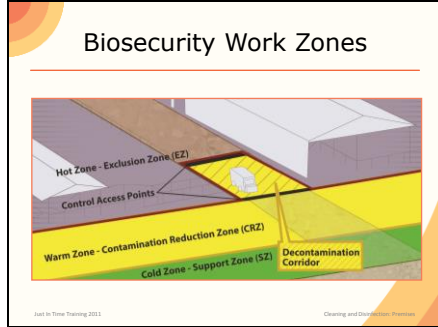


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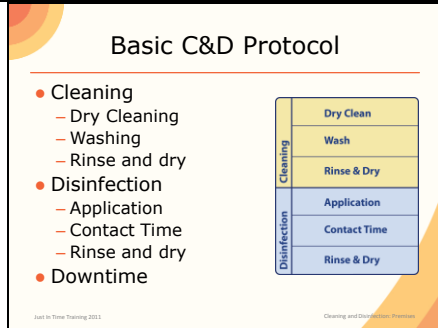
June 2011
 Cleaning and disinfection (C&D) procedures are a crucial part of any animal health emergency response. The cleaning and disinfection of infected premises during an animal health response will be necessary to eliminate the targeted disease from the location and must be done before animals can be reintroduced to the facility. This Just-In-Time training presentation will discuss the steps for conducting C&D of farm premises during an animal disease emergency response. Special considerations based on the type of animal production facility (e.g., broiler house, milking parlor, feedlot) exist and will also be discussed later in this presentation.

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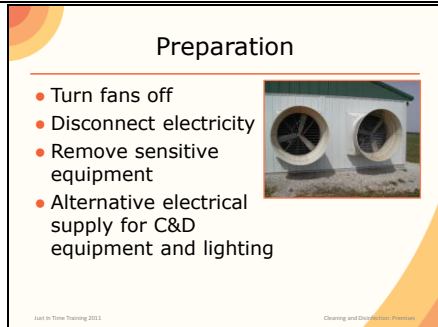
Biosecurity work zones must be maintained during C&D procedures. Premises are located in the Hot Zone – Exclusion Zone. This high-risk area is where infected animals were housed and is potentially contaminated and considered unsafe. PPE must be worn in this area. Entry onto the premises for C&D procedures occurs through the Decontamination Corridor, after appropriate PPE is donned in the Cold Zone. The Decontamination Corridor is an area between the Hot Zone-Exclusion Zone and the Warm Zone-Contamination Reduction Zone. [Graphic illustration by Andrew Kingsbury, Iowa State University]

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The cleaning and disinfection of premises should be carried out in a systematic manner to ensure disinfection efforts are effective. The basic C&D protocol, regardless of item involves a cleaning step, which includes dry cleaning and a thorough wash and rinse. This is followed by the disinfection step, which includes disinfectant application, appropriate contact time, followed by rinsing and drying. When possible, drying between the cleaning and disinfection steps should occur. [Graphic illustration by Andrew Kingsbury, Iowa State University]

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Before initiating the C&D process, all fans should be turned off to prevent dissemination of the infectious agent. The electricity supply to the building should also be disconnected to allow the removal of sensitive equipment and prevent electrical accidents during cleaning. An alternative electrical supply should be acquired to power any cleaning equipment. Good lighting is essential to ensure that surfaces are visibly clean after the washing step. [Photo source: Iowa State University Veterinary Diagnostics and Production Animal Medicine (VDPAM)]

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Vectors

- To avoid transfer of pathogens
 - Detect and remove disease vectors
 - Seal rodent entrances
 - Remove and prohibit wild bird nesting areas
 - Eliminate insect breeding areas




Just In Time Training 2011 Cleaning and Disinfection: Premises

To avoid the potential transfer of pathogens to additional areas, animal vectors, such as rodents, birds, or other wildlife must be detected and dealt with appropriately. Areas of potential rodent entrances should be sealed. Roof areas and eaves with holes or nesting areas for wild birds must be addressed. Insect vector control procedures, such as eliminating insect breeding areas, will also be needed to prevent further dissemination of the disease agent. Feral animals must be trapped and removed or destroyed. [Photo source: Centers for Disease Control and Prevention]

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Preparation

- Footbaths
 - Set up at entrance/exits
 - Ineffective if used incorrectly
 - False sense of security
 - Should not be sole process of disinfection
 - Use fresh solution
 - Allow contact time




