Cleaning and disinfecting poultry equipment and poultry houses

Figure 1. Cleaning and disinfecting a live-poultry delivery truck can help prevent disease transmission.

AVOID TROUBLE!

Protect your flock against disease. Set up a management program of effective cleaning and disinfecting to remove sources of infection. And insist on the cooperation of those responsible for your supplies and services.

WHAT NEEDS TO BE CLEANED AND DISINFECTED?

Droppings, litter, broken eggs, feathers, dead poultry, blood, and other debris from any flock, including your own, may harbor disease-producing agents. Even a flock that looks healthy may be a source of infection. Do you let equipment, supplies, or people enter your ranch without first removing all traces of manure and other contamination? Do you send dirty equipment elsewhere? Don't spread trouble. Plan ahead!

Equipment and Supplies

Look around. The modern poultry industry rolls on wheels: feed trucks; egg trucks; fertilizer trucks; live-poultry trucks for started pullets, force-molt hens, and market poultry; hatchery trucks; and rendering plant pick-up trucks. How about the trucks that visit your ranch? If they look clean inside and out, they may be all right. But if they are sanitized, you are a lot safer. Another publication in this series will give more details on cleaning and disinfecting trucks. But the main thing is to keep them—and their drivers—away from your birds.

This is one of a series of publications on Planned Disease Prevention, which includes all aspects of management to help prevent exposure of poultry to disease and to minimize the effects of disease. The publications have been prepared by University of California Agricultural Extension and Experiment Station personnel as part of a statewide poultry disease prevention project.

