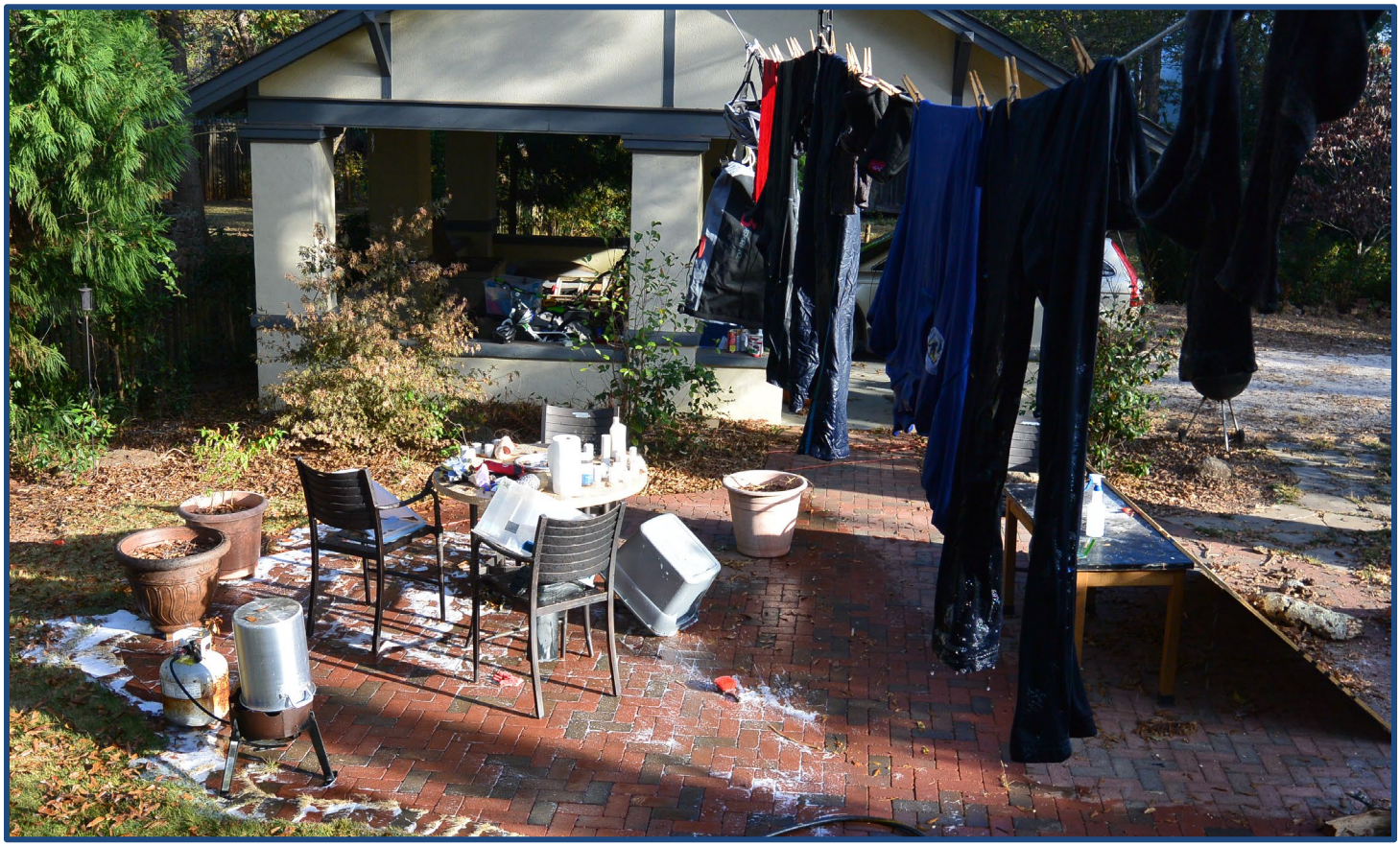
National White-Nose Syndrome Decontamination Protocol

Updated March 2024



White-Nose Syndrome Disease Management Working Group

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Key updates to this protocol include:

- Ethanol, Formula 409 and Hibiclens are removed from the approved disinfection product table.
- Isopropanol concentration is narrowed to 50-70%. In the previous protocol, >50% isopropanol was approved.
- The WNS management areas map is updated to reflect the current status of Pd and WNS occurrence in the US. Hawai'i, Alaska, and Puerto Rico are added to the map of management areas.
- Guidelines for movement of gear and when to decontaminate gear are stated in a bulleted list rather than a diagram.
- Additional information is provided regarding decontamination of mist-nets, harp traps and acoustic equipment.

