

Recommended Procedures to Prevent the Spread of White-nose Syndrome (WNS)
U.S. Fish and Wildlife Service
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You should not handle bats. If you come across live or dead bats with white-nose syndrome, click on these links to contact [your state wildlife agency](#), WhiteNoseBats@fws.gov, or contact [your nearest U.S. Fish and Wildlife Service Ecological Services Field Office](#).

We ask that you take the following precautions to prevent the possible spread of WNS ("cave" includes all caves, fissures, mines, portals, etc.):

- The U.S. Fish and Wildlife Service recommends that all cavers observe all cave closures and advisories in all states, especially in WNS affected states¹ and unaffected adjacent states². Some states have instituted closures and issued advisories beyond normal permanent and seasonal closures. Other states have instituted, or are considering instituting, closures of caves with bats and/or advisories to stay out of caves with bats. **Please visit <http://fws.gov/northeast/wnscavers.html> for a list of current cave closures.** If closure information from a state in which you plan to go caving is not listed, contact that state's wildlife agency to obtain the latest information on cave access. Before caving in another country, check with the country's wildlife agency for information on cave access.
- Should you enter a cave, whether inhabited by bats or not, upon exiting a cave in the affected zone of New York, Vermont, Connecticut, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Virginia, and West Virginia and adjacent states (Rhode Island, Maine, Maryland, Delaware, Ohio, Tennessee, North Carolina, and Kentucky), follow the containment and decontamination procedures below.
- **Decontaminate all clothing, footwear, and gear prior to departing for a caving outing if you did not decontaminate these items after last exiting a cave.** To avoid contaminating a cave in a currently unaffected state, we ask that you not use gear that was used in a WNS affected state¹ if that gear cannot be thoroughly decontaminated or disposed of (e.g., if harnesses, ropes, or webbing cannot be decontaminated, we advise that you not enter caves or parts of caves requiring use of this gear).
- Because clothing, footwear, and gear used in a cave in a WNS affected state¹ within the past 3 years could pose a risk of spreading WNS, the Service advises that these items not be used in caves anywhere.
- We advise that you decontaminate previously used gear immediately (see decontamination procedures below), store them away, and thoroughly wash and decontaminate any surfaces with which these items may have come into contact (e.g., car trunk, duffle bag, etc.). Currently, 10% bleach solution, Lysol[®] All-purpose Professional Cleaner, and the antibacterial form of Formula 409[®] have been demonstrated to be effective at killing *Geomyces* sp., the fungus associated with WNS, on nonporous surfaces.

¹ **WNS Affected States:** Connecticut, Massachusetts, New York, Pennsylvania, Vermont, New Hampshire, New Jersey, West Virginia, and Virginia

² **Adjacent States:** Maine, Rhode Island, Maryland, Delaware, Ohio, Kentucky, Tennessee, and North Carolina

Note: The listed WNS affected and adjacent states are current as of 6-2-09, please visit http://www.fws.gov/northeast/white_nose.html for the most updated information.

White-Nose Syndrome Containment and Decontamination Procedures

The Service asks that cavers please follow these procedures for containment and decontamination in the circumstances identified above. The main goal of this discussion is to put in place reasonable practices that reduce the transfer of infectious agents, which potentially affect bats, from one cave to another cave. Prior to each caving outing, please check <http://www.fws.gov/northeast/wncavers.html> for updates to these procedures.

Any gear, including outer clothing, should not be used in multiple caves in the same day unless the cleaning and disinfection recommended below can be performed. Companion animals should be kept out of caves. A cave should only be entered with clothing, boots, and equipment that have been fully cleaned with the protocol below and rinsed prior to entry to remove disinfectant residue. Upon exiting a cave, scrape or brush off any dirt and mud from your clothes, boots, and gear and then place them in a sealed plastic bag or plastic container with lid to be cleaned and disinfected off site. Outer clothing should be removed prior to entering a vehicle after/between a site visit. A clean change of clothing is recommended. Surface cleaning of exposed skin (arms, face, neck, hands, etc.) with antibacterial hand sanitizer (i.e. Purell[®]) should occur prior to entering the vehicle's cab.

The first step of decontamination is to remove all soil and organic material from equipment, clothing, and boots using repeated rinses with water. This is especially important as organic material (i.e. clay soils) can prevent the cleaning and disinfecting agents from penetrating equipment, clothing, and boots, etc.

Submersible Gear (i.e. clothing and soft-sided equipment):

- **For clothing** – Wash all clothing and any appropriate equipment in washing machine using the hottest cycle possible for material and conventional detergents. Laboratory testing has found Woolite[®] fabric wash to be the best surfactant for clothing. Rinse thoroughly, and then follow by soaking with sodium hypochlorite bleach (i.e. household bleach) solution diluted to 1 part bleach to 9 parts water in a tub or plastic container. Soak for 10 minutes, then rinse and air dry.
- **For other submersible gear** (i.e. bags, gloves, etc.) – Disinfect any equipment that can be submersed in a solution with an appropriate and compatible disinfectant such as sodium hypochlorite bleach (i.e. household bleach) solution diluted to 1 part bleach to 9 parts water in a tub or plastic container or $\geq 3\%$ concentration of quaternary ammonium compounds (i.e. Sparquat 256, Lysol[®] All-purpose Professional Cleaner or the antibacterial form of Formula 409[®]). Keep submerged for 10 minutes, then rinse and air dry.

