Cleaning and Disinfection

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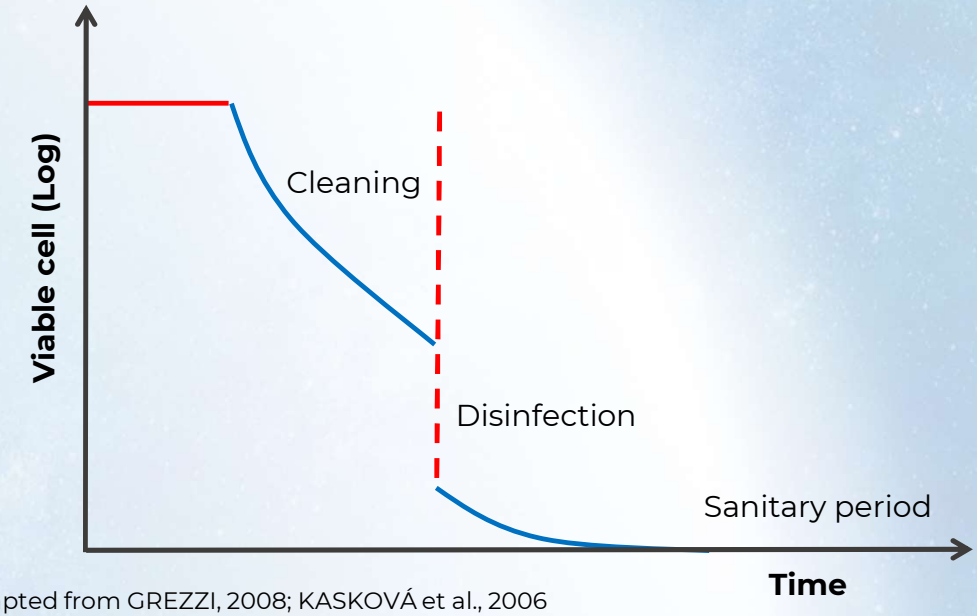
CLEANING AND DISINFECTION

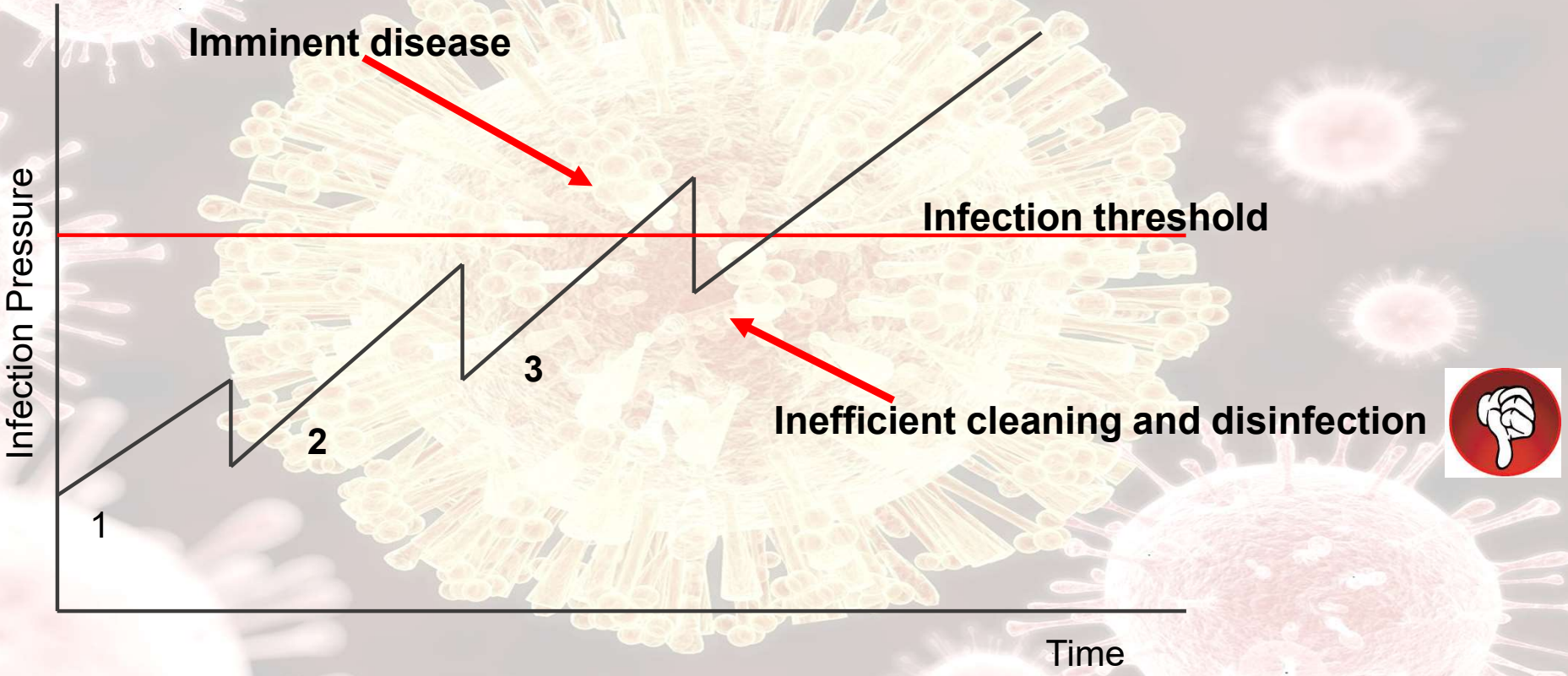


Adapted from GREZZI, 2008; KASKOVÁ et al., 2006

Cleaning and disinfection of facilities are key to reducing the **risk of disease introduction and permanence** (LUYCKX et al., 2015)

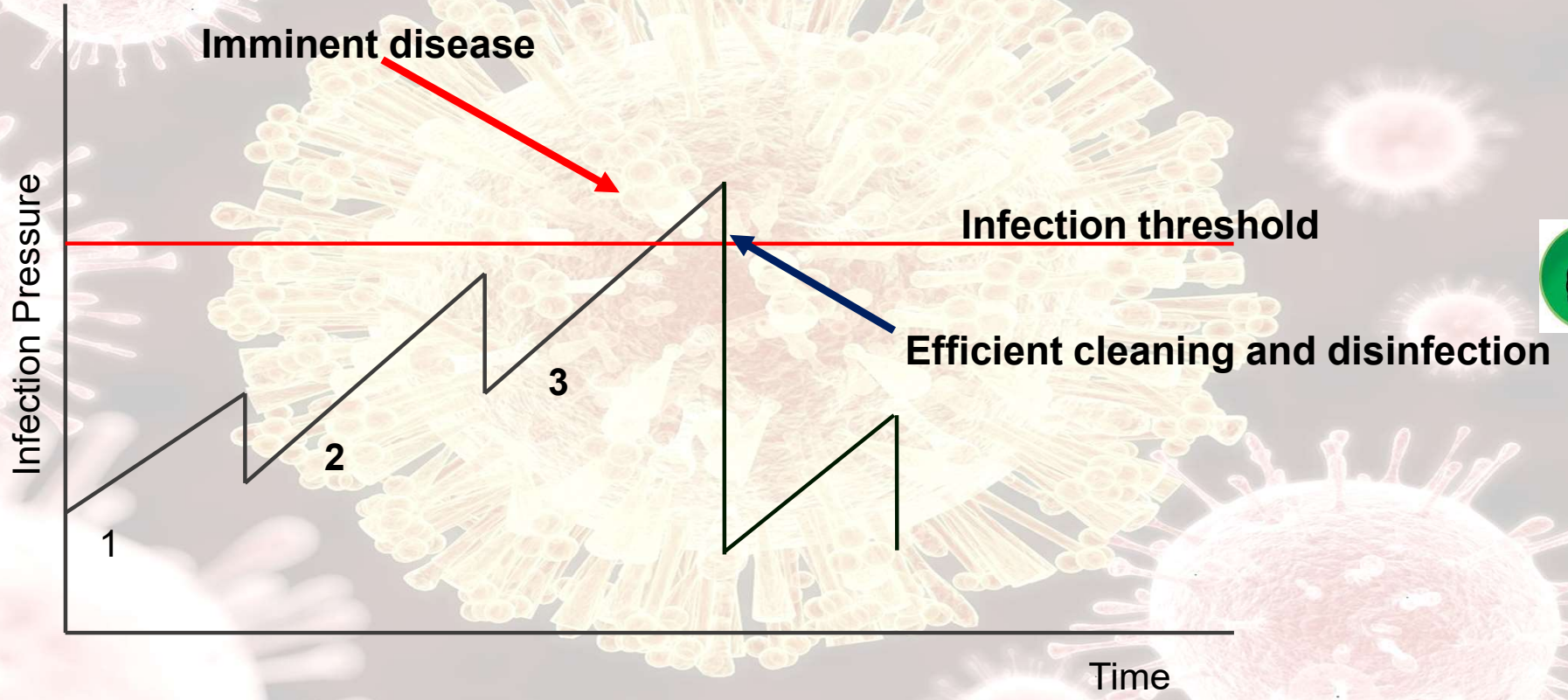
DRY CLEANING → **WET CLEANING** → **DISINFECTION** → **SANITARY PERIOD**

