Steinemann
DISINFECTION

Whitepaper

Automated Aerosol Systems And The Science Behind Validated Room Disinfection

FH, Steinemann Disinfection, 2026

The information contained in this document has been prepared with the utmost care and to the best of our knowledge and belief. However, no guarantee is given regarding the completeness, accuracy, or timeliness of the content. This material is intended solely for general informational purposes and ***does not constitute professional medical advice or an officially recognised medical training resource****. There is no claim of legal or scientific validity, particularly in the context of medical diagnosis, therapy, or education. Use of the information is at the user's own responsibility. The publisher accepts no liability for any damages or consequences arising from the use of the provided content. Subject to change and errors excepted.*

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

Steinemann DISINFECTION

Content

1 Company Introduction 3
2 Fundamentals of Disinfection 4
3 Log Reduction – The Scientific Measure of Efficacy 5
4 From Surface Disinfection to Three-Dimensional Room Decontamination 6
5 Aerosol Behaviour and Distribution 7
6 Environmental Influences 8
7 The Concentration–Time Principle 8
8 EN 17272 – The European Standard for Automated Room Disinfection 9
9 Validation Through Chemical and Biological Indicators 10
10 The Validation Logic of Automated Room Disinfection 11
11 From Science to Solution 12

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

1 Company Introduction

Steinemann Disinfection AG was founded in 2013 and is headquartered in Flawil, St. Gallen, Switzerland. Since its establishment, the company has specialised in the development and engineering of **automated aerosol systems for validated three-dimensional room disinfection**.

Operating from Switzerland, Steinemann Disinfection integrates **engineering design, microbiological validation methodology and regulatory alignment** into a structured system approach. Its solutions are developed for environments where reproducible, measurable and documented decontamination is required.
The company maintains an international distribution network and collaborates with trained technical partners worldwide. Distributors are positioned not merely as resellers, but as **technically informed representatives capable of communicating validation principles, regulatory requirements and system engineering concepts**.

From its foundation, the company has followed a clear technical principle:
Room disinfection must be engineered, not improvised.

Many aerosol devices focus primarily on dispersion. However, dispersion alone does not guarantee microbiological reduction. Effective room disinfection requires a controlled process that integrates:

- dose calculation
- spatial distribution
- exposure control
- microbiological verification

This document outlines the **scientific and engineering principles behind validated room disinfection using automated aerosol systems**.

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

2 Fundamentals of Disinfection

In discussions about hygiene, terminology is often used inconsistently. Cleaning is frequently confused with disinfection, and visible cleanliness is sometimes equated with microbiological safety.
However, in professional hygiene management these concepts describe **fundamentally different processes**.

Cleaning refers to the **mechanical removal of contamination**, typically through wiping, scrubbing or detergents. Cleaning can reduce microbial load indirectly by removing organic material, but it does not necessarily inactivate microorganisms.

Disinfection refers to the **targeted reduction of microorganisms to a defined safe level**. Effective disinfection depends on controlled parameters such as disinfectant concentration, exposure time, environmental conditions and microbial resistance.

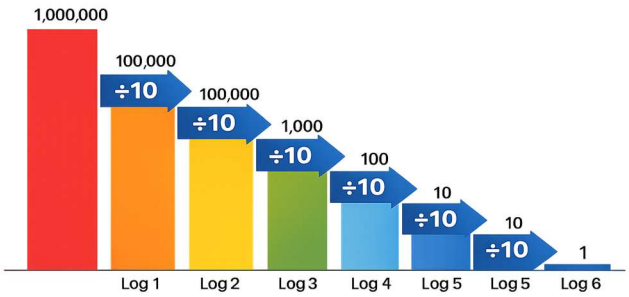
Sterilization represents the **complete elimination of all viable microorganisms**, including highly resistant bacterial spores. This level of microbial control is typically required for surgical instruments or specialised laboratory environments.
Room disinfection systems are generally designed to achieve **high-level disinfection**, rather than sterilization.

Understanding these distinctions is essential when evaluating room disinfection technologies.

