



HANTAVIRUS PREVENTION: CLEANUP OF RODENT CONTAMINATION

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Hantaviruses in the Americas may cause human disease involving the lungs, hence the name "hantavirus pulmonary syndrome" (HPS). Since May 1993, a total of 416 HPS cases (as of 1 February 2006) have been confirmed by the Centers for Disease Control and Prevention (CDC) in residents of 32 states, with 39 of these cases identified retrospectively with onset of illness prior to May 1993. One hundred and six (38%) of the HPS cases have had a fatal outcome. Sin Nombre virus (SNV) has been responsible for over 90% of the human hantavirus cases in the United States in the last nine years. *Peromyscus maniculatus*, the deer mouse, is the primary reservoir for SNV. This has also been confirmed by USACHPPM-West surveillance at 44 military installations, mostly in the western half of the United States, where 12% of the *P. maniculatus* sampled have been positive for SNV. The deer mouse is found in most of North America and frequently lives in buildings, including those on military installations. Hantaviruses that cause illness in humans are also found in other rodents, but the number of cases stemming from these hantaviruses is small when compared to SNV. Hantavirus is shed in rodent urine and feces. The primary route of infection, inhalation of airborne particles containing virus, is almost always associated with indoor environments.

Removal of rodent contamination from indoor areas will reduce the risk of personnel acquiring hantavirus infection. The level of contamination, the type of activity in the facility, and the type of personnel performing the cleanup operations will dictate the methods used and the personal protective measures to be taken. The goal of any cleanup operation is to remove rodent contaminants without exposing cleaning personnel to hantavirus-laden particles in the air or on their hands and bodies. The risk of coming into contact with hantavirus increases with the amount of contamination present and the type of cleanup required. Obviously, it is easier to clean up rodent droppings from a hard-surfaced floor than from carpet. It is also easier to clean up droppings from the floor than from contaminated furniture or other equipment. For example, the rodent-contaminated stacks of insulation shown in Figures 1 and 2 will have to be moved out of the building for disposal. The handling and movement of this material will increase the airborne virus hazard as well as contact with the hands. For this reason, additional precautions will have to be taken when cleaning up this building.



Figure 1. Stacked insulation.

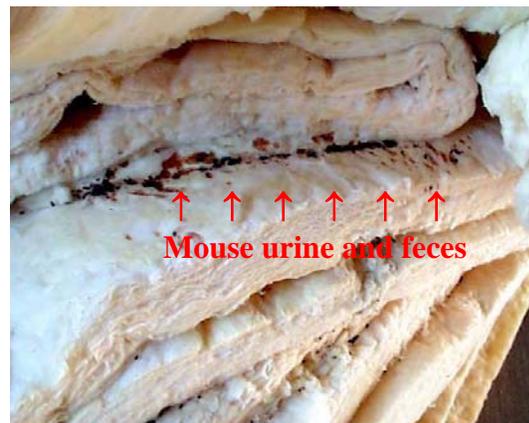


Figure 2. Mouse urine and feces on insulation.

Since hantavirus infection is acquired primarily by inhaling rodent contaminants, protection of the individual's breathing zone is the first line of defense against disease. Wearing a respirator with N-100 (HEPA) cartridges will stop particulates containing virus from entering the airway. However, not everyone should be fit-tested for a respirator when cleaning up rodent contamination. For example, light infestations that can be sprayed and cleaned up without otherwise disturbing the droppings should not pose an airborne hazard. However, cleanup of larger amounts of contaminants that will most likely be aerosolized during the cleanup operation requires respirator use.

The second route of infection is through ingestion. This happens when virus particles from rodent urine or feces enter the mouth. Rubber or plastic gloves should be worn on the hands of all individuals cleaning up rodent contamination, even when only disposing of a mouse caught in a trap. When the cleanup is finished, the gloves can be washed with disinfectant or soap and water. The gloves may be reused or discarded in the trash, but only after they have been disinfected on the outside. Wash hands with soap and water when cleanup is finished. For cleanup operations that are likely to result in rodent contaminants contacting the body, coveralls should be worn. These may be disposable or washable. All coveralls should be sprayed with disinfectant before removal from the cleanup site to prevent contamination of vehicles, offices, or other areas where the coveralls are kept. Coveralls should be taped to the gloves at the cuffs and to the legs at the ankles in order to prevent contaminants from entering sleeve or leg openings.

