

# LifeCleans cleaning and disinfectant solution indicates revolutionary improvements for the everyday challenges in chicken production

## Introduction

To meet customer demand, the production of chicken meat has developed into a high-capacity production. One of the greatest challenges for the chicken industry has been, and still is, finding solutions to maintain good biosecurity and animal welfare standards while maintaining time efficiency, productivity, and good profit. Most chickens produced for meat, also called broilers in the industry, have a life cycle of 28-48 days. One of the daily challenges in broiler breeding is maintaining low mortality rates while also ensuring the health and growth of the flock. In this regard, biosecurity routines play a crucial role. From the arrival of one day old chicks to the farm and until they are fully grown and ready for slaughter, the industry has an average of 5% mortality. This mortality is primarily attributed to various illnesses, such as those caused by pathogens like *Clostridium perfringens*, *Salmonella*, or *E. coli*, with certain regions experiencing even higher rates.

Amongst the various aspects and procedures involved in broiler production, LifeClean has specialized in improving biosecurity routines between production cycles, consequently providing a safer growth environment, resulting in improved flock health. LifeClean's know-how and purpose-developed solution for cleaning and disinfection of chicken houses between cycles have proved results which indicates the possibility of a revolutionary change in biosecurity standards for the industry. With years of implementation and rigorous field validation, the result proves key performance indicators of 49% reduction of mortality, increased slaughter weight of the broilers and shorter downtime between cycles thanks to the swift and easy application.

This paper will provide information and field results from LifeClean to show the importance of an effective and less toxic cleaning and disinfection solution to maintain strict microbial control and healthy animals within broiler production. Biosecurity management is not only a matter of preventive care but a key strategy to achieve good profit as a producer.

## The poultry industry

The poultry industry is one of the most important sectors of agriculture, providing a significant source of protein and employment opportunities around the world. In 2020, poultry meat represented almost 40% of global meat production and the demand keeps growing. From 1961 to 2020 the world poultry meat production increased rapidly from 9 to 133 million tons<sup>1</sup>. The European Union is one of the world's largest poultry meat producers and a net exporter of poultry products with an annual production of around 13,4 million tons<sup>2</sup>. Among poultry, the broiler industry is the primary sector globally, representing over 90% of the poultry industry<sup>3</sup>. Within the EU, broiler production accounts for more than 80% of the produced poultry meat<sup>4</sup>.

Most broilers in the EU are produced under standard intensive systems, in flocks of up to 50,000 birds or more, in houses with controlled temperature, light, ventilation and floors made of concrete or gravel covered with litter. The broilers are usually of fast-growing breeds and are fed nutrient dense diets usually inclusive of coccidiostats, synthetic amino acids, and genetically modified ingredients.

1- [www.fao.org/poultry](http://www.fao.org/poultry)

2- European Commission ([europa.eu](http://europa.eu))

3- [www.feedandadditive.com](http://www.feedandadditive.com)

4- [ec.europa.eu/eurostat/statistics](http://ec.europa.eu/eurostat/statistics)

## Prevention of outbreaks

Another vulnerable part of the production of broilers is to keep the production facility protected from outbreaks of diseases that require costly measures in the form of disease control that could force both the producer and nearby producers to depopulate all their animals, and in the worst-case scenario turn into a disaster affecting the society and human health.

Outbreaks of livestock-associated infections (LAIs) diseases that primarily affect animals but may also pose zoonotic risks to humans are more likely to start under the mentioned intense systems in combination with lack of good biosecurity practices. For a better understanding of zoonotic viruses and the damage and threat it poses to our civilization the Corona viruses, Avian Influenza, Monkeypox, African swine fever, Ebola and Salmonella are examples of such pathogens, they originate from animals and spread to humans. New, mutated or already-known pathogens are constantly causing new outbreaks.

