USAEHA

Managing Health Hazards Associated With Bird And Bat Excrement

United States Army Environmental Hygiene Agency
Aberdeen Proving Ground, Maryland 21010-5422

CONTENTS

DEPARTMENT OF THE ARMY
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REPLY TO ATTENTION OF

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MANAGING HEALTH HAZARDS ASSOCIATED WITH BIRD AND BAT EXCREMENT

CHAPTER 1
GENERAL

1-1. Purpose and Scope.

a. Bird and bat excrement, commonly referred to as droppings, accumulates under trees near human habitations and on structures and machinery:

(1) Creating an environment favorable to the development of disease organisms harmful to humans and domestic animals.

(2) Causing corrosion.

(3) Creating objectionable odor and appearance.

(4) Impeding human activities.

b. This technical guide:

(1) Describes the potential health hazards associated with bird and bat droppings.

(2) Outlines procedures for the safe and effective management of bird and bat droppings.

(3) Is intended for use by persons interested in identifying and managing health hazards created by bird and bat droppings.

1-2. References. References are listed in appendix A.

1-3. Technical Assistance.

a. You may obtain technical advice by telephone from the following U.S. Army Environmental Hygiene Agency points of contact:

(1) Entomological Sciences Division DOD, Pesticide Hotline, DSN 584-3773, commercial (410) 671-3773.

(2) Occupational and Environmental Medicine Division, DSN 584-2714.

(3) Industrial Hygiene Division, DSN 584-3118.

(4) Sanitation and Hygiene Branch, DSN 584-2488.

b. Direct requests for services through appropriate command channels of the requesting activity to:

Commander
U.S. Army Environmental Hygiene Agency
ATTN: HSHB-MR
Aberdeen Proving Ground, MD 21010-5422

Furnish an information copy to:

Commander
U.S. Army Health Services Command
ATTN: HSCL-P
Fort Sam Houston, TX 78234-6000

CHAPTER 2
DISEASE ORGANISMS COMMONLY FOUND IN BIRD AND BAT EXCREMENT

2-1. General.

a. The high nutrient content of accumulated bird and bat excrement provides an excellent growth medium for organisms of potential human health concern. This guide primarily addresses the prevention of two illnesses caused by those organisms: cryptococcosis and histoplasmosis.

b. Cryptococcosis is usually associated with pigeon droppings at elevated roost sites. Histoplasmosis is associated with bird and bat droppings on soil under roosts. However, the infective stages of both organisms may be found in *any* accumulation of dry droppings and associated organic matter.

c. Personnel should also be aware of the possible dangers of other disease organisms associated with bird and bat excrement, discussed in paragraph 2-2.

2-2. Disease Organisms Associated with Bird and Bat Droppings.

a. Mycosis, a fungal infection resulting in disease, is usually incurred by inhaling dusts, especially organic (decaying vegetation) dusts and dusts enriched with bird or bat droppings, which contain massive amounts of the disease organisms. These fungal organisms are ubiquitous in the environment and exposure to them is impossible to avoid. However, most humans are resistant to the amounts they encounter during normal activities.

b. The risk of contracting certain of these fungal infections is greatly increased by certain predisposing conditions such as an immunocompromised state (e.g., HIV infection, immunosuppressing medication, cancer, etc.), antibiotic therapy, surgical trauma, skin injury, and chronic disease.

c. The fungal disease organisms found in bird and bat droppings are listed below, including the source of the organisms, the methods of contraction, and the health effects.

(1) Cryptococcosis (Torulosis, European Blastomycosis).

(a) Source. Organic dusts, especially those contaminated with pigeon or bat droppinqs, are the most important source of the fungus, *Cryptococcus neoformans*, in the environment. *C. neoformans*

has been found in as many as 84 percent of samples taken from old roosting sites. Up to 50-million colony forming units of *C. neoformans* have been found per gram of pigeon droppings.