Information on hantaviruses as they pertain to military personnel can be found in Armed Forces Pest Management Board (AFPMB) Technical Information Memorandum No. 41, "Protection from Rodent-Borne Diseases with Special Emphasis on Hantaviruses"; this document, published in April 1999, is available on the AFPMB web site: <http://www.afpmb.org/>. Additional educational information regarding hantavirus is available from USACHPPM-West by request or from the CDC's hantavirus web page: <http://www.cdc.gov/ncidod/diseases/hanta/hps/index.htm>.

The procedures listed below should be followed when cleaning up rodent contamination.

- All personnel involved in cleaning should wear protective clothing and equipment. Depending on the level of contamination, this may include fit-tested respirators with N-100 (HEPA) cartridges, goggles, solvent-resistant gloves, coveralls, and boots.
- Spray the floors and those portions of the building's walls that show evidence of rodent activity with a general-purpose disinfectant solution. Special attention must be given to dead rodents, rodent nests, droppings, food, or other items that have been contaminated by rodents; thoroughly soak these items with the disinfectant, and place them into a plastic bag. Use double bags when heavy rodent contamination is encountered. Depending on the amount of contamination, use a wet paper towel, mop, or shovel to remove the soaked material. Seal the plastic bags(s) when full or when the cleanup is completed, and spray the outside of the bags with disinfectant. For light to moderate rodent contamination, small bags containing disinfected materials may be wrapped in newspaper and then placed in a dumpster. Follow local installation disposal procedures, but generally, larger double bags of contaminated material may also be placed in a dumpster or other approved waste receptacle. Do not attempt to remove dry contaminated materials by sweeping or with a vacuum unless it is equipped with a HEPA filter.

- Mop all hard-surfaced floors with water containing a general-purpose disinfectant and detergent. Spray dirt floors with a general-purpose disinfectant and wait 30 minutes before use. Clean carpets and upholstered furniture with commercial-grade cleaning equipment. Remove rodent nests from furniture or equipment and decontaminate. Materials that cannot be decontaminated should be disposed of by burning or burying in accordance with the installation's medical practices. A special note about carpet: Light rodent contamination can be sprayed with disinfectant and cleaned up with a wet paper towel. The area should then be resprayed with disinfectant and air-dried. For heavier contamination, the droppings should first be sprayed with disinfectant and removed with a shovel or mop, after which the carpet should be cleaned with a carpet-cleaning machine containing hot water and disinfectant.

- Disinfect all work surfaces, storage cabinets, and drawers by washing them with a solution of water containing a general-purpose disinfectant and a detergent, followed by an additional wiping-down with disinfectant.

- Launder contaminated clothing and bedding in hot water and detergent. Items that cannot be laundered may be dry cleaned.

The various cleanup scenarios presented in the following text boxes illustrate the level of contamination, the cleanup methods, and the personal protection required. This information should be used as a general guide, subject to modification or change by Public Health personnel. Examples of light and heavy rodent contamination are shown in Figures 3 and 4.



Figure 3. Light rodent contamination.



Figure 4. Heavy rodent contamination.

METHODS FOR CLEANUP OF RODENT CONTAMINATION

The methods described below address some of the more common scenarios involving rodent contamination on military installations. If questions arise when considering any of these scenarios, or if the cleanup operation does not fit into any of the listed categories, local Public Health personnel should be contacted for advice. Public Health should also be consulted whenever any major cleanup operation is undertaken.

Personnel Involved: All personnel. 1

Level of Rodent Contamination: Dead mouse in trap.

Protective Clothing and Equipment: 1 can or spray bottle of disinfectant, 1-gal size plastic bag, newspaper, and rubber or plastic gloves (optional).

Cleanup Method: Spray the mouse and trap with disinfectant until wet. Turn the bag inside out. With the hand inside the bag, pick up the mouse and trap together. Invert the bag over the hand and seal the bag. Wrap the bag in newspaper and place it in a dumpster or garbage can. Spray the area where the trap was removed with a light amount of disinfectant and let dry. If gloves were worn to pick up the trap, spray the outside of the gloves with disinfectant. Remove gloves and wash hands with soap and water.

Personnel Involved: Family Housing and Barracks Occupants. 2

Level of Rodent Contamination: Light to moderate. Rodent droppings found inside home or barracks room are only along walls, not in traffic areas. Number of droppings per square foot should not exceed 20.

Protective Clothing and Equipment: 1 can or spray bottle of disinfectant, rubber or plastic gloves, paper towels, plastic bag, and newspaper.