I. INTRODUCTION

The fungus *Pseudogymnoascus destructans* (*Pd*) causes white-nose syndrome (WNS), a disease that has resulted in unprecedented mortality of hibernating bats in North America. The best available science indicates that *Pd* arrived in North America from a foreign source, likely Europe or Asia. Since the first documented evidence of WNS in New York in 2006, WNS has spread rapidly in North America and continues to threaten hibernating populations of bats across the continent. The fungus grows on bat skin and can grow and persist for years in cold and damp environments such as those favored by hibernating bats. Once *Pd* is detected at a site, either on bats or in the environment, that location is considered contaminated indefinitely due to the potential for long-term persistence of the fungus. Additionally, visitors to contaminated locations may inadvertently transport the fungus to new locations on clothing or gear, i.e., fomites. Because of the devastating effects of WNS in North America and the ability of *Pd* spores to survive for months or years, this protocol has been developed to minimize the risk of human-assisted transmission that could contribute to spread of the fungus. All persons and materials that contact bats or their environments for any reason (e.g., research, recreation, etc.) are asked to take actions to reduce the risk of inadvertent transport of *Pd* to bats or their habitats. Additional recommendations for using the protocol for activities such as show cave management and wildlife rehabilitation are available on www.WhiteNoseSyndrome.org.

This protocol is designed specifically to reduce risks of people moving viable *Pd* to and from bats and their habitats but may also reduce risks of transporting other potentially harmful "biological hitchhikers." The applications identified herein have been selected for their efficacy in killing *Pd* specifically. Efficacy against other microbes is circumstantial.

II. PURPOSE:

The purpose of this document is to provide scientifically supported procedures known to effectively clean and treat (herein referred to as decontaminate) clothing, footwear, tools, and/or gear (herein collectively referred to as equipment) that may have been exposed to *Pd*. When activities involve contact with or exposure to bats, their environments, and/or associated materials like guano and tissues, the following decontamination procedures for equipment will reduce the risk of human-assisted transmission of the fungus to other bats and/or habitats.

For the protection of bats and their habitats and the safety of all persons:

1) Comply with all current advisories and regulations on federal, state, tribal, and private lands related to accessing caves, mines, or other bat roosts;

2) Avoid transporting any equipment that has contacted bats or their environments into or out of the United States; and
3) Do not delay emergency actions related to human safety in order to comply with the WNS decontamination protocol.

This document was developed as national guidance by the Disease Management Working Group of the multi-agency National WNS Response Team. **Local, state, federal, and other management agencies may have exceptions or additional requirements or clarifications for equipment used on lands under their jurisdictions[1] or for work involving public trust resources.** Always follow all state and federal permit conditions. Contact the pertinent agency office(s) for additional information.
https://www.whitenosesyndrome.org/contact/local-bat-expert

III. PRODUCT USE:

Ensuring the safety of individuals using any of the applications and/or products identified in this document must be the first priority. Safety data sheets (SDS) for chemicals and user's manuals for equipment developed by product manufacturers provide critical information on the physical properties, reactivity, potential health hazards, storage, disposal, and appropriate first aid procedures for handling, application, and disposing of each product in a safe manner. Familiarization with the SDS for chemical products, and manufacturer's product care and use standards, will help to ensure appropriate use of these materials and safeguard human and animal health. Read product labels in advance of intended use.

It is a violation of federal law to use, store, or dispose of a product regulated by the Federal Insecticide, Fungicide, and Rodenticide Act in any manner not prescribed on the approved product label and associated SDS. Products, including their contaminated rinse water, must be managed and disposed of in accordance with local environmental requirements and the product label to avoid contamination of groundwater, drinking water, or other bodies of water. **Follow all local, state, and federal laws. Requirements for product disposal may vary by state.** Note: Disinfectant wastewaters (especially those containing quaternary ammonium) should not be disposed or released in nature and may not be permitted in septic systems because of the potential for toxicity to the microbes in the septic system.

