LUMBERYARD MOLD IN NEW CONSTRUCTION AND ITS COMPLEXITIES

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Lumberyard mold, the dark, fluffy, patches on new lumber, has become an issue in new construction. When the presence of lumberyard mold is discovered, indoor air quality professionals (IAQ) are frequently called upon during the construction process to assess, assist and answer mold-related questions.

Various stakeholders such as the developers, risk managers, banking representatives, contractors, and other persons with an interest in the project may raise questions regarding the presence of fungal growth on the lumber used during the construction process and its subsequent liabilities.

Design and construction firms are frequently faced with construction defect claims that involve mold related problems. Construction defect claims can commonly be accompanied by other claims for property damage, delays, profit losses, interruption of business, breach of contract, or payment disputes. Sometimes mold-related claims can also be accompanied by or evolve into class action lawsuits, where personal injury is declared due to mold exposure and mold related problems.

Each year millions of dollars are spent in the United States on mold related problems. All of the parties involved in a new construction project, such as designers, suppliers, architects, engineers, owners, contractors, developers, etc, are subject to the possibility of facing mold related claims. Risk management tools and steps can prevent or reduce the likelihood of mold related claims and/or problems in the future.

1. What is Lumberyard Mold

Lumber and other modern building materials found on construction sites provide potential food sources for fungal growth. Lumberyard mold is a term often used to encompass a wide variety of fungi that are visible on new wood, and wood products. Lumber is differentiated into sapwood and heartwood. Sapwood refers to the area near the bark and heart wood to the center of the tree.

Heartwood is more resistant to decay and fungal growth as a result of deposition of chemical substances (a genetically programmed process) and can still chemically react to decay organisms when dead. Heartwood is usually much darker than sap wood and appears in a cross-section as a usually colored circle. Framing lumber and other construction wood products are usually sap wood. (photo Univ. Wisconsin)

All wood in a tree is first formed as sapwood. Its principal functions are to conduct water from the roots to the leaves and to store up and give back, according to the season, the food prepared in the leaves. Sometimes trees need to grow to
considerable size before any heartwood begins to form. In building construction, it is mainly the sapwood section of the lumber which is affected by lumberyard mold and the secondary growth of other fungi.

Based on their ability to penetrate wood tissue, wood inhabiting fungi that can grow in a lumberyard or a building construction site can roughly be grouped into surface, sap stain and decay fungi.

1.1 Surface Molds - Microfungi
Surface molds can grow on the surface of freshly cut wood and utilize the wood carbohydrates as a nutrient source. Some of these molds can also grow on the hyphae and mycelia of other fungi. Surface molds cause discoloration of the wood surface by their pigmented spores and mycelia, usually they do not damage the wood structure.

1.2 Sap Stains - Ascomycetes
Sap Stain fungi utilize nutrients stored in the sap wood tissue and cause discoloration of wood tissue by their dark pigmented mycelia, spores, and melanin produced by the fungi. Sap stain fungi do not significantly decompose wood cell wall components, but they may reduce the wood strength and increase wood permeability making the wood more vulnerable to further microbial attack. Species such as Ceratocystis, Ophiostoma, and Graphium are common sap stain fungi found on lumber. These fungi are the ones most often identified from the dark, fuzzy growth on the surface of lumber. (Photo University of Wisconsin)

Microfungi such as Alternaria and Aureobasidium also can contribute to the sap stain fungi.

1.3 Wood Decay Fungi – Basidiomycetes – (Mushrooms)
Wood decaying fungi can pose real damage to lumber and wood products. Wood decaying fungi penetrate into wood tissue and destroy the wood structure compromising its structural integrity. They destroy the wood structure by attacking both the sapwood and heartwood of wood and wood products.

On lumber, both new and old, basidiomycetes most often appear as white or brown fan shaped patches (mycelial fan). They can also appear as root like structures (Poria incrassata).
2. Evaluating Lumberyard Conditions

“All fungi have four basic elements for growth: suitable temperature, oxygen, food and moisture. Eliminating one of these elements can prevent fungal growth” (Scheffer, 1940, 1973). Controlling temperature and oxygen on a construction site is typically not practical therefore controlling moisture is an effective way of prohibiting or reducing fungal growth. Reducing the moisture content of lumber can help decrease the likelihood of mold formation on the wood selected for the project. “Lumber at moisture contents greater than 20% without drying can allow decay fungi to develop” (Forrest Products Laboratory, 1999).

The type of visible mold growth on lumber can vary from a simple stain, the presence of varying amounts of dark Ceratocystis and/or Ophiostoma mycelia, secondary scavenger fungi such as Trichoderma, Penicillium and Aspergillus or wood decay fungi and its mycelia. We developed a 3-tiered evaluation process for our projects consisting of the following parameters.

