Decontamination Procedures for Use on
National Forest System Lands
To Help Prevent the Spread of White-Nose Syndrome
Associated with Cave and Abandoned Mine Entry

USDA Forest Service
July 21, 2010

WNS has been documented across the eastern United States (U.S.) and Canada, and most recently in Missouri and Oklahoma. A fungus, recently identified as *Geomyces destructans*, is considered the primary causal agent associated with the mass mortalities of White-nose Syndrome (WNS) in bats. Mortality rates at affected sites are typically 80 to 100 percent. In addition to the presence of the fungus, fat reserves of afflicted bats are prematurely depleted by mid-winter, as opposed to persisting until spring. This depletion of fat reserves results in starvation and typically subsequent death. Although bat-to-bat transmission has been the focus of transmission studies and has been found to be a significant vector for the spread of WNS, long distance jumps of WNS from New England to West Virginia could have been aresult of human transmission between sites. Recent unpublished studies have shown persistence of *G. destructan*s spores on field equipment exposed to contaminated caves. Other research has shown that spores may become adhered to cave clothing, boots, gear, etc. indicating that *G. destructan*s could be transported this way between sites. In light of this information, it is imperative that individuals who must enter caves or abandoned mines follow the containment and decontamination procedures described in Sections 4 and 5 to prevent further spread of WNS.

Forest Service employees and contractors can continue to enter caves and abandoned mines on National Forest System (NFS) lands for the purpose of conducting sanctioned and necessary work only. Additionally, Forest Service personnel are expected to work with grottos, permittees, concessionaires, and the general public to identify when and where cave entry should be allowed by the public. When official entry is necessary or allowable, ensure decontamination protocols are understood and followed. Not using these decontamination procedures could result in transmission of the fungus *Geomyces destructans* and WNS. Should cave or abandoned mine entry be necessary, this protocol outlines procedures designed to potentially reduce the spread of the fungus. All decontamination products listed in Section 4 have been found to be very effective at killing the fungus in a laboratory setting; however, research is still needed to test effectiveness of these products in the field. We are aware that implementing this protocol requires a significant change to the way most of us have historically conducted official underground surveys, inspection or other visitations. It is more expensive, time consuming, and could potentially decrease the life of equipment. It requires a shift in perspective that human activity is potentially lethal to bats, we must tread lightly and it is our responsibility to do everything in our power to avoid being vectors of WNS.

In addition to USFS employees and contractors, starting October 1, 2010 this decontamination protocol is applicable to public entry/exit to caves, including show caves. Public entry into abandoned mines is very strongly discouraged because of safety reasons, and application of the decontamination protocols by the public would apply only when this message is ignored.

You should not handle bats. However, if you should observe live or dead bats that potentially are exhibiting characteristic signs of WNS (see Section 1), report this immediately to the appropriate Forest Biologist and state wildlife professional (see link below).
State Wildlife Agency Office Listing - http://www.fws.gov/offices/statelinks.html
For WNS, bat and cave research decontamination procedures, refer to protocols given by the FWS at:
USFWS White-Nose Syndrome Decontamination Protocols for Researchers

SECTION 1: Characteristic Signs of WNS

During summer months, bats are normally viewed near dusk and dawn, but during winter they may be observed out during the day during periods of warmer temperatures. This may not be unusual behavior for bats. Different bat species naturally go into varying degrees of torpor during hibernation, and therefore, can arouse and exit hibernacula more frequently especially under warm conditions. However, bats **may** be considered WNS-affected when:

- They are observed flying on the landscape during very cold temperatures.
- They are observed clinging to surfaces outdoors in winter.
- White fungus is observed on their bodies, particularly the nose and forearms.
- They have a dehydrated appearance.
- They are alive, but found on the ground and appear unresponsive.
- Numerous individuals have been found sick or dead at a location where a large population exists.

SECTION 2: Status of WNS as of May, 2010
Visit http://www.fws.gov/white_nose.html for the latest information and the current spread of WNS.

