

NML-20201008-Blue Owl Inspection Test Samples

Spore Analysis Completed for



40 Whispering Pine Road, Sudbury, MA 1776
978-852-4840

ray@blueowlhomeinspection.com

Collected Date	10/6/2020
Collected Street Address	40 Whispering Pine Road
Collected & Relinquished by	Raymond Phillips
# of Sample Sent	2
# of Sample Received & Accepted	2
Sample/s Received & Accepted on	10/08/2020
Sample/s Received & Accepted by	Janna Komorowski
Sample/s Analyzed on	10/08/2020
Sample/s Analyzed by	Janna Komorowski
Report Approved by	Crystal Hernandez
Report/Test Type	Standard

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Spore Analysis Completed by



Janna Komorowski
Laboratory Director, B.A. in Biological Sciences
PAACB Analyst ID Number: 04190170

Janna Komorowski



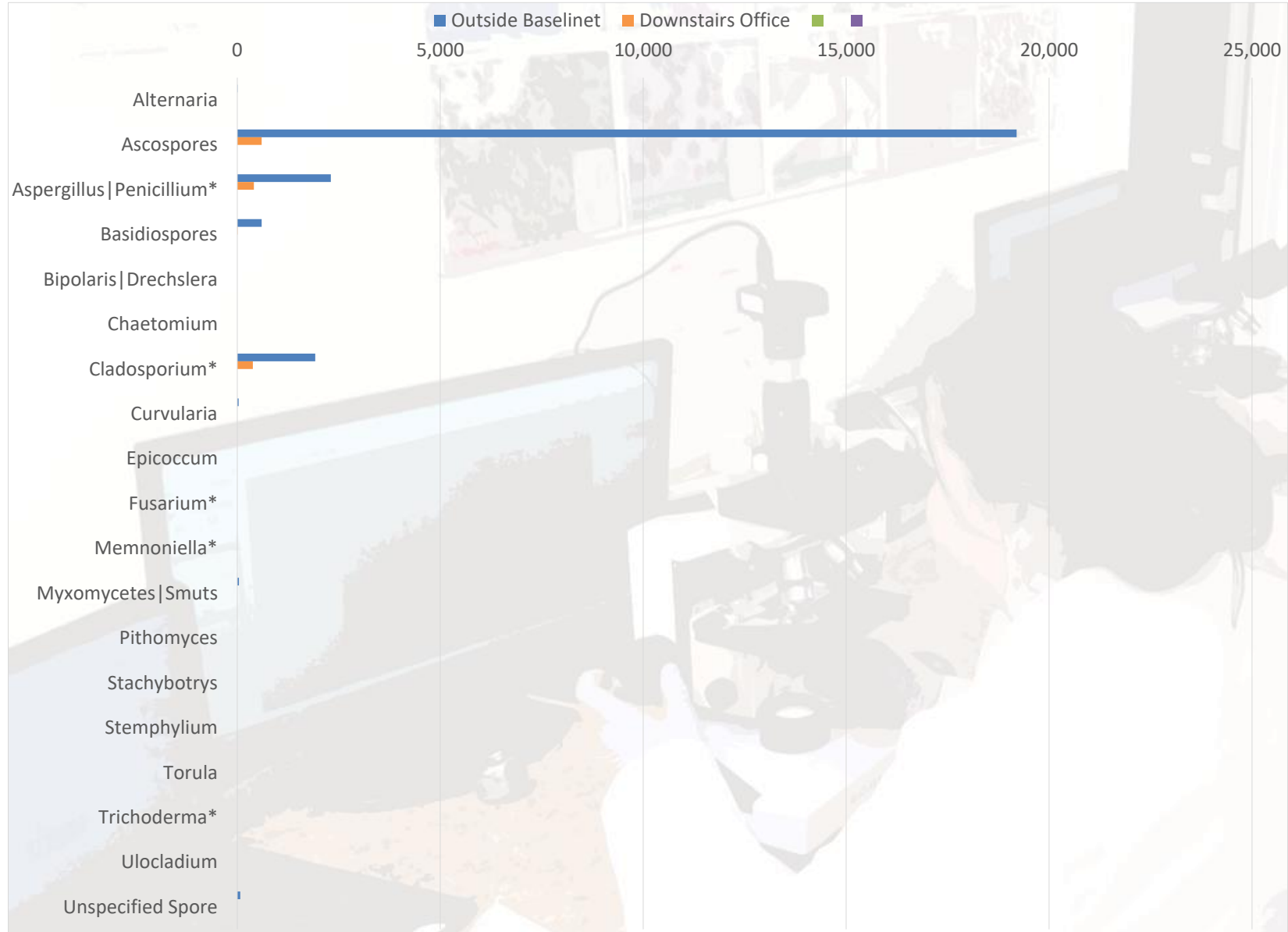
810 Dutch Square Blvd Suite 204, Columbia, SC 29210