(b) Contraction. Cryptococcosis is acquired by inhaling the yeast-like vegetative cells of the organism. These cells measure 1-3 microns in diameter and are easily airborne.

(c) Health Effects. Clinical manifestations of pulmonary infection are not characteristic and may be absent. The infection may disseminate to the central nervous system, resulting in cryptococcal meningitis (inflammation of the membranes of the brain and spinal cord), which is difficult to diagnose and fatal if not properly, and promptly, treated.

(2) Histoplasmosis.

(a) Source. The causative agent of histoplasmosis, *Histoplasma capsulatum*, a dimorphic fungus (mold), is found in soils throughout the world. It flourishes by overwhelming other soil organisms when high relative humidity and optimum temperatures are present in soil that has been enriched by accumulated bird droppings for 3 or more years. It has also been found in bird and bat droppings not in contact with the soil. Once established in soil enriched by bird or bat droppings, *H. capsulatum* is difficult to eliminate even after the nutrient source is removed (Krzysik 1989).

(b) Contraction. Humans are infected by inhalation of the spores of this fungus which can be carried by wind and dust.

(c) Health Effects. Most infections produce no symptoms or only a mild influenza-like illness. However, pneumonia, blindness, and even death from a chronic infection are possible.

(3) Psittacosis (Ornithosis, Parrot Fever).

(a) Source. A rickettsial-like organism, *Chlamydia psittaci*, causes psittacosis. Approximately 150 cases are reported annually in the United States.

(b) Contraction. This disease is contracted by inhaling *C. psittaci* which is found in feathers and droppinqs from infected birds. Since the organism becomes less infectious with time, active roosts are of greatest concern. While the disease most often occurs in bird handlers, persons cleaning up bird excrement could contract the disease as well.

(c) Health Effects. Psittacosis is characterized by fever, headaches, and muscle pain, with or without obvious respiratory symptoms. Untreated cases, especially in older patients, can progress to pneumonia and/or generalized toxemia resulting in death.

(4) Other Fungal Diseases. Paracoccidioidomycosis is a serious mycosis among workers in contact with the soil in tropical and sub-tropical regions from Mexico to Brazil. Although little is known about it at present, it is probably acquired by inhaling soil or fungus laden dust. Other fungal diseases found in soil and/or decaying organic matter--such as aspergillosis, coccidioidomycosis, blastomycosis, and sporotrichosis--are less likely to cause disease in humans.

d. Unlike the diseases listed above, **rabies** (a rhabdovirus) is not a fungal disease. However, rabid bats may be encountered during cleanup operations.

(1) Source. Rabies is contracted when the virus-laden saliva of an infected animal is introduced into the body by a bite or scratch (very rarely through mucous membranes or a fresh break in the skin). Airborne rabies infection has been demonstrated only in one cave in Texas where millions of bats had roosted for many years.

(2) Contraction. The danger of rabies infection by inhalation is slight, but the danger from handling bats is much greater, especially since infected bats may be present during a cleanup operation. Cleanup personnel should be cautioned to handle bats only with nets and gloves.

(3) Health Effects. The onset of rabies often begins with a sense of apprehension, headache, fever, malaise and indefinite sensory changes. The disease progresses to paralysis, throat muscle spasms when attempting to swallow (causing fear of water or hydrophobia), delirium and convulsions. Death is often from respiratory paralysis. Rabies can be prevented by vaccination during the disease's incubation period. Once symptoms appear, however, death is almost always inevitable.

CHAPTER 3
REPRESENTATIVE CASES OF CRYPTOCOCCOSIS AND HISTOPLASMOSIS

3-1. **Case Studies.** As an example of the health threat of mycotic organisms inhabiting bird and bat droppings, four documented cases of human infection are presented in the following paragraphs.