SECTION 3: General Guidelines to Prevent the Spread of WNS

A "cave" includes all caves and fissures whether they are known to be used by bats or not. A cave is defined under the Federal Cave Resource Protection Act as “any naturally occurring void, cavity, recess, or system interconnected passages beneath the surface of the earth or within a cliff or ledge that is large enough for a person to enter, whether the entrance is excavated or naturally formed.” “Abandoned mines” include inactive open adits, tunnels, and shafts, but do not include active mines where ongoing mining activities are being conducted. If entry into these caves and/or abandoned mines is necessary, take the following precautions to prevent the possible spread of the fungus *Geomyces destructans*:

- Avoid entry into all caves and abandoned mines, and observe cave and abandoned mine closures and advisories. Some federal agencies, states, private individuals and organizations have instituted closures and issued advisories beyond normal permanent and seasonal closures. Others have instituted, or are considering instituting, closures of caves with bats and/or advisories to stay out of caves with bats. Please visit: http://www.fws.gov/WhiteNoseSyndrome/cavers.htmlfor a list of current 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.

- To avoid contaminating a cave or abandoned mine in a currently unaffected state, DO NOT use gear that was used in a WNS-affected state outside that affected state. Within WNS-affected states, if gear (i.e. harnesses, ropes, or webbing) used within the affected state cannot be thoroughly decontaminated, do not enter other caves or abandoned mines in that state where the use of this gear is required. If gear can be thoroughly decontaminated and you must enter a cave or abandoned mine within the affected state, decontaminate all clothing, footwear, and gear prior to departing for an underground entry if you did not decontaminate these items after the last underground entry. Consult state wildlife and caving authorities for possible additional guidelines and requirements.

- In unaffected states, DO NOT bring gear, clothing, etc. in to a cave or abandoned mine that has been used in a cave or mine of any kind outside of the unaffected state or other regionally accepted area of delineation (e.g. Pacific Northwest Region; also coordinate with your State Wildlife Departments to be consistent about areas of delineation).

- In all States, decontaminate previously used gear, clothing, etc. immediately (see Section 4), store gear away, and thoroughly wash and decontaminate any surfaces with which these items may have come into contact (e.g., car trunk, duffle bag, etc.).

SECTION 4: Recommended Decontamination Products

The following chemical products were tested in a laboratory setting and were found to be particularly effective against killing the more resistant, spore-form of *Geomyces destructans*, as well as the hyphae:

1. Lysol® IC Quaternary Disinfectant Cleaner (with a minimum of 0.3% quaternary ammonium compound) - this is a concentrate which requires a 1:128 dilution (1 part concentrate to 128 parts water or 1 ounce of concentrate per gallon of water)
2. Lysol® All-purpose Professional Cleaner
3. Formula 409® Antibacterial All-Purpose Cleaner (with a minimum of 0.3% quaternary ammonium compound)
4. A 10% solution of household bleach - this must be made by measuring 1 part bleach to 9 parts water (an estimate of 1:9 is insufficient)
5. Lysol® Disinfecting Wipes
6. Boiling water

Quaternary ammonium products such as 409 and Lysol cleaner must be properly disposed into a municipal water system (poured down a drain or toilet) or similar system to receive required treatment. It is illegal to dump these products on the ground. Follow the label instructions and do not wipe these products directly on your skin or surfaces that come in contact with humans, pets, bats, or other wildlife.

If using bleach solution, do not store dilution for more than 24 hours as the bleach will begin to break down once it is diluted. Store in opaque bottles as bleach also breaks down when exposed to sunlight.

Product guidelines should be consulted for compatibility before using any decontamination product listed under Section 3 on specific equipment. Also, detergents and quaternary ammonium compounds (i.e. Lysol® IC Quaternary Disinfectant Cleaner) should not be mixed directly with bleach as this will inactivate the bleach and in some cases produce a toxic chlorine gas.

SECTION 5: Containment and Decontamination Procedures

There is increasing evidence that *Geomyces destructans* can be transmitted by human activities and that a cave/abandoned mine environment containing this fungus is infectious to hibernating bats. Follow these procedures for containment and decontamination to reduce the transfer of *Geomyces destructans.*

Abandoned Mines

For the purposes of this discussion a "site" may consist of one or more related underground mine openings and may be as large as several square miles. Under situations where surveys are being conducted in association with abandoned mine closures for human safety, and multiple sites are being visited in a single day in states currently undocumented as affected by WNS, containment and decontamination between each site may be impractical. Specifically for abandoned mine entry associated with human-safety closures we recommend the following:

- Avoid entry if possible
- Limit entry to that necessary to safely perform survey or construction work. For construction this is typically less than 50 feet inside the adit or shaft.

