AND WHEY PRODUCTION

by

Olivia Shruck

MPH Candidate

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Graduate Committee:
Dr. Justin Kastner
Dr. Ellyn Mulcahy
Dr. Abbey Nutsch

Public Health Agency Site:
Mullins Cheese and Whey Inc.
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Supplementary field experience activities with the Door County Fair and 4-H food stand in June 2025

Site Preceptor:
Dustin Seefeldt, BS – Director of Quality Assurance

KANSAS STATE UNIVERSITY
Manhattan, Kansas

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Abstract

This Applied Practical Experience (APE) examined the public health challenges and regulatory demands of modern dairy production through a comprehensive field placement at Mullins Cheese and Whey Inc., a multi-facility cheese and whey manufacturer in central Wisconsin. The purpose of the APE was to strengthen the organization's food safety and quality assurance systems by developing Global Food Safety Initiative (GFSI)-aligned policies, improving Corrective Action and Preventive Action (CAPA) procedures, and creating communication tools that support employee understanding of preventive controls. The project addressed the broader public health issue of foodborne illness prevention in dairy processing, a sector historically linked to outbreaks of scarlet fever, typhoid fever, and other milk-borne diseases. As dairy supply chains expand and processing technologies evolve, the need for robust hazard analysis, standardized sanitation practices, and clear communication becomes increasingly critical for protecting consumers.

Activities conducted at the Mullins facility included policy development, hazard analysis, internal auditing design, and employee training. Methods involved reviewing regulatory frameworks, observing production processes, analyzing biological, chemical, and physical hazards, and synthesizing scientific material into public-facing educational materials. I developed multiple GFSI-aligned documents, including a Milk Protein Concentrate (MPC) hazard analysis, an internal auditing policy, a corrective action policy, a personal hygiene policy, and a color-coded cross-contamination system. I also created a new CAPA protocol to strengthen documentation and root-cause analysis. Additional activities included leading a Good Manufacturing Practices and Preventive Controls training session for production staff, producing three educational blog posts, and supervising youth food handling operations at a Door County 4-H Food Stand. These activities were supported by coursework completed in my MPH program at Kansas State University.

The APE demonstrated that Mullins Cheese and Whey Inc. has adopted strong foundational food safety practices but requires updated documentation and clear communication tools to support its expanding operations. The hazard analysis revealed critical control points in MPC production, while the internal auditing and CAPA systems identified opportunities to improve consistency, traceability, and preventive action. The color-coding program and hygiene policy addressed cross-contamination risks and employee practices, and the training session improved staff understanding of the regulatory expectations. The blog posts and youth leadership experience highlighted the importance of public health education and community engagement in promoting safe food handling.

The significance of this work lies in its contribution to strengthening preventive controls, enhancing organizational clarity, and supporting compliance with national and international food safety standards. Recommendations include continued employee training, routine internal auditing, integration of the CAPA protocol into digital systems, and expanded environmental monitoring as the new facility becomes operational. These findings underscore the importance of system-based approaches to dairy safety and demonstrate how applied public health training can directly support industry practices, regulatory compliance, and consumer protection. The APE ultimately reinforced the critical role of quality assurance in safeguarding the food supply and prepared me to contribute effectively to the dairy industry and public health field.

Subject Keywords: Dairy food safety, preventive controls, hazard analysis, quality assurance, GFSI, communication, systems thinking

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Chapter 1 - Literature Review

1.1 History of Milk Safety

Throughout the last century, the safety of dairy products has posed a public health challenge. For example, milk-borne scarlet fever outbreaks played a decisive role in reshaping public health regulation by exposing the profound weaknesses in milk-handling practices of the nineteenth and twentieth centuries (Wilson, 1986). Early outbreaks repeatedly revealed that milk was produced and distributed under conditions that made it a highly effective vehicle for disease transmission. Despite its wholesome reputation, milk moved through production and distribution systems that were largely unregulated and often unsanitary. Cows were frequently kept in crowded urban dairies, milking was performed by hand with little attention to hygiene, and milk containers were reused without proper cleaning. Without refrigeration or standardized sanitation practices on the farm, the milk provided an ideal environment for bacterial pathogens such as *Streptococcus pyogenes,* the causative agent of scarlet fever, to grow (Wilson, 1986).

These failures were not unique to scarlet fever. Milk-borne typhoid fever in late Victorian Britain revealed similar structural vulnerabilities, including inadequate oversight of distributors, inconsistent sanitation practices, and the absence of centralized regulatory authority (Steere-Williams 2010). Like the scarlet fever epidemics described by Wilson, typhoid outbreaks traced to contaminated milk forced public health officials to confront the reality that milk could act as a powerful vehicle for enteric pathogens when handled under unsanitary conditions. Epidemiologists in Britain used spatial clustering, household interviews, and supply-chain tracing to link cases to specific dairies. Together, these historical accounts illustrate that milk-borne disease was not an isolated national problem, but a widespread public health challenge across industrializing nations.

The outbreaks also challenged the scientific assumptions of the time. Wilson describes several epidemics in which a single dairy worker, often an asymptomatic carrier of scarlet fever, contaminated an entire milk supply. Because the concept of asymptomatic carriage was poorly understood, these cases initially baffled investigators. In one instance, nearly every household served by a particular milk route fell ill within days, while neighboring households supplied by other dairies remained unaffected. These sharply defined geographic patterns became some of the earliest epidemiological evidence that milk could transmit scarlet fever (Wilson, 1986.

Steere-Williams similarly notes that typhoid fever investigators struggled to reconcile the apparent purity of milk with its role in disease transmission, prompting the development of more systematic epidemiological methods. The inability of existing theories to explain these patterns created pressure for new investigative methods and a more systematic approach to foodborne disease (Steere-Williams, 2010).

As these outbreaks accumulated, they catalyzed a broader transformation in milk regulation. Public health officials began to recognize that preventing milk-borne disease required structural interventions rather than relying on consumer vigilance or producer goodwill. Wilson shows how the epidemiological lessons drawn from these crises contributed to the gradual adoption of pasteurization, licensing requirements for producers, and the establishment of routine inspections. Steere-Williams likewise documents how British authorities moved toward more centralized oversight, standardized sanitation expectations, and the professionalization of dairy distribution. Each outbreak served as a case study in regulatory failure, demonstrating that milk safety could not be ensured without standardized controls across the entire supply chain.

Taken together, the historical outbreaks documented by Wilson (1986) and Steere-Williams (2010) did more than reveal the dangers of contaminated milk; they, along with other milk-borne diseases, including tuberculosis, fundamentally reframed milk as a regulated public health commodity rather than a natural, inherently safe food. This shift in understanding was essential for the development of modern dairy safety systems and continues to shape contemporary approaches to foodborne disease prevention.

1.2 Modern Day Safety Adaptations

Following the identification of the root causes and etiological agents of scarlet fever, typhoid fever, tuberculosis, and other diseases, the dairy industry underwent a series of transformative safety adaptations that reshaped milk processing into the highly regulated system seen today. The early recognition that milk could serve as a vehicle for disease transmission laid the groundwork for modern regulatory frameworks, including federal standards such as 21 CFR Part 133, which establishes legal, enforceable definitions, composition requirements, and processing expectations for cheese and related products. These standards ensure uniformity in manufacturing practices and help prevent adulteration. One of the more important points from this regulation is the pasteurization of milk before processing.

Modern pasteurization parameters were shaped not only by historical outbreaks, but also by the discovery of *Coxiella burnetii,* the causative agent of Q fever and the most heat-resistant non-spore-forming pathogen found in raw milk. Research in the mid-twentieth century demonstrated that traditional pasteurization temperatures were insufficient to reliably inactivate *C. burnetii*, prompting the development of the High-Temperature, Short-Time (HTST) method. HTST—heating milk to 161 degrees Fahrenheit for 15 seconds—was validated specifically to ensure destruction of *C. burnetii*, thereby establishing a scientifically grounded safety benchmark for the entire dairy industry (Enright et al., 1957). By adopting HTST, modern dairy processing significantly reduced the risk of pathogen survival and created a standardized, evidence-based approach to milk safety that continues to underpin contemporary cheese and whey production.