2 PLANNED DISEASE PREVENTION $

Agricultural Extension **University of California**

AXT-406-2
10/73

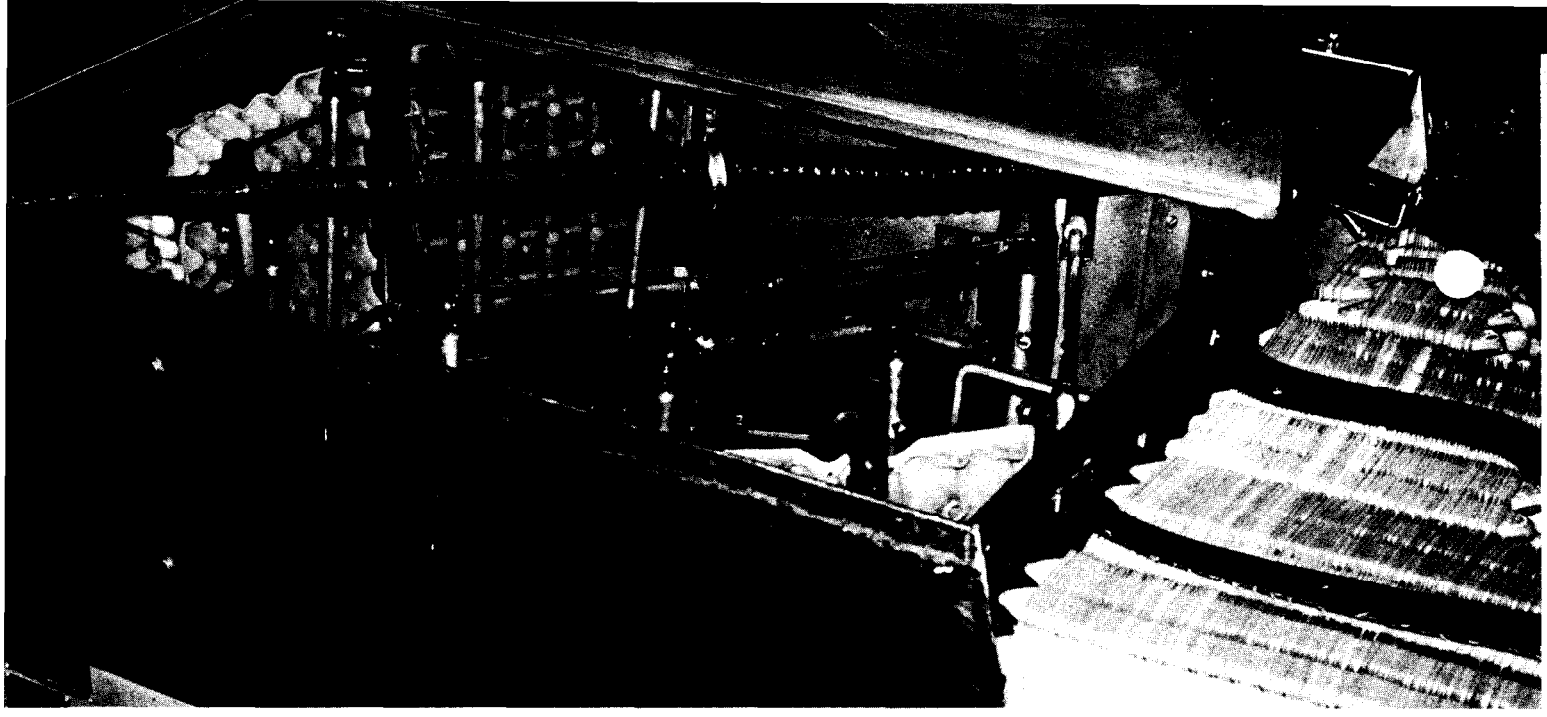

Figure 2. Plastic egg flats are automatically cleaned and sanitized. As the egg flats rotate like a merry-go-round, they are hit by jets of 180° F. (82° C.) water and finally sprayed with a sanitizer. Notice the rows of clean plastic egg flats on the right side of the machine.

Other equipment that moves from ranch to ranch, such as manure clean-out machines and tractors, should also be cleaned and sanitized. Some equipment, like spray-vaccine machines, probably should stay on one ranch.

Reject dirty supplies. Do you frequently check the cleanliness of egg flats, egg cases, egg racks, and other material that comes to your ranch?

People

Vaccination, loading, and insemination crews, and others who go from ranch to ranch must be careful not to spread disease. They should wear clean clothing, rubber boots that can be easily sanitized, and clean disposable or washable caps.

Figure 3. This is what the well-dressed vaccination crew wears—clean coveralls, rubber boots, and disposable caps. The crew is mixing vaccine as they start the day's work.

To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products which are not mentioned.

Co-operative Extension work in Agriculture and Home Economics, Division of Agricultural Sciences, University of California, and United States Department of Agriculture co-operating. Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914. George B. Alcorn, Director, California Agricultural Extension Service.

HOW LONG DO DISEASE ORGANISMS SURVIVE?

The length of time a disease organism survives varies with the organism or causative agent, the amount of protection it has, and the environment.

Pasteurella multocida, the fowl cholera organism, can survive for a month in manure and about 3 months in a dead carcass or in soil. But when the organism is dried on glass, it usually dies in less than 24 hours. Disinfectants applied to a clean surface also destroy the organism easily.

In a UC Davis experiment, one isolate of exotic Newcastle virus (VVND) remained infective no longer than 10 to 14 days in chicken droppings in litter. However, the experiments were conducted in a highly controlled, vermin-free environment. In a Newcastle Disease Task Force trial, VVND virus remained infective for 17 days in room temperature drinking water.

If unprotected by dirt or by proteins like those in eggs and mucus, the Newcastle virus is destroyed by sunlight, by boiling for 1 minute, or by disinfectants. For example, Newcastle virus has been experimentally inactivated in 3 to 5 minutes by the use of 2 percent lye, 1 percent cresylic acid, 1 to 2 percent sodium orthophenylphenate or quaternary ammonium compound (quat), or 5 to 20 percent household chlorine bleach.

CLEANING AND DISINFECTING

Cleaning Comes First

You cannot satisfactorily decontaminate a dirty surface. Using disinfectants on dirty surfaces wastes time and money and lulls you into a false sense of security. Another fact to remember—smooth surfaces are easier to clean and disinfect than porous ones.