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Set up footbaths at all entrances and exits to the building. NOTE: While disinfectant footbaths may be used upon entering and exiting the premises, these “stations” may give a false sense of security to responders and should not be used as a sole process of disinfection. However, the process will serve to raise awareness about the need for biosecurity and disinfection for the disease situation present. A freshly prepared, appropriate disinfectant solution should always be used and adequate contact time allowed on footwear for optimum efficacy. [Photo source: Alex Ramirez, Iowa State University]

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Disinfectant Preparation

- Use according to product label
- Only EPA-registered or approved products
- Prepare fresh solutions
 - Old solutions may have reduced efficacy
- Test kits can help check concentration



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The preparation and application of disinfectant solutions must be in accordance with product label directions. Only EPA-registered or approved products should be used. Fresh solutions should be prepared prior to use; some disinfectant solutions may only be active for the same day of preparation. Failure to make fresh solutions may result in using a product that has reduced efficacy. The use of test kits can help to determine whether any chemical degradation of the disinfectant’s active ingredients has occurred and that diluted solutions contain the necessary amount of active ingredient. As a rough estimate, 1 gallon of solution will cover approximately 100-150 square feet. [Photo source: Top: Carla Huston, Mississippi State University; Top: Teresa Robinson, USDA]

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Basic Protocol

- Systematic manner
 - Start at back and work toward front
 - Start at ceiling and work down walls
 - Small sections at a time
 - Work toward the drain
- Use marking tape to indicate completed areas


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Premises C&D should follow the basic C&D protocol previously described. Use a systematic procedure for cleaning and disinfection. Start at the back of the facility and proceed to the front. Begin all procedures on the ceilings, moving down the walls to the floor, then across the drain. Work in small sections at a time to ensure thorough coverage of each area. Use marking tape to clearly indicate where disinfection has and has not taken place.

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Dry Clean

- Use brooms, shovels, brushes, scrapers
- Moisten to control dust
- Remove
 - Visible organic material
 - Washable items
 - Rotten wood fixtures
- Scrape windowsills, floors
- Dispose of debris in biosecure manner



Just In Time Training 2011 Cleaning and Disinfection: Premises

Begin the premises C&D procedure by dry cleaning the area to remove any gross contamination and organic material (e.g., soil, manure, bedding, feed). Shovels, manure forks, brooms and brushes should be used to sweep, scrape and remove organic material from surfaces and areas. Heavy equipment may be needed to remove large quantities of bedding or manure. Air blowers should not be used for dry cleaning due to the risk of spreading pathogens. Move any washable and removable equipment (hand feeders, mangers) to the outside for cleaning and disinfection. Remove rotten wood fixtures, posts and flooring for burial or burning. Scrape windowsills and floors and other permanently attached equipment to remove any adherent organic material. Disposal of all organic material and gross debris should be in a manner that minimizes further spread of microorganisms and that is compliant with federal, state and local requirements and policies. In the case of a highly contagious disease, a disinfectant solution should be applied using a low-pressure sprayer to damp down dust in the building. This is **not** a disinfection step, but helps to minimize dust generation and further spread of the pathogen from the building interior while cleaning. [Photo Danelle Bickett-Weddle, Iowa State University]

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Wash and Rinse

- Wash area with detergent using sprayer, scrub brush
 - Avoid high pressure if highly contagious
- May need pre-soaked
- Scrubbing may be necessary
- Steam
 - Effective for cracks, crevices, pipework
- Rinse with clean, warm water
- Allow to dry overnight

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The second step in the cleaning process is washing. The washing process helps to reduce the number of microorganisms as well as remove any oil, grease, or exudates that may inhibit disinfection. This is one of the most overlooked steps in the C&D process. Areas and items with organic material adhered to the surfaces should be pre-soaked for several hours. Mechanical scrubbing and scraping may be necessary to remove oils, grease or exudates from rough surfaces, deep cracks, or other surface irregularities. High pressure water and detergent is very effective in removing the heavy accumulation of urine and feces and for cleaning porous surfaces, but should be avoided in cases of highly infectious or zoonotic pathogens to avoid further spread. Whenever possible, warm to hot water (110°F) should be used to increase efficacy. Hot water and steam can be effective for cleaning cracks, crevices and the inside of pipework where pathogens are likely to linger. Whenever possible, surfaces should be allowed to dry completely (if possible overnight) before the application of a disinfectant. Fans can be helpful to the drying process but should not be used if dealing with a highly infectious or zoonotic pathogens.