CLEANING AND DISINFECTION



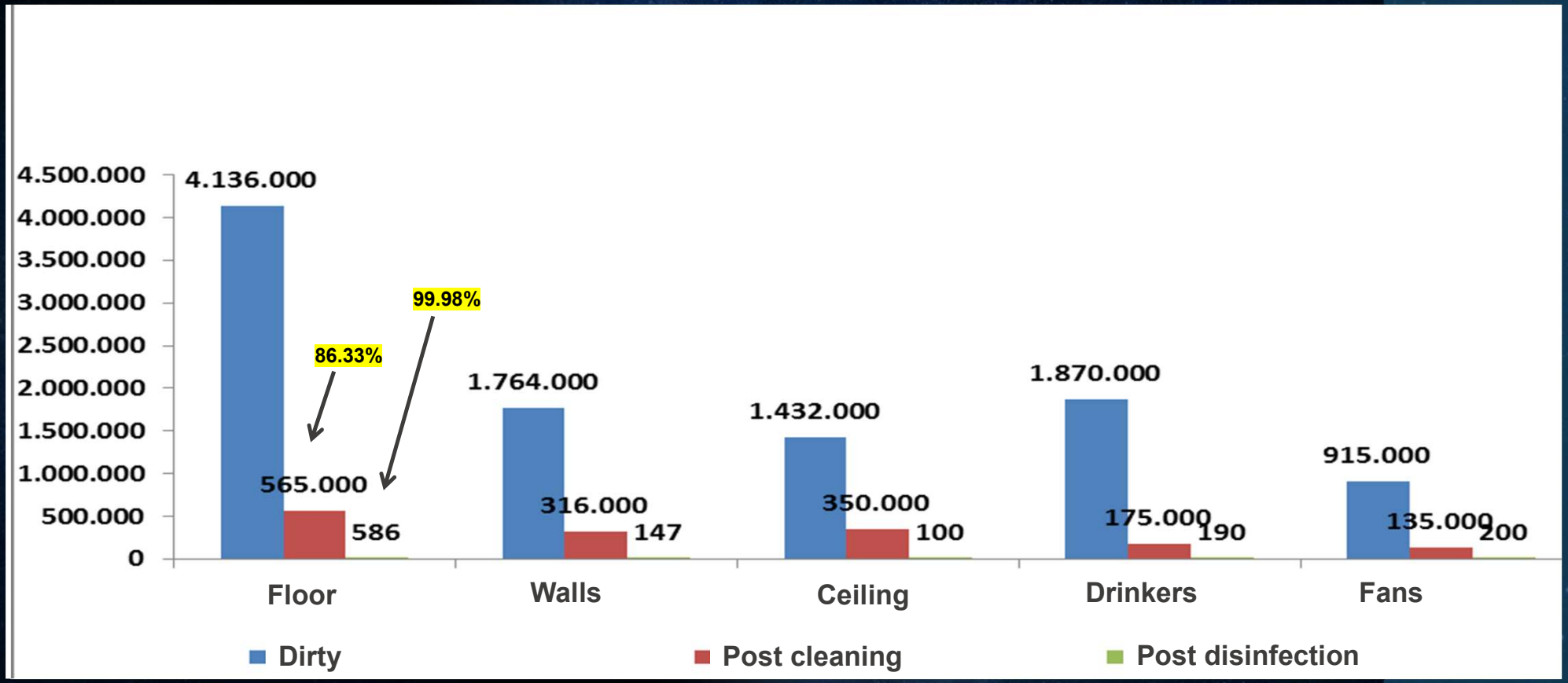
Source: Sesti et al, 1998

CLEANING AND DISINFECTION



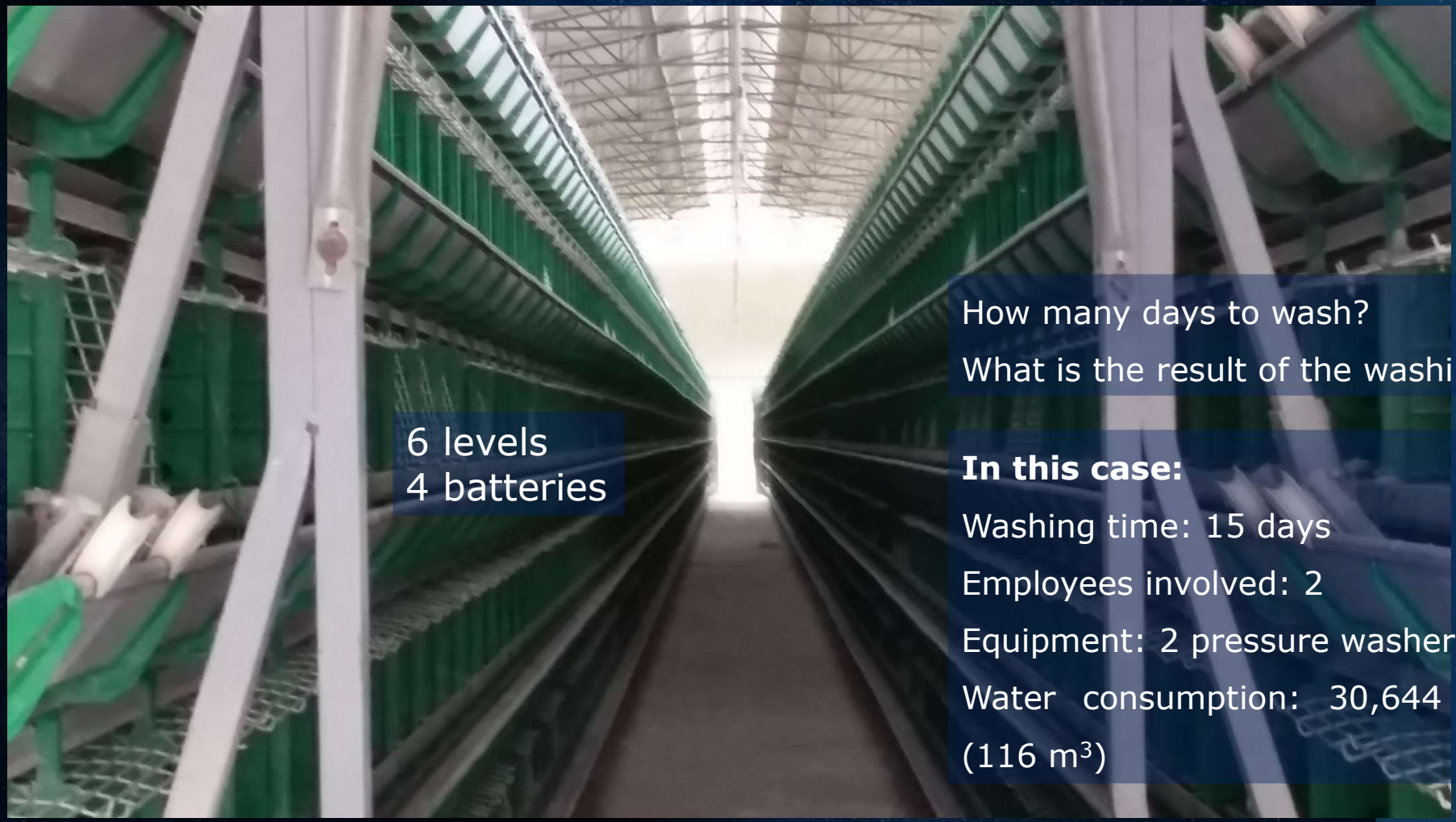
Source: Sesti et al, 1998

CLEANING AND DISINFECTION



Adaptado de Kašková, A., et al. "Efficiency of sanitary treatment in poultry breeding and poultry meat processing plant." *Acta Veterinaria Brno* 75.4 (2006): 611-617

Microbiological Field Evaluation



6 levels
4 batteries

How many days to wash?

What is the result of the washing?

In this case:

Washing time: 15 days

Employees involved: 2

Equipment: 2 pressure washers

Water consumption: 30,644 gallons (116 m^3)

Microbiological Field Evaluation

SWAB SAMPLES COLLECTION

1. Corridor Floor 4
2. Corridor Wall 4
3. Roller Crawler 1 /1
4. Foot 10 / 11 – bat 3
5. Cage 10/ 5 – bat 1
6. Box 1, 2 e 3 – bat 3

ENTEROBACTERIA	MESOPHILES
DIRTY	DIRTY
5,95	6,20
5,20	5,95
6,18	6,32
4,86	6,34
2,30	5,20
4,40	5,34
4.81 A	5.89 A

A, B, C differ statistically by Tukey's method (P < 0,05);
Data expressed in log 10

Microbiological Field Evaluation

SWAB SAMPLES COLLECTION

1. Corridor Floor 4
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6. Box 1, 2 e 3 – bat 3

ENTEROBACTERIA		MESOPHILES	
DIRTY	WASHED	DIRTY	WASHED
5,95	6,61	6,20	7,64