Cleaning removes most of the contamination—probably 95 percent or more. Heated water has better cleaning power than cold water, and hot water under pressure removes a lot of dirt and contamination. Elbow grease helps too.

Use detergents to wash buildings and equipment. Detergents reduce surface tension and help water to penetrate organic matter. Synthetic detergents usually work well in hard or soft water. Ordinary soap works best in soft water but you may need hot water to bring the soap into solution.

Do not mix different types of detergents, because one can make another ineffective. You should not mix quats like Germex, Hi-Lethol™, San-o-Fec®-50, and Warden, which are detergent-disinfectants, with ordinary synthetic detergents or soap. But quats are compatible with washing soda, trisodium phosphate (TSP), and lye. For more details on compatibility, consult the manufacturer's recommendations.

After the surfaces are clean and relatively free of organic matter, you can effectively sanitize or disinfect them. For example, a quaternary ammonium compound at 325 parts per million (ppm) completely inhibits growth of the bacterium *E. coli* in the absence of organic matter. If 2 percent sterile feces is present, a 1,950 ppm quat concentration is needed.

Pick the Right Disinfectant

Select the disinfectant to fit the job. A chlorine solution would be good for sanitizing eggs because chlorine volatilizes. But to disinfect a concrete or wood floor, a longer lasting disin-

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™ Trademark.

®Registered trade name.

fectant with good penetration would be preferable. Some other things to consider are:

- How effectively will it destroy your problem "bug"?
- Is it registered for the intended use?
- Does it kill germs in the presence of a limited amount of organic matter?
- How stable is it?
- Is it soluble and effective in hard water?
- Is it easy to apply?
- How toxic is it to humans and animals?
- Does it damage metals, rubber, plastic, and other materials? For example, chlorine is hard on metal equipment.
- Does it affect the taste of products?
- Does the disinfectant have an offensive odor?
- Is it low cost, or does it just seem that way?
- Is it readily available?

There are many chemical disinfectants on the market. Some are mixtures. Find out what the active ingredients are and how much are in the product. The table on page 7 lists the more common disinfectants and describes their uses. Also see page 8 for more details on these disinfectants.

Formaldehyde, another common disinfectant, is not mentioned in the table. Hatcherymen and hatching egg producers use formaldehyde gas extensively to decontaminate incubators, hatchers, eggs, and enclosed spaces. Formalin (37 to 40 percent formaldehyde) is usually recommended at 0.5 to 1 milliliter per cubic foot and paraformaldehyde at 0.3 gram per cubic foot. For effectiveness, the relative humidity should be at least 70 percent and the temperature 70° F. (21° C.) or higher. Formalin, as a 1 to 5 percent solution, can also be used to disinfect walls and floors of buildings. One commercially available product, DC&R Spray Fumigant, contains a chemical that slowly decomposes to yield formaldehyde.

Fumigants like methyl bromide,[1] which is toxic to man, or ethylene oxide, which is explosive, are effective decontaminants when properly applied under tarps or bags. Methyl bromide is especially effective in litter, on dirt floors, etc. But BE CAREFUL!

You can apply disinfectants as sprays, dips, fogs, or gases. Except for chlorine or organic iodine, which volatilize, most disinfectants work best in warm or hot water. Follow the manufacturer's directions.

Useful Equipment

Cleaning and disinfecting equipment might include a truck and tractor for manure removal, shovels, wheelbarrows, brushes, brooms, buckets, tanks for soaking and washing smaller items, water under high pressure—perhaps supplied by a spray rig or by special washers—steam cleaners, proportioners, and feather burners. Machines are available for cleaning and sanitizing egg flats and hatching trays.

On a small ranch, your equipment may be simple and relatively inexpensive. In all cases, cleaning and disinfecting take planning, the will to do an effective job, and some investment of time, money, and effort.

