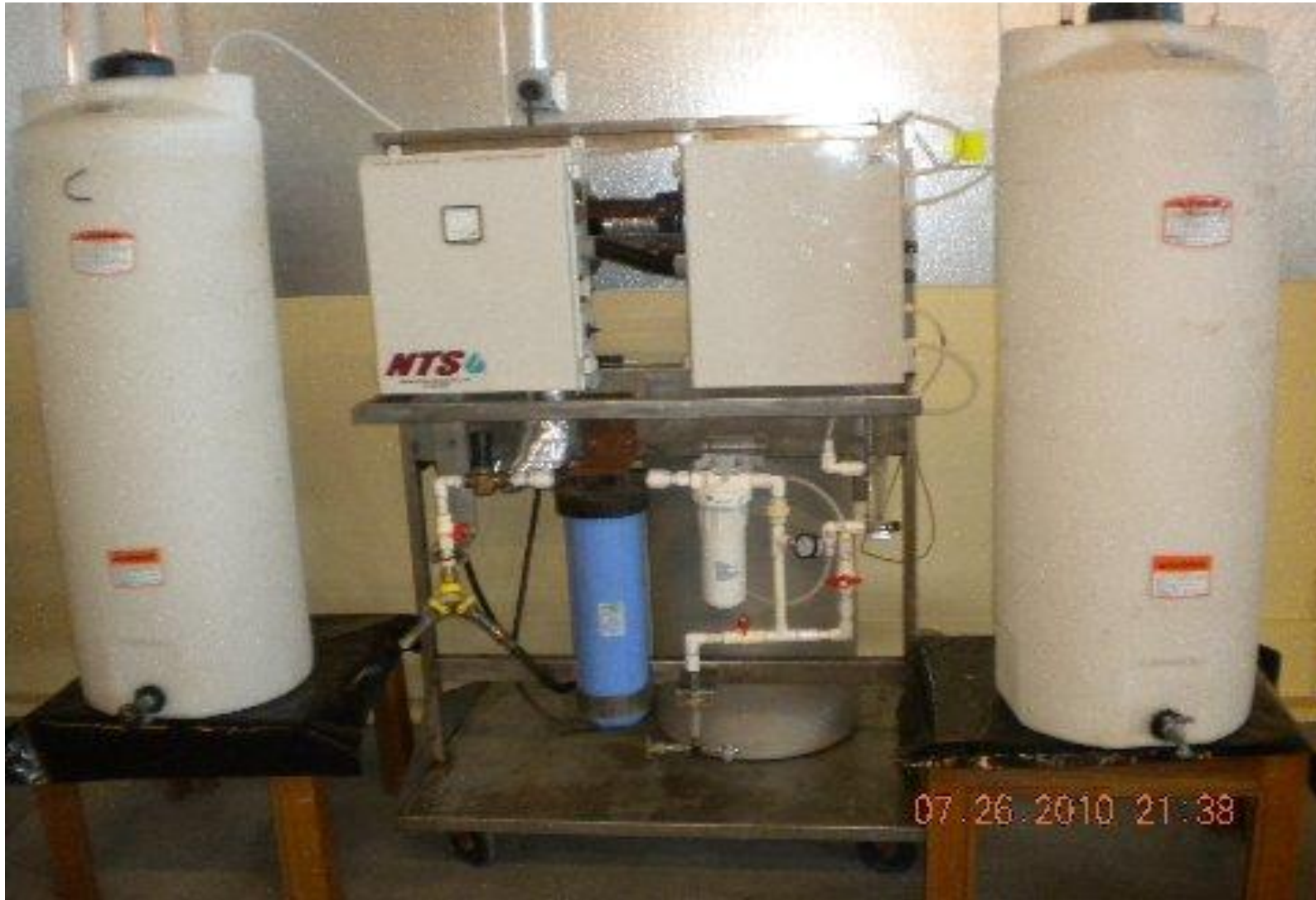


Electrolyzed Water Technology



Electrolyzed Water Technology



Lake Forest Sanitizing Systems



Electrolyzed Water Trial
At Evergreen Farms

October 21, 2010

Trial Objective and Approach

Trial Objective

- To demonstrate the effectiveness of using electrolyzed water for the cleaning and sanitization of milk storage tanks and pipelines on a Grade A dairy farm.
- To secure FDA approval of the system, solutions and process for use on Grade A dairy farms as covered by the PMO.