5,20	5,49	5,95	7,11
6,18	6,48	6,32	7,90
4,86	4,00	6,34	6,30
2,30	4,15	5,20	6,43
4,40	7,04	5,34	7,36
4.81^{A}	5.62 ^{A}	5.89 ^{A}	7,12 ^{B}

$^{A, B, C}$ differ statistically by Tukey's method ($P < 0,05$);
Data expressed in log 10

Microbiological Field Evaluation

SWAB SAMPLES COLLECTION

1. Corridor Floor 4
2. Corridor Wall 4
3. Roller Crawler 1 /1
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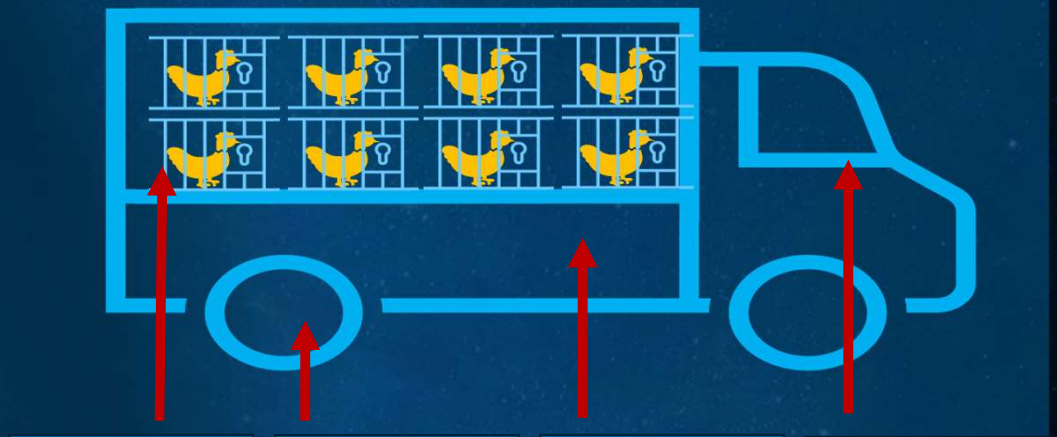
ENTEROBACTERIA				MESOPHILES			
DIRTY	WASHED	DISINFECT	Reduction	DIRTY	WASHED	DISINFECT	Reduction
5,95	6,61	**1,91**	-99,998	6,20	7,64	**4,28**	-99,9568
5,20	5,49	**4,78**	-80,65	5,95	7,11	**5,26**	-98,6154
6,18	6,48	**5,90**	-73,33	6,32	7,90	**5,94**	-98,8987
4,86	4,00	**3,32**	-78,79	6,34	6,30	**5,91**	-59,5
2,30	4,15	**3,18**	-89,29	5,20	6,43	**5,28**	-92,963
4,40	7,04	**1,60**	-99,999	5,34	7,36	**2,98**	-99,9959
4.81 A	5.62 A	3,44 B		5.89 A	7,12 B	4,94 C	

A, B, C differ statistically by Tukey's method (P < 0,05);
Data expressed in log 10

Microbiological Field Evaluation

Detection of Avian Influenza in trucks used for duck farms depopulation during the 2021 HPAI outbreak in France

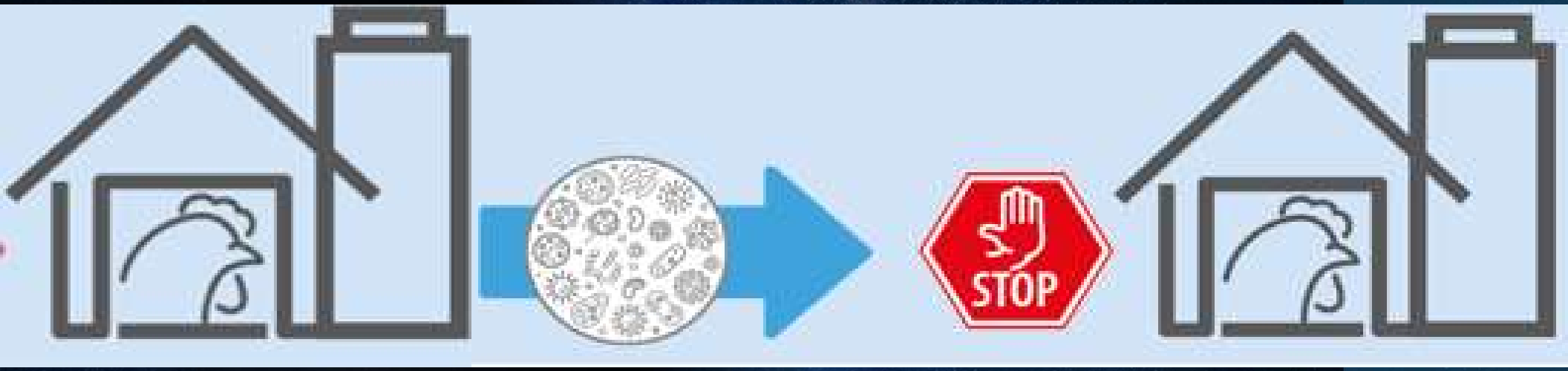
Detection of the AIV genome was carried out by r-RT-PCR for type A influenza virus