70% of new and emerging infectious diseases are zoonoses. However, the microbial transmission pool is vastly larger. Just accounting for viruses, an estimated 1.7 million viruses occur in mammals and water birds, and of these, 631 000-827 000 could theoretically infect humans<sup>5</sup>. Even if these pathogens are microscopic, they make a conceivable threat to the world's biosecurity and human health.

LifeClean's patented antimicrobial chemistry technology with superior efficacy across the entire antimicrobial spectrum, including bacteria, viruses, yeasts, fungi, mycobacteria, biofilm, parasites (incl. Coccidia), and spores, is a game changer when it comes to disease control in broiler production.

Through extensive validation and implementation of LifeClean's cleaning and disinfection solution to the Norwegian broiler industry, we see a reduction in outbreaks from 10-30% to 2.6-3%, proving that the right cleaning and disinfection solution between production cycles together with good biosecurity practices prevent outbreaks and improve animal welfare.

In addition to LifeClean's broad-spectrum effectiveness, as mentioned, the solution also solves two common problems in the broiler industry:

1. Reducing toxic compounds and exposure to the animals.
2. Providing an effective solution for porous materials to create a cleaner environment for the animals.

5- IPBES (2020) Workshop Report on Biodiversity and Pandemics of the Intergovernmental Platform on Biodiversity and Ecosystem Services. Daszak, P., Amuasi, J., das Neves, C. G., Hayman, D., Kuiken, T., Roche, B., Zambrana-Torrel, C., Buss, P., Dundarova, H., Feferholtz, Y., Földvári, G., Igbinosa, E., Junglen, S., Liu, Q., Suzan, G., Uhart, M., Wannous, C., Woolaston, K., Mosig Reidl, P., O'Brien, K., Pascual, U., Stoett, P., Li, H., Ngo, H. T., IPBES secretariat, Bonn, Germany, DOI:10.5281/zenodo.4147317.



## Beyond disease control

The core of the high-capacity industry of producing chicken meat is the genetic selection to make tasteful meat with good quality in a time and cost-effective manner. The genetic selection aims to make the broiler grow as fast as possible, which in practical terms means they absorb feed very effectively. Toxic compounds are well known to be absorbed by humans, animals, and nature with multiple hazardous consequences, and by humans often through the food consumed. When producing broilers, an environment free from toxic compounds is as important as keeping it clean from microbes.

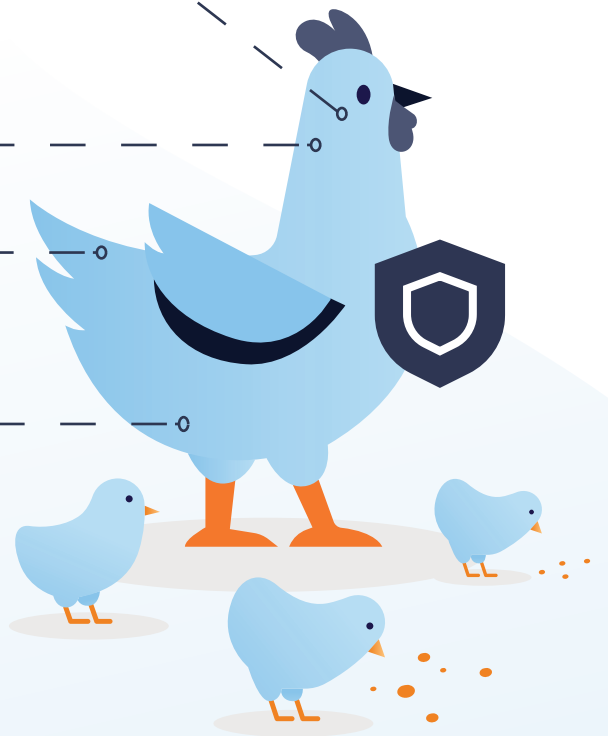
The chemical residues of most established products for cleaning and disinfection of broiler facilities, the remains of active components after evaporation, many times retain elements of toxicity. This concern escalates when these residues interact with the vulnerable physiology of the broilers. Toxins accidentally ingested by broilers require metabolic breakdown by the liver and kidney to mitigate their harmful effects. Furthermore, this inadvertent toxin exposure can elicit an immune response, divert energy from essential growth processes and potentially increase vulnerability to opportunistic pathogens. LifeClean's disinfection solution's remaining residues are only water and salt, protecting the flock from unnecessary stress on the immune system to protect itself against toxic substances.