[1] **CAUTION**: Methyl bromide is a highly toxic, odorless fumigant. Whenever possible, use this material in combination with chloropicrin as a warning agent. Wear special protective equipment, especially gas masks, when there is a possibility of inhaling the vapor. Chloropicrin is a fumigant that is highly irritating to the eyes. See your County Agricultural Commissioner to obtain a permit to purchase, apply, and possess these materials, and to become familiar with any special restrictions. Always read the labels before using and carefully follow all safety precautions.

Figure 4. A butane burner is useful. It is especially good for destroying feathers and cobwebs —but short exposure to heat provides only limited disinfection.

Other Means of Disinfecting

We often use physical means to destroy pathogens, sometimes without realizing it. Heat, dryness, and ultraviolet light are especially important nonchemical disinfecting agents.

Heat generated in composting destroys bacteria, viruses, and even coccidia, if all parts of the pile are properly composted. But don't compost on a wood floor or you may have a fire!

Many pathogenic organisms thrive at body temperature—98.6° F. (37° C.)—but fail to grow when temperatures are much above or below this. Cool temperatures—50° to 60° F. (10° to 15° C.) or less—prolong the life of most infectious agents. For instance, mycoplasma, other bacteria, and viruses can survive long periods of freezing temperatures.

High temperatures destroy microorganisms and viruses. Moist heat at 131° to 149° F. (55° to 65° C.) for 5 to 10 minutes kills non-spore-forming bacteria and the vegetative cells of spore-forming bacteria. Steam generators supply high temperature and moisture; this moist heat cleans and, depending on exposure time and the temperature at points of contact, also partially or completely destroys many germs and viruses.

Dry heat is less effective because it takes higher temperatures and more time to kill organisms. Bacteria that do not form spores are killed in a few hours at 116° F. (47° C.), in 1 hour at 140° F. (60° C.), and in 5 minutes at 158° F. (70° C.). Laboratory glassware is sterilized by exposure to dry heat at 320° to 356° F. (160° to 180° C.) for 1 to 2 hours or longer. Butane burners supply hot, dry heat and thus help to disinfect. Air drying also kills the vegetative forms of some pathogenic bacteria in a few hours.

The sun's ultraviolet rays, although they do not penetrate deeply, are also important physical agents that help destroy pathogens. Hospitals sometimes install ultraviolet lighting in operating rooms or in air ducts to help purify the air. As a further safeguard after cleaning and sanitizing equipment, place it in the sunlight and make use of the pathogen-destroying properties of ultraviolet. It's free!

Figure 5. It is time to apply disinfectant after the building is thoroughly cleaned. Note that the worker is wearing protective gear.

STEP-BY-STEP PROCEDURES

1. Cleaning and disinfecting is practical only after you remove all poultry and their droppings or litter. If possible, move droppings and litter to an off-ranch site. An alternative is to compost to reduce or destroy harmful organisms.

Sometimes it is advantageous to wet the building down lightly to settle dust. Turn off the electricity when you wash or spray near electrical wiring.

2. Remove as much equipment as you can. You can soak some of it in tanks to loosen dirt. A concrete slab near the building, with a water supply and good drainage, may be convenient for cleaning portable equipment. Or you can clean the equipment inside the building.

3. Use water at high pressure to give buildings and equipment a first wash. Shovel up loose dirt.

4. Next, use detergent and wash more thoroughly. Scrape and brush where necessary to loosen and remove dirt.

5. Then spray disinfectant on the inside of the house and on stationary equipment.

6. Before you replace portable equipment, dip or spray it, perhaps with a different disinfectant than you used on the walls, overhead areas, and floor. Choose the disinfectant for the job; for example, to avoid the odor of cresylic acid, you might change to quat.

SAFETY PRECAUTIONS

Most cleansers and disinfectants are poisonous. Store them in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Keep labels on all containers. Always read and carefully follow all precautions and safety recommendations given on the container label. Use a closed container to carry concentrated materials from one area to another.