Furthermore, gear and equipment may be damaged by certain applications if the treatment is not specifically recommended for use with that product. Adhering to the manufacturers' cleaning and maintenance instructions is paramount to avoid affecting the integrity and efficacy of your equipment.

IV. TRIP PLANNING/ORGANIZATION:

1) First and foremost, local state/federal regulatory or land management agencies may have specific requirements, exemptions, or addendums pertaining to movement of equipment, decontamination requirements, work permissions, etc. for locations under their jurisdictions. It is your responsibility to know and adhere to these local requirements.
2) Identify the current status of *Pd* and WNS in the area you are visiting. (See WNS Management Areas, Figure 1.)
3) Restrict transfer of equipment according to the following rules to avoid risk of moving Pd to uncontaminated locations:
    a. Do not move equipment from a *Pd*-positive roost location to a roost location with *Pd*-unknown or *Pd*-negative status.
    b. Do not move equipment from more contaminated states and counties to less contaminated states and counties. (For example, equipment should not be moved from the WNS Endemic area to the Intermediate area and should not be moved from the WNS Endemic nor Intermediate areas to the At-risk area. Figure 1.)

4) This protocol applies to both subterranean and terrestrial equipment that has an elevated risk of being in contact with bats or materials contaminated with *Pd*, which includes the following categories:
    a. Equipment that has been used in a subterranean bat roost (e.g. cave, mine, tunnel, bunker, etc.) during any time of year.
    b. Equipment that comes in contact with bats, bat guano, or ground inside or adjacent to terrestrial bat roosts during any time of year.
5) When permissible to use equipment in multiple locations, equipment should be decontaminated between locations. (See below.)
6) Choose equipment that can be most effectively decontaminated in accordance with manufacturers' care instructions [e.g., rubber or synthetic boots rather than leather boots] or otherwise designate use of equipment to a specific location (herein referred to as "dedicated equipment"). Brand new equipment can be used at any location if it has not been stored or come in contact with contaminated equipment.
7) Prepare a safe and efficient strategy (i.e., outline how and where all equipment and waste materials will be contained, stored, treated, and/or discarded) that allows you to decontaminate equipment at the work location or contain equipment for off-site decontamination.