More recently, the Food and Drug Association (FDA) Food Safety Modernization Act (FSMA) further advanced dairy safety by shifting the regulatory focus from reactive responses to proactive prevention. Under FSMA's Final Rule for Preventive Controls for Human Food finalized in 2015, dairy processors must have a food safety plan where they conduct hazard analyses, implement and oversee preventive controls, provide a risk-based supply chain program, and write a recall plan; requirements that directly address the types of systematic vulnerabilities that once enabled milk-borne disease. Together with pasteurization mandates, hygienic equipment design, and standardized Good Manufacturing Practices (GMPs), these modern adaptations reflect a comprehensive public health response to historical outbreaks, ensuring that cheese and whey production operate within a framework designed to minimize risk and protect consumers.

Environmental and sustainability considerations also play a significant role in modern processing. Abisha et al. (2024) note that untreated milk and whey can pose environmental challenges due to their high biochemical oxygen demand, but deep-processing technologies allow manufacturers to convert them into functional ingredients that benefit both human and animal nutrition. This shift aligns with broader industry trends toward waste reduction and resource efficiency.

The dairy industry needs to be vigilant in addressing the biological concerns of environmental pathogens. *Listeria monocytogenes*, a psychrotrophic bacterium capable of growing at temperatures between 31 and 113 degrees Fahrenheit, commonly contributes to biofilm formation on processing equipment. Because *L. monocytogenes* can persist in drains, floors, conveyor belts, and other hard-to-sanitize niches, modern dairy facilities have adopted environmental monitoring programs (EMPs) as a core preventive strategy to detect and eliminate harborage sites before they contaminate products. Contemporary control measures also emphasize hygienic zoning, sanitary equipment design, and biofilm-targeted sanitation protocols, including rotating sanitizers and verifying cleaning effectiveness through microbial testing (Riberio et al., 2024). Together, these adaptations reflect a shift toward proactive, science-based interventions that address the unique environmental resilience of *L. monocytogenes* within dairy processing.

Quality assurance and food safety are also central themes in the dairy science literature. Studies consistently emphasize the importance of Hazard Analysis and Critical Control Points (HACCP), sanitation standard operating procedures (SSOPs), and regulatory compliance in ensuring product safety and consistency. Rural food facilities, such as those in Wisconsin, face unique challenges, including workforce limitations and the need for cross-functional training. These factors highlight the importance of mentorship, technical expertise, and continuous improvement within the quality assurance department.

Collectively, the literature demonstrates that modern dairy operations operate at the intersection of tradition, technologies, and sustainability. Wisconsin's dairy heritage provides a strong cultural and economic backdrop, while advancements in dairy processing and quality assurance shape the landscape of dairy manufacturing. This body of research provides essential context for understanding Mullins Cheese and Whey Inc.'s operations, product lines, and quality systems.

1.3 The Purpose of my Experiential Learning in Dairy Safety

The dairy industry plays a central role in U.S. agriculture, with Wisconsin consistently ranking as the nation's leading cheese producer. Wisconsin's dairy sector benefits from a network of many multigenerational operations and cheesemakers that support this innovation. This environment provides the foundation for understanding the operational context of companies such as Mullins Cheese and Whey Inc., which contribute to the state's production of both cheese and whey products.

Despite its strengths, the dairy industry faces persistent public health challenges related to food safety. Dairy products, particularly those produced at large scale, require rigorous controls to prevent contamination, ensure regulatory compliance, and protect consumers from foodborne illness. Outbreaks linked to dairy products, both historically and in modern-day settings, highlight the importance of preventive systems, standardized sanitation practices, and effective hazard analysis. As dairy processing technologies evolve and supply chains become more complex, the need for strong quality assurance frameworks becomes even more critical. Through this experience, I am increasingly motivated to deepen my expertise in dairy safety systems from coursework and strengthen my ability to design evidence-based quality assurance strategies that address emerging risks in modern milk processing. Prior work within Mullins Cheese and Whey Inc. has focused on meeting Global Food Safety Initiative (GFSI) standards, maintaining compliance with the Pasteurized Milk Ordinance (PMO), and implementing preventive controls aligned with FSMA. However, the expansion of operations, including the development of a new facility in Plover, created a need for updated policies, clearer documentation, and strengthened Corrective Action and Preventive Action (CAPA) systems. These gaps provided a meaningful opportunity for my Applied Practical Experience (APE) activities that directly support public health by enhancing the company's capacity to prevent, detect, and respond to food safety risks.

The purpose of this practicum was to support Mullins Cheese and Whey Inc. in strengthening its food safety and quality assurance systems through the development of GFSI-aligned policies, improved CAPA procedures, and targeted employee training. The goal was to enhance the organization's ability to identify and mitigate hazards across production, ensure regulatory compliance, and promote a culture of food safety within the workforce. By contributing to the development of standardized procedures and educational materials, the practicum aimed to advance both operational efficiency and public health protection.

1.4 Location

Mullins Cheese and Whey Inc. is a fifth-generation business focusing primarily on the production of Italian and American-style cheeses. The history of the Mullins family begins in Ireland, where Patrick Mullins sold his ten head of cattle to immigrate to the United States in search of a new life in farming. Later, Patrick's son, Mel Mullins, and his friend, Emil Wimmer, established a legacy of cheesemaking in central Wisconsin, which, 60 years later, grew into a thriving industry. Their mission going into the business was to drive a strong work ethic and an innovative spirit. They wanted to strive to revolutionize the functionality of dairy products, using the best and most efficient methods.

The main location of the facility is in “downtown Knowlton,” an unincorporated town in central Wisconsin, bordering the Eau Plaine Flowage. This location produces mostly Italian-style cheeses such as Parmesan and Asiago in a fully enclosed system. This is when the curds and whey are contained within sealed vats and move through an enclosed line to then culminate in fully sealed packaging to control moisture, temperature, and hygiene. In whey production at the same location, five byproducts are made: lactose, whey protein isolate, procream, permeate, and milk minerals. A second cheese facility, located in the countryside near Marshfield, Wisconsin, focuses on softer, American-style cheeses such as cheddar, pepper jack, and Colby jack through the traditional open table system. A third facility in the heart of Plover, Wisconsin, will begin producing Milk Protein Concentrate (MPC) in the summer of 2026.

During my time in the Quality Assurance department of Mullins Cheese and Whey Inc., my preceptor, Dustin Seefeldt, guided me as I learned many concepts related to food safety and control within a rural food facility. Dustin is a graduate of the same university I attended, the University of Wisconsin-River Falls, and obtained a degree in Agricultural Engineering with a minor in Food Science. He has worked in the food safety field for 18 years, all at Mullins Cheese and Whey Inc. Dustin has encouraged me to research various dairy-related topics, form policies, and think critically about improving the production line. Food safety is the top priority in the Quality Assurance Department, and it is our responsibility to ensure that all products released are of the highest quality.

Chapter 2 - Learning Objectives and Project Description

2.1 Objectives

- **Objective 1 –** Gain familiarity with the biological, chemical, and physical hazards of concern in cheese manufacturing.
- **Objective 2 –** Create documents suitable for compliance with regulations and audits.
- **Objective 3 –** Gain multidisciplinary breadth in the following areas: food microbiology, quality assurance, business management, and consumer preferences.
- **Objective 4 –** Gain an appreciation for the unique public health challenges of food fraud and crisis communication.
- **Objective 5 –** Grow in writing skills.