3-2. **Cryptococcosis in a Farm Mechanic.** A farm mechanic worked on machinery in a grain-drying building where live pigeons were present. The mechanic developed cryptococcal meningitis and was hospitalized for 8 weeks. The pigeon droppings from the grain-drying building were found to have 24.4×10^6 colony-forming units per gram. Eventually he recovered fully.

3-3. **Cryptococcosis Misdiagnosis.** Failure to diagnose cryptococcosis can result in fatalities. A 46-year-old man developed a chronic neurologic syndrome after dismantling a steeple. He was treated for tuberculous meningitis and the symptoms went into remission (as they may do for a disseminated infection). One year later he was hospitalized with chronic inflammation of the brain and diagnosed as having cryptococcal meningitis. Treatment at that time with amphotericin B and flucytosine was unsuccessful.

3-4. **Histoplasmosis Outbreak at an Arkansas Courthouse.** Pigeon droppings had accumulated to a depth of one foot on the catwalk around an Arkansas courthouse tower. Cleanup workers shoveled the dry droppings off the catwalk, allowing them to fall four stories to the ground. Air conditioners picked up the falling spore-laden dust and distributed it within the building. Of the 84 employees inside, 52 percent developed fever, cough, chest pain, myalgia, and/or laboratory evidence of histoplasmosis. Twenty-four other cases of histoplasmosis occurred among construction workers and people who visited the courthouse during the cleanup; one individual contracted the disease after visiting for only 10 minutes. Of those exposed who escaped illness, 87.5 percent had been previously infected. However, five people with evidence of previous infection did become ill. It is probable that their previous infection afforded only partial immunity.

3-5. **Histoplasmosis Outbreak Due to Disturbing a Bird Roost.** The potential for histoplasmosis to disseminate downwind is clearly illustrated by an outbreak that occurred in Iowa when the dry soil under a starling roost was bulldozed. People up to one mile away contracted histoplasmosis and the bulldozer operator died after a 7-week illness.

CHAPTER 4
CLEANUP OF BIRD AND BAT EXCREMENT

4-1. Assessment and Decontamination of Bird and Bat Droppings.

a. Risk Assessment.

(1) *Cryptococcus neoformans* is primarily found in pigeon droppings and less often in soil and organic debris. The risk of contracting cryptococcosis is not related to the age of the excrement.

(2) *Histoplasma capsulatum* usually develops only at bird roosts that have existed for 3 years or more. It is uncommon at pigeon roosts. Although *H. capsulatum* grows well in excrement-enriched soil, it cannot form spores under the acidic conditions of fresh droppings. An active bird roost may only produce a few spores. However, when the droppings have dried and/or been leached by rain, massive amounts of spores can be released, especially if the soil is disturbed under dusty conditions. Once established, *H. capsulatum* will remain in the soil under a roost for many years after the birds have abandoned it.

b. Sampling for Disease Organisms. Sampling is not recommended due to the difficulty, time, and expense involved. Laboratory processing of samples may require up to 8 weeks, test procedures are not totally reliable (the disease organisms may be present but not detected), and interpretation of the results is difficult. Sampling is generally not necessary if the cleanup precautions outlined in this guide are followed. If sampling to determine a health hazard is needed, see appendix B.

c. Decontamination.

(1) *Cryptococcus neoformans* is sensitive to alkali. Areas of suspected contamination can be treated with an alkaline wash consisting of 500 grams of hydrated lime and 18 grams of sodium hydroxide per 12 liters of water. Commercial disinfectant products of similar alkalinity may also be used.

(2) Decontamination of droppings and associated soil for control of *Histoplasma capsulatum* is not recommended. Decontamination with formalin presents a health hazard, and no other effective material is available. Decontaminated soil is subject to reinfestation as long as the nutrients that enabled the fungus to establish itself are still available. Information on decontamination with formalin is included in appendix C for those situations, such as construction sites, where extensive and/or prolonged soil disturbance with attendant exposure risks may occur.