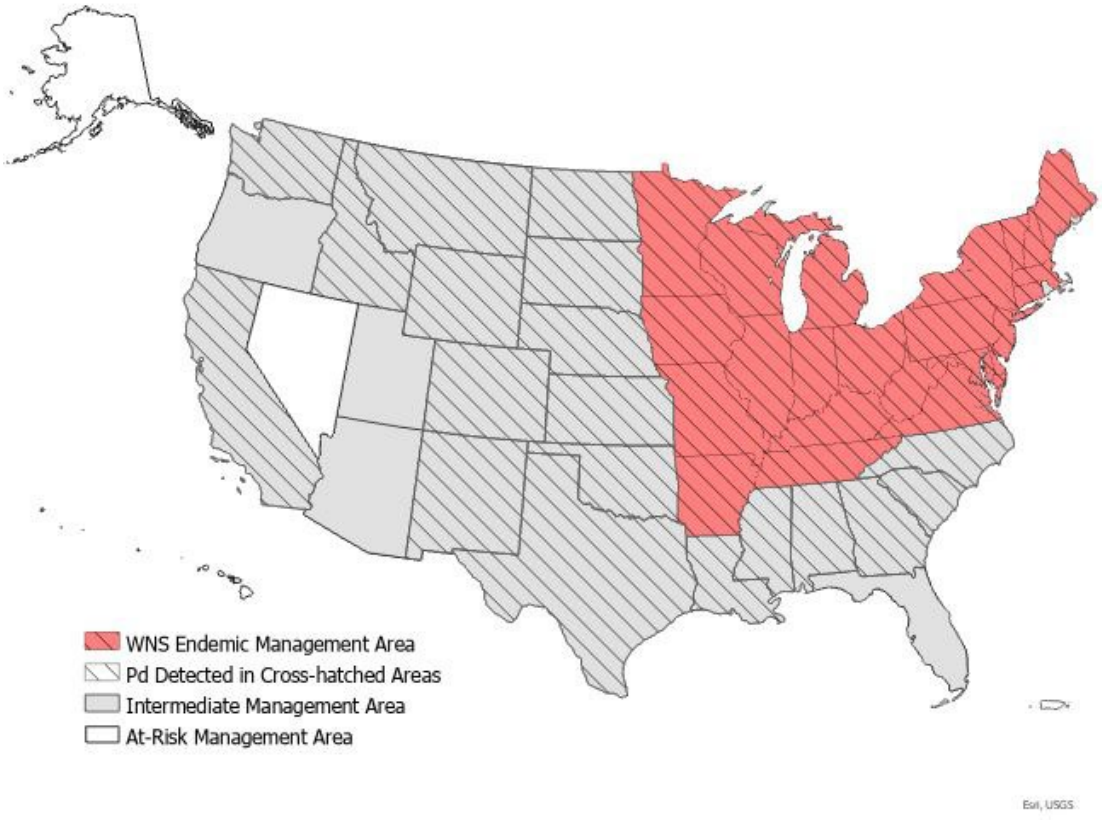

Figure 1. WNS Management Areas for decontamination. Endemic (red): Endemic states are those where WNS is widespread and *Pd* is determined or assumed present in all hibernacula. Intermediate (grey): Intermediate states are those where *Pd* is determined or assumed present in some but not all hibernacula. States adjacent to states with confirmed or suspected WNS are also included in the Intermediate category. At-risk (white): At-risk states are those that have at least one state between them and a WNS-confirmed or WNS-suspected state Updated February 2024.[2]

V. PROCEDURES FOR DECONTAMINATION:

1) Before leaving a site:
    a. INSPECT: Thoroughly inspect all gear, bags, etc. for "stowaway" bats.

    b. REMOVE: Thoroughly remove sediment and dirt from equipment upon exiting the site.

    c. CONTAIN:
        i. Contain in a garbage bag any disposable equipment used in the site, including Tyvek, shoe-coverings, gloves, etc., for proper disposal.
        ii. If decontaminating at another location, contain and seal all potentially contaminated equipment in plastic bags or containers for treatment away from the location. Decontaminate the outside surfaces of hard, non-porous bags and containers prior to moving them to a secondary location (e.g., vehicles, labs, or storage). Store all exposed equipment separately from clean and unexposed equipment.

    d. CLEAN: Wash hands, forearms, and exposed skin with soap; change into clean clothing and footwear prior to entering a vehicle. Contain potentially contaminated equipment as per c) above.

2) At decontamination location:
    a. REMOVE: If not completed before leaving the site, thoroughly remove all dirt and debris from all items prior to cleaning and disinfecting. NOTE: If dirt and debris has been transported away from its origin, additional treatment of this debris may be needed[8].

    b. CLEAN:
        i. Wash submersible and non-submersible equipment according to manufacturer's recommendations. Conventional cleansers like Woolite® detergent or Dawn® dish soap may not kill *Pd,* but they aid in the removal of sediments and debris that may contain spores and increase the effectiveness of subsequent treatment[3&4].
        ii. Vacuum and wash the inside of field vehicles, especially floor mats and seats used by people who have been inside the bat roosts and cargo areas holding equipment that has been inside the roost. For vehicles that have been driven into or to the entrance of a bat roost, wash the exterior, including undercarriage, before being driven into or to the entrance of another roost. (The best approach is to avoid driving vehicles into or to the openings of roosts.)

    c. DISINFECT: Reference Table 1 to disinfect submersible and non-submersible equipment as legally allowable according to the instructions provided on the product label. Note that some products in Table 1 are not suitable for submerging equipment. The use of any product or application should also consider all manufacturers' instructions for care of the equipment manufacturer to ensure its safety and integrity. For equipment that cannot be safely disinfected using an application in Table 1, clean according to the equipment manufacturer's instructions. *Always wear personal protective gear suitable for the application and/or product being used.*

    Submersible Equipment (i.e., equipment that can safely withstand submersion in hot water or other specified product for the recommended amount of time without compromising the integrity of the item)