	Crates	Wheel	Outside	Cabin
Before C&D protocol	75% n=79	38% n=8	87% n=8	62% n=8
After C&D protocol	29% n=80	12% n=8	22% n=8	38% n=8

Source: Huneau-Salaun, 2022

Clean & Disinfection Procedures



Avoid the transmission of diseases from one flock of birds to the next

- Cleaning
- Disinfection
- Sampling

Clean & Disinfection Procedures

The Process is based on the STANDARDIZATION of PROCEDURES so that the RULES are followed without "deviations", resulting in excellence of results.

Rules **Method** **Standard**

Dirty house → Preparation → Dry cleaning → Wet cleaning → Disinfection → Sampling → Placement

Execution schedule

Beginning of Preparation and Dry Cleaning immediately after removal of the birds!!!

DIRTY HOUSE

PREPARATION

DRY CLEANING

WET CLEANING

DISINFECTION

SAMPLING

PLACEMENT

1. Departure of the birds
2. Insect and rodent control
3. Manure removal
4. Empty feeders, boxes and feed silos and give proper disposal
5. Emptying and dismantling equipment
6. Cleaning of non-demountable materials, utensils and equipment
7. Sweeping of ceiling, curtains/walls to remove dust and dirt
8. (Fire disinfection)
9. (Wet cleaning)
10. Checking cleanliness
11. Drinking Water Pipelines Cleaning
12. Maintenance
13. Disinfection
14. (Measuring efficiency – Laboratory Monitoring)
15. Equipment assembly
16. Insecticidal and rodenticidal application
17. Rodent control
18. Placement of a new flock

Clean & Disinfection procedures

Dirty house → Preparation → Dry cleaning → Wet cleaning → Disinfection → Sampling → Placement

DRY CLEANING

It's the removal of dirt (mechanical action).

WET CLEANING

It is removal of microorganisms. (use of detergents)
Guandalini, cols.1997

DISINFECTION

Disinfection is the set of measures employed to **prevent the entry and growth of microorganisms** in an environment or structure, **making them free of infectious agents**, with the use of **disinfectant substances or other physical forms of disinfection** (SPINOSA et al., 2006).

SANITARY PERIOD

It is the last part of the cleaning and disinfection process. Important for residual action of disinfectants and **desiccation microorganisms.**

Clean & Disinfection Procedures

Water to “Wash”…
Does it work???

Clean & Disinfection Procedures

Dry Cleaning

- ✓ Removal of dirt (dust, feathers, leftover feed and manure);
- ✓ Follow sequence: (top down and inside out)

  ceiling, curtains, walls and floor

  - ✓ Makes washing easier;
  - ✓ Improves the efficiency of the following steps;
  - ✓ Saves time;
  - ✓ Saves water.

Blowers or Vacuum Equipment?

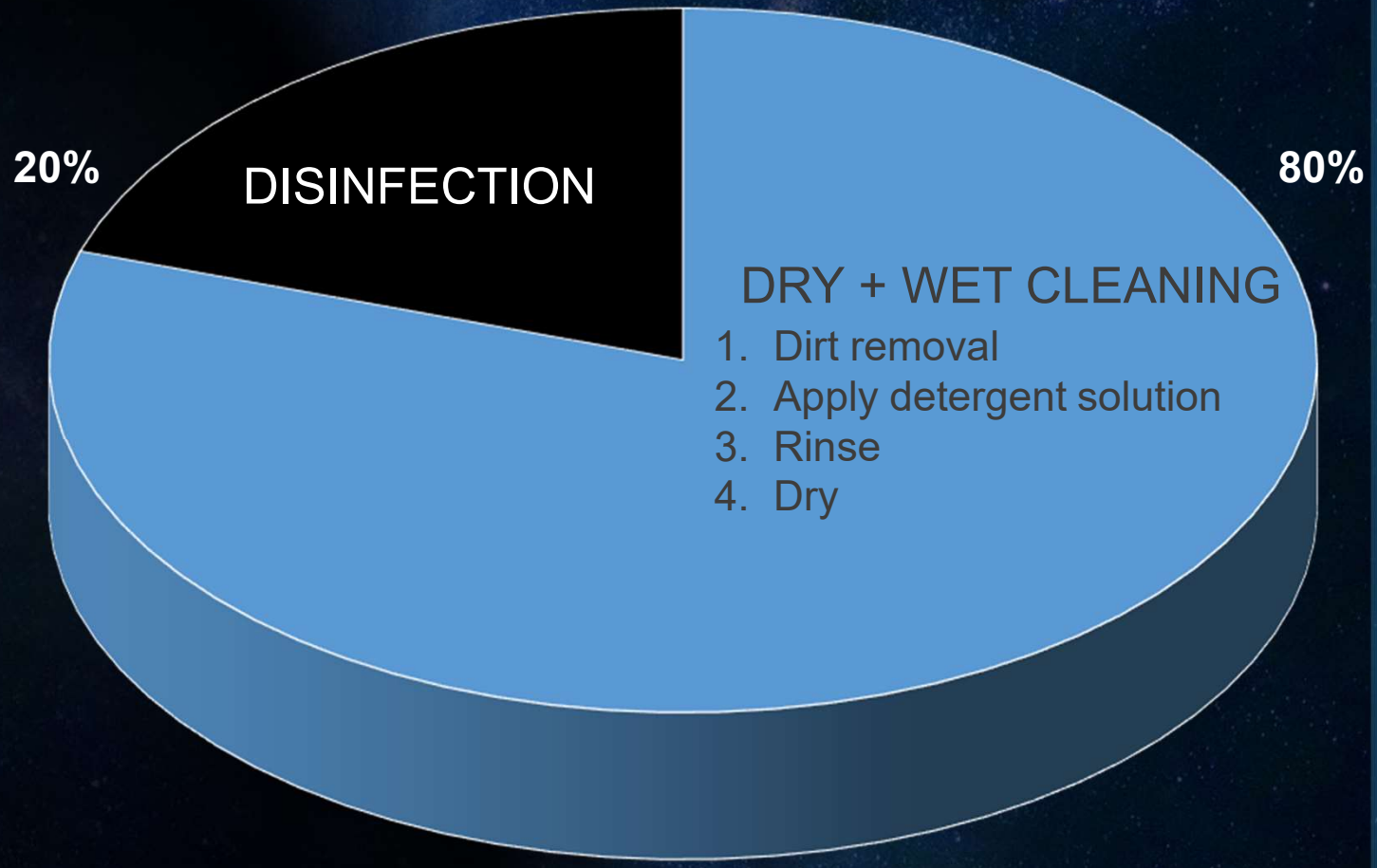
Clean & Disinfection Procedures

Wet Cleaning

Recommended Detergent	Materia	Dirty type	Exemples
Acid Detergent	**Inorganic**	Hard water waste	**Calcium and Magnesium (minerals)**
		Metal waste	Rust and other oxides
		Alkaline residues	Films that form when an alkaline detergent is not rinsed off properly
Alcaline Detergent /Surfactant	**Organic**	Feed waste	Feed scraps
		Petroleum waste	Lubricating oils, fats and other lubricants
		Non-petroleum waste	**Animal fat**

Adaptado de Marriot (1997, 2006)

Clean & Disinfection procedures



Clean & Disinfection procedures

Disinfection is not magic. It is science.

