Whiskey Aging Warehouses and the Effects to Surrounding Residential Neighborhoods in Louisville, Ky.

September 4, 2012

This report summarizes the background, research, and preliminary analysis of complaints around whiskey aging warehouses submitted to the Louisville Metro Air Pollution Control District concerning an unknown black substance accumulating on residential properties.

Jefferson County Community Complaints

Previous Complaints

In 2006, residents living near a distillery in Shively, Ky. – a part of the merged city of Louisville Metro – came to a community meeting hosted by then-Metro Mayor Jerry Abramson to voice concerns about black soot accumulating on their homes and damaging trees. Mayor Abramson forwarded the residents' concerns to the Louisville Metro Air Pollution Control District (APCD) for investigation. In May 2007, APCD released a statement indicating that in 2005, investigations were conducted on the distillery and nearby homes that revealed the black substance was mold and unrelated to the distillery. The distillery also stated that it was not responsible for the mold growth (Quality, 1994), but voluntarily contacted the complainants and had their homes pressure-washed (Springston, 1994).

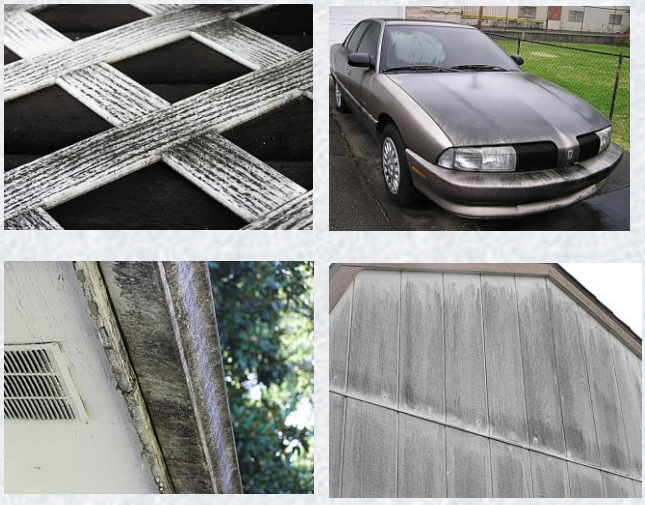
In addition to addressing the Mayor, the residents also conveyed their concerns to the distillery asking for an investigation into this matter. Unfortunately, these concerns were left unanswered for nearly one year because the request did not reach the correct personnel within the distillery. (Edelen, 2007).

Recent Complaints

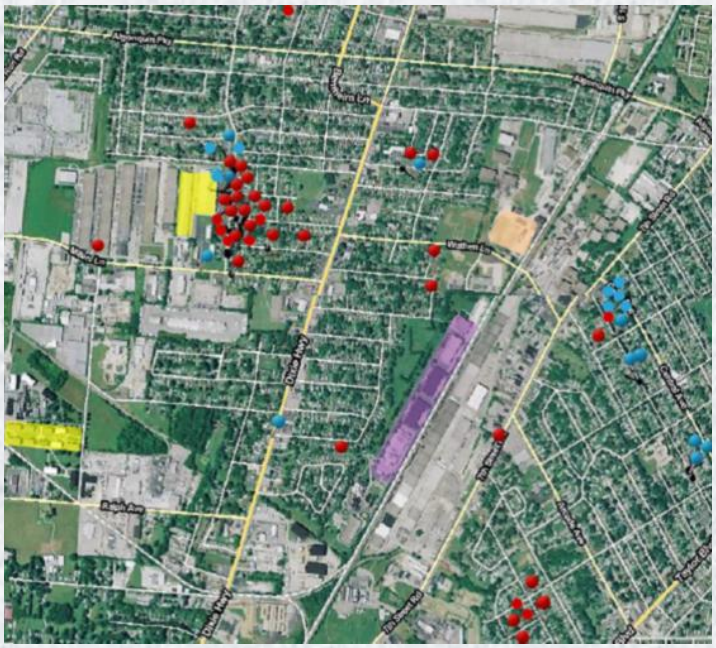
APCD has received complaints concerning a black, sooty substance that is accumulating on residential properties near whiskey aging warehouses. The complainants have stated that not only is the black soot a nuisance, but it also causes cosmetic damage to property. The complainants have made repeated attempts to remove the black soot from their properties by pressure-washing and painting. Unfortunately, this has not corrected or repaired the damage. Other homeowners have removed trees from their property due to the build-up and damage caused by the sooty substance.

APCD has also received complaints concerning objectionable odors detected in neighborhoods near whiskey aging warehouses. The odor complaints describe a smell similar to stale alcohol, vinegar, yeast, spice, wood, and baked goods. Investigations performed by APCD compliance officers have revealed an alcohol-type odor being emitted from the aging warehouse located in or near the residential neighborhoods.