Cleanup Method: Put on the gloves. Open windows and doors in the rodent-contaminated room and air out for 10 minutes. Spray disinfectant on the area containing rodent droppings until wet, whether hard surface or carpet. Wet a paper towel and wipe up the droppings. Place the wet towels and droppings into the plastic bag. Seal the bag, wrap in newspaper, and place in a dumpster or garbage can. Respray the contaminated area with a light amount of disinfectant and let dry. Spray the outside of the gloves with disinfectant. Remove gloves and wash hands with soap and water.

Personnel Involved: Family Housing and Barracks Occupants. **3**

Level of Rodent Contamination: Heavy contamination. Rodent droppings found throughout the room or storage area. Furniture, boxes, and other items contaminated with droppings or urine.

Protective Clothing and Equipment: See instructions in Box 11.

Cleanup Method: Call Public Health for onsite evaluation. Cleanup will require trained, fully protected workers.

Personnel Involved: Workers in bunkers, warehouses, motor pools, ranges, or other industrial buildings. **4**

Level of Rodent Contamination: Light to moderate. Rodent droppings found only along walls, not in traffic areas. Number of droppings per square foot should not exceed 20.

Protective Clothing and Equipment: 1 can or spray bottle of disinfectant, rubber or plastic gloves, paper towels, plastic bag, and newspaper.

Cleanup Method: Put on the gloves. Open windows and doors in the rodent-contaminated room and air out for 10 minutes. Spray disinfectant on the area containing rodent droppings until wet. Wet a paper towel and wipe up the droppings. Place the wet towels and droppings into the plastic bag. Seal the bag, wrap in newspaper, and discard in a dumpster or garbage can. Respray the contaminated area with a light amount of disinfectant and let dry. Spray the outside of the gloves with disinfectant. Remove gloves and wash hands with soap and water.

Note: These types of buildings do not usually contain carpet. However, if carpet is contaminated, the same procedures mentioned above should be followed as long as the contamination is limited. These procedures are for cleanup of **light to moderate** contamination only. If equipment, boxes, or materials other than floor space are contaminated, or the floor (including carpet) is heavily contaminated, then cleanup will require trained, fully protected workers. See instructions in Box 11 and call Public Health for onsite evaluation.

<p>Personnel Involved: Workers in offices, break areas, and other administrative buildings.</p> <p>Level of Rodent Contamination: Light to moderate. Rodent droppings found only along walls, not in traffic areas. Number of droppings per square foot should not exceed 20.</p> <p>Protective Clothing and Equipment: 1 can or spray bottle of disinfectant, rubber or plastic gloves, paper towels, plastic bag, and newspaper.</p> <p>Cleanup Method: Open windows and doors in the rodent-contaminated room and air out for 10 minutes. Spray disinfectant on the area containing rodent droppings until wet, whether hard surface or carpet. Put on the gloves. Wet a paper towel and wipe up the droppings. Place the wet towels and droppings into the plastic bag. Seal the bag, wrap in newspaper, and place in a dumpster or garbage can. Respray the contaminated area with a light amount of disinfectant and let dry. Spray the outside of the gloves with disinfectant. Remove gloves and wash hands with soap and water.</p> <p>Note: These procedures are for cleanup of light to moderate contamination only. If equipment, boxes, or materials other than floor space are contaminated, or the floor is heavily contaminated, then cleanup will require trained, fully protected workers. See instructions in Box 11 and call Public Health for onsite evaluation.</p>	<p>5</p>
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<p>Personnel Involved: Electricians servicing utility boxes.</p> <p>Level of Rodent Contamination: Light to moderate. Most rodent droppings found in bottom of utility box. Less than 20 droppings found on tops of panels in box.</p> <p>Protective Clothing and Equipment: 1 can or spray bottle of disinfectant, half-face respirator with N-100 cartridges, and rubber or plastic gloves.</p> <p>Cleanup Method: Put on the respirator and rubber or plastic gloves before opening the doors to the utility box. Leave the doors open for 5-10 minutes. Disconnect power to the box. Spray any rodent droppings, urine, or nesting materials until wet. Spray the outside of the gloves with disinfectant. At this point, the respirator and the rubber or plastic gloves may be removed and work gloves may be put on. Complete work and close the box.</p>	<p>6</p>
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Personnel Involved: Personnel cleaning out electrical utility boxes. **7**

Level of Rodent Contamination: Heavy contamination. Rodent droppings found throughout the box. Nesting materials and numerous droppings in the bottom of the box.

Protective Clothing and Equipment: Half-face respirator with N-100 cartridges or PAPR, coveralls, rubber or plastic gloves taped to the coveralls at the wrists, non-vented eye goggles, and rubber or plastic boots.