Chemical substance

Organic material

Contact time

Temperature

Characteristics of Selected Disinfectants

For More Information, see the 'Disinfection 101' document at www.cfsph.iastate.edu

Disinfectant Category	Alcohols	Aldehydes	Biguanides	Halogens: Hypochlorites	Halogens: Iodine Compounds	Oxidizing Agents	Phenols	Quaternary Ammonium Compounds (QAC)
Sample Trade Names	Ethyl alcohol Isopropyl alcohol	Formaldehyde Glutaraldehyde	Chlorhexidine Nolvasan® Virosan®	Bleach	Betadyne® Providone®	Hydrogen peroxide Peracetic acid Virkon S® Oxy-Sept 333®	One-Stroke Environ® Pheno-Tek II® Tek-Trol®	Roccal® DiQuat® D-256®
Mechanism of Action	•Precipitates proteins •Denatures lipids	•Denatures proteins •Alkylates nucleic acids	•Alters membrane permeability	•Denatures proteins	•Denatures proteins	•Denature proteins and lipids	• Denatures proteins • Alters cell wall permeability	• Denatures proteins • Binds phospholipids of cell membrane
Advantages	•Fast acting •Leaves no residue	•Broad spectrum	•Broad spectrum	•Broad spectrum •Short contact time •Inexpensive	•Stable in storage •Relatively safe	•Broad spectrum	• Good efficacy with organic material • Non-corrosive • Stable in storage	• Stable in storage • Non-irritating to skin • Effective at high temperatures and high pH (9-10)
Disadvantages	•Rapid evaporation •Flammable	•Carcinogenic •Mucous membranes and tissue irritation •Only use in well ventilated areas	•Only functions in limited pH range (5–7) •Toxic to fish (environmental concern)	•Inactivated by sunlight •Requires frequent application •Corrodes metals •Mucous membrane and tissue irritation	•Inactivated by QACs •Requires frequent application •Corrosive •Stains clothes and treated surfaces	•Damaging to some metals	• Can cause skin and eye irritation	
Precautions	Flammable	Carcinogenic		Never mix with acids; toxic chlorine gas will be released			May be toxic to animals, especially cats and pigs	
Vegetative Bacteria	Effective	Effective	Effective	Effective	Effective	Effective	Effective	YES—Gram Positive Limited—Gram Negative
Mycobacteria	Effective	Effective	Variable	Effective	Limited	Effective	Variable	Variable
Enveloped Viruses	Effective	Effective	Limited	Effective	Effective	Effective	Effective	Variable
Non-enveloped Viruses	Variable	Effective	Limited	Effective	Limited	Effective	Variable	Not Effective
Spores	Not Effective	Effective	Not Effective	Variable	Limited	Variable	Not Effective	Not Effective
Fungi	Effective	Effective	Limited	Effective	Effective	Variable	Variable	Variable
Efficacy with Organic Matter	Reduced	Reduced	?	Rapidly reduced	Rapidly reduced	Variable	Effective	Inactivated
Efficacy with Hard Water	?	Reduced	?	Effective	?	?	Effective	Inactivated
Efficacy with Soap/ Detergents	?	Reduced	Inactivated	Inactivated	Effective	?	Effective	Inactivated

? Information not found

Disclaimer: The use of trade names does not in any way signify endorsement of a particular product. For additional product names, please consult the most recent Compendium of Veterinary Products.

References: Linton AH, Hugo WB, Russel AD. Disinfection in Veterinary and Farm Practice. 1987. Blackwell Scientific Publications; Oxford, England; Quinn PJ, Markey BK. Disinfection and Disease Prevention in Veterinary Medicine, In: Block SS, ed., Disinfection, Sterilization and Preservation. 5th edition. 2001. Lippincott, Williams and Wilkins: Philadelphia.

the Center for Food Security & Public Health
Iowa State University
www.cfsph.iastate.edu

Clean & Disinfection procedures

Disinfection is not magic. It is science.

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Mycobacteria	Effective	Effective	Variable	Effective	Limited	Effective	Variable	Variable
Enveloped Viruses	Effective	Effective	Limited	Effective	Effective	Effective	Effective	Variable
Non-enveloped Viruses	Variable	Effective	Limited	Effective	Limited	Effective	Variable	Not Effective
Spores	Not Effective	Effective	Not Effective	Variable	Limited	Variable	Not Effective	Not Effective
Fungi	Effective	Effective	Limited	Effective	Effective	Variable	Variable	Variable
Efficacy with Organic Matter	Reduced	Reduced	?	Rapidly reduced	Rapidly reduced	Variable	Effective	Inactivated
Efficacy with Hard Water	?	Reduced	?	Effective	?	?	Effective	Inactivated
Efficacy with Soap/ Detergents	?	Reduced	Inactivated	Inactivated	Effective	?	Effective	Inactivated

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Clean & Disinfection procedures

FACTORS INERT TO THE CONDITIONS OF APPLICATION

Contact time

Temperature

Application Time:
Morning? Noon? Afternoon?

Solution volume

Clean & Disinfection Procedures

Efficacy Testing of X Disinfectant (50%) at 1:1000

Pseudomonas aeruginosa	**1'**	**5'**	**10'**	**15'**
Without Organic Matter	Resistant	Sensible	Sensible	Sensible
3% Organic Matter	Resistant	Sensible	Sensible	Sensible
5% Organic Matter	Resistant	Sensible	Sensible	Sensible
7% Organic Matter	Resistant	Sensible	Sensible	Sensible

Escherichia coli	**1'**	**5'**	**10'**	**15'**
Without Organic Matter	Resistant	Sensible	Sensible	Sensible
3% Organic Matter	Resistant	Resistant	Sensible	Sensible
5% Organic Matter	Resistant	Resistant	Sensible	Sensible
7% Organic Matter	Resistant	Resistant	Sensible	Sensible

Efficiency Testing of disinfectants against bacterias, 2021

Clean & Disinfection Procedures

What does it mean when the label says 1:1000?

1:1000 = 1 gallon of product in 1,000 gallons of water

If the product is 50% of active principle

So… if I use 1:1000 of a 50% product,
It means **500 ppm of active principle in the final solution**

Clean & Disinfection Procedures

Why the solution volume matters?

Recommendation:
4 gallons of disinfectant solution per 10.8 ft^2

If the house has 328 ft x 65.6, it means 21,517 ft^2

So… if the recommendation is 4 gallons per 10.8 ft^2,
It means **8,000 gallons of disinfectant solution per house**

Clean & Disinfection procedures

So… in this example:

1. Fill the tank with 8,000 gallons
2. Close the entrance of water
3. Add 8 gallons of the disinfectant
4. Apply solution disinfectant volum of 8,000 gallons per dry house to disinfect (ceiling, walls and equipment)

Clean & Disinfection Procedures

Clean & Disinfection Procedures

Clean & Disinfection Procedures

DRY CLEANING

It's the removal of dirt (mechanical action).

~~WET CLEANING~~

The scarcity of water determines the death of many microorganisms and the sporulation of certain fungi and bacteria, so drying is an important decontamination option (Kamwa, 2012)

DISINFECTION

Disinfection is the set of measures employed to **prevent the entry and growth of microorganisms** in an environment or structure, **making them free of infectious agents**, with the use of **disinfectant substances or other physical forms of disinfection** (SPINOSA et al., 2006).