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Disinfection

- Apply EPA-registered disinfectant
 - Allow appropriate contact time
 - Must remain “wet”
 - Reapply if needed
- Rinse with clean, warm water
- Allow to air-dry


Just In Time Training 2011 Cleaning and Disinfection: Premises

After thorough rinsing and if possible drying of the facility, apply an EPA-registered disinfectant. This can be done by low pressure spraying or wiping. Ensure all areas are covered thoroughly with the solution. Don't forget areas such as the ceilings, rafters, light fixtures, fan blades, louvers and other structural components. Areas must remain “wet” with the solution for the necessary contact time. Apply disinfectant a second time if necessary. Rinse areas thoroughly with clean, warm water. Thorough rinsing is very important as some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely rinsed away. Allow the area and items to air-dry.

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Building Interior

- Ensure C&D of interior components
 - Water dispensers, troughs, augers, fans
- Electrical equipment
 - Turned off first
 - Wipe clean, sanitize




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Special care should be taken to ensure components of any watering systems (e.g., water lines, dispensers, nipple drinkers, troughs), feeding equipment (e.g., feed lines, augers, hoppers), and other mechanical structures (e.g., fans, casings, motors, belts, curtains, ventilation pads, louvers) within the building are thoroughly cleaned and disinfected. Equipment such as thermostats, scales, time clocks, electrical panels, switches, and light bulbs may need to be individually wiped, cleaned, sanitized, and protected from the more severe effects of cleaning--such as high-pressure sprayers and disinfectant chemicals--and protected from recontamination during the cleaning process. Fumigation can only be performed where it is possible to seal or tent the building completely and requires considerable care to be performed safely and correctly. [Photo source: Alex Ramirez, Iowa State University]

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Building Exterior

- Width will vary with pathogen
 - May be as wide as 10 feet
- Flame gun
 - Wet surfaces prior to distinguished areas treated
- Fan inlets
 - EPA-registered disinfectant with low pressure sprayer



Just In Time Training 2011 Cleaning and Disinfection: Premises

The immediate area around the exterior of the building must also be cleaned and disinfected. The width of the perimeter will vary depending on the pathogen involved, but may be as wide as 10 feet around the exterior. In some situations, a flame gun may be used on outdoor concrete, brick, or metal surfaces after disinfection. Surfaces should be wet before starting so that flamed and unflamed areas can be easily distinguished. A flame gun should only be used in areas where no combustible materials are present. Attention should be given to fan inlets on the exterior of the building. A low-pressure sprayer should be used for disinfecting of these areas. [Photo source: Danelle Bickett-Weddle, Iowa State University]

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Material Composition

- Concrete = porous
 - Difficult to clean
 - Registered product, flame gun
- Metal = easier to clean
 - Some products corrosive
 - Flame gun
- Wood = very porous
 - Discard if possible
- Soil, sand, clay
 - No environmentally safe product



Just In Time Training 2011 Cleaning and Disinfection: Premises


The material composition of items and areas on animal production facilities can be quite diverse. This can impact the ability to adequately C&D these items or areas. Raw concrete surfaces are porous and therefore difficult to clean. A disinfectant product registered for concrete surfaces should be applied to all surfaces once gross organic debris has been removed and the area has been washed, rinsed, and thoroughly dried. High pressure washing with a disinfectant solution can be helpful for improving adequate contact of these surfaces, but may cause damage to some concrete surfaces. Some disinfectants can be corrosive to concrete surfaces. Flame guns may be an alternative disinfection method. Metal surfaces are generally easy to clean and disinfect, especially when surfaces are smooth. However, some chemical disinfectant are incompatible or corrosive to metal surfaces. A flame gun may be a useful alternative for metal surfaces. Wood is extremely porous and therefore difficult to disinfect. Any decaying wood surface that cannot be disinfected should be appraised, removed, and disposed of appropriately (e.g., burn or burial). Wood surfaces should not be rinsed, soaked, or sprayed with plain water prior to washing or disinfectant application as this can cause unintended dilution. A disinfectant solution of a product registered for wood surfaces should be applied once gross organic debris has been removed. If a registered product is not available, then an EPA-exempted product should be used. No environmentally safe procedures exist for “disinfecting” soil surfaces

(e.g, dirt, sand, packed clay). [Photo source: Alex Ramirez, Iowa State University]

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Downtime

- Free of any animals or activity
- Reduces pathogens by drying
- Time varies based on pathogen
 - Three times expected incubation period
- Block of area




Premises that have been cleaned and disinfected should have a period of downtime following the procedures. This involves the area being free of any animals or activity for a period of time to allow it to completely dry. The application of disinfectant solutions uniformly over large areas (e.g., ceilings, walls, floors) can be very difficult. Adequate downtime serves to further reduce or eliminate any remaining microorganisms on the premises through desiccation. Downtime can begin as soon as the premises is certified as clean and disinfected and should be at least three times the longest expected incubation time of the targeted pathogen. Areas should be cordoned off with marking tape to designate these areas. [Photo source: Carla Huston, Mississippi State University]