**The remaining residues of LifeClean are water and salt**

**No unnecessary burden on the immune system to protect itself from toxic substances**

**No illnesses or mortality due to toxic residues from the disinfectant**

**Energy from the nutrition can generate growth instead of combating toxic substances**

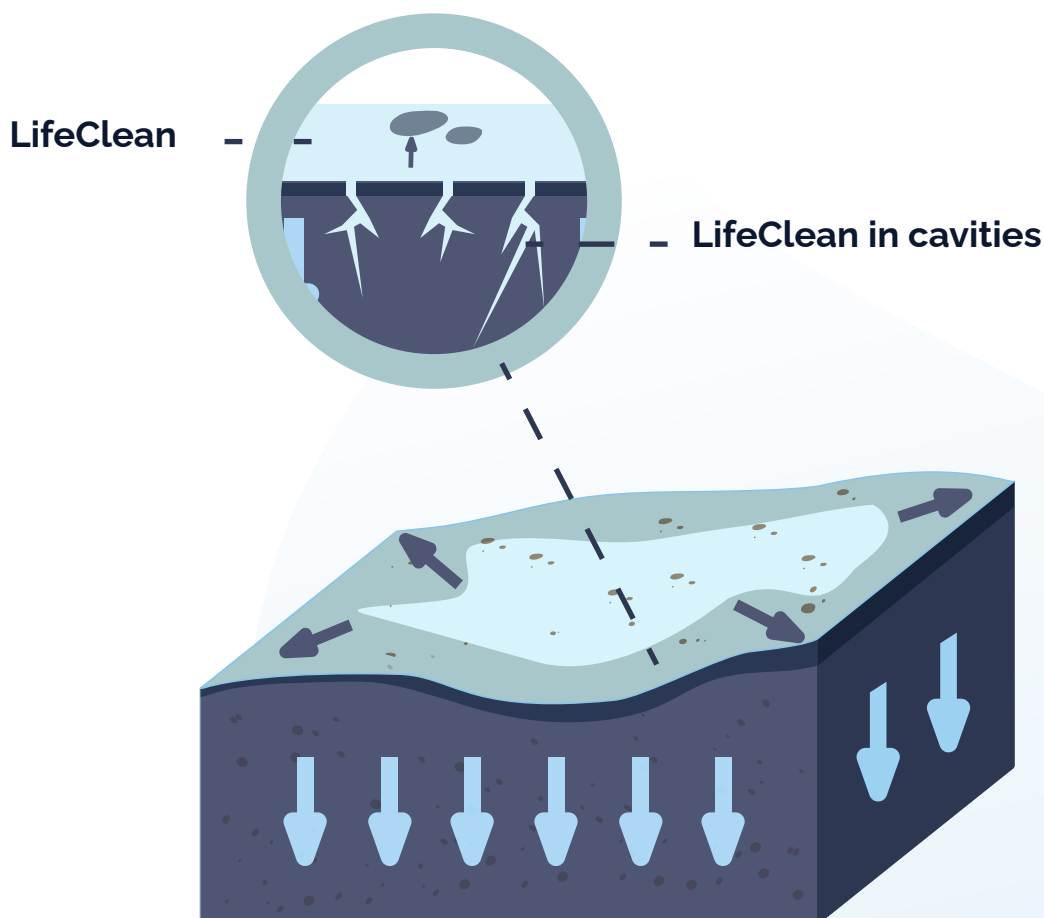


## Porous surface

To address the complex and evolving challenges within biosecurity in broiler facilities comprehensive antimicrobial control measures must contend with a spectrum of pathogens. This includes gram-negative and gram-positive bacteria, enveloped and non-enveloped viruses of varying sizes, mycobacteria, endoparasites, and highly resilient bacterial endospores.