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

3 Log Reduction – The Scientific Measure of Efficacy

Microbial reduction is quantified using **logarithmic reduction values**.
Each additional log step represents a **tenfold reduction** of the remaining viable microorganisms.



Log Reduction	Microbial Reduction	Remaining Microorganisms	
Log 1	90%	100,000	
Log 2	99%	10,000	
Log 3	99.9%	1,000	
Log 4	99.99%	100	→ **Disinfection**
Log 5	99.999%	10	→ **Disinfection**
Log 6	99.9999%	1	→ **Sterilisation**

Professional disinfection typically requires reductions of **4–5 log**, depending on the application and microorganism type and may even reach **6 log**.

Log reduction provides a **quantifiable and comparable measure of disinfection efficacy**, allowing technologies to be evaluated objectively rather than based on visual impressions.

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

4 From Surface Disinfection to Three-Dimensional Room Decontamination

Traditional disinfection methods rely on **manual surface treatment**, such as wiping or spraying disinfectants onto accessible areas.
However, real environments contain complex geometries including:

- vertical surfaces
- ceilings
- equipment undersides
- recessed structures
- shadowed areas

Manual surface application is therefore inherently **two-dimensional**.
Room decontamination requires exposure across the **entire three-dimensional space**, including areas that cannot be accessed directly.

Automated aerosol systems enable this by transforming liquid disinfectants into **microscopic droplets suspended in air**, allowing the active substance to reach complex spatial structures before deposition occurs.

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

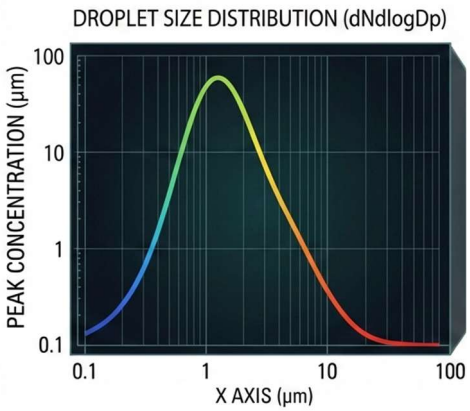
5 Aerosol Behaviour and Distribution

An aerosol is a suspension of fine liquid droplets in air.
In automated room disinfection systems, these droplets contain the active disinfectant and serve as a **transport mechanism** within the treated space.

The behaviour of aerosols is influenced primarily by **droplet size and airflow dynamics**.
Large droplets settle quickly due to gravity and mainly affect horizontal surfaces. Smaller droplets remain suspended longer and follow airflow patterns, allowing them to penetrate complex geometries and difficult-to-reach areas.

Effective systems therefore generate a **controlled droplet spectrum** that balances suspension time, transport behaviour and controlled surface deposition.
Uniform spatial distribution cannot rely solely on passive dispersion. Without active mixing, concentration gradients may occur, leading to overdosed areas near the emission source and underexposed regions elsewhere.

Advanced aerosol systems therefore incorporate airflow dynamics that promote **three-dimensional circulation and spatial homogenization** within the treated volume.



Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

6 Environmental Influences

Aerosol distribution does not occur in a neutral environment.
Several factors influence transport behaviour and deposition patterns, including:

- room geometry
- obstacles and furnishings
- ventilation systems
- air exchange rates
- temperature gradients
- humidity levels

These parameters can affect concentration levels and exposure time within different areas of the room.
For this reason, reproducible room disinfection requires **defined environmental conditions and controlled dosing strategies**.

7 The Concentration–Time Principle

Microbial inactivation depends on the relationship between **disinfectant concentration and exposure time**.
This relationship is known as the **concentration–time principle**.
For a given microorganism under defined environmental conditions, a minimum exposure dose is required to achieve a specific log reduction.
In automated aerosol systems, the quantity of active substance introduced into the room is therefore calculated relative to:

- room volume
- target microbial reduction
- disinfectant formulation

Dose calculation transforms aerosol application from simple fogging into a **controlled disinfection process**.

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

8 EN 17272 – The European Standard for Automated Room Disinfection

EN 17272 is the European standard for **automated airborne room disinfection processes**.
Importantly, the standard evaluates the **complete system**, including:
• the disinfectant formulation
• the device
• the distribution mechanism
• the exposure process

System evaluation consists of two distinct stages.

