# NVAP Reference Guide: Cleaning and Disinfection

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## Importance of Cleaning and Disinfection

Cleaning and disinfection (C&D) involves using physical or chemical processes to reduce, remove, inactivate, or destroy pathogenic microorganisms. C&D procedures are crucial in controlling the spread or transfer of microorganisms between animals, locations, or people. The potential for spread or transfer of microorganisms can occur from the direct or indirect contamination of equipment, facilities, vehicles, people, and the movement of animals or animal products.

C&D processes vary: many factors affect the efficacy of the process, including the method or product selected, the organism involved, and other environmental factors, such as temperature, organic load, or water hardness. The procedures necessary will vary depending on the situation. No single method is adequate for all situations.

As an accredited veterinarian, you should be able to advise on the selection of an appropriate disinfectant for various disease threats or situations, make recommendations for disinfection procedures and techniques to use, understand any limitations of the procedure, and provide guidance for the safety of animals and people during the process.

In some situations (e.g., inspection and movement of animals, infectious disease outbreaks), your duties may involve ensuring cleaning and disinfection procedures are implemented properly. For example, when dealing with certificates of veterinary inspection and the movement of animals, the accredited veterinarian must certify that transportation vehicles have been properly cleaned and disinfected before animals can be moved across state or international borders. Title 9 of the Code of Federal Regulations (CFR), part 91, subsection 91.3 (d), stipulates that “the origin health certificate accompanying animals shall be accompanied by a statement from the issuing accredited veterinarian or inspector that the means of conveyance or container has been cleaned and disinfected since last used for animals with a disinfectant approved under subsection 71.10 of this chapter, prior to loading, or that the carrier or container has not previously been used in transporting animals.”

For more information on cleaning and disinfection, see NVAP Module 4: Preventing Disease Introduction and Spread,

## Cleaning

Cleaning involves the removal of visible organic and inorganic matter (e.g., soil, dirt, debris, salts, oils, blood) from objects or surfaces. Cleaning is one of the most important steps in the C&D process! When done appropriately, cleaning alone can remove a large percentage of microorganisms. This step also helps improve disinfection efficacy since many chemical disinfectants have reduced effectiveness in the presence of organic material. The cleaning process should be conducted before applying all EPA-registered disinfectants.

The cleaning process can be broken down into four basic steps: dry cleaning, washing, rinsing, and drying.

1. **Dry Clean:** Dry cleaning involves the removal of gross contamination and organic material (e.g., soil, manure, bedding, feed) from equipment, objects, or animal areas. Use brooms, brushes, shovels, and manure forks to sweep, scrape, and remove organic material and debris from surfaces. To ensure thorough cleaning, use a systematic approach, beginning at the top of the structure and continuing down to the bottom or floor. Pay special attention to corners, crevices, or other areas where debris may accumulate. Remove as much gross debris as possible. Do not use air blowers for dry cleaning due to the risk of spreading pathogens. Cleaning personnel should wear suitable

personal protective equipment (e.g., masks) if they anticipate significant dust generation. Moistening the areas or items with water may help control dust and minimize the aerosolization of pathogens. The cleaning process may require considerable time and effort, but it is essential as debris can harbor microorganisms, reduce disinfection efficacy, or even inactivate some disinfectant products. All material should be disposed of to minimize the further spread of microorganisms and comply with federal, state, or local requirements and policies.