- Follow the decontamination and containment protocol between sites if feasible. If decontamination is not feasible between sites, identify feasible opportunities for decontamination at the smallest possible geographic unit to minimize risk of contamination between locations. These geographic units could be hydrologic unit code boundaries (HUCs) or bat habitat use areas.
- Decontamination must occur no less frequently than at the end of each day.
- Protect the interior of vehicles with tarps, sheets, etc. if driving between sites without decontaminating clothing (including outer clothing), boots, socks, harness/ropes, helmet, hardhat, fannypack/daypack, headlamp, flashlight, camera or other gear.

Caves

Avoid cave entry if possible. Clothing (including outer clothing), boots, socks, harness/ropes, helmet, hardhat, fannypack/daypack, headlamp, flashlight, camera, and other gear should not be used in multiple entries in the same day unless the cleaning and decontamination recommended below can be performed between each entry. In situations where caves are known to be interconnected and have multiple entrances, decontamination is not required between entries at the various entrances, within the same day. In some situations in the west where caves are concentrated in a small area, Regions or Forests may identify logical decontamination areas that allow decontamination between cave clusters that are likely to be used by the same group of bats.

Decontamination Procedures for Abandoned Mines and Caves

We encourage Regions, Forests and Districts to develop decontamination plans for cave and abandoned mine entry on their administrative unit.

- Entry will only occur with clothing (including outer clothing), boots, socks, harness/ropes, helmet, hardhat, fannypack/daypack, headlamp, flashlight, camera and other gear that have been fully cleaned following the protocol below and rinsed prior to entry to remove residue of chemical product used.
- Minimize gear taken in to a site (e.g. take a small fanny pack instead of a large day pack, take 1 camera per group instead everyone taking a camera).
- Tyvek® or other disposable outerwear, rubber boot covers, and latex rubber gloves may be used for each entry in lieu of decontamination procedures for clothing. Upon exit, place these items in sealable containers, to be appropriately decontaminated and disposed of off-site.

Upon exiting a cave or abandoned mine and while still close to the opening, scrub off any dirt and mud from your clothing (including outer clothing), boots, socks, harness/ropes, helmet, hardhat, fannypack/daypack, headlamp, flashlight, camera and other gear and place them in a sealed plastic bag or plastic container with lid to be cleaned and decontaminated off site. This is especially important as organic material (i.e. clay soils) can prevent the chemical products from penetrating equipment, clothing, and boots, etc.

Outer clothing should be removed prior to entering a vehicle and after/between a cave/abandoned mine visit. A clean change of clothing is required after a cave or mine visit. Companion animals should be kept out of caves and mines as fungal spores could adhere to fur and be transferred to another cave.

Showering or bathing is required following cave or mine visits, including when conducting multiple-day excursions to multiple sites.

Submersible Gear (i.e. clothing and equipment that can be submerged without damage)**:**

- Wash all clothing and any appropriate equipment in washing machine or by hand using conventional detergents. Washing can be done in cold, warm or hot water. Laboratory testing has found Woolite® fabric wash to be the best detergent for this procedure. Rinse thoroughly, and then follow by soaking for a minimum of 10 minutes in one of the recommended decontaminating products listed under Section 4, then rinse and air dry. Boiling items for 15 minutes can be done in lieu of chemical treatment.

Footwear:

- Where possible, rubber (wellington-type) caving boots (which withstand harsh decontaminating products and are easily cleaned) are recommended. Boots need to be fully scrubbed and rinsed so that all soil and organic material are removed. The entire rubber and leather boots, including soles and leather uppers, can then be decontaminated with an appropriate chemical product listed under Section 4 for a minimum of 10 minutes, then rinse and air dry. Boiling items for 15 minutes can be done in lieu of chemical treatment.