The preferred treatment for equipment deemed suitable for submersion is hot water that maintains a temperature of at least 55ºC (131ºF) for a minimum of 5 continuous minutes. **All equipment surfaces must remain in direct contact (i.e., avoid all trapped air) with the ≥55ºC (131ºF) water for the entire 5-minute disinfection period.** Many commercial and home washing machines with sanitize (or allergen) cycles may be capable of submerging gear in the recommended hot water application for the required time, but each machine should be tested to ensure it reaches and sustains the needed temperatures throughout the process. *Remember, if heat may affect the safety and/or integrity of the otherwise submersible piece of equipment, consider equipment dedication or an alternative application or product listed in Table 1.*

Non-submersible Equipment (i.e., equipment that may be damaged by liquid submersion)

Treat all non-submersible equipment using the most appropriate application or product in Table 1 that complies with the equipment manufacturer's recommendations and product label instructions.. *Remember, if an application or product may affect the safety and/or integrity of the equipment, do not use it.*

d. RINSE: Thoroughly rinse equipment in clean water or wipe with a clean cloth dampened with water, if appropriate. This step is particularly important if the items will subsequently contact humans, animals, or sensitive environments. Allow all equipment to dry prior to the next use.

e. CLEAN UP: Repeat these steps for equipment bins and non-disposable bags, sinks, countertops, and other surfaces exposed to equipment during the decontamination process using the most appropriate applications or products in Table 1.

Table 1. Applications and products with demonstrated efficacy against *Pd* [3,4,5,6, 7]. Remember to consult equipment labels, registered product labels, and the appropriate SDS for regulations on safe, acceptable use.

	Tested Applications & Products [3,4,5,6,7]	Federal Reg No.:	Laboratory Results
Preferred Applications	Equipment Dedication	N/A	Clean according to manufacturer standards and dedicated to a site.
	Submersion in Hot Water[4,6,7]	N/A	Effectiveness demonstrated when submerged for 5 continuous minutes in water ≥55℃ (131℉).
Other Products	Isopropyl Alcohol (50% to 70%)[4,6,7]	CAS - 67-63-0	Effectiveness demonstrated upon exposure in solution for >20 seconds.
	Isopropyl Alcohol Wipes (70%)[4,6,7]	CAS - 67-63-0	Effectiveness demonstrated immediately following contact and air drying.
	Hydrogen Peroxide Wipes (3%)[4,6,7]	CAS - 7722-84-1	
	Clorox® Bleach (Sodium Hypochlorite 8.25%)[3,4,5,6,7] 2400 PPM or 3600 PPM (see label for dilution volumes and required exposure times)	EPA - 5813-100	**Effectiveness demonstrated when used in accordance with product label.**
	Accel® [4,5,6,7]	EPA - 74559-4	
	Clorox® Clean-Up Cleaner + Bleach[4,5,6,7]	EPA - 5813-21	
	Clorox® Disinfecting Wipes[4,5,6,7]	EPA - 5813-79	
	Clorox Healthcare Hydrogen Peroxide Disinfectant Cleaner [4,5,6,7]	EPA - 67619-24	
	Lysol All Purpose Cleaner Lemon Breeze[4,5,6,7]	EPA – 777- 66	
	Lysol Disinfecting Wipes[4,5,6,7]	EPA - 777- 114	
	Lysol® IC Quaternary Disinfectant Cleaner[3,4,5,6,7]	EPA - 47371-129	
	Rescue Hydrogen Peroxide Personal Wipes[4,5,6,7]	EPA – 74559-4	
	Sani Cloth Germicidal Disposable Wipes[4,5,6,7]	EPA - 9480-4	
	Up and Up Disinfecting Wipes[4,5,6,7]	EPA – 6836-336-56952	
	Virkon ® S (1%) [4,5,6,7]	EPA - 39967-137	

Other effective treatments with similar water-based applications or chemical formulas (e.g., a minimum of 0.3% quaternary ammonium compound) may exist but remain untested at this time. Find more information on the USEPA or FDA registered product labels by accessing the individual hyperlink or searching USEPA or FDA Registration Numbers at:http://iaspub.epa.gov/apex/pesticides/f?p=PPLS:1 or http://www.accessdata.fda.gov/scripts/cder/drugsatfda/index.cfm

Products with USEPA registration numbers mitigate persistence of living organisms on surfaces and are regulated by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA, 7 USC 136, et seq.). FIFRA provides for federal regulation of pesticide distribution, sale, and use. Within FIFRA, pesticides are defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. FIFRA further defines pests as any insect, rodent, nematode, fungus, weed, or any other form of terrestrial or aquatic plant or animal life or virus, bacteria, or other micro-organism (except viruses, bacteria, or other micro-organisms on or in living man or other living animals) which the Administrator declares to be a pest under section 25(c)(1). Find more information on FIFRA at: https://www.epa.gov/laws-regulations/summary-federal-insecticide-fungicide-and-rodenticide-act.