2. **Wash:** The second step in the cleaning process is washing. This is one of the most overlooked steps in the C&D process. The physical action of scrubbing with detergents and surfactants helps to further reduce the number of microorganisms and removes any oil, grease, or exudates that may inhibit the action of disinfection. Before washing, any electrical equipment should be turned off and removed or covered tightly. Contacting an electrician may be necessary to remove or protect thermostats, timing devices, motor controls, and remote sensing equipment prior to washing. Wash the item or area by wiping or scrubbing. In larger areas, pressure spraying may be an option; however, high-pressure systems should be avoided in highly infectious or zoonotic pathogens to avoid further dispersal of the pathogen or risk to the applicator. Warm to hot water (90-130°F [32-54°C] or higher) should be used whenever possible. This can increase washing efficacy; heat may also aid in inactivating some pathogens. Hot water and steam can effectively clean cracks, crevices, and the inside of pipework where pathogens are likely to linger. Areas and items with organic material adhered to the surfaces should be pre-soaked for several hours. Rough surfaces should be scrubbed with a stiff brush to clean them as completely as possible. Deep cracks, crevices, pits, pores, or other surface irregularities should be given particular attention to dislodge accumulated grime; these areas can serve as reservoirs for pathogens.
3. **Rinse:** After washing, all surfaces should be thoroughly rinsed, as residues from cleaners and detergents can inactivate certain chemical disinfectants. Rinsing should be done at low pressure with cold water. When the rinsing process is complete, carefully inspect surfaces to ensure they are visibly clean. Moisture should spread evenly over surfaces, and no “beading” should occur, as this would indicate the presence of oil or grease.
4. **Dry:** Surfaces should be allowed to dry completely (if possible overnight) before applying a disinfectant. Excess moisture, especially on porous surfaces, may dilute and reduce the efficacy of the disinfectant applied to the surface; it

may also harm equipment. Fans or blowers can be helpful to the drying process but should not be used if dealing with highly infectious or zoonotic pathogens.

Disinfection

Disinfection involves the destruction of microorganisms, but not usually spores, on inanimate surfaces or objects. Disinfection is not sterilization. Sterilization describes a process that destroys or eliminates all forms of microbial life, including spores. Disinfection methods can involve using physical (e.g., heat or ultraviolet light) or chemical (e.g., disinfectants) processes to reduce, inactivate, or destroy pathogenic microorganisms.

Many factors can affect the effectiveness of the disinfection process. These include the microorganism being targeted, the organic and inorganic load present, the characteristics of the disinfectant (or disinfectant method) being used, as well as other factors such as temperature, pH, water hardness, relative humidity, and the physical nature of the object or surface being disinfected. For physical disinfection methods, including heat, there are likely to be specific requirements and processes based on the situation and/or the disease agent involved.

## A Typical Disinfection Process

1. **Select a Disinfectant:** The first step is disinfectant selection. Determine and select a disinfectant registered by the U.S. Environmental Protection Agency (EPA) for use against the microorganism(s) of interest and for the object or area that needs to be treated. Product labeling includes detailed information, including the ingredients statement, warnings and precautionary statements, and directions for use. Disinfectants must be used according to their approved labels at the indicated dilution, labeled use, application method, contact time, and safety measures.

2. **Disinfection Preparation:** Prepare fresh solutions of disinfectants daily or as specified on the label. Some disinfectants can lose stability shortly after being prepared or stored over long periods. Use of an outdated product may result in ineffective disinfection.

   If a product is to be diluted, the label will provide specific mixing directions. Proper concentration is important to achieve the best results for each situation.

Some products will have different dilutions depending on the intended use of the product (e.g., sanitizing, disinfecting, sterilizing). Disinfectants are tested and proven effective at the specified dilution provided on the label. The dilution listed on the label must be followed exactly unless a FIFRA Section 18 exemption allows a different dilution (see Regulation of Disinfectants). Additionally, using disinfectants at higher concentrations than specified on the label may increase the hazard to personnel and the environment. Conversely, over-dilution of a product may render the process ineffective to the target microorganism.

Personnel safety during disinfection preparation is essential. Gloves, eye protection, and masks may be needed during this process. Consult the product label for safety precautions; inform personnel of these safety measures.

3. **Application:** Disinfectants must only be used for the item or area specified on the label. Additionally, the required application method and contact time will be provided. Application methods may involve spraying, fogging or misting, wiping, immersing, or mop-on. Appropriate safety measures (e.g., personal protective equipment) should be used during all disinfection processes, including the application process.
4. **Contact Time:** One of the most important components of the disinfection procedures, regardless of the method chosen, is to allow adequate contact time. This is essential for the process to have the desired impact – destroying microorganisms. In some cases (e.g., when long contact times are required), the disinfectant may need to be reapplied to keep the surface “shiny” wet for the full required contact period.
5. **Rinse:** Following the application (and appropriate contact time), items and areas should be thoroughly rinsed. Many chemical disinfectants can harm animals and should be rinsed with potable water.
6. **Dry:** Whenever possible, surfaces should be allowed to dry completely (if possible overnight). The drying process can also further aid in reducing or eliminating microorganisms through desiccation. Premises that have been cleaned and disinfected should have a downtime following disinfection. This involves the area being free of any animals or activity for a period of time to allow it to not only dry completely, but since the application of disinfectant solutions uniformly over large areas (e.g., ceilings, walls, floors) can be very difficult, adequate downtime helps to further reduce or eliminate any remaining microorganisms through desiccation.