4-2. Cleanup and Removal of Bird and Bat Droppings. Cryptococcosis and histoplasmosis infections typically occur by inhaling the pathogenic spores through the nose and mouth. Therefore, bird droppings are most dangerous when they are dry and subject to becoming airborne as a fine dust, particularly when disturbed by sweeping or scraping. Although germicides could be applied to accumulated droppings prior to cleanup, their effectiveness is not proven. Safe cleanup is based on protection from spore inhalation and minimization of spore dispersal. If at all possible, coordinate cleaning efforts with the installation of a modern birdproofing system. Assume that a health hazard is present whenever bird and bat droppings are disturbed and observe the following precautions:

a. Protection of Workers from Infective Organisms.

(1) Preliminary Consultation. Prior to disturbing accumulated droppings, inform the occupational medicine physician of the proposed activity and consult with an industrial hygienist for advice on personal safety measures such as protective clothing and the proper selection, use, and fitting of respirators.

(2) Breathing Protection. When working with accumulated droppings, wear a NIOSH-approved full face respirator with high efficiency particulate air (HEPA) filters capable of excluding particles of 0.3 micron size or a supplied air respirator with full face piece. Dust and particle masks will not provide adequate protection and are not approved for this use.

(3) Protective Clothing. Wear disposable coveralls, gloves, boots, and hats to protect personal clothing from contamination with infective organisms. Seal the glove/sleeve and boot/leg interfaces with duct tape before entering the worksite. Before leaving the work site, vacuum the protective coveralls, boots, and gloves using a HEPA vacuum, then walk to an excrement free area, remove the protective clothing, and place it in plastic bags prior to removing respiratory protection. Treat disposable clothing believed to be contaminated with disease agents as infectious waste.

(a) Nondisposable work clothing and respirators should be removed, placed in a plastic bag, and sealed. These items must be disinfected in the bag before final cleaning and reuse. Workers must not wear their own personal street clothing under the disposable coveralls.

(b) If the disposable coveralls or other protective clothing are torn, the worker(s) must shower prior to putting on their street clothes. It is recommended that workers shower and thoroughly wash their hair at the end of their shift.

b. Application of Water. Although droppings are usually easier to clean up when they are dry and crusted, saturating them with water prior to removal is recommended to prevent the debris and any pathogens from becoming airborne. This should be done with a low-velocity mist spray. Using high pressure and/or a concentrated stream, such as from a hose nozzle, may scatter the droppings before they can be adequately wetted. However, hosing may be used for removing small amounts of recently deposited droppings from sidewalks and pavement. A portable, hand pressurized sprayer is satisfactory for applying limited amounts of water.

c. Nonmetallic Tools. On historic structures, use only nonmetallic tools (such as plastic spatulas and brushes with natural fiber or nylon bristles) to remove droppings. Do not use tools that can easily damage building surfaces, such as coarse wire brushes.

d. Public Protection. Do not perform bird excrement removal on public buildings during normal working hours. If possible, schedule the removal for weekends or other periods of minimum building use. Protect interior air by closing all heating and cooling system air intakes during the cleanup (shut down the entire system if possible). Unless droppings are inside the building itself, perform all work from the outside of the building. Provide barricades and signage to keep the public clear of the work site during all operations.

e. Disposal.

(1) Double bag the droppings and associated soil in 3 mil or thicker plastic bags, close the bags securely, and transport them directly to a landfill to be buried. If the droppings have been proven to contain *Cryptococcus neoformans* and/or *Histoplasma capsulatum* they may be incinerated. Do not place the bags in a dumpster or leave at a collection point for later pickup as they could be torn during handling and release their potentially infectious contents. Wear protective clothing and equipment when collecting the bird and bat droppings for final disposal.

(2) You may clean up small amounts of fresh droppings by scraping or hosing with water.