VI. EQUIPMENT AND ACTIVITY SPECIFIC RECOMMENDATIONS:

1. Clothing & Footwear:

IMPORTANT: All clothing (i.e., inner and outer layers) and footwear should be decontaminated after every site visit using the most appropriate Application/Product in Table 1 or otherwise cleaned and dedicated for use at individual sites or areas as determined appropriate in Section IV.

Use of a disposable suit (e.g., Tyvek® or ProShield®) or site-dedicated, reusable suit (i.e., coveralls) is an appropriate strategy to minimize sediment/soil accumulation on clothing during a cave/mine or bat research activity. All non-disposable clothing layers should still be decontaminated or otherwise cleaned and dedicated after every use.

Contain all used equipment in plastic bags upon final exit from a site, separating disposable materials from reusable equipment. Seal and store plastic bags in plastic containers until trash can be properly discarded, and/or reusable equipment can be properly decontaminated off site.

2. Technical Equipment:

Dedicate, as possible, or decontaminate all safety and other technical equipment (e.g., backpacks, helmets, harness, lights, ropes, etc.) using the most appropriate guidance in Section V. Most types of technical equipment have not undergone manufacturers' consented testing for safety and integrity after decontamination using the applications and products in this protocol. *Carefully review and adhere to the manufacturer's care and use standards to maintain equipment functionality and safety protective features.* If the application/product options in Table 1 are not approved by the manufacturer's care and use standards for the respective equipment, clean and inspect equipment according to manufacturer's specification and dedicate to similarly classified locations. Only reuse in progressively more contaminated caves/mines/bat roosts as determined appropriate in Section IV.

3. Scientific Equipment:

Consider the use of disposable scientific equipment and materials that can be refreshed between contact with individual bats. All disposable scientific equipment (e.g., work surfaces, containers/envelopes, exam gloves, etc.) should only be used to process one bat, then discarded after use. Similarly, reusable equipment (e.g., cotton holding bags, gear bags, gloves, banding pliers, rulers, and other field instruments) should be decontaminated between individual bats. Note: exceptions may be made in situations where all bats being handled are known to be comingling in a roost; however, decontaminating tools between individual bats is still advised. Any bag used to hold bats must be breathable and safe for the animals.

Use the guidance in Section V to determine the relevant procedure for decontamination of all work surface area(s) and equipment (e.g., light boxes, banding pliers, holding bags, rulers, calipers, scale, scissors, wing biopsy punches, weighing containers).

Autoclaving of tools and equipment is an acceptable sterilization measure if feasible and permissible for the items.

4. Mist-Nets & Harp Traps:

Pd can be transferred from a contaminated bat to a mist-net or harp trap bag, and contaminated soil or sediment may cling to the poles, stakes, and other hardware used to deploy nets and traps.
IMPORTANT: If you are trapping bats for Pd surveillance activities, careful decontamination between bats will reduce risk of cross-contaminating samples.

Dedicate, as necessary, or decontaminate all netting and harp trapping equipment that has contacted bats or potentially contaminated ground or substrate (e.g., netting, poles bases, stakes, trap bags, trap lines, trap frame and feet) using the most appropriate application in Table 1. This is only necessary after each night of use when the net and/or trap equipment contacted one or more bats. Any equipment should be decontaminated when being moved away from that location. Disposable harp trap bags or liners and disposable funnel traps can also be used to reduce transmission risks and should be discarded at the end of each night if any bats contacted the bag.

5. Acoustic Monitor, Camera, and Related Electronic Equipment:

Electronic devices used on the landscape (e.g., acoustic detectors, cameras, and weather stations that remain away from roosts) and not handled with contaminated gloves or hands pose a negligible risk of transmission. However, if used near or in roosts, it is important to clean, disinfect, and rinse the feet of tripods, mounting brackets, stakes, or other points that have contacted bats or surfaces of bat roosts.