The water bound ClO<sub>2</sub> composition of LifeClean's disinfection solution effectively eliminates pathogens on the surface. The product directs its action to the entire target surface, including cavities, microcavities, or other irregular structures, and forms a cohesive film over the surface. With its low surface tension and the high diffusivity of chlorine dioxide, it results in a deep penetration into the material, effectively eliminating microbes on porous materials.

A case in point, counting only bacteria. Qualitative samples of floors and cracks in floors after the requisite pre-cleaning step on ten Norwegian broiler facilities revealed both gram-positive and gram-negative bacteria among multiple genera, species, and families, including spore-forming bacteria (*Bacillus* spp. and *Clostridium perfringens*) which are the most intrinsically resistant microorganism to chemical disinfectants.



## Norwegian field data trials

### Study design

In collaboration with our local partners in Norway, ten case farms were carefully chosen for the study. Each farm had experienced well-documented and persistent problems with different types of microbes and outbreaks whereof none had used any of LifeClean's products before.

The study was structured to assess the effectiveness of LifeClean's disinfectant technology against three alternative products, each with different active substances: glutaraldehyde, a combination of glutaraldehyde/p-chloro-m-cresol, and formaldehyde. Data were collected from 30 production cycles across the 10 broiler facilities participating in the trial. Alongside quantitative analysis of key performance indicators (KPIs)—such as feed consumption and weight, the coefficient of variation (CV) in flock uniformity, and mortality rates—valuable qualitative insights were also gathered from veterinarians who serviced the farms. These professionals provided expert observations and feedback on the health and well-being of the flocks, offering a comprehensive perspective on the impact of the disinfectant regimes.

### Quantitative results

Remarkable improvements in all KPIs were observed immediately following the initial transition to the use of LifeClean's cleaning and disinfection solution. More impressively, the outcomes showed progressive enhancement over subsequent cycles across all tested facilities. Additionally, healthier growth patterns indicate the need for a cleaner, less toxic environment for the broilers, highlighting the success of a disinfection strategy that is both effective against pathogens and contributes to an environment with less toxic exposure.

The following table encapsulates the significant enhancements observed when switching to LifeClean's disinfectant solution, benchmarked against the performance of three other disinfectant solutions previously in use at the 10 broiler facilities:

	Final weight (grams)	CV	Mortality (%)	Starter feed (days)	Growth feed (days)	End feed (days)
Glutaraldehyde	+ 7.46%	-9.96%	-42.7%	-15.4%	-9.47%	+ 25.82%
Glutaraldehyde / p-chloro-m-cresol	+ 8.48%	-9.25%	-39.1%	-6.0%	-11.79%	+ 19.2%
Formaldehyde	+ 6.71%	-10.21%	-46.32%	-29.5%	+ 1.18%	+ 8.36%

The benchmarks presented include effects on slaughter weight, the coefficient of variation (CV) in flock uniformity, percentage mortality and duration across three different feeding stages. These numbers underline the improvements that LifeClean provides, with positive changes in weight gain, reductions in CV, and mortality. In addition, adjustments to the duration of the feeding regimen reflect an improvement in growth efficiency, leading to cost savings. Of note is the reduction in the duration that flocks require starter and growth feeds, which are usually more expensive compared to finishing feeds. To illustrate the economic impact, switching to the cheaper final feed just four days earlier in a production cycle can provide savings estimated at between NOK 90,000 and 120,000 per 30,000 broilers reared. Such figures demonstrate not only the health and productivity benefits of LifeClean's cleaning and disinfection solution, but also its significant contribution to cost efficiency.

## Summary of results from 600-800 cycles

As we advance beyond the initial Norwegian study, LifeClean, in collaboration with local partners, remains steadfast in our commitment to strengthening biosecurity measures. Further experience from 600-800 production cycles reinforces our preliminary results. Field trials and initial market introduction in the Kingdom of Saudi Arabia beginning of 2024 confirm the same or similar improvement and result of KPIs.