2.2 Project Description

I began my Applied Practical Experience (APE) in May 2025 with Mullins Cheese and Whey Inc., where I worked in the Quality Assurance department under the supervision of my preceptor, Dustin Seefeldt, Director of Quality Assurance. In the spring of 2025, Mr. Seefeldt, Dr. Kastner (my major professor), and I communicated via email and Zoom to outline the scope of my field experience, including daily responsibilities and a potential product focus area. Mr. Seefeldt informed us that a new facility was under construction in Plover, Wisconsin—approximately twenty miles south of the main plant in Knowlton—which would require the development of policies aligned with the Global Food Safety Initiative (GFSI) Brand Reputation through Compliance Global Standard (BRCGS) scheme, followed by Mullins. Throughout the summer, I created multiple policies in line with the standard and learned how the facility complies with audit regulations. GFSI is configured into 8 sections that are based on different sectors of food safety. Based on one of the policies, I developed a new system for conducting Corrective Action and Preventive Action (CAPA) reports that are aligned with GFSI standards. Toward the end of my internship, I led a training session for the production staff on Good Manufacturing Practices (GMPs) and Preventive Controls (PCs) that align with section 7 of GFSI, drawing from both my research and practical experience at Mullins. In addition to policy development and training, I conducted independent research on dairy-related topics and created blog posts to communicate my findings; these topics included Hazard Analysis and Critical

Control Points (HACCP) within cheesemaking, antibiotic testing on milk before production, and the various GFSI schemes. Much of the research focused on biological, chemical, and physical hazards that a food plant may face, and how the government has created regulations to protect against harm from entering the system. The drafting and arrangement of these policies, the presentation to workers, and the exploration of research topics have not only improved my writing skills but also allowed me to gain an appreciation for the challenges a food facility may face, how to prevent food fraud, and practice crisis communication. As a supplementary experience, I also led the Door County 4-H food stand at the county fair. My responsibilities included instructing K-12 students on safe food handling practices, ensuring consistent use of Personal Protective Equipment (PPE), and assigning age-appropriate tasks. This opportunity broadened my understanding of food safety leadership across diverse educational and operational contexts. Indeed, as a food safety and biosecurity (FSB)-focused MPH student, I not only completed an APE but also grew as a public health-minded industry leader.

Chapter 3 - Products and Results

3.1 Noteworthy Coursework

My prior MPH coursework directly supported the outputs I produced during my APE by equipping me with the analytical, communication, and evaluation skills needed to effectively complete project tasks. Through MPH 720 and MPH 854, I gained experience synthesizing peer-reviewed literature, identifying bias, and evaluating the reliability of scientific findings; these skills I applied when reviewing regulatory documents, drafting policies, and interpreting scholarly literature for blog posts. Coursework in MPH 701 and MPH 754 strengthened my ability to analyze nonconformity trends and translate technical findings into auditor-ready documentation, leading to the development of revised CAPA materials and clearer SOP literature. Additionally, MPH 818 and MPH 802 prepared me to communicate with diverse stakeholders and assess operational risks, enabling me to contribute effectively to discussions on preventive controls, facility expansion needs, and food safety system improvements. An additional elective that I partook in during my MPH was QA 695. This course, alongside FDSCI 730 and FDSCI 731, explored the principles of hazard analysis, the development of preventive controls, and the practical steps required to correct operational problems to maintain a safe and compliant production system. Together, these courses emphasized how to translate scientific literature into real-world decision-making by evaluating process risks, identifying system vulnerabilities, and applying evidence-based interventions to improve food safety outcomes. This academic foundation directly shaped the deliverables included in the appendix, including updated policies, hazard analyses, and documentation templates.

3.2 Frontier Field Trip Experience

Although I am a remote-based student, I spent the first two semesters of my MPH program located in Manhattan, Kansas, and was able to participate in Dr. Kastner's Frontier Field Trip (FFT) in Council Grove, Kansas. During the Frontier Field Trip, I participated in an immersive simulation based on the 1993 Milwaukee cryptosporidiosis outbreak, the largest waterborne disease outbreak in U.S. history. Although this disease is not milk-borne, it was a uniquely Wisconsin-based disaster, and it highlighted the central importance of water infrastructure in public health and the wider food system; indeed, water is the backbone of the food industry! This experience placed students in a mock public health crisis, where we assumed roles such as community members, health officials, and government leaders while responding to evolving outbreak information. Throughout the simulation, I observed how interdisciplinary teams analyze water-contamination data, craft public health messaging, and address misinformation under time pressure. I contributed to group discussions, helped interpret epidemiological data, and participated in developing and delivering a press conference briefing modeled on real-world public health communication. This field experience served as a practical "product" of my training by strengthening my ability to synthesize environmental health information, communicate risk to diverse audiences, and collaborate across roles during an outbreak investigation. The insights gained from this simulation directly informed my understanding of outbreak response dynamics.

3.3 Door County Leadership Experience

In August of 2025, I devoted five days of my APE in assisting with the leadership of the Door County 4-H Food Stand. Because of my background in agriculture and my MPH training in Food Safety and Biosecurity, the fair coordinator identified me as a strong fit to supervise daily operations and ensure safe food-handling practices. Each day, I prepared the kitchen for service, welcomed students into the workspace, and instructed them on essential hygiene practices, including proper handwashing and the use of proper protective equipment such as gloves, hats, and secured hair. I assigned students to roles that aligned with their abilities—ranging from food preparation to customer service—and monitored their performance to ensure that food was prepared, handled, and served safely. Throughout the day, I supported the team by assisting with orders, restocking supplies, and troubleshooting workflow issues to maintain an efficient operation.

This multidisciplinary leadership experience allowed me to apply my coursework directly in a real-world setting by teaching youth the sanitary and operational requirements of running a food service operation. I explained the rationale behind each safety practice, modeled appropriate behaviors, and reinforced the importance of maintaining consistent standards. As a result, this experience produced a tangible demonstration of my ability to integrate food safety principles, youth education, and operational management to create an outcome that directly contributes to the supplementary products and results of my APE.

3.4 Applied Practical Experience Products

During my APE, I produced a series of written, analytical, and operational tools that strengthened food safety practices at Mullins Cheese and Whey Inc. and demonstrated my ability to apply public health competencies in a production environment. Each product reflects a distinct component of my work and is included in Appendix 3.

Product 1a – Blog Post #1: Foodborne Illness Reduction in a Cheese Factory

For this deliverable, I researched historical and contemporary foodborne illness trends in dairy processing and synthesized scientific literature into an accessible blog post for public audiences. I observed how complex regulatory concepts, such as preventive controls, sanitation requirements, and hazard identification, could be translated into clear messaging that supports consumer education. In addition to the analysis, a causal loop diagram was also created using systems thinking to promote how a production system may face risks and the ways additional tasks may contribute to the overall system's success. This product demonstrated my ability to communicate technical information in a format that promotes public understanding of dairy safety.

Product 1b – Blog Post #2: Antibiotic Testing in Raw Milk Intake

In this post, I explained the purpose and process of antibiotic residue testing at milk intake, drawing on both regulatory requirements and Mullins' internal procedures. I analyzed intake workflows, observed how screening tests were conducted, and described their role in preventing contaminated milk from entering production. This product strengthened my ability to connect operational observations with broader public health implications.

Product 1c – Blog Post #3: Global Food Safety Initiatives (GFSI)

This blog post required me to interpret GFSI principles and explain how certification schemes influence dairy manufacturing. I reviewed Mullins' compliance efforts and communicated these concepts in a way that was understandable to non-technical readers. This product reinforced my skill in translating regulatory frameworks into public-facing educational content and later assisted me in designing policies for Mullins Cheese and Whey Inc., for their new plant.

Product 2a – Milk Protein Concentrate Hazard Analysis (GFSI Policy 2.7.1-2.7.4)

For this deliverable, I conducted a detailed hazard analysis for Milk Protein Concentrate (MPC) production at the new facility. I evaluated each processing step, identified biological, chemical, and physical hazards, and aligned my findings with GFSI requirements. This work required direct observation of production flow, review of ingredient specifications, and collaboration with quality assurance personnel. The resulting document provides a structured, GFSI-compliant hazard analysis for future auditing and operational use.

Product 2b – Internal Auditing Program (GFSI Policy 3.4.1-3.4.3)

I developed an internal auditing program that outlines audit frequency, scope, responsibilities, and documentation procedures. To complete this product, I observed existing practices, identified gaps in recordkeeping, and created a standardized approach that supports continuous improvement. This program now serves as a foundational tool for verifying compliance across departments.

Product 2c – Corrective Action Policy (GFSI Policy 3.7.1)

For this policy, I analyzed Mullins' existing corrective action procedures and identified inconsistencies in documentation and follow-through. I then drafted a revised policy that clarifies roles, timelines, and verification steps. This product directly supports regulatory compliance and strengthens the company's ability to respond to nonconformances.

Product 2d – Color Coding Program (GFSI Policy 4.11.2A)

This deliverable involved designing a color-coded tool-use system to reduce cross-contamination risks. I observed traffic patterns, sanitation workflows, and equipment use across the facility, then created a visual program that assigns specific colors to designated zones. The final product includes a chart and implementation guidance that can be used for employee training and auditing.