SANITARY PERIOD

It is the last part of the cleaning and disinfection process. Important for residual action of disinfectants and **dissecting microorganisms.**

Clean & Disinfection Procedures

Dry disinfectants to reduce the Pression of Infection

WHAT IS MY NEED?

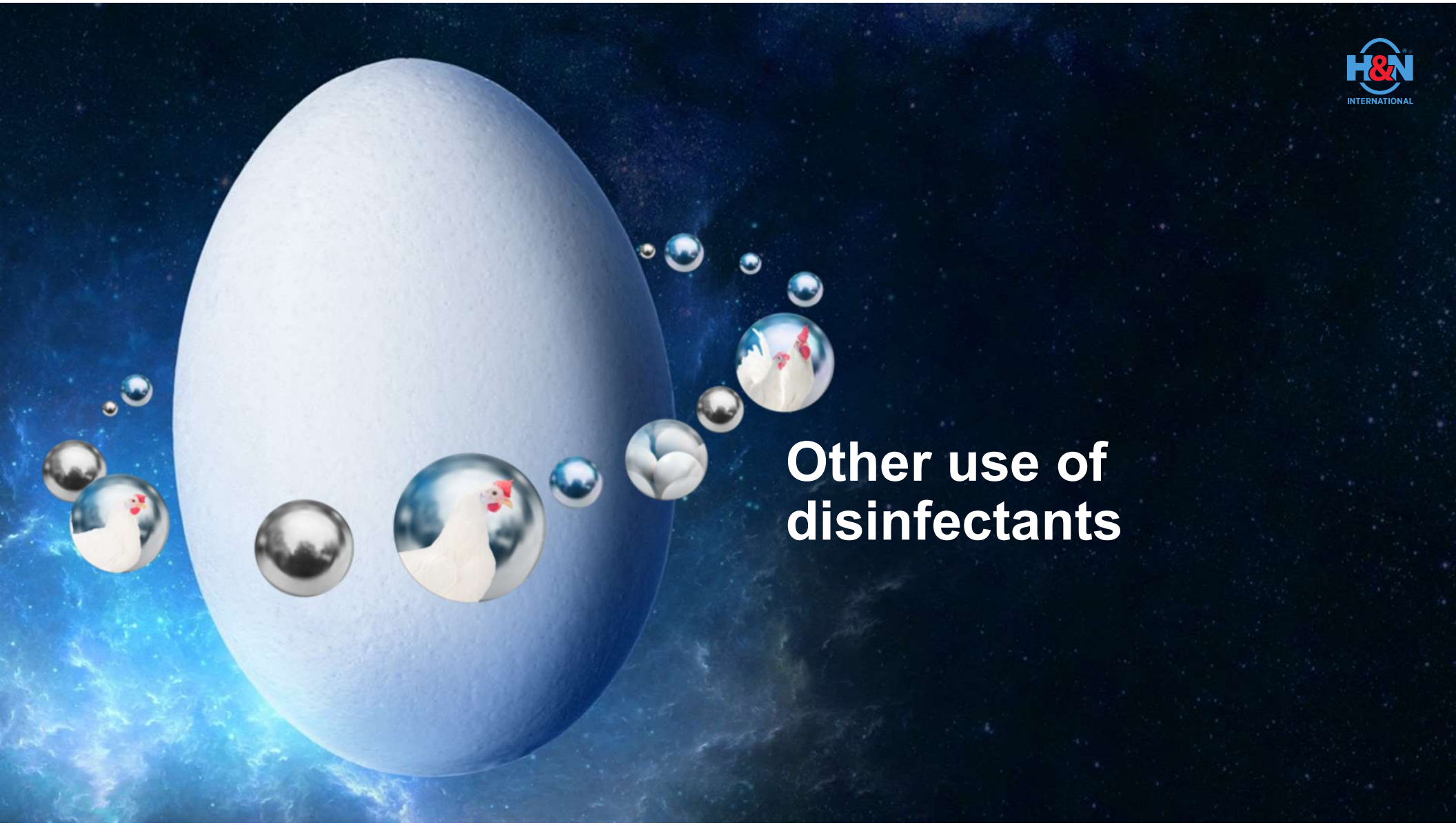
CHOICE OF DISINFECTANT

There is no ideal disinfectant for all situations and the determinant at the time of choice is multifactorial (COLDEBELLA et al., 2004).

When selecting a disinfectant, we must consider the specific characteristics:

- ✓ **Active ingredient**
- ✓ **Target microorganisms**
- ✓ **Environmental factors;**
- ✓ **Operators' health**.

Fonte: DROVAK et al., 2008.


H&N
INTERNATIONAL
Other use of disinfectants

People Flow

After going through this foot bath my boots will be:

A) More contaminated?

B) Less contaminated?

(**Hint**: It's Answer A!)

People Flow

Evaluating the efficacy of boot baths in biosecurity protocols

Sandra F. Amass, DVM, PhD, Dipl. ABVP; Bryan D. Vyverberg; Darryl Ragland, DVM, PhD; Carol A. Dowell; Cheryl D. Anderson; Jason H. Stover; Dwight J. Beaudry

SFA, BV, DR, CD, CA: Department of Veterinary Clinical Sciences, Purdue University, 1248 Lynn, West Lafayette, IN 47907–1248; email: amasss@vet.purdue.edu; JS, DB: Department of Statistics, Purdue University

This article is available online at http://www.aasp.org/shap.html.

Amass SF, Vyerberg BD, Ragland D, et al. Evaluating the efficacy of boot baths in biosecurity protocols. *Swine Health Prod.* 2000;8(4):169–173.

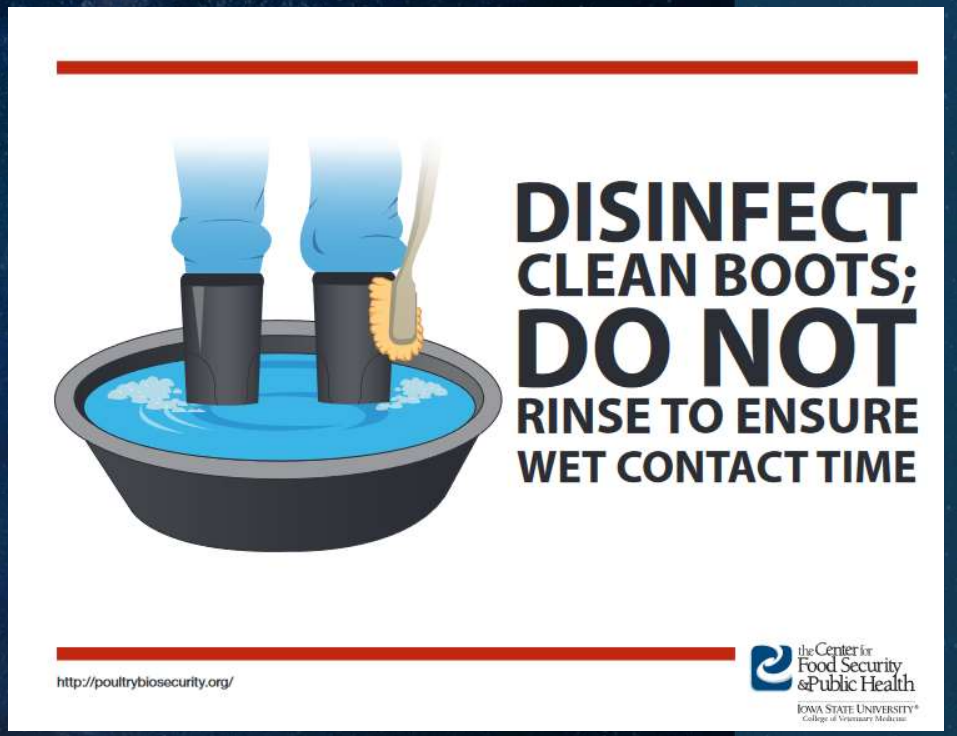
Swine Health and Production — Volume 8, Number 4

Results: The type of disinfectant was irrelevant if manure was not removed from the surface of boots prior to disinfection. Scrubbing was indicated to adequately remove manure. Contaminated boot baths increased boot contamination during cleaning. Disinfection was accomplished after manure-free boots were soaked in Roccal™-D Plus for 5 minutes.