Approach

1. The initial focus of this trial has been on the cleaning and sanitization of one of the two milk storage tanks at Evergreen Farms. Given the positive trial results, work is currently underway to incorporate the second tank into the new cleaning process.
2. The next step is to expand the trial to include the milk pipelines, which will require additional production capacity due to the total volume of sodium hydroxide solution required.
3. Lastly, expand the trial to include additional dairy farms of various sizes, equipment configuration, and interface/process requirements in order to demonstrate system performance under different operating conditions.

Evergreen Farms in Spruce Creek, PA



- Evergreen Farms is owned and operated by Wayne Harpster's three sons, and resides on about 5,000 acres in central Pennsylvania.
- As one of the largest dairy farms in PA, the Harpsters milk approximately 2,450 dairy cows three times a day.
- Evergreen Farms was the first to install a double 40 parallel parlor with a 4" low line that is cleaned three times a day.
- Evergreen Farms operates with two 6,000 gallon milk storage tanks that on average are each drained and cleaned twice a day.
- LFSS is working closely with Abe Harpster on the installation and field testing of its electrolyzed water based cleaning and sanitizing system.

System Configuration



- The majority of the system components are located on the opposite side of the wall from the tank room. This includes the EW production machine, solution storage tanks, electronic flow valves, water supply pipes, hot water heater and a separate circuit breaker/power supply box.
- All of the solutions used in the cleaning and sanitizing process are pumped into the milk tank room via a single flexible pipe to avoid any potential contamination.
- A separate PLC unit was developed and installed to independently control the cleaning and sanitizing process.
- Throughout the entire trial, the original system remained in-place with the ability to reactivate it with the flip of a switch.

Electrolyzed Water Production Machine

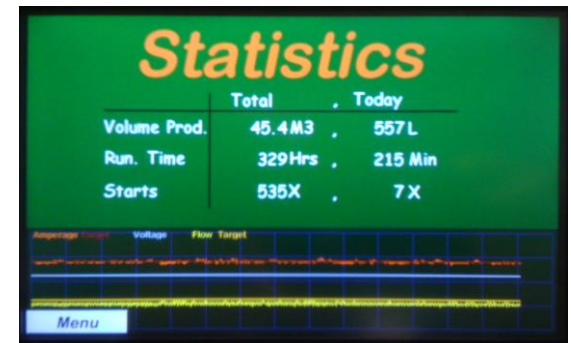
The production machine is capable of producing up to 50 gallons of electrolyzed water per hour – 70% being hypochlorous acid and 30% being sodium hydroxide.

Once installed and configured, the machine should operate without any major maintenance – only the salt supply must be checked regularly.

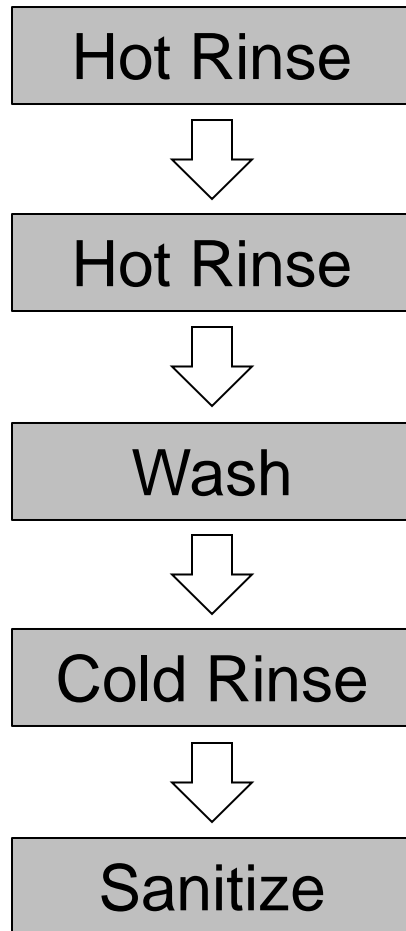
A fully integrated PLC unit controls all of the critical processes. In a situation when an operating parameter is out of spec, an on-screen alarm will be activated and the machine will automatically shut down.