CHAPTER 5
SELECTION OF PERSONNEL FOR DECONTAMINATION AND CLEANUP

5-1. Selection of Disease-Resistant Individuals. Contact your occupational medicine physician for assistance in selecting personnel for cleanup and/or decontamination of bird and bat excrement. They should be screened for general health status, conditions that may predispose them to infection by fungi (see para 2-2.b), and resistance to histoplasmosis.

a. Currently, there are no screening tests available for determining immunity to *Cryptococcus neoformans*.

b. Most persons who come in contact with *Histoplasma capsulatum* for the first time will become infected. Personnel who have had histoplasmosis and have recovered are less likely to contract this disease again. Therefore, such individuals, if available, should be selected for the job. Skin testing for histoplasmosis is recommended for screening, with positive tests indicating active immunity in healthy workers. Histoplasmin antigen is available for skin testing and provides reliable identification of individuals who have had past infection. Blood serology titers are less sensitive than skin testing and should not be used as a screening tool.

c. The best technique to prevent infection with *Cryptococcus neoformans* or *Histoplasma capsulatum* is to provide proper respiratory protection to exposed workers and to properly handle the droppings as described in this guide.

5-2. Selection of Healthy Individuals

a. Perform preplacement evaluation on all individuals who are selected for bird and bat excrement cleanup work crews to determine if they have increased susceptibility. A medical history and physical exam should be performed with attention to cancer, steroid therapy, immunodeficiencies, pulmonary disease, diabetes mellitus, and other immunocompromising states.

b. Select workers who are physically and psychologically able to perform their work while wearing the prescribed respiratory protection. As a minimum, preplacement respiratory examinations should include the determination of the forced expiratory volume in one second (FEV_1) and forced vital capacity (FVC) (TB MED 502, para 2-10).

APPENDIX A
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APPENDIX B
SAMPLING TO DETERMINE HEALTH HAZARD

B-1. Sample Processing

a. Droppings, soil, etc., may be sampled to determine whether or not they are infested with *Cryptococcus neoformans* or *Histoplasma capsulatum* prior to initiating cleanup. A comprehensive sampling protocol, which includes site safety and health protection, should be developed for each site to be sampled.

b. The samples must be processed by a laboratory that has experience culturing such fungi. For information on laboratories that may be able to perform isolations for these organisms, contact:

Centers for Disease Control (CDC)
U.S. Public Health Service
Center for Infectious Diseases
Division of Mycotic Diseases
1600 Cliston Road
Atlanta, GA 30333
(404) 639-3158

c. Contact the processing laboratory to ascertain the number of samples needed, how to collect and submit them, and other sampling protocol details. The sampling process will vary depending on the situation and is beyond the scope of this technical guide. However, the procedures outlined below may be used as an aid in preliminary planning.

B-2. Fair Representation

a. Care must be exercised to ensure that a fair representation of the material is collected. Typically, 6-ounce samples are required, ranging from a minimum of 2 per 100-square feet to a maximum of about 40 for areas of one acre or more. Each 6-ounce sample should be a composite of material from various locations within the sample site.

b. For example, if one sample is to represent a 50-square foot quadrant, the 6 ounces should be collected from various locations within that sample quadrant. To prevent cross contamination, each individual sample must be collected with a separate sterile tongue depressor or spoon and placed into its own clean plastic bag. Each sample should be labeled on the outside of the bag. A map should also be prepared that identifies the site and the sample locations within the site.

APPENDIX C
DECONTAMINATION OF EXCREMENT AND CONTAMINATED SOIL

C-1. Introduction.

a. Situations may be encountered where site decontamination is necessary to protect personnel not directly involved in cleanup or removal of the bird or bat excrement.

b. The removal or disturbance of pathogen-contaminated bird droppings, bat droppings, or soil contaminated with bird droppings can present a health hazard to those doing the work *and* the general population downwind of the operation. The safety of workers and the general population can be assured only by killing the causative agents of human diseases prior to activities which could cause these organisms to become airborne.

c. The decontamination procedures described herein are hazardous to the personnel doing the work and any persons nearby. The procedures also destroy beneficial organisms in the treated soil. Decontamination should be undertaken only when exposure to the pathogens in excrement or soil cannot be minimized by other means.