Wear goggles or a face shield when you use strong cleaning or disinfecting solutions. Avoid breathing the mist from disinfectant sprays.

Erratum to Leaflet 2627 (formerly AXT-406-2)

LIVESTOCK
PESTICIDE USE WARNING — READ THE LABEL

Pesticides and drugs are poisonous and must be used with caution. READ the label CAREFULLY BEFORE opening a container. Precautions and directions MUST be followed exactly. Special protective equipment (as indicated) must be used.

STORAGE: Keep all pesticides and drugs in original containers only. Store separately in a locked shed or area. Keep all pesticides and drugs out of the reach of children, unauthorized personnel, pets, and livestock. DO NOT STORE with foods, feeds or fertilizers. Post warning signs on storage areas for all chemicals, pesticides, and drugs.

USE: The suggestions given in this publication are based upon best current information. Follow directions. Measure accurately, to avoid residues exceeding established tolerances. Use exact amounts as indicated on the label, or lesser amounts as specified in this publication. Use a pesticide or drug only on animals listed on the label.

CONTAINER DISPOSAL: Consult your Agricultural Commissioner for correct procedures for rinsing and disposing of empty containers. Do not transport pesticides or drugs in vehicles with foods, feeds, clothing, or other materials, and never in a closed cab with the vehicle driver.

RESPONSIBILITY: The livestock owner is legally responsible for proper use of pesticides, including drift to other crops or properties, and for excessive residues. Pesticides should not be applied over streams, rivers, ponds, lakes, run-off irrigation or other aquatic areas, except where specific use for that purpose is intended.

PERMIT REQUIREMENTS: Many pesticides require a permit from the County Agricultural Commissioner before possession or use. When such compounds are recommended in this publication, they are marked with an asterisk (*).

ANIMAL INJURY: Certain pesticides or drugs may cause injury, or give less than optimum parasite control if used: (1) at the wrong animal age; (2) at the wrong time of year; (3) on animals under extreme stress or sick; (4) with the wrong formulation; (5) at excessive rates; or (6) in simultaneous use with incompatible materials. Read the label to be sure you are using the chemical properly.

PERSONAL SAFETY: Follow label directions exactly. Avoid splashing, spilling, leaks, spray drift or clothing contamination. Do NOT eat, smoke, drink, or chew while using pesticides. Provide for emergency medical care in advance.

COMMON POULTRY DISINFECTANTS[1]

Properties and Uses	Iodophors	Quaternaries	Coal Tar Distillates	Synthetic Phenols	Hypochlorites
Spectrum of Activity					
Gram-Positive bacteria	Effective	Effective	Effective	Effective	Effective
Gram-Negative bacteria	Effective	Effective	Effective	Effective	Effective
Bacterial spores	Moderately effective	Not effective	Not effective	Not effective	Moderately effective
Fungi	Effective	Controls some forms	Most types effective	Most types effective	Effective
Animal viruses	Controls some forms	Controls some forms	Controls some forms	Controls some forms	Controls some forms
Physical Properties					
Speed of kill	Very rapid	Very rapid	Rapid	Rapid	Very rapid
Resistance to organic debris	Poor to fair	Fair	Excellent	Good	Very poor
Residual activity	No	Yes	Yes	Yes	No
Affected by hard water	Not affected	Reduces speed of kill	Some formulations adversely affected	Some formulations adversely affected	Not affected
Compatible with nonionics	Yes	Yes	No	No	Yes
Compatible with anionics	Yes	No	Yes	Yes	Yes
Most effective pH range	Acid	Alkaline	Acid	Acid	Acid
Most Common Use Levels					
Disinfection (active ingredients)	50 to 100 ppm	400 to 800 ppm	Varies with type	Varies with type	200 ppm
Sanitizing (active ingredients)	25 ppm	200 ppm	Varies with type	500 ppm	50 ppm
Most Common Areas of Use	Egg dipping, hatchery disinfection, terminal house disinfection, processing plants, foot baths	Egg dipping, egg washing, hatchery disinfection, terminal house disinfection	Terminal house disinfection, equipment disinfection, foot baths	Egg dipping, hatchery disinfection, terminal house disinfection, equipment disinfection, foot baths	Egg dipping, egg washing, processing plants

[1] For additional information, see "Descriptions of Disinfectants," on page 8.