Only authorized personnel have access to the PLC program and, most importantly, the machine can be remotely monitored and controlled via a secure Ethernet connection.

This specific production machine has been approved by the EPA for on-site production and use under EPA Establishment #85215-PA-00.



Tank Cleaning Process



The purpose of the first hot rinse is to flush the majority of the remaining milk from the tank as well as to begin raising the temperature of the tank using 140-150°F water.

The second 140-150°F hot water rinse is used to remove/loosen any remaining milk from the walls of the tank and to continue raising the temperature of the tank for washing.

Sodium hydroxide is used for the washing stage. The solution is used at room temperature and warmed by the walls of the tank during the circulating process.

A cold water rinse is used to remove any remaining sodium hydroxide from the tank prior to adding the acid sanitizer, thus avoiding any negative chemical reaction.

The final stage of the cleaning process is the addition and circulation of a water diluted hypochlorous acid solution as the acid sanitizer.

Cleaning Results from October 14, 2010

The table below shows the type of data collected for each test run; the positive FAC in the drained sanitizer solution indicates a successful cleaning process

| | | | Time (min) | Volume (G) | Temp (F) | pH | Causticity | ORP (mV) | FAC (ppm) |
|---|------------|-----------------|------------|------------|----------|-------|------------|----------|-----------|
| 1 | Hot Rinse | Tank temp | | | 44 | | | | |
| | | Hot water fill | 6 | 48 | 140 | 7.43 | | | |
| | | Circulate | 2 | | 78 | | | | |
| | | Drain | 4 | | 81 | 8.65 | | | |
| 2 | Hot Rinse | Tank temp | | | 69 | | | | |
| | | Hot water fill | 6 | 48 | 140 | 7.43 | | | |
| | | Circulate | 2 | | 94 | | | | |
| | | Drain | 4 | | 99 | 8.62 | | | |
| 3 | Wash | Tank temp | | | 90 | | | | |
| | | NaOH fill | 5 | 50 | 69 | 12.47 | 0.12% | | |
| | | Circulate | 10 | | 86 | | | | |
| | | Drain | 3 | | 83 | 10.82 | 0.06% | | |
| 4 | Cold Rinse | Tank temp | | | 79 | | | | |
| | | Cold water fill | 5 | 50 | 63 | 7.69 | | | |
| | | Circulate | 2 | | 74 | | | | |
| | | Drain | 3 | | 72 | 8.92 | | | |
| 5 | Sanitize | Tank temp | | | 72 | | | | |
| | | Cold water fill | 4 | 40 | 63 | 7.69 | | | |
| | | HOCl fill | 1 | 10 | 67 | 3.26 | | 1000+ | 190 |
| | | Circulate | 5 | | 68 | | | | |
| | | Drain | 3 | | 68 | 8.71 | | 785 | 25 |
| | | Total Time | 65 | | | | | | |

Additional Results/Observations

ATP measurements taken after the completion of the tank cleaning cycle on October 14th were all acceptable

| | | | |
|----------------------|---|-------------------|---|
| ▪ Inside lid surface | 0 | ▪ Pump connection | 3 |
| ▪ Inside front wall | 0 | ▪ Tank connection | 3 |
| ▪ Inside left wall | 0 | | |
| ▪ Inside right wall | 0 | | |

Note that a milky substance, about the area of a quarter, has been observed at the tank outlet connection; there seems to be a design problem with the sealing ring that very slightly restricts flow at the tank outlet connection leading back to the recirculation pump/drain.

There were no other biofilms or residuals visible inside the tank immediately following the cleaning cycle and after 5 days of repeated cycles.

Standard testing results for Tank A and controlled Tank B showed no difference in milk quality between the two tanks over the development time period.

Next Steps

1. Expand the trial at Evergreen Farms to include the milk pipelines, which will require additional production capacity due to the total volume of sodium hydroxide solution required.
2. Expand the trial to include additional dairy farms of various sizes, equipment configuration, and interface/process requirements in order to demonstrate system performance under different operating conditions.
3. Secure FDA approval of the system, solutions and process for use on Grade A dairy farms as covered by the PMO.