Product 2e – Personal Hygiene Policy (GFSI Policy 7.2)

I revised and expanded the facility's personal hygiene policy by observing employee practices, reviewing regulatory expectations, and identifying areas where clearer guidance was needed. The updated policy provides explicit requirements for handwashing, PPE use, illness reporting, and hygiene-related behaviors, supporting both compliance and employee understanding.

Product 3 – Corrective Action and Preventive Action (CAPA) Protocol

This protocol was developed after identifying the need for a more structured approach to documenting and resolving nonconformances. I synthesized best practices from GFSI, FSMA, and Mullins' operational needs to create a CAPA system that includes root-cause analysis, corrective action planning, preventive action strategies, and verification steps. This product enhances the facility's ability to track issues, prevent recurrence, and demonstrate continuous improvement during audits.

Chapter 4 - Discussion

Throughout my APE, my understanding of food safety systems deepened significantly as I moved from theoretical coursework to hands-on operational work in a large-scale dairy production environment. The blog posts I produced (Products 1a-1c) illustrate how contamination risks span the entire food supply chain and require coordinated preventive strategies at every stage. As highlighted in the literature cited in blog post #1, hazards can enter the system through farm-level hygiene failures, inadequate equipment sanitation, temperature abuse during transportation, or improper food handling (Hassan et al., 2023). Writing these posts required me to synthesize scientific research with real-world observations from Mullins Cheese and Whey Inc., reinforcing the reality that food safety is not a single intervention but a continuous, multi-layered process.

My work on antibiotic testing (Product 1b) further demonstrated how operational decisions intersect with public health outcomes. Observing the use of SNAP tests and understanding the consequences and antibiotic residues—both for fermentation and for regulatory compliance—gave me a clearer appreciation for the economic and public health stakes involved in raw milk screening (Polzin, 2025). This experience connected directly to my hazard analysis work (Product 2a), where I evaluated biological, chemical, and physical risks across Milk Protein Concentrate production. The literature emphasizes the importance of preventive controls and verification systems, and throughout the project, I saw firsthand how these principles are operationalized in a modern dairy facility.

Similarly, my exploration of global food safety frameworks (Product 1c) helped me contextualize the policies I developed for Mullins; this experience will serve me as both a quality assurance manager and, more broadly, food safety practitioner. Understanding how GFSI and BRCGS structure their audit expectations (Schrick, 2020) allowed me to design policies seen in Products 2a-2e that aligned with international standards while addressing facility-specific needs. This alignment of literature, regulatory frameworks, and on-site practice strengthened my ability to interpret standards not as abstract requirements but as tools that shape daily operations, employee behavior, and organizational culture.

My training in the Kansas State University MPH program prepared me to make the most of my APE. Completing my core courses as well as my emphasis-specific courses gave me the foundation to evaluate production risks and develop GFSI-related policies. Courses emphasizing communication and leadership equipped me to translate complex regulatory concepts into accessible materials such as the color-coded cross-contamination chart (Product 2d) and the employee training presentation. Even my elective courses directly provided me with a lens into what is accomplished in quality assurance to maintain a safe production system.

Beyond the dairy facility, my leadership experience at the Door County 4-H Food Stand provided an additional lens to interpret my findings. Teaching youth about hygiene, PPE, and safe food handling reinforced the importance of early education in shaping long-term public health behaviors. This experience highlighted that food safety is not only a regulatory or industrial concern, but also a community-level practice that depends on accessible education and consistent modeling of safe behaviors.

Together, these experiences advanced my understanding of food safety as a dynamic, systems-based field that requires technical expertise, clear communication, and collaborative leadership. They also demonstrate how my MPH training has prepared me to contribute meaningfully to the dairy industry and to the broader public health landscape as I move forward with my career.

While my APE provided extensive exposure to dairy safety operations, one limitation shaped the scope of my findings. Much of my work occurred during a period of facility expansion, meaning some processes were still evolving and not yet fully implemented. This limited my ability to observe long-term outcomes of the policies and tools I developed. Despite this constraint, the implications of my work extend meaningfully into public health practice. Strengthening hazard analyses, corrective action systems, and employee-facing communication tools directly supports the prevention of foodborne illness. More broadly, the experience showed how preventive controls and clear communication can reduce risk across the entire farm-to-fork continuum.

Based on my work, several recommendations emerge for sustaining and expanding this work. At the individual level, continuing routine employee training and reinforcing visual tools during onboarding and refresher sessions. At the institutional level, companies can continue to implement routine internal auditing using the program I developed in Product 2b and the CAPA protocol (Product 3) into digital recordkeeping systems to enhance traceability. At the policy level, the expansion policies will align with GFSI auditing expectations. Future work should also examine how communication tools influence employee behavior and whether additional training modalities could further strengthen compliance.

Overall, my APE advanced my understanding of dairy food safety, regulatory compliance, and public health communication, extending well beyond classroom learning. By integrating scientific literature, operational observations, and stakeholder engagement, I contributed meaningful tools and analyses that support Mullins Cheese and Whey Inc.'s commitment to safe, high-quality production. This experience has prepared me to enter the food safety field with a deeper appreciation for the complexity of preventive systems and the critical role that public health professionals play in safeguarding the food supply.

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Appendix 1 - Synthesis and/or Integration of Competencies

Table A.1 Synthesis and Integration of Competencies

Competency	**Description of Synthesis and Integration**
Propose Strategies to Identify Stakeholders and Partnerships – Foundational Competency 13	From May until August, I analyzed the operational structure of the new Mullins facility and identified the internal and external stakeholders whose roles directly influenced food safety, regulatory compliance, and daily production activities. Using the GFSI BRCGS scheme as a framework, I synthesized existing organizational practices and developed policies for the plant, ensuring that each policy clearly defined stakeholder expectations and outlined mechanisms for cross-departmental partnership. Through this process, I proposed strategies that strengthened communication pathways and integrated stakeholder engagement into the facility's broader food safety management system.
Communicate Effectively to Different Audiences - Foundational Competency 19	In August, I designed and created a visual communication tool to translate complex cross-contamination risks into clear, accessible guidance for production employees. For example, a color-coded chart for plant tools represents the specific areas that tools can be used in/on and how to differentiate between the correct colors across all audiences. In another instance, I developed and presented a PowerPoint training session on Good Manufacturing Practices (GMPs) and Preventive Controls (PCs), adapting technical regulatory concepts into practical examples that aligned with the daily responsibilities of plant personnel. Additionally, I researched, synthesized, and wrote blog posts on HACCP principles, GFSI certification, and antibiotic testing in milk intake, tailoring the content for a broader public audience seeking to understand dairy safety systems.

	Through these varied communication activities, I demonstrated the ability to effectively convey public health information across multiple stakeholder groups with differing levels of technical expertise.
Multidisciplinary Leadership – FSB Emphasis Area Competency 5	As a supplementary experience in the month of August, I applied to multidisciplinary leadership by guiding a team of 4-H students during their county fair food stand operations for one week. This was an environment that required integrating principles of food safety, youth education, and operational management. I instructed K-12 students on safe food handling practices, ensured consistent use of Personal Protective Equipment (PPE), and assigned age-appropriate tasks that aligned both safety requirements and individual capabilities. This experience allowed me to coordinate diverse responsibilities while adapting communication and leadership strategies to meet the developmental needs of children and adolescents. By facilitating a safe and efficient work environment, I demonstrated the ability to lead across educational, public health, and operational contexts, reinforcing the importance of multidisciplinary collaboration in promoting food safety.

Across my APE, these three competencies operated as an interconnected framework that shaped every component of my work. By analyzing the operational structure of the new Mullins facility, I identified the internal and external stakeholders' roles that influenced food safety, regulatory compliance, and daily production, allowing me to design policies that clarified expectations and strengthened cross-departmental partnerships. These stakeholder insights directly informed me of the communication tools I developed from creating color-coded cross-contamination charts, GMP and PC training materials, and public-facing blog posts. These translated complex regulatory and scientific concepts into accessible guidance tailored to diverse audiences. My multidisciplinary leadership experience, demonstrated through guiding 4-H students in safe food handling and operational tasks, further reinforced my ability to adapt communication and decision-making strategies across settings. Significantly, my APE allowed me to simultaneously emphasize Foundational Competency 19 and FSB Competency 5; indeed, as I communicated the risks of food contamination, I found myself integrating several skills and perspectives. Together, these competencies supported a cohesive approach to improving food safety systems, enabling me to produce deliverables that enhanced organizational clarity, strengthened preventive controls, and advanced public health practice within the dairy production environment.