Crystal Hernandez
Operations Director, B.A. in Biology
PAACB Analyst ID Number: 07190171

Crystal Hernandez



Property/Customer Name				Site Street Address			Site City			Site State			Site Zip		
Blue Owl Inspection Test Samples				40 Whispering Pine Road			Sudbury			MA			01776		
Company Email				Company Phone Number			Date Collected			Date Received					
ray@blueowlhomeinspection.com				978-852-4840			10/6/2020			10/08/2020					
Company Address				Company Name			Sample Collected by			Date Analyzed					
40 Whispering Pine Road, Sudbury, MA 1776				Blue Owl Home Inspection LLC			Raymond Phillips			10/08/2020					
Newton ML Sample ID		CAE20201008015S001DS		CAE20201008015S002DS											
Sample Name/Location		Outside Baseline		Downstairs Office											
Volume (L)		150		150											
Background		3		3											
Analyt. Sensitivity 100X (Cts/M³)		7		7											
Analyt. Sensitivity 400X* (Cts/M³)		13*		13*											
Sample Type		Spore Trap		Spore Trap											
Organism		Counted	Cts/M³	% of Total	Counted	Cts/M³	% of Total								
Alternaria		1	7	0.03%	Not Detected										
Ascospores		2,880	19,200	79.41%	90	600	42.85%								
Aspergillus Penicillium*		180	2,304	9.53%	32	410	29.25%								
Basidiospores		90	600	2.48%	1	7	0.48%								
Bipolaris Drechslera		Not Detected			Not Detected										
Chaetomium		Not Detected			Not Detected										
Cladosporium*		150	1,920	7.94%	30	384	27.42%								
Curvularia		5	33	0.14%	Not Detected										
Epicoccum		Not Detected			Not Detected										
Fusarium*		Not Detected			Not Detected										
Memnoniella*		Not Detected			Not Detected										
Myxomycetes Smuts		6	40	0.17%	Not Detected										
Pithomyces		Not Detected			Not Detected										
Stachybotrys		Not Detected			Not Detected										
Stemphylium		Not Detected			Not Detected										
Torula		Not Detected			Not Detected										
Trichoderma*		Not Detected			Not Detected										
Ulocladium		Not Detected			Not Detected										
Unspecified Spore		11	73	0.30%	Not Detected										
Total		3,323	24,178	100.00%	153	1,400	100.00%								
Hyphal Fragment		1	7	-	Not Detected		-								
Spore Trap +	Dander*	na		-	na		-								
	Fiber*	na		-	na		-								
	Pollen*	na		-	na		-								
Comments															
Color Code		Common Outdoor		Common Indoor		Water Damage Indicator		Elevated Counts							



Spore Trap Analysis Explanation

Volume	Flow Rate * Flow Rate Minute
Background	<p>None: Recollect</p> <p>1: <5%</p> <p>2: $5\% \leq \text{Background Coverage} < 25\%$</p> <p>3: $25\% \leq \text{Background Coverage} < 70\%$</p> <p>4: $70\% \leq \text{Background Coverage} < 90\%$</p> <p>5: $90\% \leq \text{Background Coverage} < 100\%$, Recollect</p>
Cts/M³	Spore Counts per Cubic Meter
Hyphal Fragment	Fragments of hyphae. Can be an additional indicator of possible mold presences
Unspecified Spore	Less commonly identified spore types, other than those listed on the report
Limit of Detection	1 spore count per coverage examined area
Sample Type	
Spore Count	Spore Trap Cassettes Identification & Enumeration of Fungal Spores
Spore Count+	Spore Trap Cassettes Identification & Enumeration of Fungal Spores + Total Dander, Fiber, and Pollen Count
Spore Trap Analytical Report Method	NML-SAM-1611, adapted from ASTM D7391-9

* Uncertainty available upon request

Alternaria



Growth & Distribution

- Alternaria is one of the most common and widely distributed molds on the planet (2). The reproductive spores become airborne easily and are prolific in the atmosphere worldwide.
- **Growth Rate:** Rapid Mature with 0.5 to 8 days (34)
- **Water activity:** 0.85-0.88 (1)
- **Outdoors:** In the outdoor environment, Alternaria is found in soil, water and plant material- it plays an important role in vegetable matter decomposition (1) . Airborne Alternaria spore counts are often higher around farming and agricultural operations, particularly during harvesting processes when spores are released into the air in large numbers. (3) It is well studied as a plant pathogen having saprophytic effects on a wide variety of vegetation and is often the source of early blights in crops (2). It reaches peak concentrations during late summer and fall (2).
- **Indoors:** Alternaria can be found growing indoors on textiles, dust, wood, carpeting, flooring, drywall or gypsum board, wall paper, furniture, and other cellulose materials. It can be found in humidifiers, heating and air conditioning units, inside of ductwork, and surrounding damp areas i.e. sinks, showers, and windows(1).