The APCD responded to each complaint and performed a detailed investigation into the identification and cause of the black, sooty substance and odors. During the District's investigation, compliance officers took photographs of the properties affected (e.g. siding, lawn furniture, vegetation, vehicles, etc.), and collected surface samples from several complaint locations.



From top left to right clockwise: Plantation Dr., Plantation Dr., Plantation Dr., Hardesty Dr.



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Global Accounts of Similar Reports



Reports of a black, sooty substance located in close proximity to distilled spirit warehouses have been reported worldwide. One such report in Bonnybridge, Scotland, shows residential homes located near whiskey warehouses becoming severely blackened, along with blackening of local vegetation to the extent that it has died off (BBC News, 2009).

For years residents in Dumbarton, Scotland, have battled a fungal substance that they call "whisky black" (Kemp, 2011). The residents claim the mold is linked to the warehouses near their neighborhood, where the black fungus clings to brick, wood, and metal. Similar blackened buildings can be found in places like West Lothian, UK (Mcwhirter, 2011), Cognac, France (Weiner), Ontario, Canada (Smith, 2011), Bardstown, Ky. (Curtis, 2004) and Loretto, Ky. (Wykes, 2010)

Research

The District's analyses and research indicate the black soot and odors are the result of emissions from whiskey aging warehouses. During the aging process, whiskey is stored in oak barrels for several years, and throughout this process, 2% of the whiskey evaporates annually from each barrel in the form of ethanol, otherwise known as the "angel's share." Research performed by mycologist Dr. James Scott and his company, Sporometrics Inc., genetically analyzed the black, sooty substance, and identified it as a mold called Baudoinia Compniacensis (a.k.a. "whiskey fungus") which thrives in ethanol-rich environments.

Discovery and Evolution of the Whiskey Fungus

In the 1870s, the pharmacist Antonin Baudoin called attention to a black, soot-like growth on buildings near spirit aging warehouses in the town of Cognac, France. In 1881, the black soot was classified as a fungus named *Torula Compniacensis*. Remarkably, the fungus was forgotten by science for 80 years, then briefly studied by Scandinavian and French researchers in the 1960s. Finally, in the late 1990s, the public became aware of health problems associated with black mold in water-damaged buildings, and associated these same problems with the soot-like fungal growths found on distilleries. Thus, attention was once again given to the study of Torula Compniacensis (Sporometrics, 2009).

One such place attracting attention was the Hiram Walker Distillery located in Lakeshore, Ontario, Canada. The Distillery had been studying the black substance accumulating on neighborhood homes for nearly a decade. The fungal growths could be seen on structures as far away as a mile from the whiskey warehouses, with the thickest growths observed closer to the warehouse. The nature of the fungus, however, baffled modern experts. Ordinary culturing as well as the most modern genetic sampling techniques were unsuccessful due to the organism's slow growth and the overgrowth of competing "weed" fungi, that accumulated on top of the primary black growth (Dixon, 2009).

Eventually, the problem was solved by mycologist Dr. James Scott and his company, Sporometrics Inc. Dr. Scott determined that the fungus seemed to grow only where ethanol vapors were present in the air. Therefore, he added ethanol to the growth medium at low concentrations. The initial slow-growing fungi finally grew well enough to be sorted out from the overlying "weeds" and brought into pure culture. This led to the identification of a new fungal species called *Baudoinia Compniacensis* (Rogers, 2011).

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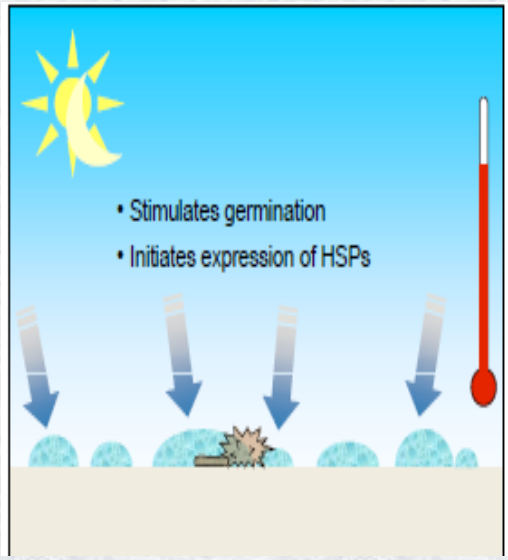
Understanding Baudoinia Compniacensis

The production of whiskey requires storing or aging in oak barrels for several years. During this aging process, at least 2% of the whiskey (per barrel) evaporates each year. Whiskey evaporates in the form of ethanol vapors, which distillers call the "a*ngels share*" (Ewaze, 2008).