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Slurry Pits

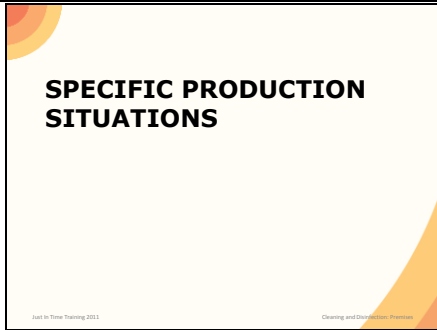
- Decontaminate by chemical process that alters the pH
 - Vigorous stirring
 - Maintain pH for several days
- Precautionary measures
 - Minimum of 2 personnel
 - Wear respirators, safety harnesses, lifeline
 - Area well ventilated due to toxic gases produced with agitation



Slurry pits contain liquid manure, which are a combination of feces, urine, fresh rainwater and runoff, cleaning materials, and bedding materials. Different methods of rendering a slurry pit inactive of pathogens exist, however, the most practical in the event of an animal disease emergency is the use of chemical processes that alter the pH for determined periods of time. The goal is to maintain the required pH for the necessary time period. Vigorous stirring will be required once a chemical is added to ensure adequate distribution of the disinfectant. This should occur for a minimum of 6 hours after application and on a daily basis for a minimum of 2 hours per day. The required pH must be maintained for the necessary time period to ensure the needed destruction of pathogens. Note that the agitation of slurry can release toxic gases such as carbon monoxide, carbon dioxide, hydrogen sulfide, ammonia, and methane. Therefore, safety precautions for responders must be implemented. These include having a minimum of two personnel engaged in mixing or preparing the tanks, as well as ensuring the area is well ventilated. Responders should wear respirators, safety harnesses and a lifeline. [Photo source: Danelle Bickett-Weddle, Iowa State University]

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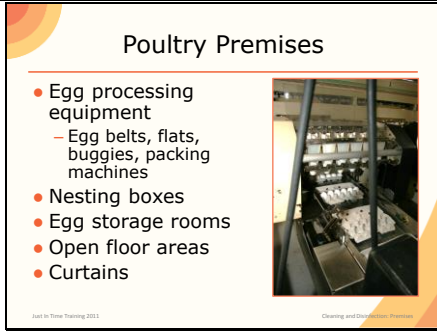
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Next lets look at some of the special premise features of various animal production facilities that will require C&D processes during an animal disease emergency situation.

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Poultry production premises, depending on the type of facility, can have a number of areas or equipment requiring C&D procedures. These may include egg processing equipment such as egg belts, flats, buggies, packing machines, nesting boxes and egg storage rooms. Production facilities may also consist of open floor areas which require removal of litter and manure prior to disinfection efforts. Curtains set up within the facility will need to be completely extended to ensure thorough cleaning and disinfection.

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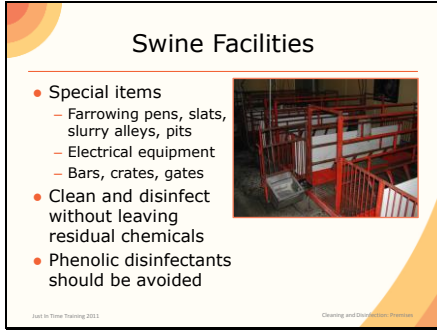
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Unique challenges for C&D of dairy operations include milking equipment such as milking units, strainers, coolers, the bulk tank and pipelines. Milk film or deposits on equipment can impact disinfection efficacy. Since the daily operation of dairies involves strict sanitation and disinfection protocols for milking equipment, input and assistance from the dairy manager or personnel may be useful to determine effective disinfection methods that will not cause damage to milking machines and tanks. Disinfection products used on milking equipment must specifically list this equipment on its label since they are considered food-contact surfaces. [Photo source: Danelle Bickett-Weddle, Iowa State University]

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Special situations in swine facilities include farrowing pens, slats, slurry alleys, and pits. Farrowing areas can present particular problems for C&D processes due to any number of complex structures (e.g., bars, crates, gates) that can be difficult to clean, as well as electrical equipment that may be sensitive and easily damaged. A further consideration is that after C&D measures, the building will need to house parturient and neo-natal animals; therefore, it is necessary to clean and disinfect without leaving residual chemicals. Phenolic disinfectants should be avoided as they can be toxic to swine. [Photo source: Alex Ramirez, Iowa State University]