C-2. Selection of Decontaminant. The CDC recommends the use of formalin solutions for killing all viable stages of *Cryptococcus neoformans* and *Histoplasma capsulatum*. At this time, formalin is the decontaminant of choice. It is the only material that has been proven through laboratory analysis and field experience to effectively kill these pathogens in the environment. In addition to killing these agents on contact, formalin vapors also penetrate cracks and crevices, thereby reaching areas which may not have otherwise been contacted. However, soil treated with formalin is readily recolonized by *H. capsulatum* due to elimination of competing organisms.

C-3. Use of Formalin to Decontaminate Bird and Bat Droppings or Soil.

a. Formulation of Disinfectant. In order to be effective, the formalin solution must completely saturate the material being decontaminated. This is prepared by diluting commercially available formaldehyde (which contains 37-40 percent by weight of formaldehyde gas in water, stabilized with 10-15 percent methanol) with water to create a 5-percent, by volume, formalin solution.

b. Environmental Temperature Considerations. Decontamination should be conducted when the temperature of the material being decontaminated is between 62° F and 90° F. Formalin is less effective at temperatures outside of this range.

c. Application Rates.

(1) The CDC recommends the following application rates. One third of these quantities of 5-percent formalin solution is to be applied during each of three treatments:

(a) Vertical walls: one gallon per 150-square feet.

(b) Horizontal surfaces (except when bird droppings are on soil): one gallon per 6-square feet.

(c) Bird droppings on soil: one gallon per 1-square foot.

(2) It is important to realize that these quantities are guidelines. The proper amount of formalin to use is that which completely saturates the contaminated material, and this will vary depending on the situation. However, exercise care to avoid formalin runoff.

d. Application Procedure. The most effective formalin saturation of infected material occurs if the formalin is applied in three separate applications.

(1) In areas where the accumulation of bird droppings is shallow, formalin should be applied on three successive days.

(2) Where bird excrement is deep, the formalin should be applied on alternate days to enhance the probability of contact with all of the infected material.

(3) It may be necessary to turn, probe, or aerate the droppings/soil between the second and third applications to gain complete saturation. Perform any manipulation of the infected material in a manner that will liberate as few organisms into the air as possible. Spray formalin during the manipulation to help limit the number of viable organisms that may become airborne and increase saturation. Even building surfaces with very little or no bird droppings visible may be contaminated and should, therefore, be treated. Disinfect contaminated equipment by soaking in 5-percent formalin for 15 minutes.

e. Disinfection of Soil. Pathogenic organisms have been recovered from a soil depth of 6 to 8 inches. Therefore, if soil is contaminated with *Histoplasma capsulatum*, it should be saturated with formalin to this depth.

f. State Regulations. Consult state regulatory authorities to determine if there are state restrictions on formalin application.

C-4. Protection of Workers from Formaldehyde and Infective Organisms.

a. Pre-Cleanup Consultations.

(1) Consult an occupational medicine physician for guidance on medical surveillance of cleanup personnel.

(2) Consult an industrial hygienist prior to disturbing deposits of bird and bat droppings for advice on matters of personal safety such as protective clothing and the proper selection, use, and fitting of respirators.

(3) Contact an industrial hygienist to determine formalin breathing zone concentrations so appropriate respirator selection may be made.

(a) For breathing zone concentrations that do not exceed 7.5-parts per million (ppm) formaldehyde, use a full-facepiece chemical cartridge respirator with a formaldehyde cartridge(s) and high-efficiency filter(s) capable of excluding particles of 0.3-micron size (29 CFR 1910.1048).

