

Enhancing Water Quality, pH & Microbial Control in Egg Production

A Case Study of Hydroxyl-Based Advanced Oxidation Process (AOP) Water Treatment

THE CLIENT OVERVIEW

This case study highlights how the Clear Comfort AOP (*advanced oxidation process*) water treatment solutions can address water quality challenges in a large-scale egg production facility, ensuring the consistent production of high-quality eggs.

- Laying Hen Capacity:**
Between 3 and 3.5 million layers, generating eggs year-round in a controlled environment
- Production Capacity:**
Facility expects to produce roughly 2.7 million eggs per day or about 1 billion eggs per year
- Water Source:**
Groundwater from an on-site well
- Estimated Total Peak Water Consumption:**
140,000 gallons per day
- Estimated Total Process Flow:**
Approximately 140 GPM (*gallons per minute*) which is delivered to a 50,000-gallon intermediate storage tank that is filled on-demand
- Water Uses:**
Poultry drinking, egg washing, facility wash down and other applications

THE BACKGROUND

Commercial egg production involves multifaceted critical stages, including laying, collecting, washing, candling, grading, sorting, packing, shipping and storing. Each of stage presents unique challenges that impact the overall efficiency and quality of egg production. As the egg production industry continues to evolve, it has harnessed technological advancements to address these challenges effectively.

Water, a fundamental resource, plays a central role in various egg production stages, including hen health during laying, equipment cleaning, sterilization and egg washing processes. Scientific studies have shown that water quality has a substantial influence on critical factors, like shell thickness and the relative salt and mineral composition within both the egg and hen plasma. Additional research has demonstrated that high water quality can improve feed conversion efficiency and reduce egg loss due to breakage.

This study focuses on the impact water quality has on large-scale commercial egg production, outlining the engineering, design and integration strategies deployed Clear Comfort.

THE CHALLENGES

- Microbial Vulnerability:** The client was defenseless against microbial contamination due to untreated water, excluding an existing RO side stream.

Client needed to maintain a low level of microbiological activity in stored process water. Client used total coliform bacteria levels as indicative metrics for microbial control, using third-party microbial plate culture media as per established protocols.

- pH Control to Prevent Corrosion:** Sourced well water had high mineral and salt content, leading to increased buffer capacity and relatively high pH.

The combination of mineral content and high pH posed risk of downstream system fouling from calcium carbonate scale deposits. Lowering pH would prevent corrosive damage to the facility.

- Egg Breakage Loss:** Moderately high egg loss from breakage in production due to egg shell quality concerns.
- System Validation:** Ensure Clear Comfort's control system effectively managed pH, system functionality and provided accurate data.



THE PROCESS

Clear Comfort takes employs a systematic approach to assess new opportunities, tailoring water treatment solutions to meet the unique needs of livestock farming operations. This process, which we implemented at the client's facility, involved the following key steps, familiar to livestock farmers:

- ▶ **Detailed Facility Site Survey:** The study conducted a thorough examination of the client's facility to gain insights into water-related challenges and establish preliminary objectives.
- ▶ **Client Consultations:** The Clear Comfort engaged in discussions with clients to identify specific water-related challenges and goals.
- ▶ **Baseline Water Analysis:** The study performed comprehensive water analysis, focusing on key indicators of common water quality issues that are pertinent to livestock farmers.

As an example of this evaluation process, a buffer capacity analysis was conducted. Buffer capacity assesses how groundwater chemically responds when an acid solution is added to maintain a lower pH level. Using this analysis data, Clear Comfort engineers determined the maximum acid consumption rate, predicted the chemical feed rate and identified appropriate stock acid concentration.

THE SOLUTION

To address the client's needs, Clear Comfort's engineering team used a two-part treatment solution:

- ▶ **Oxidative Hydroxyl Radical Creation:** Using a patented Hydroxyl-Based AOP technology, the Clear Comfort's AOP system injected treated air into the blended water stream to introduce highly potent oxidative hydroxyl radicals. These radicals provided fast-acting microbial disinfection before the water reached the intermediate storage tank.
- ▶ **SMART Dosing Technology:** Clear Comfort's SMART dosing technology maintained precise pH control within a range of 0.5 standard pH units.

The inclusion of an in-line injection loop ensured continuous, uninterrupted treatment despite uneven water flows due to batch filling of the downstream storage tank. The integrated system incorporated alarm functionality, interactive touch-screen inputs, enhancing built-in biosecurity safety and treatment flexibility. In addition, automated data logging provided an audit trail for the client to monitor water quality and treatment performance.



THE RESULTS

In evaluating the Clear Comfort AOP water treatment solution, the client's egg production facility experienced notable outcomes:

- ▶ **Top-Tier Microbial Protection:** Total coliform levels consistently remained below the target threshold of 50 CFU/CC (*colony-forming units per cubic centimeter*), ensuring top-tier biosecurity and a hygienic environment for egg production.

Routine third-party water analysis confirmed that the microbial control achieved with the patented Clear Comfort Hydroxyl-Based AOP water treatment surpassed expectations, ensuring livestock health and well-being.

- ▶ **pH Regulation Excellence:** The targeted pH value of 6.8 ± 0.5 SU (*standard units*) was consistently achieved. pH levels remained within ± 0.2 SU of the target, preserving the facility's equipment and quality by averting scaling and corrosion damage.

- ▶ **Improved Egg Quality:** The client reported that implementing the Clear Comfort AOP water treatment solution led to a net increase of the average egg shell thickness, which resulted in a reduction of corresponding egg loss due to breakage.

Better egg shell quality led to enhanced production efficiency and minimized loss. Additionally, the egg wash process was more sanitary and effective, ensuring clean and high-quality eggs.

- ▶ **Enhanced Feed Conversion:** Drinking the Clear Comfort AOP treated water, the laying hens had improved feed conversion rates, signifying increased efficiency in utilizing feed resources.

- ▶ **Validation for Future Expansion:** As a testament to its success, the client initiated plans to expand the use of Clear Comfort AOP water treatment solutions to other corporate production facilities.

At the client's egg production facility, the Clear Comfort AOP water treatment solution yielded remarkable results for biosecurity, egg quality and equipment preservation. The study underscores the transformative impact advanced water solutions can have on the efficiency and performance at large-scale livestock operations.

To learn more about topic, visit: clearcomfort.com/livestock

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