Implications: Proper disinfection of boots includes removing all visible manure from boots and then soaking the boot in a clean bath of disinfectant for the time period recommended on the disinfectant label. Improper boot cleaning methods waste time and money and may place the herd at risk of pathogen spread.

People Flow


USE THE HOSE
AND A BOOT BRUSH
TO CLEAN
MANURE, BEDDING
OFF BOOTS
BEFORE DISINFECTING
http://poultrybiosecurity.org/
the Center for Food Security & Public Health
Iowa State University
College of Veterinary Medicine


DISINFECT
CLEAN BOOTS;
DO NOT
RINSE TO ENSURE
WET CONTACT TIME
http://poultrybiosecurity.org/
the Center for Food Security & Public Health
Iowa State University
College of Veterinary Medicine

People Flow

1. dirty boots
2. rinsed with water
3. disinfected

Source: ILVO

Prevalence of Salmonella was 19,7%

Fonte: Prev. Vet Med., 2011

People Flow

After shower before Henhouse

X

On farm outside of hen house

X

Inside of Hen house

"It is estimated that men are responsible for 90% of disease outbreaks."

(Oscar Rivera Garcia-Bioseguridad Industria Avicola)

People Flow

People Flow

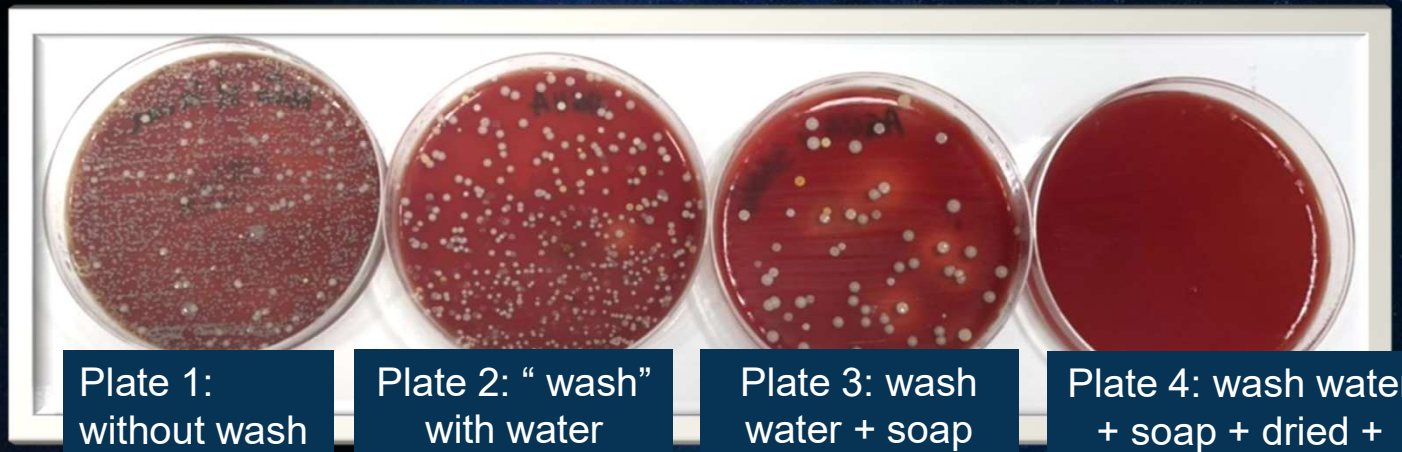
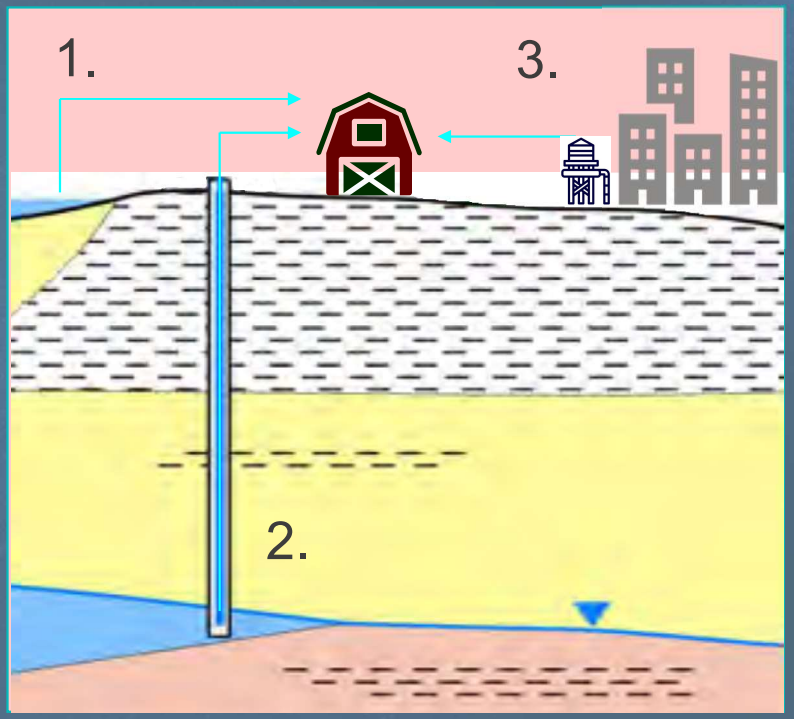


Plate 1: without wash	Plate 2: “ wash” with water	Plate 3: wash water + soap	Plate 4: wash water + soap + dried + alcohol 70%


H&N
INTERNATIONAL
Drinking Water
Disinfection

Water Program

Water source really maters



1. **Surface waters**
2. **Well**
3. **Public water network**

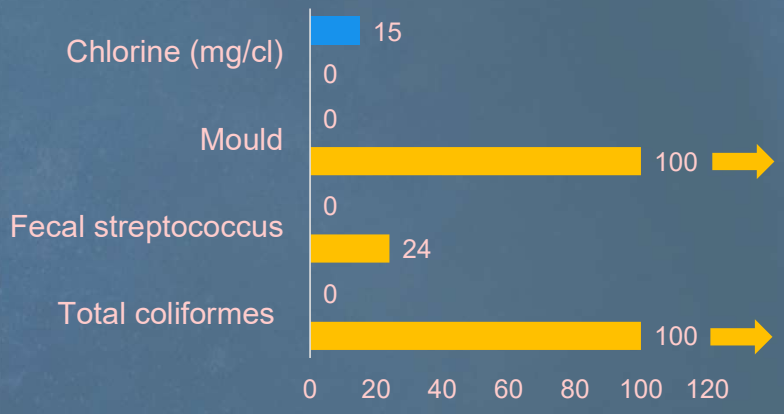
- Microbiological quality
- Physic-Chemical Quality
- Pre-treatment