Disposable clothing and footwear:

- Use of Tyvek® or other disposable outerwear, rubber boot covers, and latex rubber gloves may be used for each entry. Upon exit, place these items in sealable containers, to be appropriately decontaminated or disposed of off-site.

Ropes and Harnesses:

- It is the responsibility of each individual using life-support equipment – such as harnesses and ropes – to ensure that the decontamination protocols in use are chemically compatible with this equipment. To date, only Sterling rope and webbing have been shown not to be damaged by the following decontamination protocol: Wash rope/webbing in a front loading washing machine on the gentle cycle using Woolite® Extra Delicates detergent. Treat by immersion in a 1:128 dilution of Lysol IC Quaternary Disinfectant Cleaner for 15 minutes. Rinse in fresh, clean water for a minimum of two rinses and allow to air dry.

  If you are using other brands of rope and webbing not mentioned above, these products have yet to be tested for integrity after decontamination. In cases where safety following decontamination has not yet been evaluated, then ropes and webbing should be dedicated to one cave or not used at all to prevent the spread of WNS.

Non-submersible Gear (i.e. equipment that will be damaged by submersion)**:**

- Clean thoroughly with soap and water (or use Lysol® Disinfecting Wipes), then decontaminate by applying one of the recommended chemical products listed under Section 4 to the outside surface for a minimum of 10 minutes, then rinse and air dry. This may include flashlights, headlamps (elastic straps can be removed and washed as a submersible item), and headgear.

Air Monitors:

- Air monitors are required safety equipment for underground abandoned mine entry. The manufacturer of your air monitor (ESPECIALLY THE SENSORS) must be consulted with prior to applying any decontaminant chemicals, to ensure that the sensors and electronic components are not compromised in any way. Follow the manufacturer's recommended procedures.

Cameras and Electronic Equipment:

- If possible, do not bring electronic equipment underground. If practical, cameras and other similar equipment that must be used may be placed in plastic casing (i.e. underwater camera housing) or 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, Lysol® Disinfecting Wipes can be applied directly on camera surfaces or plastic casing.

Vehicles:

- In addition to caving or abandoned mine gear, vehicles used to transport equipment may harbor spores. Always remove and contain clothing and gear away from your vehicle in sealed plastic bags and storage containers with lids and wipe them with wipes prior to placing them in your vehicle. Be sure to dispose or decontaminate bags and storage containers along with your gear using one of the chemical products listed under Section 3.

Show Caves and Tourist Mines

Work with contractors, special use permittees, and concessionaires to enlist a decontamination process for all individuals entering show caves or tourist mines by implementing a combination of the following actions that best fits the situation and will be most effective:

- Provide education to visitors on caves, bats, and WNS such as is being conducted at Mammoth Cave (http://www.nps.gov/maca/whitenose.htm)
- Close these sites to entry for anything other than WNS surveillance during hibernation season (roughly from October 1 – May 1).
- In WNS unaffected States prohibit entry with footwear that has previously been in a cave or mine outside the State or other regionally accepted area of delineation (e.g. Pacific Northwest Region); Also coordinate with your State Wildlife Departments to be consistent about areas of delineation). In WNS affected States, forbid entry with footwear that has previously been in a cave or mine of any kind outside the county, **OR** require footwear decontamination prior to entry at a provided/supervised decontamination station, **OR** sell disposable rubber booties to be worn in place of footwear.
- In WNS unaffected States, prohibit entry with clothing that has previously been in a cave or mine outside the State or other regionally accepted area of delineation (e.g. Pacific Northwest Region); Also coordinate with your State Wildlife Departments to be consistent about areas of delineation). In WNS affected States, forbid entry with clothing that has previously been in a cave or mine of any kind outside the county **OR** provide disposable Tyvek suits for sale.
- Forbid carrying accessory items such as water bottles, cameras, cell phones, daypacks in to caves or tourist mines that have previously been in a cave, abandoned mine or tourist mine, unless decontaminated on site.
- Provide a decontamination station and personnel to run it.
- Restrict human entry in to portions of caves or tourist mines used by bats any time of year.
- Restrict human traffic to well-defined contained pathways that avoid opportunities for human contact with cave features other than the pathway.