Studies reveal that *Baudoinia Compniacensis* thrives in environments with low levels of ethanol vapors, such as those in close proximity to distillery aging warehouses and commercial bakeries (Dixon, 2009). *Baudoinia* also favors surfaces with extreme environmental exposures, such as roofing materials and exterior walls subjected to full sun exposure (Scott, 2007). The pronounced blackening of *Baudoinia* on exterior building surfaces can often be seen a considerable distance away from an ethanol emission source, indiscriminately colonizing on the exposed surfaces. Mature colonies of *Baudoinia* are crust-like and scorched in appearance, sometimes reaching 1-2 cm in thickness (Grigoriev, 2011).

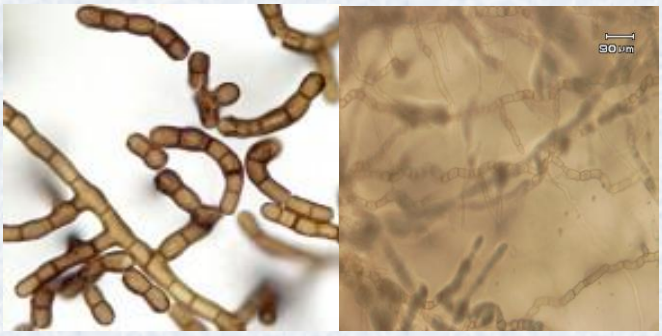


Low-levels of ethanol vapors affect *Baudoinia Compniacensis* in two ways. First, ethanol vapors act as a stimulant for germination by accelerating fungal growths. Second, ethanol stimulates the production of heat-protective (or heat-shock) proteins, which act as a shield against high temperatures.

Another feature of *Baudoinia Compniacensis* that allows it to thrive in extreme environments is the production of trehalose, a carbohydrate storage compound and energy source for germinating fungi. In other words, *Baudoinia* has the capability to make and store its own food for use during stressful conditions. The presence of ethanol makes trehalose production capable (Al-Naama, 2009).

Microscopically, *Baudoinia Compniacensis* appears as a thick-walled, darkly-pigmented hyphae (long-branching filamentous structure of a fungus which is also the main mode of vegetative growth) that separates to form barrel-shaped conidia. The cells are rough-walled and arranged in chains of short, rounded cells, which can break into fragments, making it resemble dead debris. Visual observations reveal the fungus growth as dark spots, streaked, or clumped (Scott, 2007).

Left to Right; Dr. James Scott image of B. Compniacensis and APCD image of surface sample from Plantation Dr.



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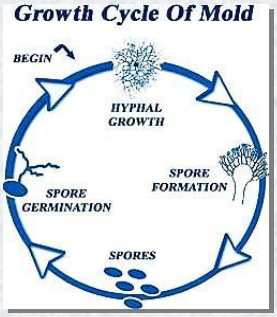
The Basics of Fungi/Mold

There are between 1.5 million and 5 million species of fungi on earth, and only 100,000 of them have been named. Of those named, barely a fifth have gene sequences and only a couple hundred, mostly yeasts, have been sequenced completely.

A fungus is a non-motile microorganism that contains a nucleus, produces branched structures, and has a cell wall that contains cellulose (inert carbohydrate). Fungi absorb nutrients from their environment, such as dead or living organic matter, and lack photosynthetic pigments. Fungi can exist as a yeast form, a filamentous form (mold), or can be both depending on the incubation temperature.

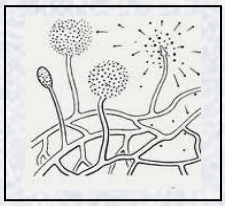
Molds are elusive and will be more prevalent at different times of the day or night, depending on their type. Molds need four things to thrive:

1. Food
2. Fungal spore
3. Moisture (water)
4. Preferably warm temperature (40^0-100^0 F) with humidity above 60%



The spores of fungi that become mold are always present in the air and on objects. When the temperature and moisture in the environment are suitable for germination, the fungal spores burst and take the shape of a thread-like filament (long strand or fiber) called a "hyphae." Usually the object it grows on is also its food source. When the hyphae forms a mass, called a "mycelium," four to nine days afterwards, the mycelium begins to produce spores of its own. At maturity, spore sacs release their spores and move about via air currents or by adhering to insects, animals, or water, eventually landing on other material to begin the reproductive cycle again.

Mold Removal



Molds release tiny spores to reproduce, just as some plants produce seeds. Mold spores can be found in both indoor and outdoor air, and settled on indoor and outdoor surfaces. When mold spores enter a damp environment, they can begin growing and digesting whatever they land upon in order to survive. Since molds gradually destroy the things they grow on, eliminating mold growth will prevent damage to building materials and furnishings (Agency, 2011).

Common anti-fungal remedies like copper and zinc salts improve short-term resistance on a range of materials, but do not deter long-term growth. Additional treatments include pressure-washing, applying approved anti-fungal cleaners, and applying bleach water. However, these treatments are only temporary, while long-term solutions have yet to be studied. Professional mold remediation services should be consulted prior to any treatment (Sporometrics, 2009).

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