Health Effects

- **Allergenic**
 - Considered by some to be among the most common mold allergens in the US (1).
 - Alternaria can cause allergy symptoms following ingestion, inhalation, injection or direct contact.
 - Alternaria spores are airborne allergens (1). Reactions due to inhalation may increase during peak concentration times in late summer and early fall.
 - Inhalation of high concentrations by sensitive individuals may manifest in Type I and Type III hypersensitivity reactions. These include allergic asthma, conjunctivitis (redness of the eye), rhinitis (hay fever), anaphylaxis, angioedema (dermal swelling), urticarial (hives) or hypersensitivity pneumonitis (Type III).
- **Pathogen**
 - Invasion is rare but can occur, particularly in immunocompromised individuals. Cases of onychomycosis (nail infection), sinusitis, ulcerated cutaneous infections, keratitis, phaeohyphomycosis, as well as osteomyelitis and peritonitis in patients undergoing peritoneal dialysis have been reported (1,4).
 - Can occasionally cause phaeohyphomycosis (fungal infection), usually in subcutaneous tissue (6).
- **Toxins/ Metabolites**
 - Alternariol (antifungal uses), AME (alternariol monomethylether), tenuazonic acid, & altertoxins (1)

Found in Sample(s)

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- Ascospores are found worldwide with prevalence and distribution depending on particular genus and species.
- **Outdoors:** Ascospores are found ubiquitously in outdoor environments; often found on dead and decaying plant material. Many types are known to have pathogenic or parasitic properties in plants.
- **Indoors:** Common substrates include damp building materials such as gypsum or lumber, carpeting, dust, and other organic materials.

- Allergen

- Ascospores can be allergenic to sensitive individuals, most often producing Type I or Type III hypersensitivity reactions. These include allergic asthma, conjunctivitis (redness of the eye), rhinitis (hay fever), anaphylaxis, angioedema (dermal swelling), urticarial (hives) or hypersensitivity pneumonitis (Type III). (5)
- Reactions due to spore inhalation may increase following rain or high humidity. (5)
- Unlike some fungi which rely on air currents for spore dispersal, ascomycetes are capable of a more active form of spore dispersal that utilizes water droplets to catapult their spores into the air. Various species of Ascospores are known to use this method to liberate spores every single day, regardless of air flow. Subsequently, exposure to ascospores may be more consistent from day to day than exposure to other spores which are only dispersed with adequate air currents. For this reason these spores may be of particular interest in cases of chronic respiratory disease such as asthma and rhinitis (5).

- **Pathogen**

- Some types can be pathogenic; dependent upon genus and species.

- **Toxins\Metabolites**

- Vary greatly depending on genus and species.

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Aspergillus/Penicillium



Growth & Distribution (7):

- Aspergillus & Penicillium are incredibly adaptive and abundant organisms. Their distribution is world-wide with many species possessing abilities to tolerate environmental conditions that challenge other molds (i.e. extreme temperatures & pH levels, restricted water availability and exposure to radiation). Colony growth rates are rapid for many species. Mature colonies are capable of quickly producing large numbers of spores. Because of the morphological similarity of the spores, the two genera are typically grouped together as “Aspergillus-Penicillium.”
- **Growth Rate:** Usually Rapid – Mature within 3-4 days; however, some species are slower(6).
- **Water Activity:** Aspergillus: 0.93-0.97 & Penicillium: 0.88 – 0.99 (33, 35)
- **Outdoors:** Both can be found outdoors on a variety of substrates- particularly plant materials such as cereals, grains, decaying wood, and soil (7).
- **Indoors:** Found indoors on organic materials such as wood, textiles, cellulose materials, carpeting, painted surfaces, and food stuffs such as cheeses, butter/margarine meats, breads, fruits and vegetables. Halotolerant species may be found growing on refrigerated foods (7). Penicillium is used in cheese production and is responsible for the veins in blue cheese.