Appendix 2 - Demonstration of Competency Attainment

Table A.2 Attainment of Competencies

Practice-Based Products that Demonstrate Competency Attainment			
Specific Product		**Competency Addressed**	
1a	Blog Post #1 – Foodborne Illness Reduction in a Cheese Factory	5	Compare Mullins' structure and in-place procedures with the national regulation.
		19	Communicate audience-appropriate material based on research in writing to the public.
		22	Create and determine the different worker roles that are associated with risks in a feedback loop.
1b	Blog Post #2 – Antibiotic Testing in Raw Milk Intake for Cheese Production	5	Compare Mullins' structure and in-place procedures with the national regulation.
		19	Communicate audience-appropriate material based on research in writing to the public.
1c	Blog Post #3 – Global Food Safety Initiatives in Food Production	5	Compare Mullins' structure and in-place procedures with the national regulation.
		19	Communicate audience-appropriate material based on research in writing to the public.
2a	Milk Protein Concentrate Hazard Analysis (GFSI Policy 2.7.1-2.7.4)	22	Apply systems thinking tools to a public health issue related to product safety.
2b	Internal Auditing Program (GFSI Policy 3.4.1-3.4.3)	11	Evaluate the internal auditing program and determine what prerequisites need to be included to meet public health requirements.
		13	Identify the prerequisites required to focus on internal auditing and the system used to document non-conformances.
2c	Corrective Action Policy (GFSI Policy 3.7.1)	11	Evaluate the corrective action policy and determine what steps need to be taken for various non-conformance types.
		13	Identify the types of non-conformances that need to have a corrective action policy implemented and how these can be solved.
2d	Color Coding Program (GFSI Policy 4.11.2A)	19	Communicate appropriate material in writing for production workers to effectively read.

2e	Personal Hygiene (GFSI Policy 7.2)	13	Determine the manufacturing practices that are essential for employees to maintain a safe production environment.
		19	Communicate appropriate public health content during mandatory training.
3	Corrective Action and Preventive Action (CAPA) Protocol	11	Evaluate the CAPA protocol and determine how it can be improved to meet public health and customer expectations.
		13	Determine the essential needs to be included in a CAPA protocol and how they can be efficiently read and understood by customers and personnel.

Foundational Competency 5 - Compare the organization, structure, and function of health care, public health, and regulatory systems across national and international settings

During my internship, I researched several topics related to food safety systems, including HACCP in cheesemaking, antibiotic testing protocols for milk before production, and the various GFSI schemes. This work allowed me to compare biosecurity measures required by regulatory frameworks with those implemented within the organization where I completed my APE. I strengthened my ability to interpret and communicate these comparisons by writing blog posts that translated my research findings into accessible, practice-based insights.

Foundational Competency 11 - Select methods to evaluate public health programs

GFSI BRCGS serves as the global standard that Mullins Cheese and Whey Inc. follows to ensure that food safety is a top priority. Milk Protein Concentrate (MPC) is a new product line being developed at the new Mullins facility, and I formulated several policies based on this global standard. Through this process, I identified specific policies that directly supported my learning, particularly those related to internal auditing and corrective actions. After reviewing these policies, I also identified the need for a new CAPA system to more effectively document nonconformances and strengthen the corrective action program.

Foundational Competency 13 - Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes

When crafting written policies during my internship, I first identified key stakeholders who played essential roles in applying food safety practices throughout the plant. For three of the policies—internal auditing, corrective actions, and personal hygiene—I evaluated what actions personnel at different levels could take to ensure compliance. This process reinforced for me the public health importance of recognizing all stakeholders who can contribute collectively to shape the health and safety outcomes within any food system facility.

Foundational Competency 19 - Communicate audience-appropriate public health content, both in writing and through oral presentation

During my internship, I applied audience-appropriate communication strategies to support food safety practices within the facility. In quality assurance, it is essential to conduct training programs that help plant personnel understand the policies and procedures in place and the rationale behind them. I used the research I conducted to develop a PowerPoint presentation to teach production staff about the importance of PCs and GMPs in their daily work. In addition to training, I created a color-coding procedure for the new plant to visually communicate which tools should be used in specific production areas. This system was based on the types of surfaces each tool would contact and was designed to minimize cross-contamination risk. By combining written materials, visual communication, and oral instruction, I ensured that food safety concepts were accessible and relevant to personnel with diverse roles and varying levels of technical competence.

Foundational Competency 22 - Apply systems thinking tools to a public health issue

Systems thinking is a critical framework for addressing complexity in food safety. As part of my Applied Practical Experience, I developed two system-based tools to analyze risk and organizational dynamics within the production of MPC. The first was a detailed hazard analysis that examined each ingredient and processing step to assess its potential contribution to contamination risk. This product-level tool allowed me to identify control points and align them with regulatory expectations under the GFSI scheme. The second tool was a causal feedback loop diagram that mapped how different worker roles—production, sanitation, maintenance, quality assurance, and management—interact to influence food safety outcomes. This diagram illustrates reinforcing and balancing loops, showing how frontline adherence, training, and leadership culture can either reduce or amplify contamination risk.

Appendix 3 – Portfolio Products

Appendix 3 features the totality of portfolio products (listed below, and sequentially following) for Olivia Shruck's APE.

MPHTC Student Field Placement Blog #1

Foodborne Illness Reduction in a Cheese Factory

Olivia Shruck

Kansas State University

Food production has many points of entry where contamination may occur, so prevention of this specific issue is crucial. Contamination may occur at the farm, in processing facilities, during transportation, from improper storage, in grocery stores, or from consumer misuse. Globally, 31 known agents cause 9.4 million illnesses, 56,000 hospitalizations, and 1,300 deaths annually. Many of these outbreaks are caused by fresh produce, raw meat, or unpasteurized dairy. Microbiological, Chemical, and Physical hazards are all possible contaminants that can enter the food supply chain. This can be caused by improper hygiene, lack of pest and herbicide control, lack of employee PPE, and many other factors. Creating less risk for contamination can be done by implementing certain practices and creating partnerships with local and national governments.