A comprehensive review, compared to three industry competitors, consistently demonstrates LifeClean's superior effectiveness: significant reductions in mortality and outbreaks, increased weight and shorter cleaning and disinfection procedure between cycles, all resulting in significant financial gain for the producer. Here is a consolidated overview:

	LifeClean cleaning and disinfection solution	Compared to three other disinfectants	Comments/clarifications
Animals per barn / per cycle	30.000	30.000	
Cycles per year	Possibility for 1-1.5 more cycles per year	7.5-8	Due to swifter dis. solution, and growth and possibility of earlier slaughter
Cleaning/disinfection days per cycle including aeration	3 days	7-11 days	
Days, total production cycle	Ross 308: 36 - 37 days	Ross 308: 40 - 45 days	
Weight per animal, kg	1.58	1.58	Optimum weight by Norwegian regulations. Slaughter weight is achieved earlier with LifeClean
Mortality per cycle	1.2 - 2.2%	2.0- 5%	Average reduction 49% Before 3.5%, after LifeClean 1.7%
Mortality per cycle, outbreak	2.6 - 3.0%	10 - 30%	With continuous use of LifeCleans cleaning and disinfection solution after the 2nd-3rd prod cycle
Number of cycles performed	600-800 cycles in 2 years		
Saved nutrition cost per / amount of chickens / cycle	90.000-120.000 NOK / 30.000 chickens in the last 4 days (end-feeding)		Eventually, after 2-3 cycles using LifeClean's cleaning and disinfection solution
Volumes of disinfection in L / m2	2dL/m2		Applied by spraying

## Testimonials from Norwegian broiler producers

### VÆREN SØNDRE

- Number of chickens: 15 750 chickens per cycle
- Been using LifeClean for: 9 months

*"We think LifeClean is good to work with, and we feel it will be used everywhere. Mortality has decreased and the number of cases is on the way down"*

STIAN HAUGAN

### KULSTAD

- Number of chickens: 37 500 chickens per cycle
- Been using LifeClean for: 8 months

*"I like that it works so fast. I can quickly disinfect tools and equipment if I need to. I also like that it is not dangerous for the skin if I spill. It is much easier to disinfect and gives good and consistent results."*

LARS MAGNUS KULSTAD

### ERSTAD NEDRE

- Number of chickens: 30 000 chickens per cycle (2 stables)
- Been using LifeClean for: 8 months

*"We have used various products over the years to disinfect our barns and LifeClean seems like a good product. So far, we have used LifeClean with a positive effect on the results."*

BJØRNAR STØRE

## Advantages of LifeClean in the broiler industry

- Faster growth (slaughter weight: + 7.55%)
- Lower CV (-9.8 %)
- Reduced mortality (-49%) with continuous application
- Reduced time spent cleaning/disinfecting
- Faster start of production, no need for days of ventilation/airing after disinfection
- No resistance development

- Very effective on biofilm
- Deeper disinfection of absorbent/porous surfaces
- Possibility of increasing slaughter weight and shorter production cycles
- Reduced nutrition costs (end-feeding)
- Easy to work with and user-friendly
- Better smell at the disinfected sites
- High cleanliness on floors and walls
- Healthier broilers

## The impact on a global level

As evidenced in this paper, LifeClean offers a proven product applicable in agriculture, tailored for high-level disinfection, fostering a safer environment for humans, animals, and nature. The LifeClean solutions address 9 out of the 17 Sustainable Development Goals (SDGs) established by the United Nations. LifeClean provides products and services designed to assist businesses, organizations and governments in addressing social, economic and environmental challenges in an holistic manner. Through the adoption of revolutionary technology, organisations can embrace greater social and environmental responsibility, taking significant strides towards achieving global multiple sustainability goals by addressing more than half of the SDGs.