Health Effects

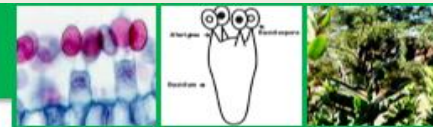
- **Allergen:**
 - Because these spores are so abundant, daily exposure to Aspergillus/Penicillium is very common in both indoor and outdoor environments. Often this exposure occurs without any noticeable reaction or symptoms. However, sensitivities may develop in some instances- especially with prolonged exposure to high spore concentrations. This can result in allergic responses.
 - Spores may progress further into the respiratory system than other common spores due to their small aerodynamic diameter.
 - Penicillium is the mold from which the antibiotic Penicillin was first derived. Penicillin is now made synthetically. It does not contain the mold Penicillium. Allergy to one does not necessarily imply allergy to the other.
- **Pathogen (6,7):**
 - There are approximately 175 species of Aspergillus, only about 20 of which are known to cause disease in humans.
 - Diseases caused by Aspergillus are known as aspergillosis and include invasive infection, colonization, & toxicosis.
 - Certain species of Penicillium are considered pathogens. Infection may occur in skin, blood, bone marrow, internal organs or lymph nodes. (6). In the immunocompromised (particularly HIV patients or those who have recently been in Southeast Asia) *P. marnefei* can cause severe infection capable of affecting respiratory, lymphatic, and nervous systems.
- **Toxins/Metabolites:**
 - Different species of Aspergillus/Penicillium are associated with an array of mycotoxins and metabolites, some of which are medically significant in humans. The importance of these toxins can vary from species to species and depends largely on the prevalence of that species.

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Basidiospores



Growth & Distribution:

- Basidiospores are spores produced by the division of Fungi known as Basidiomycota. These spores are unique for lacking septation, containing bilateral symmetry, and often having a visible pore at the site of detachment from the basidium (7). This is a large group of organisms consisting of a large number of individual genera & species. Distribution is world-wide with the prevalence in any given area varying for each genus and species. Like ascospores, basidiospores disperse using water droplets. Therefore, airborne spore concentrations are often higher following rain or high humidity. This division includes edible mushrooms.
- Outdoors:** Basidiospores are found growing on plant material, organic debris, and soil. Many species of basidiospores are known to be plant pathogens.
- Indoors:** Basidiospores may be found growing on damp materials. Colonies may grow given sufficient access to water (leaks, flooding, high humidity, or surrounding plumbing, heating/air conditioning components, appliances, house plants, etc.).

Health Effects:

- Allergenic:**
 - Exposure to these spores is commonplace in both indoor and outdoor environments. Nonetheless they are also potentially allergenic. Allergic responses may occur following inhalation, ingestion, or direct contact. Reactions due to inhalation may be increased following rain or high humidity when spore concentrations are often elevated.
 - In sensitive individuals, typically manifest Type I or Type III hypersensitivity reactions. These include allergic asthma, conjunctivitis (redness of the eye), rhinitis (hay fever), anaphylaxis, angioedema (dermal swelling), urticarial (hives) or hypersensitivity pneumonitis & allergic sinusitis (Type III). (5)
- Pathogenic:**
 - Invasion is not typical but can occur, particularly in the immunocompromised or immunosuppressed. These infections can include sinusitis, keratitis, phaeohyphomycosis, & peritonitis.
- Toxins\Metabolites:**
 - Mycotoxins vary depending on genus and species. They are especially relevant in edible fungi of this division such as mushrooms.
 - Common sources of mushroom poisoning include *Amnita*, *Lepiota*, *Coprinus*, & *Psilocybe*

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Cladosporium



Growth & Distribution:

- Cladosporium are found in air and soil worldwide. Cladosporium are among the most common airborne fungi (4). Spores are produced in abundance and easily disperse through the air. Extremely common on decaying organic matter. These mold are common plant pathogens. Molds of this genus are dematiaceous with over 40 named species (1).
- **Growth Rate:** Moderately Rapid – Mature within 7 days. (6)
- **Water Activity:** 0.85-0.88 (1)
- **Outdoors:** Cladosporium can be found on food sources such as cereals, fruit, vegetables. Commonly found on dead plants and shrubs in temperate regions. Halotolerant (salt tolerant) species exist. (7) The most common species isolated from plant materials & soils (*C. cladosporioides*) experiences peak airborne spore concentrations between June/July and September/October in temperate climates (2).
- **Indoors:** Cladosporium can be found on water damaged materials (i.e. plaster, paint, textiles, gypsum, wall paper, wood, moist window sills). May affect food sources such as cheeses, butter/margarine, vegetables, fruits and vegetables(7). Often found on the surface of fiberglass duct liners, in bathroom showers, and on basement walls (2). Some studies have reported Cladosporium in 70% of homes examined in the US & 100% of homes examined in Canada (1).