Cleanup Method: Put on all protective equipment before opening the doors to the box. Leave the doors open for at least 10 minutes. Disconnect power to the box. Spray the contaminated surfaces until wet with disinfectant using a 2-gallon sprayer or other device that minimizes dust. Use scrapers or wet cloth to remove the contaminants. Place contaminants into a plastic bag. Respray the box a second time with disinfectant and air dry. Remember to dispose of the contaminated cloth wipes in the same manner as the cleaned up contaminants. More detailed guidance on decontamination of workers following cleanup can be obtained from the local Public Health office.

Personnel Involved: Stables personnel. **8**

Level of Rodent Contamination: Light to moderate. Rodent droppings found inside tack rooms and storage rooms are only along walls, not in traffic areas. Number of droppings per square foot should not exceed 20.

Protective Clothing and Equipment: 1 can or spray bottle of disinfectant, rubber or plastic gloves, paper towels, plastic bag, and newspaper.

Cleanup Method: Put on the gloves. Open windows and doors in the rodent-contaminated room and air out for 10 minutes. Spray disinfectant on the area containing rodent droppings until wet. Wet a paper towel and wipe up the droppings. Place the wet towels and droppings into the plastic bag. Seal the bag, wrap in newspaper, and discard in a dumpster or garbage can. Respray the contaminated area with a light amount of disinfectant and let dry. Spray the outside of the gloves with disinfectant. Remove gloves and wash hands with soap and water.

Personnel Involved: Stables personnel. 9

Level of Rodent Contamination: Heavy contamination. Rodent droppings found throughout the tack room or storage area. Boxes and other items contaminated with droppings or urine.

Protective Clothing and Equipment: See instructions in Box 11.

Cleanup Method: Call Public Health for onsite evaluation. Cleanup will require trained, fully protected workers.

Personnel Involved: Vehicle maintenance personnel. 10

Level of Rodent Contamination: Light to moderate contamination. Rodent droppings or nesting materials present on seats and floors in the cabs, in heater vents and glove boxes, and on engine blocks. No more than 10 droppings per square foot.

Protective Clothing and Equipment: 1 can or spray bottle of disinfectant, rubber or plastic gloves, paper towels, plastic bag, and newspaper.

Cleanup Method: Put on the gloves. Open all external doors and windows to the cab; open the engine compartment and air out for 10 minutes. Spray disinfectant on the area containing rodent droppings until wet. Wet a paper towel and wipe up the droppings. Place the wet towels and droppings into the plastic bag. Seal the bag, wrap in newspaper, and discard in a dumpster or garbage can. Respray the contaminated area with a light amount of disinfectant and let dry. Spray the outside of the gloves with disinfectant. Remove gloves and wash hands with soap and water. If rodent droppings are found in the heater vents, spray those portions of the vents accessible from the cab. When cleanup is over, start the engine, turn the heater on to low, and, from the outside of the vehicle, spray the disinfectant into the heater vent intake for 30 seconds. Shut off the heater vent and engine and leave the vehicle doors and windows open for 30 minutes.

Note: When heavy rodent contamination is encountered, call Public Health for onsite evaluation. Cleanup will require trained, fully protected workers.

Personnel Involved: Rodent cleanup team members.

11

Level of Rodent Contamination: Heavy contamination. Rodent droppings, urine, or nesting materials present throughout the area. Area to be cleaned may be hard surfaced or carpeted.

Protective Clothing and Equipment: Half-face respirator with N-100 cartridges or PAPR, coveralls, rubber or plastic gloves taped to coveralls at the wrists, non-vented eye goggles, and rubber or plastic boots.

Cleanup Method: Put on all protective clothing and equipment. Open all external doors and windows. Spray the contaminated surfaces until wet with disinfectant using a 2-gallon sprayer or other device that minimizes dust. Use a shovel or wet mop to remove the contaminants -- never use a broom. Place contaminants into a plastic bag. Mop the floor a second time with disinfectant and air dry. Carpet should be cleaned with a carpet cleaning machine containing hot water and disinfectant. Remember to dispose of the mop head(s) in the same manner as the cleaned up contaminants. More detailed guidance on decontamination of workers following cleanup can be obtained from the local Public Health office.

Note: This is a brief overview of cleanup procedures for substantial amounts of rodent contamination. Detailed instructions and safety briefings will be coordinated with Public Health prior to the time cleanup operations commence.

For further information, contact Jim Harrison, USACHPPM-West, at DSN 347-0084, Commercial (253) 966-0084, or e-mail: frederick.harrison@amedd.army.mil