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Equine Facilities

- Equine facilities highly variable
 - Products labeled for wood, concrete should be applied once organic debris removed
 - Special attention to metal bars on stalls
 - Flame gun for non-flammable surfaces




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Equine facility environments are highly variable since they often contain pastures and paddocks as well as extensive porous materials like wood and cement block and variable stall flooring like dirt, clay, sand, rubber, and concrete. Disinfection products labeled for wood and concrete surfaces should be applied once organic debris is removed. Non-flammable surfaces may be treated with a flame gun. Special attention should be paid to metal bars on stalls. [Photo source: Danelle Bickett-Weddle, Iowa State University]

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C&D Equipment

- Equipment used for C&D procedures must also be either cleaned and disinfected before reuse or properly disposed of




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Following all C&D procedures on the infected premises, equipment used for C&D processes (e.g., brooms, rakes, shovels, brushes, hoses, sprayers) must be cleaned and disinfected before reuse or disposed of. [Photo source: Shutterstock]

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Safety

- Chemical Hazards
 - Skin, eye, respiratory irritation
- Physical Hazards
 - Slips, trips, falls
 - High pressure sprayer




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Most chemical disinfectant products have health hazards or risks, such as irritation to the skin, eyes or respiratory tract. All disinfectants must be used with care to avoid injury or health issues. Personnel preparing and applying chemicals should follow all label safety precautions and wear appropriate PPE (e.g., gloves, goggles), as required. Additionally, physical hazards, such as slips, trips or falls from slippery surfaces can also occur, as can injury from high pressure sprayers. [Photo source: Travis Engelhaupt, Iowa State University]

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Environmental Hazards

- Runoff must be avoided
 - Infectious material
 - Chemical solution
- Toxic to aquatic organisms
- Further spread of pathogens



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During premises C&D procedures, runoff of infectious material or chemical solutions must be avoided. This is necessary to prohibit environmental impacts, since many chemical disinfectants are toxic to aquatic organisms, as well as prevent the further spread of pathogens into the environment. [Photo source: USDA Natural Resources Conservation Service]

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Evaluation

- Areas properly cleaned/disinfected
- Personnel aware of/implementing C&D measures
- Proper disinfectant selected
 - Appropriate concentration
 - Correct contact time achieved
- C&D Waste
 - Minimize or avoid environmental impact

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Inspection of a site following C&D procedures should ensure all tasks have been performed effectively. Factors to be checked should include:

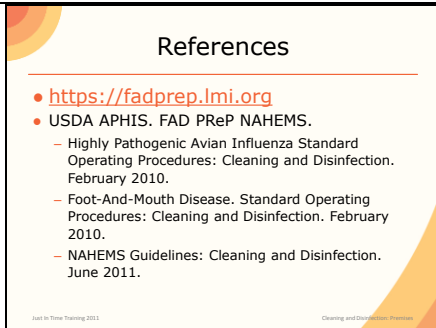
- All grossly contaminated, infected or suspected areas have been identified and properly cleaned and disinfected
- All personnel are aware of and are implementing C&D measures for themselves and their equipment
- One or more appropriate disinfectants have been selected and used at the appropriate concentration and the correct contact time was achieved

- Effluent from the C&D procedures has been handled in a manner to minimize or avoid environmental impact

Final inspection of the premises should be conducted by experienced personnel. If there is any doubt or sign of inadequate procedures, the disinfection measures must be repeated. Once final inspection of the premises has occurred, any and all personnel present should proceed through the personnel C&D disinfection station before leaving the premises.

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References

- <https://fadprep.lmi.org>
- USDA APHIS. FAD PReP NAHEMS.
 - Highly Pathogenic Avian Influenza Standard Operating Procedures: Cleaning and Disinfection. February 2010.
 - Foot-And-Mouth Disease. Standard Operating Procedures: Cleaning and Disinfection. February 2010.
 - NAHEMS Guidelines: Cleaning and Disinfection. June 2011.

Just In Time Training 2011 Cleaning and Disinfection: Premises

The cleaning and disinfection of infected premises will be essential during animal disease emergency situations. The diversity of facility types and set up can produce a number of challenges. Attention to proper C&D procedures will help to minimize the further spread of pathogens and protect personnel from exposure. Information in this presentation was taken from the following USDA APHIS Foreign Animal Disease Preparedness and Response Plan documents. The full version of these documents can be obtained at the FAD PReP website.

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Acknowledgments

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