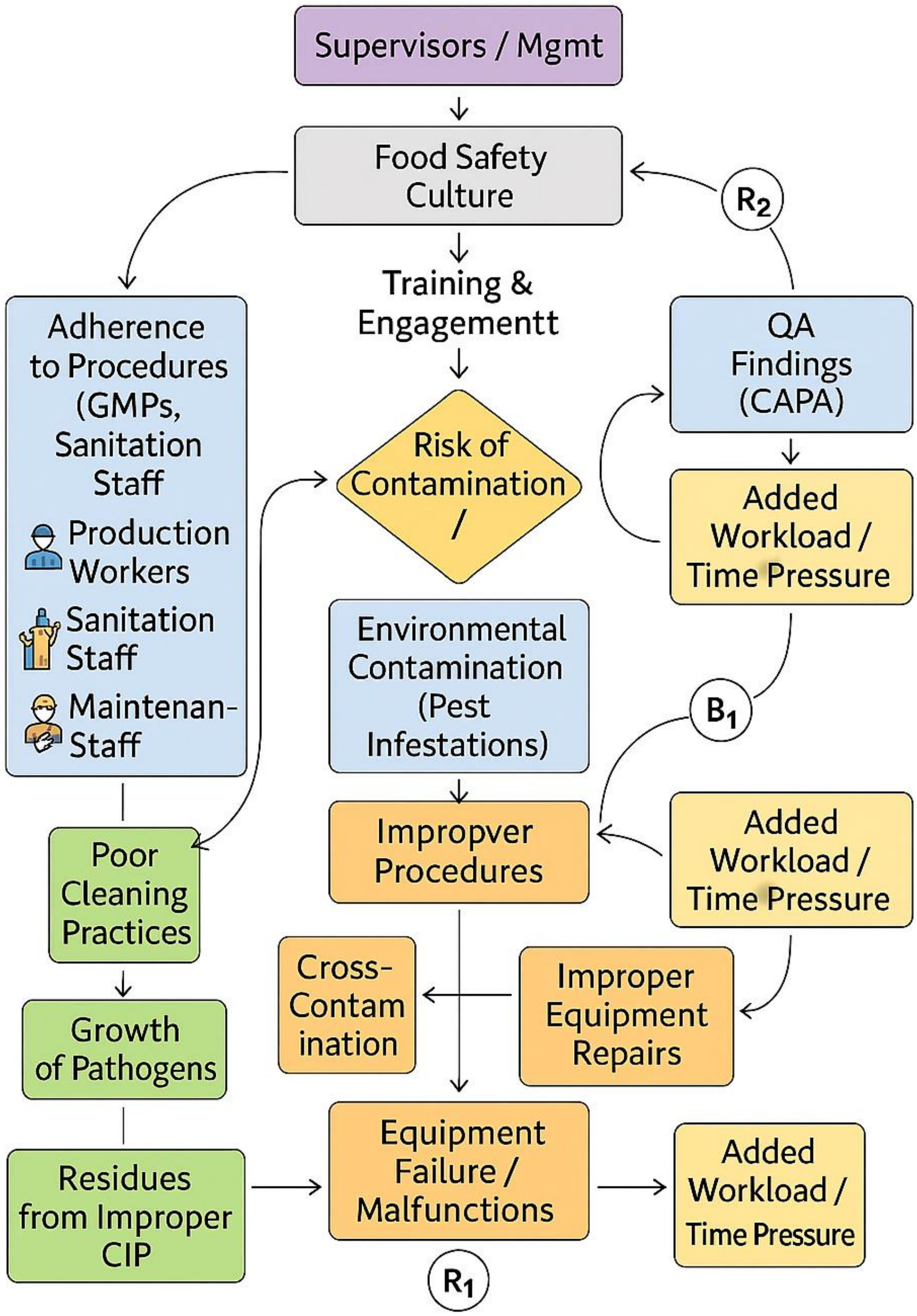
Good Hygiene Practices are overseen by FAO and WHO, which focus on preventing those microbiological, chemical, or physical hazards from entering the supply chain through proper sanitization, storage, transportation, and of course, employee hygiene. Good Manufacturing Practices are overseen by the FDA and focus on the management within a facility and an overall broader practice to ensure facility cleanliness, equipment maintenance, and training of the employees. Hazard Analysis Critical Control Points is overseen by the USDA and FDA and is a more systematic approach to identify control points in any stage from farm to fork. This contains analysis of potential risks, creating those critical control points, and implementing monitoring procedures to ensure food safety. The Food Safety Modernization Act is an international policy that mandates food facilities registered under the Food, Drug, and Cosmetic Act to incorporate risk-based preventive control. This plan must include a HACCP plan, GMP/GHP protocols, and a recall plan to enhance food safety.

Transparency in the food supply chain is crucial for avoiding contamination and maintaining food integrity through the sharing of data. Impacts of implementing these protocols include employee involvement and making all of those involved in the process aware of the concerns that may occur. During my current internship, working in quality assurance for a cheese and whey production facility, I am reviewing the production flowcharts that are shared to provide information on critical control points, as well as where the most important points of preventive control are. This company thrives on the transparency it shares with all to ensure that there is no risk within production.

Educating employees is important when providing such risks to employees. Not all understand a flowchart when just handed to them, so educating employees to understand why they are preventing such risks is crucial. By breaking the language barrier with simplified infographics, implementing proper onboarding protocols that enable employees to complete their tasks upon hiring, and offering informative lunch-and-learns by bringing in educated professionals to address various industry concerns, we can enhance employee engagement. Looking at the future of foodborne illness reduction and partnerships, improving this is extremely important in public health, as it not only reduces the number of those falling ill of a disease, but it also creates a steady flow of food production and distribution of goods across the entire world.

To demonstrate the line of defense when it comes to foodborne illness reduction, a feedback loop was created to represent how worker roles can associate risks in the system. The diagram illustrates how food safety outcomes emerge from the interconnected behaviors of workers, supervisors, and organizational systems, showing that contamination risk is shaped less by isolated errors and more by reinforcing pressures across the production environment. Supervisors and management set the tone for food safety culture, which in turn influences the quality of training, worker engagement, and adherence to GMPs and sanitation procedures. When this culture is strong, workers across production, sanitation, and maintenance roles are more likely to follow proper procedures, reducing contamination risks; when it is weak, shortcuts and inconsistent practices become more common. Increased contamination risk contributes to environmental contamination, equipment residue, and cross-contamination events, which trigger quality assurance findings and CAPA requirements. Although CAPAs are intended to correct deviations, they often increase worker workload and time pressure, unintentionally encouraging further procedural shortcuts. These shortcuts degrade cleaning effectiveness, lead to improper equipment repairs, and contribute to equipment malfunctions, which further elevate contamination risk and operational stress. Together, these interactions form a set of reinforcing and balancing feedback loops in which culture, workload, equipment reliability, and worker practices continuously influence one another, demonstrating that food safety is a systems property shaped by the alignment—or misalignment—of organizational expectations, worker capacity, and environmental conditions.

Worker Roles and Associated Risks:
A Causal Loop Diagram



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MPHTC Student Field Placement Blog #2

Antibiotic Testing in Raw Milk Intake for Cheese Production

Olivia Shruck

Kansas State University

Policies and regulations that govern dairy testing and production in Wisconsin are crucial to ensure food safety along the line of cheese making. To do this, testing is performed at every step in the process, from the farm, bulk tanks, during transport, at the processing plant, and in finished products. Residual drug testing is the process of collecting samples and using a rapid SNAP test to detect beta-lactams. Beta-lactams are commonly used in the treatment of mastitis in cows that contains antibiotics such as penicillin. In previous years, it was shown that the presence of residual drugs inhibited the growth of starter cultures in milk, which affects the pH and causes it to coagulate faster, which also causes incomplete fermentation that reduces the true flavor and texture of the cheese produced. The FDA concluded in 1955 that consuming antibody residues caused a health risk, and the American Dairy Science Association passed a resolution stating that any cow that is treated for mastitis with residual drugs and milked for human consumption cannot have their milk shipped for production for 72 hours after completing antibodies (Navratilova et al. 2024).

Looking at the process of testing within a cheese plant, the first test done is on the dairy farm (raw milk production). Farmers must ensure their cows are milked in sanitary conditions, the milk is rapidly cooled and placed in a bulk tank, checked for visual and odor concerns, and the milk is cooled at 45 degrees Fahrenheit or lower. Maintaining antimicrobial control within their herd and performing snap testing before the treated cows are milked for production can reduce the risk of having an entire load dumped from running a positive. A licensed milk hauler comes to collect their milk from their bulk tank and takes a sample before pumping it onto the truck, and puts the farm ID, date, and temperature of the bulk tank on record to then store the sample properly on the way to the facility. When the milk reaches the processing plant, this is the critical step to ensure there is no residual drug present in the milk. A composite sample of every farm is collected in one truck and taken for a SNAP test to check for drug residue. If a negative test comes back, the truck goes on its way and is unloaded at the facility. If a positive test comes back, this is where extra testing must be conducted, and if more positives come back, that truck load is dumped, and the farms that put milk in that truck are now at a loss.

Now within the processing plant, commingling of all negative truck loads is used and moved from raw intake to pasteurization. Pasteurization isn’t a testing method but is crucial for cheese making and undergoes strict controls and monitoring. Annually, pasteurizers undergo time and temperature seals to ensure working quality, and each load run through has a time and temperature chart associated to ensure uniformity. When products are finished, whether that be cheese, dried whey or dairy powders, a fat and moisture test is taken to ensure standards are met (Polzin, 2025). The Food Safety Modernization Act (FSMA) is a policy that ensures compliance with Hazard Analysis Critical Control Points (HACCP), regular pathogen testing, and oversees the testing of all that has been stated. The importance of policy and regulation is to provide safe and delicious dairy products for consumers to enjoy without fear of falling ill. It's not only crucial in the dairy processing alone, but in every step from farm to fork.