Health Effects:

- **Allergen:**
 - Allergic reaction to airborne spores are of particular importance because these spores exist in in such high concentrations in the air. Symptoms may increase during peak concentrations from June-October. Sensitization may occur. (1)
 - In sensitive individuals typically manifest Type I or Type III hypersensitivity reactions. These include allergic asthma, conjunctivitis (redness of the eye), rhinitis (hay fever), anaphylaxis, angioedema (dermal swelling), urticarial (hives) or hypersensitivity pneumonitis & allergic sinusitis (Type III). (5)
- **Pathogen:**
 - Is pathogenic in humans very rarely, reported cases include skin lesions, keratitis, onychomycosis, sinusitis, pulmonary infections (1).
- **Mycotoxins/Metabolites:**
 - Cladosporic acid (12)
 - Gibberellin (hormone influencing developmental processes in plants) & ergosterol (precursor to vitamin D2 which may have anti-tumor properties). (1)
 - Toxic effects have been seen in animals (chicken embryos & horses) but not known to be reported in humans to date (1,2).

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Curvularia



Growth & Distribution

- Curvularia is found world-wide with a particular preference for the tropics and warmer climates (7). Spores usually have a unique curved shape caused by an enlarged central cell (2). Airborne spores are common in both indoor and outdoor environments worldwide.
- **Growth Rate:** Moderately rapid - 4 to 12 days (32)
- **Water activity:** 0.80 (this is a generalized number for common molds) (26)
- **Outdoors:** Curvularia is typically seen growing on plant material. They are weakly pathogenic to plants and are the cause of leaf spots, seedling blight, and failing of seedling germination (2).
- **Indoors:** Curvularia may be found growing on materials containing cellulose such as woods and grains. Growth is less frequent indoors but may be seen on food.(7)

Health Effects:

- **Allergen:**
 - Poorly studied but believed to be an allergen and irritant (13).
 - In sensitive individuals typically manifest Type I or Type III hypersensitivity reactions. These include allergic asthma, conjunctivitis (redness of the eye), rhinitis (hay fever), anaphylaxis, angioedema (dermal swelling), urticarial (hives) or hypersensitivity pneumonitis & allergic sinusitis (Type III). (5)
- **Pathogen:**
 - Believed to cause corneal infections in the immunocompromised (14)
 - Opportunistic infections of cornea and sinuses, nails, subcutaneous tissue, and systemic organs. Dissemination to the brain can occur rarely. (6)
 - Can be causal agent in mycetoma (6):
 - Infections of subcutaneous tissue and skin. Untreated, chronic infections may progress to involve muscle, fascia & bone. Typically seen on the lower leg or foot, rarely disseminated.
 - Fungi enters the skin via wound, a nodule slowly develops into a tumor or abnormal tissue mass beneath the skin, cavities are formed within the mass and discharge occurs.
 - This is a rare condition which is not contagious. (6) Most infections occur in immunocompromised hosts. (2)
- **Toxins/Metabolites:**
 - Some toxins produced- mainly studied in plants.

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Myxomycetes



Growth & Distribution

- Myxomycetes is a large class with approximately 500 individual species and worldwide distribution (25). Interestingly, these organisms are no longer considered to be true fungi like other molds, but have been reclassified as protozoans. These organisms belong to group commonly called “slime molds” that exhibit an amoeba-like stage. Spores are common in both indoor and outdoor environments worldwide (15). Spores can be dispersed by air, arthropods and other animals due to their small size (4 – 20 µm)(25).
- **Growth Rate:** Generally Rapid – Mature within 2 to 4 day; however, specific growth rate does depend on species (24).
- **Water Activity:** 0.80 (this is a generalized number for common molds)(26).
- **Outdoors**
 - Found in soil, decaying plant material (especially damp wood), and dung. Species of Myxomycetes are not as geographically constricted as most organisms; most Myxomycetes species can be found world wide. (15)
- **Indoors**
 - Can be found growing indoors on damp building materials such as cardboard, wallpaper, gypsum board, wood, etc.

Health Effects:

- **Allergen:**
 - These spores are very common in both indoor and outdoor air. They are small, foreign particles which may be inhaled deep into the respiratory system and may cause allergic responses.
 - In sensitive individuals, typically manifests Type I or Type III hypersensitivity reactions. These include allergic asthma, conjunctivitis (redness of the eye), rhinitis (hay fever), anaphylaxis, angioedema (dermal swelling), urticarial (hives) or hypersensitivity pneumonitis & allergic sinusitis (Type III). (5)
- **Pathogen:**
 - Unknown
- **Toxins/Metabolites:**
 - Unknown

Founded in Samples(s)

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