Water Program

Water sanitation is a must in any case

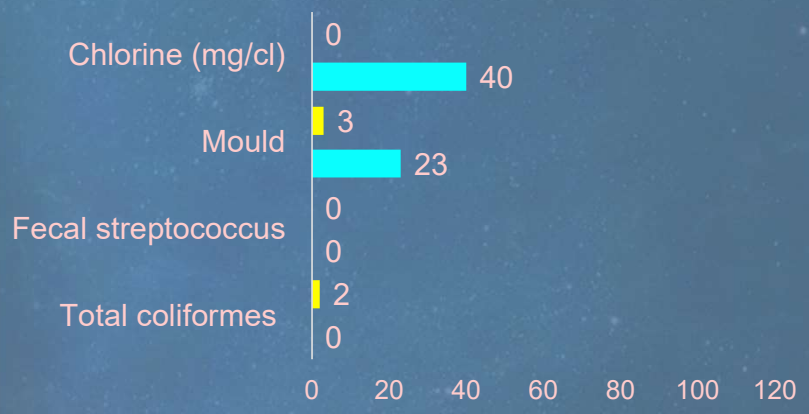
Farm 1

Public network water
No treatment @ farm



Farm 2

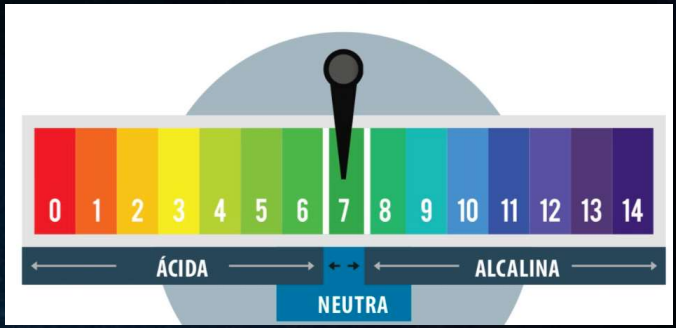
Well water
Chlorine @ farm



Collection point

End of the pipeline

Water Program



pH above 8 impacts chlorine effectiveness
(Matkins, 2020)

Avian Cholera, Bordetella, E.coli, Salmonella, Avian Influenza, Campylobacter and Staphylococci.

Ensure **3 to 5 ppm of chlorine** in the water consumed by the birds

Potential Oxy Reduction > 650

Water Program

Why do we need to clean water lines?

APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Dec. 1994, p. 4339–4344
0099-2240/94/$04.00+0

Vol. 60, No. 12

Direct Measurement of Chlorine Penetration into Biofilms during Disinfection

DIRK DE BEER,[1]† ROHINI SRINIVASAN,[2]‡ AND PHILIP S. STEWART[2]*

Center for Biofilm Engineering[1] and Department of Chemical Engineering,[2] Montana State University, Bozeman, Montana 59717

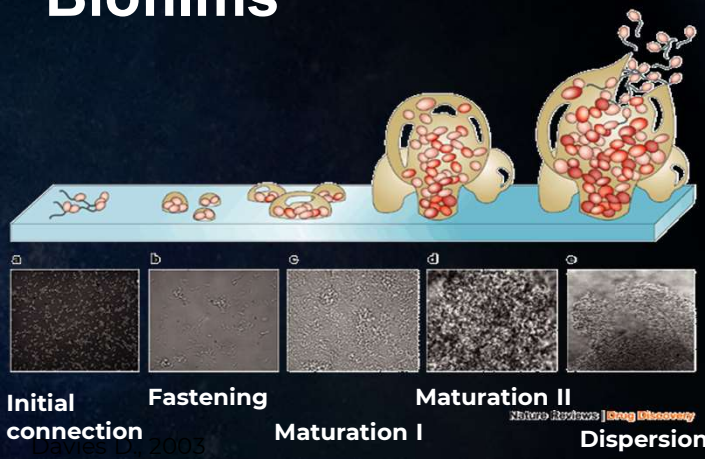
Received 20 June 1994/Accepted 29 September 1994

Transient chlorine concentration profiles were measured in biofilms during disinfection by use of a microelectrode developed for this investigation. The electrode had a tip diameter of ca. 10 μm and was sensitive to chlorine in the micromolar range. The biofilms contained *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*. Chlorine concentrations measured in biofilms were typically only 20% or less of the concentration in the bulk liquid. Complete equilibration with the bulk liquid did not occur during the incubation time of 1 to 2 h. The penetration depth of chlorine into the biofilm and rate of penetration varied depending on the measurement location, reflecting heterogeneity in the distribution of biomass and in local hydrodynamics. The shape of the chlorine profiles, the long equilibration times, and the dependence on the bulk chlorine concentration showed that the penetration was a function of simultaneous reaction and diffusion of chlorine in the biofilm matrix. Frozen cross sections of biofilms, stained with a redox dye and a DNA stain, showed that the area of chlorine penetration overlapped with nonrespiring zones near the biofilm-bulk fluid interface. These data indicate that the limited penetration of chlorine into the biofilm matrix is likely to be an important factor influencing the reduced efficacy of this biocide against biofilms as compared with its action against planktonic cells.

Water Program

Why do we need to clean water lines?

Biofilms



Davies D., 2003

Survival time of pathogens in water

Microrganismos	Tempo	Fonte
	dias	
Salmonella sp	16	André et al. (1967)
Shiguella sp	12	André et al. (1967)
E.coli	26	André et al. (1967)
S. Tiphimurium	100	Filip et al. (1988)
Mycoplasma gallisepticum	2	Bonaduce (1980)
S. Enteritidis	30	Pokorny (1988)

(Amaral, 1996)

***Treatment and vacccines thru driking water

Water Line Cleaning

Biofilm Remotion

Volume of water:

½" = 500ml/m
¾" = 700ml/m

Do it when the house is epmty of birds!!!!!

1. Measure volume to complete the water line inside the house;
2. Fill water tank with this volume and add Quaternary ammonia 500ppm;
3. Open the end of the line and fill until foam comes out at the end of the line.
4. Close and leave the solution to soak for 24 to 48 hours;
5. Flush and check if there is a need to unclog nipples..
6. Repeat if necessary.

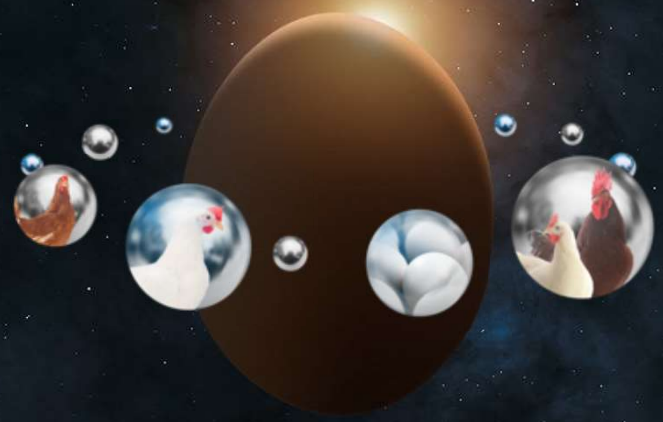
MORE QUESTIONS

- ✓Double? Triple disinfection is needed in the house?
- ✓What about house fumigation?
- ✓How to check if the C&D result is satisfactory?
- ✓Which product (disinfectant) is better?

Taking Home Mesages

- ✓ Check effectively and "on the spot" to take actions;
- ✓ Do technical based choice;
- ✓ Planning for the execution of actions;
- ✓ Compliance with pre-established deadlines;
- ✓ Consider feasible deadlines;
- ✓ Training, Health and Continuing Education for EVERYONE involved!
- ✓ Cleaning and disinfection is biosecurity;
- ✓ Biosecurity is prevention!

Thank you for your attention



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