Distribution Test
The distribution test verifies that the disinfectant reaches all areas of the room.
Chemical indicators are placed at multiple locations throughout the space, including:
• corners
• shadowed areas
• different heights
• behind obstacles
This test confirms that the disinfectant achieves adequate **spatial coverage**.

Microbiological Efficacy Test
Once distribution is confirmed, microbiological efficacy is evaluated using **biological indicators containing defined microorganisms**.
Typical minimum reductions include:

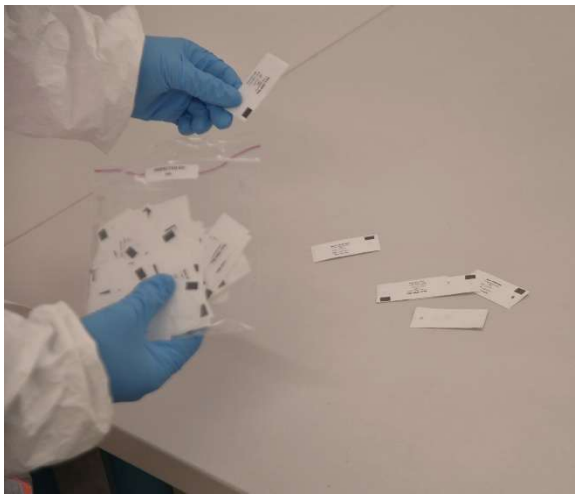
• bactericidal ≥ 5 log
• fungicidal ≥ 4 log
• sporicidal ≥ 4 log
• virucidal ≥ 4 log

A strict rule applies:
Every test position must achieve the required reduction.
If even one indicator fails, the entire system fails the test.
This ensures that disinfection is effective throughout the entire treated space.

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

9 Validation Through Chemical and Biological Indicators

Validated room disinfection requires both **exposure verification and microbiological proof**.



Chemical indicators respond to defined exposure conditions of the disinfectant. They confirm that the active substance reached a specific location and that sufficient exposure conditions were present. However, chemical indicators do not demonstrate microbial inactivation.
Biological indicators provide this proof. They contain highly resistant microorganisms that serve as a challenge organism for the disinfection process.

In hydrogen peroxide-based systems, spores of **Geobacillus stearothermophilus** are commonly used due to their high resistance to oxidative disinfectants.
Indicator placement must represent **worst-case conditions**, including areas with reduced airflow or potential shadowing.

If all indicators demonstrate the required reduction, the disinfection process can be considered validated.

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

10 The Validation Logic of Automated Room Disinfection

Validated room disinfection follows a defined process chain:

Dose
↓
Distribution
↓
Exposure
↓
Log Reduction
↓
Documented Proof

Only when each of these elements is controlled and verified can room disinfection be considered **reproducible and scientifically validated**.

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch

11 From Science to Solution

The preceding chapters have outlined the scientific and engineering foundations of validated room disinfection.

These include:
• microbiological principles
• logarithmic reduction metrics
• aerosol physics
• environmental influences
• regulatory standards
• validation methodology

Together, these elements demonstrate that room disinfection is **not simply a matter of dispersing a disinfectant into the air**.

It is a controlled process that requires engineering, validation and scientific understanding.
This is precisely where expertise becomes essential.
Steinemann Disinfection approaches room decontamination as a **complete engineered process**, integrating system design, aerosol physics, dose calculation strategies and validation methodologies.
Rather than focusing solely on devices, the company develops **structured solutions for reproducible and verifiable room disinfection**.
The systems themselves are only the visible result.
The scientific and engineering expertise behind them is the true differentiator.
In environments where hygiene standards are critical, room disinfection must be **measurable, validated and reproducible**.
And when science defines the process, the right partner makes the difference.

Securing Health

Steinemann Disinfection (CleanService Group AG) | Wilerstrasse 2180 | 9230 Flawil | Switzerland | +41 71 555 11 30 | disinfection@steinemanngroup.com | steinemann-disinfection.ch