NOLAN HINRICHS

SCHOOL: The University of Iowa

MAJOR: Mechanical Engineering

ANDERSON ERICKSON DAIRY - WASHOUT

COMPANY PROFILE:

Anderson Erickson (AE) Dairy is a family-owned company that has been dedicated to producing high-quality dairy products since 1930. AE is headquartered in Des Moines, Iowa, where it has been producing products in the same facility since 1938. The plant operates three shifts, 24 hours a day, seven days a week with approximately 375 employees. AE's quality products are in numerous grocery stores across Iowa and the Kansas City area, with a select presence in neighboring states.

PROJECT BACKGROUND

Any time production changes over to a new product, all equipment must be thoroughly cleaned and sanitized. Washout processes and cleaning procedures constitute the majority of water usage at the plant. Nearly all production equipment is cleaned using a clean-in-place (CIP) program. Commonly used in food manufacturing facilities, CIP programs are automated, multi-phase cleaning cycles that don't require the disassembly of equipment. After a washout baseline was created, areas of opportunity were identified to optimize washout water consumption and associated costs. Additionally, water baseline work was completed to begin mapping water usage in non-CIP focused applications.

INCENTIVES TO CHANGE

AE Dairy continues to actively seek ways to enhance the quality of its products while minimizing its environmental footprint. As part of this commitment, AE is diligently working towards achieving carbon neutrality by adopting renewable energy sources and employing carbon-neutral brown boards for milk containers. As AE continues to strive toward sustainability, it has targeted the optimization of production water use as a key next step.

RESULTS

The intern started with establishing a baseline of water usage at the plant. Approximately 80 percent of the water consumed by AE Dairy was found to be used for sanitation. Sanitation includes product rinses, facility cleaning, and CIP programs. The CIP programs can be divided into four major categories: tanks, lines, fillers, and pasteurizers. The CIP programs dedicated to cleaning tanks and lines make up 55 percent of the total water consumption, while the fillers and pasteurizers use 4 percent and 10 percent respectively. These baseline percentages confirmed the value of further analyzing the CIP systems for water use efficiencies.

Installation of Turbidity Meters: The standard CIP program consists of four timed stages. First, freshwater is flushed through the system to remove any remaining product. Then a wash solution is recirculated through the system to kill bacteria and remove protein buildups. Freshwater is then flushed through the system again to remove the wash solution from the system and lastly a sanitizing solution is used. Sampling was completed on ten CIP programs to test for the presence of any product remaining in the rinse water. The results of this sampling verified that most of the product is fully removed before the end of the first pre-rinse timed cycle, meaning excess water is being used.

Turbidity sensors measure the amount of suspended particles within a fluid. Using turbidity sensors to control rinse times could reduce the amount of water used for the pre-rinse by automatically ending the rinse cycle when all remaining milk product is removed from the rinse stream.

A pilot turbidity meter was installed and tested to validate this recommendation. It was determined that the water needed for the pre-rinse could be reduced by 14 percent and still maintain the quality standards of the cleaning process. The pilot testing was still in progress at the end of the internship. When approved, turbidity meters could be installed on all CIP skids for plant-wide savings.

Case Wash Tank Water Reuse: In each CIP program, fresh post-rinse water is pumped through the system following the wash cycle before a new milk product run begins. Some of this post-rinse water is then sent to a tank to wash the plastic dairy crates used for packaging and distribution. However, the crate wash does not use all of the post-rinse water and the excess is diverted to the drain. The excess post-rinse water could be piped back to select CIP skids and used as pre-rinse water. Pre-rinse water is not required to be fresh water from the city because it precedes the wash solution cycles that perform the sanitization process. If this recommendation is approved, piping installation for the targeted CIP skids would be scheduled to minimize production downtime.

Tank Sprayer Upgrade: A large number of tanks are used throughout production to hold and store product. As part of the CIP process, most tanks utilize a static spray ball to spray down the interior of the tank. Made of stainless steel, these spray balls have holes drilled into the surface and spray water in all directions. The spray balls operate using high flow rates and long rinse times in order to effectively clean the tank.

Rotary spray heads operate by spraying a flat, fan-shaped jet while the entire sprayer rotates, providing 360-degree coverage. Due to the mechanical action of the moving jets, rotary spray heads can provide faster, more efficient coverage than the spray balls, using up to 30 percent less water. The most effective implementation process is to install the rotary spray heads along with the turbidity meters so the rinse cycles can be automatically updated as the new tank sprayers are installed. Two rotary spray heads have been purchased and are currently being piloted in one of AE's batch tanks. If testing is successful AE will consider plant-wide replacement.

ENVIRONMENTAL AND ECONOMIC SAVINGS TABLE

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
INSTALLATION OF TURBIDITY METERS	$16,250	1,417,000 gallons	RECOMMENDED
CASE WASH TANK WATER REUSE	$13,431	1,171,000 gallons	RECOMMENDED
TANK SPRAYER UPGRADE	$28,627	2,393,608 gallons	RECOMMENDED