For electronic equipment and accessories used within bat roosts, dedicate tripods, poles, mounting brackets, etc. for use in single or limited sites, if possible. All devices used inside roosts, including acoustic detectors, cameras, computers, temperature loggers, etc. should be decontaminated using the most appropriate guidance in Section V for the particular equipment. The material composition of this equipment requires careful review and adherence to the manufacturer's care and use standards to maintain their functionality and protective features. If application/product options in Table 1 are not approved by the manufacturer's care and use standards for the respective type of equipment, clean equipment accordingly and dedicate to similarly classified roosts or only reuse it in progressively more contaminated roosts as determined appropriate in Section IV.

Equipment used in a cave/mine/bat roost may be placed in a sealed plastic casing, plastic bag, or plastic wrap to reduce the potential for contact/exposure with contaminated environments. The outer surfaces of plastic protective covers should be cleaned after leaving the cave, mine, or roost and prior to removing the equipment. Plastic wraps should then be discarded (if disposable) or decontaminated (if reusable) using the most appropriate guidance in Section V.

6. Personal Protective Equipment:

When preparing and using disinfectant products or solutions, use personal protective equipment according to the label instructions or Safety Data Sheet (SDS) for the product. If as SDS is not available, chemical-resistant gloves (e.g., nitrile), gown or apron, and face mask with either googles or a face shield are recommended as general precautions. The Centers for Disease Control provides detailed information about proper use of protective equipment for personal safety here: Environmental Cleaning Supplies and Equipment | Environmental Cleaning in Global Healthcare Settings | HAI | CDC

These recommendations are the product of the multi-agency WNS Decontamination Team, a sub-group of the Disease Management Working Group established by the National WNS Plan (A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats, finalized May 2011). On 15 March 2012 the initial national decontamination protocol was approved and adopted by the WNS Executive Committee, a body consisting of representatives from Federal, State, and Tribal agencies which oversees the implementation of the National WNS Plan. The protocol is updated as necessary to include the most current information and guidance available.

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1 - To find published addenda and/or supplemental information, visit http://www.whitenosesyndrome.org/topics/decontamination.

2 - Visit https://www.whitenosesyndrome.org/where-is-wns for the most updated information on the status of counties and states. County and state level determination is made after a laboratory examination and subsequent classification of bats according to the current WNS case definitions. Definitions for the classification can be

found at https://www.whitenosesyndrome.org/working-group/surveillance-and-diagnostics. NOTE: Counties without a Pd or WNS detection should not be assumed to be Pd or WNS-negative.

3 - Information from: Shelley, V., S. Kaiser, E. Shelley, T. Williams, M. Kramer, K. Haman, K. Keel, and H.A. Barton. 2013. Evaluation of strategies for the decontamination of equipment for *Geomyces destructans*, the causative agent of White-Nose Syndrome. Journal of Cave and Karst Studies 75: 1–10. DOI: 10.4311/2011LSC0249 https://www.caves.org/wp-content/uploads/Publications/JCKS/v75/cave-75-01-01.pdf

4 - Information from: Glaeser, J. A. and C. Kunze. *Unpublished Report.* Further Evaluation of Decontamination Products to Minimize Human-based Transmission of *Pseudogymnoascus destructans.* These products were tested by the Northern Research Station, under USDA Forest Service Cooperative Agreement 13-IA-11242310-036 (U.S. National Park Service and U.S. Forest Service) & 16IA11242316017 (U.S. Fish and Wildlife Service and U.S. Forest Service)

5 - The use of trade, firm, or corporation names in this protocol is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by state and/or federal agencies of any product or service to the exclusion of others identified in the protocol that may also be suitable for the specified use.

6 - Product guidelines should be consulted for compatibility of use with one another before using any decontamination product. 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. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

7 - Final determination of suitability for any decontaminant is the sole responsibility of the user. All users should read and follow all labeled instructions for the products/applications and/or understand associated risks prior to their use. Treatments and the corresponding procedures may cause irreversible harm, injury, or death to humans, bats, equipment or the environment when used improperly. Always use personal protective equipment in well-ventilated spaces to reduce exposure to these products or applications.

8 - https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/permits/plant-pests/sa_soil/domestic-soil