Non-submersible Gear (i.e. hard-sided equipment):

- **For non-submersible gear** (i.e. hard hats, flashlights, etc.) – Disinfect any equipment that cannot be submersed by applying an appropriate and compatible disinfectant to the outside surface by using $\geq 3\%$ concentration of quaternary ammonium compounds such as Lysol[®] All-purpose Professional Cleaner, Lysol[®] disinfecting wipes or the antibacterial form of Formula 409[®]; or use sodium hypochlorite bleach (i.e. household bleach) solution diluted to 1 part bleach to 9 parts water. Keep on surface for 10 minutes, then rinse and air dry.
- **For boots** – Boots need to be fully scrubbed and rinsed so that all soil and organic material is removed. The entire rubber and leather boots, including soles and leather uppers, can then be disinfected with an appropriate disinfectant such as $\geq 3\%$ concentration of quaternary ammonium compounds (i.e. Sparquat 256, Lysol[®] All-purpose Professional Cleaner or the antibacterial form of Formula 409[®]) and sodium hypochlorite bleach (i.e. household bleach) solution diluted to 1 part bleach to 9 parts water. Keep on surface for 10 minutes, then rinse and air dry.

It should be noted that product guidelines should be consulted for compatibility before using any disinfectant on specific equipment. Also, detergents should not be mixed directly with bleach as this will inactivate the bleach and in some cases produce a toxic chlorine gas.

Ropes and harnesses:

This equipment should be dedicated to one cave or not used at all. Decontamination of vertical equipment is recommended. However, the performance integrity may be compromised by using these disinfecting agents mentioned above repeatedly. Laboratory testing is ongoing.

Cameras and other electronic equipment:

If possible, do not bring electronic equipment to a cave. If practical, cameras and other similar equipment that must be brought to a cave may be wrapped in plastic wrap where only the lens is left unwrapped to allow for photos to be taken. The plastic wrap can then be decontaminated by using Lysol[®] disinfecting wipes and discarded after use. If using plastic wrap is not practical, alcohol wipes or Lysol[®] disinfecting wipes can be applied directly on surfaces.

Vehicles:

In addition to caving gear, vehicles used to transport equipment may harbor spores. It is important to keep vehicles as clean as possible by storing gear in clean containers, and to decontaminate those containers along with your gear.

Also note: Puregreen 24 disinfectant (compound) DOES NOT KILL the fungus.

Disclaimer: Use of trade names does not in any way signify endorsement of a particular product.

Useful Websites and References:

<http://www.cfsph.iastate.edu/BRM/resources/Disinfectants/CharacteristicsSelectedDisinfectants.pdf>

<http://www.cfsph.iastate.edu/BRM/resources/disinfectants/Disinfection101Feb2005.pdf>

http://www.fws.gov/northeast/white_nose.html

http://protectyourwaters.org/prevention/prevention_generic.php

<http://www.westdenvertu.org/NZMS/waderbootinfo.htm>

(see product compatibility with 10% bleach disinfectant)

Merchant, D.F. 2003. Life on a line. Published online at draftlight.net/lifeonline (\$14.95 PDF file; see Maintenance, inspection and disposal of equipment)

What is known about *Geomyces* sp. viability:

- The fungus survives exposure to mammalian body temperature (38° C/100° F) for at least 3 days but does not remain viable after 8 days (W. Stone, NYSDEC, pers. communication 4/14/09).
- The fungus survives exposure to temperature (30° C/86° F) for at least 15 days (W. Stone, NYSDEC, pers. communication 4/14/09).
- Short-term incubation of fungus at higher temperatures reduces the number of conidia present and alters the morphology of the hyphae which may not inhibit growth once returned to colder temperatures (W. Stone, NYSDEC and D. Blehert, USGS NWHC, pers. communication 4/14/09).
- Clothes dryer heat treatment (49° C/ 120° F) alone increases fungal spore germination and does not kill the fungus (H. Barton, NKU, pers. communication 4/22/09).

What kills the *Geomyces* sp. fungus (spores):

Method	Conditions	Kill Time	Source	Cautions*
Disinfectant				
5.25% Chlorine bleach	10% bath solution (1 part bleach: 9 parts water)	10 min	Over the counter	Inactivated by organic material, detergents; corrosive to metals; produces toxic gas if combined with ammonia; skin irritant
Lysol® Professional	1:128 bath	10 min	Janitorial supply	Corrosive; skin &

Antibacterial All Purpose Cleaner	solution (1 oz per 1 gal water)_			eye irritant
	1:64 bath solution (2 oz per 1 gal water)	5 min		
Sparquat 256	½ oz per 1 gal water	10 min	www.chemsearch.com	May require license to obtain; requires special disposal methods
Promicidal™	1:128 bath solution (1 oz per 1 gal water)	10 min	www.chemsearch.com	May require license to obtain; requires special disposal methods
Grenadier™	1:64 bath solution (2 oz per 1 gal water)	10 min	www.chemsearch.com	May require license to obtain; requires hazardous waste disposal methods
	1:32 bath solution (4 oz per 1 gal water)	5 min		
Formula 409®	At least 0.3% concentration	10 min	Over the counter	
Woolite®	Refer to product label		Over the counter	
Dawn® antibacterial hand soap	Refer to product label		Over the counter	
Purell®	Refer to product label		Over the counter	
Lysol disinfecting wipes®	Refer to product label		Over the counter	
70%-95% ethanol	Undiluted bath	2 min	Lab supply distributor	Flammable, skin irritant
Temperature				
Dry heat	110° F/ 43° C	12 hr	Oven, incubators	
	165° F/ 74° C	15 min		
	175° F/ 79° C	5 min		
	180° F/ 82° C	5 min		
Sterilization				
Steam autoclave	121 F; 15 psi	15 min	Laboratory or hospital settings	
Gas sterilization	Ethylene oxide	16-18 hr	Only available at hospitals	

Flame sterilization	Alcohol & open flame	15-20 sec		Fire hazard; burn injuries
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* The effects of different decontamination methods on the integrity of caving equipment are currently being tested.