EXPLANATION OF TERMS

Descriptions of Disinfectants

COAL TAR DISTILLATES: cresylic acid, also called cresol, is the usual product. Commercial cresylic acid has soap added and is mixed with water before use. Add only water. Adding more soap or other materials, like oil or detergents, reduces the product's antibacterial action. Some examples of trade products are Cres-A-Chek, Cresl-400, and Pantex II.

HYPOCHLORITES: various types of chlorine-releasing compounds are available. Household bleach contains about 5 percent available chlorine, derived from sodium hypochlorite; swimming pool chlorine contains about 15 percent. To avoid a calcium precipitate when making sodium hypochlorite stock solutions for proportioners, use softened water. Calcium hypochlorite and chlorine dioxide are other chlorine-releasing compounds.

IODOPHORS: sometimes called organic iodine, these are mixtures of iodine with other chemicals. When the characteristic iodine color fades, effectiveness is gone. Some examples are Iosan®, Iofec®, and "tamed iodine®" Scrub.

QUATERNARIES: called quats for brevity, the full name is quaternary ammonium compound (QAC). A typical QAC chemical formula is n-alkyl (with hydrocarbon chains mostly C_{12-16}) dimethyl benzyl ammonium chloride. Quats vary in composition, and a trade product may be a mixture of two or three. Examples are Germex, Hi-Lethol™, San-o-Fec®-50, and Warden.

SYNTHETIC PHENOLS: many chemicals of this type are manufactured. Orthophenylphenol and 1-Stroke Environ® are examples.

> It is easy to change percentages into parts per million. Just remember that 1 percent equals 10,000 ppm. For example, 5 percent chlorine bleach has 50,000 ppm chlorine; when it is diluted 250-fold, the concentration is 200 ppm.

Definition of Terms[2]

ANTISEPTIC: a product that destroys microorganisms or retards their rate of growth, especially a product applied to living tissue.

DETERGENT: any substance that improves the cleaning action of water. Soaps are detergents, but the term has come to mean synthetic substances, such as Tide® and Dreft®. Both soap and synthetic detergents are cleansing and wetting agents. A wetting agent, sometimes called a **surfactant** or surface-active agent, helps water to penetrate or to cover the surface of another substance.

DISINFECTANT: usually a chemical agent, often applied to buildings and equipment, that inactivates viruses or kills microorganisms but not necessarily their spores.

SANITIZER: a product used in such a way that it reduces the microbial contamination to a safe level.

STERILIZATION: the complete destruction of all microorganisms, including vegetative bacteria, spores, fungi, and viruses.

WORDS ENDING IN "-CIDE": this suffix means that the product, when correctly used, kills the disease agent described in the first part of the word. For example:

Bactericide – kills bacterial cells.

Fungicide – kills molds or fungi.

Germicide – kills bacteria, but not necessarily their spores.

Viricides – kills or inactivates viruses; most germicides are good viricides.

WORDS ENDING IN "-STAT": this suffix means the product retards the multiplication of organisms, without necessarily destroying the organisms themselves. It is often a more dilute chemical than one that kills disease agents. For example:

Bacteriostat – slows the growth of bacteria.

Fungistat – slows the growth of molds or fungi.

[2] Meanings sometimes overlap.

ACKNOWLEDGMENT

We thank James F. Mock, V.M.D., Whitmoyer Laboratories, Inc., and *Poultry Digest* for the table on page 7, and the State-Federal Newcastle Disease Task Force for providing several photographs.

This publication was prepared by Farm Advisors William F. Rooney and William D. McKeen, San Bernardino, Los Angeles, and Riverside Counties.