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MPHTC Student Field Placement Blog #3

Global Food Safety Initiatives in Food Production

Olivia Shruck

Kansas State University

The Global Food Safety Initiative (GFSI) is an organization that enforces food safety through internationally recognized standards within the food industry. By having a GFSI certification, institutions create a strong focus on food safety and production, optimize their resources, and enhance performance within the facility in many ways. In 2000, there was a series of food recalls that concerned the government and created a sense of need to restore confidence in the food and beverage industry. By developing this internationally recognized system, audit fatigue is decreased as companies would perform internal audits, as well as bring in third-party audit companies to conduct a review of the quality initiatives throughout their facility. GFSI finally published its first set of standards in 2001 and later emerged with different types of schemes to allow a variety of options based on what a company needs (Schrick, 2020).

Within the standards of GFSI, there are benchmark schemes that provide certification to companies if they achieve a successful audit against the schemes. According to mygfsi.com, scope CII focuses on the processing of perishable plant products, which would include cheese-making facilities. The best certification options for this category include SQF, FSSC 22000, PrimusGFS, and BRCGS, which would be decided based on the type of facility and production affiliation.

Safe Quality Food (SQF) Program is available for institutes focused on food retail and service, supplemental ingredients, aquaculture, meat and dairy livestock operations, and packaging and storage facilities. This form of scheme has evolved to adapt more to retailers' and suppliers' needs. The program consists of the global market fundamentals, food safety code (HACCP + GFSI), and quality code (SQFI, 2025). SQF focuses on ensuring Food Safety Modernization Act (FSMA) compliance through its food safety code. Because of this, SQF is ideal for facilities whose consumers request global market audits for those who are advancing their programs. FSSC 22000 is similar in the sense of focusing on FSMA protocols as well as ISO standards, which is an international standard that specifies the requirements for Food Safety Management Systems (FSMS). Besides ISO and requirements to contribute to sustainable developmental goals, FSSC 22000 also focuses on Pre-Requisite Programs (PRP), which is an assurance of hygienic environments within the organization (FSSC, 2025).

Primus GFS covers operations such as primary production and manufacturing sectors at the global level. Audits with Primus GFS focus on the FSMS, Good Agriculture Practices (GAPs), Good Manufacturing Practices (GMPs), and Hazard Analysis Critical Control Points (HACCP). Primus GFS is moving to help change the procedure industry closer to a globally safe industry through an integrated supply chain approach (PrimusGFS, 2025).

BRC Global Standard is the largest and easiest GFSI scheme globally. The main goal of BRCGS is their objective to maintain consistency in food safety and facilitate trust and confidence. There are seven sectors within the scheme, which include the commitment of senior management, HACCP, food safety and quality control, site standards, product control, process control, and personnel. The basis of BRCGS auditing gives facilities a grade based on how many non-conformities they receive from the third-party auditor. A company can choose from an annual announced, mixed, or unannounced audit, which determines if they receive a regular grade, or, for unannounced, a plus is added to prove they are always audit-ready (Schrick, 2020). The cheese production facility that I am familiar with works with BRCGS and their auditing procedures, where they follow GFSI requirements annually through an announced audit. By doing this annually, they can continually ready themselves and improve based on the Standard. GFSI is such an important aspect that facilities can be used to certify themselves to prove they ensure all safety standards in any aspect of the facility, to provide consumers with the best product possible.

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Material Name	Storage Requirements	Biological Hazards (Table 2)	Biological Hazard Control	Chemical Hazard / Radiological Hazard (Table 3)	Chemical Hazard / Radiological Hazard Control	Allergen	Allergen Hazard Control	Physical Hazard	Physical Hazard Control
Raw Milk (###)	R	1.Pathogenetic Microorganisms (VH-3) (VH-3) (TRL-6) (S&L)	1.Temperature Control 2.Pasteurization	1.Antibiotics (M-1) (M-1) (TRL-2)	1.Antibiotic Test	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
Milk Receiving (PC#1) (###)	R	1.Pathogenetic Microorganisms (VH-3) (VH-3) (TRL-6) (S&L)	1.Temperature Control 2.Pasteurization	1.Antibiotics (M-1) (M-1) (TRL-2)	1.Antibiotic Test	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
Raw Milk Storage (###)	R	1.Pathogenetic Microorganisms (VH-3) (VH-3) (TRL-6) (S&L)	1.Temperature Control 2.Pasteurization	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
Pre Pasteurizer Milk Filter (###)	N/A	1.Pathogenetic Microorganisms (VH-3) (VH-3) (TRL-6) (S&L)	1.Temperature Control 2.Pasteurization	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
Milk Separator (###)	N/A	1.Pathogenetic Microorganisms (VH-3) (VH-3) (TRL-6) (S&L)	1.Temperature Control 2.Pasteurization	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
Cream Silo (###)	N/A	1.Pathogenetic Microorganisms (VH-3) (VH-3) (TRL-6) (S&L)	1.Temperature Control 2.Pasteurization	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors

Milk UF (###)	N/A	1.Pathogenetic Microorganisms (VH-3) (VH-3) (TRL-6) (S&L)	1.Temperature Control 2.Pasteurization	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
Permeate (###)	A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Sanitization 2.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
Pasteurizer (CCP) (PC#2) (###)	N/A	1.Pathogenetic Microorganisms (VH-3) (VH-3) (TRL-6) (S&L)	1.Temperature Control 2.Pasteurization	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
MPC Silo (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Sanitization 2.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
HPP (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Sanitization 2.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Filters 2.Metal Detectors
Dryer (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.Magnet 3.GMPs
Bag House (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.Magnet 3.GMPs

Air Filter (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (L)	1.Finished Product Testing 2.Maintenance	N/A	N/A	N/A	N/A	N/A	N/A
Heated Air (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing 2.Maintenance	N/A	N/A	N/A	N/A	N/A	N/A
Cooled Air (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (L)	1.Finished Product Testing 2.Maintenance	N/A	N/A	N/A	N/A	N/A	N/A
Fluid Bed (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.Magnet 3.GMPs
Instantizer (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.Magnet 3.GMPs
Lecithin (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (L)	1.Supplier Guarantee	N/A	N/A	N/A	N/A	N/A	N/A
Ingredient Storage (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Supplier Guarantee	N/A	N/A	N/A	N/A	N/A	N/A

Ingredient Receiving (PC#5) (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Supplier Guarantee 2.COA Review	N/A	N/A	N/A	N/A	N/A	N/A
Rework (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.Magnet 3.GMPs
Sifter (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.Magnet 3.GMPs
Magnet (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.Magnet 3.GMPs
Powder Bin (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.Magnet 3.GMPs
Hopper (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.Magnet 3.GMPs
Bagger / Scale (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Finished Product Testing	N/A	N/A	1.Milk (VH-3) (VH-3) (TRL-6)	1.Declare on Ingredient Statement	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Metal Detectors 2.GMPs

Bags (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Supplier Guarantee	N/A	N/A	N/A	N/A	1.Other Foreign Material (L-0) (L-0) (TRL-0) 2.Metal (L-0) (L-0) (TRL-0)	1.Supplier Guarentee
Bag Storage (###)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Package Receiving (PC#6) (###)	N/A	1.Pathogenetic Microorganisms (VH-0) (VH-3) (TRL-3) (S&L)	1.Supplier Guarantee	N/A	N/A	N/A	N/A	N/A	N/A
Label / Allergen Verification (PC#3) (###)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metal Detector (PC#4) (###)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Palletizer (###)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dry Storage (###)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Distribution (###)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sanitization (PC#7)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Total Risk Level:
5-6 = High Risk
2-4 = Medium Risk
0-1 = Low Risk
*Anything that is a 5/6 (high risk) will be a CCP or PC

Pink Wording: Critical Control Point
Yellow Highlight: Preventive Control
L&S: Listeria and Salmonella
*4.2/5.4 policies have our fraud and malicius program spelled out FDA states that there are no radiological hazards in the are of the plant

Consequences/Severity of Hazard:
L = Low (0)
M = Medium (1)
H = High (2)
VH = Very High (3)

Frequency/Likely Occurrence of Hazard:
L = Low/Not Likely (0)
M = Medium/Remote (1)
H = High/Possible (2)
VH = Very High/Common (3)

Storage Requirements:
A = Ambient
R = Refrigeration
F = Frozen

Fraud Hazard	**Fraud Hazard Control**	**Malicious Hazard**	**Malicious Hazard Control**
1.Water (L-1) (L-0) (TRL-0)	1.Spot Check Loads	1.Adulteration (L-0) (M-1) (TRL-0)	1. Camera
1.Water (L-1) (L-0) (TRL-0)	1.Spot Check Loads	1.Adulteration (L-0) (M-1) (TRL-0)	1. Camera
1.Water (L-1) (L-0) (TRL-0)	1.Spot Check Loads	1.Adulteration (L-0) (M-1) (TRL-0)	1. Camera
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	Adulteration (L-0) (L-0) (TRL-0)	1.Camera

N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	1.Adulteration (L-0) (L-0) (TRL-0)	1.Camera
N/A	N/A	N/A	N/A

N/A	N/A	N/A	N/A
N/A	N/A	1.Adulteration (L-0) (L-0) (TRL-0)	1.Camera 2.Multiple Personal

MULLINS CHEESE/WHEY INC.
QUALITY ASSURANCE POLICY

Title: Internal Auditing Programs - Plover		Date of Development: 07-07-2025	Policy Number: 3.4.1 & 3.4.2 & 3.4.3
Supersedes: 07-07-2025	Revision Number: 1	Revision Date: 07-07-2025	Page: 1 of 2
Issued By: Olivia Shruck		Approved By: Dustin Seefeldt	

Objective: to audit the HACCP program and supporting prerequisite programs and procedures.