(b) For concentrations up to 75 ppm, provide one of the following: a full-face gas mask with industrial-size formaldehyde canister and filter capable of excluding particles of 0.3-micron size, or a type C supplied-air respirator, pressure demand or continuous flow type, with a full-facepiece, hood, or helmet (29 CFR 1910.1048).

(c) For breathing zone concentrations greater than 75 ppm formaldehyde or unknown concentration, provide a self-contained breathing apparatus (SCBA) with positive pressure full-facepiece (29 CFR 1910.1048).

(d) Unless the canister contains a NIOSH-approved end-of-service-life indicator to show when breakthrough occurs, canisters used in atmospheres up to 7.5 ppm (10 x PEL) shall be replaced every 4 hours and industrial-sized canisters used in atmospheres up to 75 ppm (100 x PEL) shall be replaced every 2 hours or at the end of the work shift, whichever is sooner (29 CFR 1910.1048).

b. Protection During Decontamination.

(1) The National Institute for Occupational Safety and Health (NIOSH) recommends that "formaldehyde be handled in the workplace as a potential occupational carcinogen" and that "as a prudent public health measure, engineering controls and stringent work practices be employed to reduce occupational exposure to the lowest feasible limit," (appendix A, reference 16). Formaldehyde vapor is intensely irritating to the eyes, nose, and throat. It may cause skin irritation and is harmful if swallowed.

(2) To protect against formalin contamination, wear formalin-impervious hat, coat, pants, boots, and gloves. Immediately remove nonimpervious clothing that becomes contaminated. Wash immediately when skin becomes contaminated. Provide a "quick drench eyewash" unit at the work site.

(3) When collecting the bird and bat droppings for final disposal, protective clothing and equipment is necessary to protect personnel against the possibility that decontamination was not completely successful, or the possibility that formalin is still present:

(a) If formalin is present in quantities that could wet garments, formalin-impervious clothing and appropriate respiratory protection (paragraph C-4a) must be worn.

(b) If formalin is not present, disposable coveralls, boots, and hats should be worn to protect from contamination of personal clothing with infective organisms.

(4) After work, remove protective clothing at the work site prior to removing respirator protection. If the protective clothing is believed to be contaminated with disease agents, treat it as infectious waste.

C-5. Determining Decontamination Effectiveness. Generally, evaporation and inactivation of formalin occurs in 2 to 4 days. Prior to physically collecting and disposing of the droppings, collect samples of the droppings/soil and have them retested to make sure that the decontamination was effective. In order to ensure that all the formalin has dissipated, wait for 1 week after the last formalin application before taking post treatment samples.

a. If decontaminated pigeon droppings are reinoculated with *Cryptococcus neoformans*, the organism could recolonize them before the laboratory results are received. Therefore, if there is confidence that the decontamination was done correctly and birds cannot be

excluded from the treated area, it would be prudent to commence the cleanup immediately rather than wait for the completion of laboratory tests to confirm that decontamination was successful.

b. Following the cleanup, sample decontaminated building surfaces to ensure there are no infective organisms present before using the building.

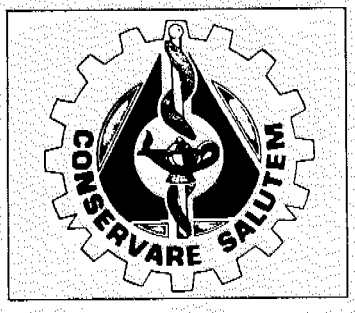
c. *Histoplasma capsulatum* can also reinfect decontaminated soil if the bird roost is not removed. However, the rate with which decontaminated soil is typically reinfected is slow enough to allow for testing of the soil to determine the effectiveness of the decontamination procedures.

d. Soil that has been treated is not permanently sterilized and normal vegetation and microorganisms will recolonize the area.

C-6. Disposal. After decontamination with formalin solution, the bird and bat droppings should be double bagged and disposed of in a sanitary landfill.

Local Reproduction is Authorized and Encouraged

DECEMBER 1992



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