Regulation of Disinfectants

Chemical disinfectants in the United States are registered and regulated by the U.S. Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (40 CFR Parts 150-189). Under FIFRA, chemical disinfectants are considered “antimicrobial pesticides” or “substances or mixtures of substances intended to destroy or suppress the growth of harmful microbiological organisms, and pesticides that protect inanimate objects and surfaces from organisms such as bacteria, viruses, or fungi.”

Before product registration and marketing, manufacturers must submit product chemistry, efficacy, and toxicity data, along with proposed labeling, for the EPA’s review. FIFRA requires that any pesticide be registered or exempted before being sold or distributed in the United States. All EPA-registered pesticides must have an EPA registration number.

FIFRA requires that all label use directions and safety precautions be followed. Using a registered disinfectant in a manner inconsistent with its labeling may not only result in an ineffective application, but it may be a “misuse” of the product subject to potential enforcement action. Thus, a chemical disinfectant should be selected not only based on its desirable characteristics but also on whether it is registered or exempted under FIFRA and whether it can be used following its label safety precautions and use directions for its intended use(s). Individual states also have regulations that may be stricter than federal regulations.

The product label for any EPA-registered disinfectant may be retrieved by entering the registration number in the EPA’s Pesticide Product Label System (PPLS) Search engine .

## Emergency Exemptions

In some situations, a particular pathogen may not be listed on the product label of an EPA-registered disinfectant. In these cases, Section 18 of FIFRA authorizes the EPA to grant exemptions to federal agencies or states to use unregistered pesticides for a limited time if the EPA determines that emergency conditions exist. If granted, such exemptions would allow the use of non-registered pesticides or the “off-label” uses of a registered pesticide for a specified time period. Use is only allowed for designated personnel and as described in the exemption.

A full explanation of FIFRA Section 18 exemption process can be found on EPA's website.

Federal regulations regarding emergency exemptions are described in the Code of Federal Regulations (40 CFR Part 166).

## Additional Resources

Information about the antimicrobial pesticide registration process, data requirements, labeling requirements and other issues pertaining to chemical disinfectants can be found on the EPA's web site.

The EPA has developed a Label Review Manual that includes detailed information on content and format of labels and labeling.

An extensive list of potential EPA-approved pesticides (1.32 MB) for use against selected foreign animal disease agents in farm settings can be found on the APHIS website.

Disinfectants recently approved for Section 18 exemption for use in the event of high consequence animal diseases can be found on the APHIS website.

Safety

Most disinfection methods or disinfectant products have some level of hazard. Most can irritate the eyes, skin, and/or the respiratory tract. Some may cause allergic reactions, such as allergic dermatitis; others may cause burns or other injury. Physical hazards are also possible while conducting C&D procedures. These may include slips, trips, or falls from slippery surfaces; heat exposure or burns from hot water, or skin punctures from high-pressure sprayers.

The safety of all personnel is paramount when handling, mixing, and applying chemical disinfectants. Training personnel on mixing, application procedures, and hazards is essential. Personal Protective Equipment (PPE), such as gloves, masks, or goggles, should be worn when mixing or applying disinfectants. All chemical disinfectants have Safety Data Sheets listing the stability, hazards, and personal protection needed for the product and first aid information; this safety data is also on the product label.

Many chemical products may be toxic to animals or the environment. Make efforts to avoid exposure to animals or runoff into the environment.

The Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 CFR 1910.1200) is designed to ensure that information about hazards and associated protective measures is communicated to workers. Training must be provided if the hazardous chemicals are used. This training must be provided before personnel begin using the product.

The Worker Protection Standard (WPS) is a regulation issued by the EPA under the authority of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA; Title 40 CFR part 170), that requires the protection of employees from agricultural pesticides. (Navigate to Title 40 using the drop-down menu.)

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