All prerequisite programs will be internally audited on an annual basis, but at a minimum four different times. The HACCP program and supporting documentation will also be audited on an annual basis. In the event that an internal audit discovers a critical failure, the program will be re-audited the following month. Internal audits of the HACCP plan and prerequisite programs will be done by personnel independent of the area that they are auditing in the quality assurance department. All auditors will be trained appropriately. All activities that form part of the site's food safety and quality systems, including the ones relevant to food safety, authenticity, legality and quality, will be covered once a year.

Documentation of audit findings of the HACCP plan and prerequisite programs is very critical for the improvement of the program. The audit will be performed using the BRC issue 9 audit checklist. All nonconformities will be addressed with those associated with the program and will also be discussed with management during monthly food safety meetings. Corrective actions will be completed in a timely fashion and implementation will be verified by quality assurance

There are 11 prerequisite programs at Mullins Cheese/Whey Inc. that need to be audited along with HACCP. Programs to be audited include:
1. Purchasing
2. Pest control
3. Maintenance
4. Foreign Material Control
5. Allergens
6. Cleaning and Sanitation
7. Transportation
8. Training
9. Personal Hygiene
10. HACCP
11. Food Defense/Food Fraud

See 2.2.1 for more detail on the prerequisite programs at Mullins Cheese/Whey Inc.

MULLINS CHEESE/WHEY INC.
QUALITY ASSURANCE POLICY

<table>
<tr><td colspan="2">Title: Internal Auditing Programs - Plover</td><td>Date of Development:
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</table>

Revisions:

1. 07-07-2025 New

MULLINS CHEESE/WHEY INC.
QUALITY ASSURANCE POLICY

Title: Corrective Actions Policy - Plover		Date of Development: 07-08-2025	Policy Number: 3.7.1
Supersedes: 07-08-2025	Revision Number: 1	Revision Date: 07-08-2025	Page: 1 of 2
Issued By: Olivia Shruck		Approved By: Dustin Seefeldt	

Objective: to make sure corrective actions are put in place if needed after an onsite visit or when plant programs are not performed in the plant satisfactorily.

Corrective actions let companies know when non-conformities need to be addressed and give the plant a time line to follow for fixing issues.

For any non-conformance identified in the food safety and quality system which have a potential adverse effect on product safety, authenticity, legality of quality; Mullins Cheese/Whey Inc. has a CAPA plan in place to deal with such non-conformance.

CAPA must be completed for areas in the standard where it is a requirement and for all programs stated below:

- Complaint
- Environmental Pathogen
- Internal Audit
- Glass & Brittle Plastic
- Preventive Control
- Site Inspections
- Third –Party Audits
- Product Recalls
- Product Testing

Below is the outline of how non-conformances are handled:

1. The corrective action program will be written up in 30 days of findings
2. Root cause will be determined for the system failure. Using five why analysis.
3. All nonconformities in the corrective action program will have a dated timeline of when the issue will be addressed.
4. When the non-conformity is addressed, the date and initials of who fixed or witnessed the non-conformity being completed will be written next to that item.
5. Verification by the management team will be recorded next to the item being fixed.
6. Any consequences resulting from the system failure will be documented.
7. Monthly QA Team must review all CAPA finding for the month
8. Final verification of CAPAs will be done by a PCQI

Any nonconformity which will directly affect product safety will be addressed immediately. Corrective action timeline could be extended based on severity and availability of materials for the failure that needs to be addressed.

Corrective actions dealing with production paperwork and procedures will be dealt with at time of nonconformance either by the plant supervisor verifying the work done or by the quality assurance department reading and relaying results to plant personnel. All corrective actions will be documented on production paperwork.

Corrective actions related to BRC audits would be handled following Cert ID requirements and will be closed out prior to receiving BRC certification.

Completion of root cause analysis and implementation of preventive action will be added

The quality assurance department will handle corrective action reports and they will be filed in the quality assurance office or in the quality assurance folder at the Plover Division.

Revisions:

1. 07-08-2025 New

MULLINS CHEESE/WHEY INC.
QUALITY ASSURANCE POLICY

Title: Color Coding Program - Plover		Date of Development: 07-10-2025	Policy Number: 4.11.2A
Supersedes: 07-10-2025	Revision Number: 1	Revision Date: 07-10-2025	Page: 1 of 2
Issued By: Olivia Shruck		Approved By: Dustin Seefeldt	

OBJECTIVE: to ensure food safety by **using only specific colored brushes, pails and squeegees** to perform plant cleaning and production processes.

COLOR CODES:

RED	will be used **specifically** for raw product areas **ONLY**
ORANGE	will be used **specifically** for cheese fines/permeate dust-fines **ONLY**
YELLOW	will be used **specifically** for basic (acid) chemicals **ONLY and** non-product contact areas; brushes NOT for floors and drains
GREEN	will be used **specifically** for salt applications **ONLY**
BLUE	will be used **specifically** for basic (caustic) chemicals **ONLY and** non-product contact areas; brushes NOT for floors and drains
WHITE	will be used **specifically** for pasteurized/ finished cheese and product contact **ONLY**
BLACK	will be used **specifically** for waste cheese **ONLY**, brushes & squeegees for floors and drains **ONLY**
Gray	will be used for maintenance ONLY
PURPLE	Will be used **specifically** for Perasan acid sanitizer ONLY
Pink	Will be used specifically for whey plant bagging rooms

Revisions:

1. 07-10-2025 New

MULLINS CHEESE/WHEY INC.
QUALITY ASSURANCE POLICY

Title: Personal Hygiene - Plover		Date of Development: 07-14-2025	Policy Number: 7.2
Supersedes: 07-14-2025	Revision Number: 1	Revision Date: 07-14-2025	Page: 1 of 2
Issued By: Olivia Shruck		Approved By: Dustin Seefeldt	

Objective: to ensure understanding of the requirements of GMP and personal hygiene.

At Mullins Cheese/Whey Inc., all new hires are given a GMP Manual with the employee handbook. The GMP Manual goes over all GMP and personal hygiene requirements when entering into the plant. Also the GMP Manual is posted throughout the plant for employees to read over if so desired. The GMP Manual is reviewed annually and reposted if changes are made.

GMP and personal hygiene requirements are trained semi-annually to all employees including seasonal, temporary, contract, volunteer employees, whether hired directly or through a recruitment firm.

Some items covered in the GMP Manual are jewelry, hairnets, hand washing, visitor requirements, band aides and some safety requirements. At the employee entrance into the plant, a hand wash station is installed so that proper hand washing is performed. Hand washing procedure is addressed at GMP meetings.

For employees with cuts where a band aid is required, a blue metal detectable strip is provided to be worn when in the plant for color distinction. The blue band aid is checked when a lot change happens with each different type of band aide against the metal detector.

Written instructions for personal medicines are identified in the employee handbook. All personal medicines are to be kept in personal lockers, be locked at all times and not leave the break room for any reason.

Revisions:

1. 07-14-2025 New

CAPA Protocol

Non-conforming Condition:

Root Cause Analysis:

5 Why's		**Before Photo**	**After Photo**
1.	Location:		
2.	Corrective Action:		
3.			
4.	Preventive Action:		
5.			