2.1 Visual inspection
We conduct a general assessment of the extent and degree of the affected lumber and develop an overall estimate on how much of the wood surfaces are affected by fungal growth. We inspect the three or four accessible sides of a piece of lumber and determine the approximate fungal coverage in percentage (%) of the entire surface area. We summarize the overall affected surface area which commonly varies from 0.1%, 1%, 2% or 5% of the total lumberyard surfaces.

2.2 Surface Sampling
Collection of cello or swab surface samples to confirm the presence of mold and to determine the type of molds present. Laboratory analysis results could show staining only, presence of Sap stain mold, surface mold, or secondary scavengers such as Penicillium or Tricoderma. The presence of the micro fungi secondary colonizers can affect the recommendations for remediation. When Aspergillus, Penicillium, and Tricoderma species or other microfungi implicated in health effects are present, the appropriate level of personal protection should be utilized in all phases of the remediation.

2.3 Moisture Measurements
Pin probe type moisture meters are used to ascertain the Moisture Content (MC) of the installed or stored lumber. Representative areas are selected and data is recorded to assess the moisture condition. In general:

- Wood is considered dry below 15 to 17 MC
- Potential for mold growth with >17% MC
- Potential for wood decay fungi with >20%MC

The amount of moisture present in the wood is also a mater of the ambient weather conditions. Local temperatures and relative humidity need to be taken in consideration.

2.4 Evaluation Criteria
Use the site inspection observations, moisture measurement data, laboratory analysis results and risk management tools to determine your opinion and recommendations.

A visual inspection, moisture survey, and/or sampling conducted by an indoor air quality professional can be used to help provide remediation recommendations based on moisture content as well as the amount and types of mold present.
2.5 Summary

Many industry publications opine that lumberyard mold does not create an indoor air quality issue because the *Ceratocystis* and *Ophiostoma* species are rarely found in indoor air samples and have not been implicated in health issues. If these fungi are present, they are inside wall cavities or in unfinished attic spaces and crawl spaces.

More definitive research needs to be conducted and the presence of the microfungi / secondary colonizers (“mold eats mold”) evaluated.

3. Remediation Approaches

Remediation efforts to treat mold on wood at a new construction site depend on the amount of mold, the type of mold present, moisture content, and the likeliness of a moisture source being introduced in the future. All sources of moisture intrusions and/or leaks, including but not limited to: plumbing, drainage systems, inadequate ventilation, irrigation, etc. should be identified and eliminated. The presence of microbial contaminants will continue or return unless the sources of moisture are identified and eliminated.

Remediation requires the removal of the visible fungal growth. The dark stains will not likely be removed, only the surface growth. The stains penetrate into the wood and, though unsightly, are usually only a visual discoloration.

Remediation may be conducted by regular construction personnel working on the job site. However, they should receive training on proper cleanup methods, personal protection, and potential health hazards. Individuals performing the work should wear respiratory protection, gloves, and eye protection. When there are heavy amounts of mold growth present on a large number of lumber or wood products, then professional remediation services may be required.

Containment of the work area is not typically necessary at a new construction site open to the outside environment. The immediate work area should be unoccupied during mold cleanup and dust suppression methods such as HEPA vacuuming and scrubbing, misting or damp wiping.

Surface molds and stain fungi present on lumber should be treated with an abrasive cleaning method, such as wire brushing, sanding, and media blasting. If lumber with decay fungi are present or the wood looses structural integrity during the cleaning process, these materials should be removed and replaced. Refer such judgment calls to a structural engineer or qualified
contractor. Wood products made with OSB, which shows fungal growth, should be individually evaluated as the fungal mycelia frequently penetrates into the product beyond where surface removal is effective.

Air sampling for fungi is not recommended as part of a routine assessment at a new construction site (open to the environment, high dust levels, lots of debris, etc…). It is important to remember that sampling is not required for remediation efforts to take place.

By being proactive and following through with risk management steps to assess, prevent, treat mold growth, and document efforts taken, the stakeholders can minimize and prevent the chances of indoor air quality concerns and mold related claim problems in the future.

4. Case Study - New Construction - 290 Unit Apartment Complex

The case study was prompted after the head framer raised a red flag and stated that something just doesn’t look right with the lumber. The owner of the property walked the construction site and did not like the cosmetic look of the wood framing. The senior superintendent noted heavy amounts of black growth on a significant amount of the lumber. A third party mold remediation company was called in to inspect the situation. Following their inspection, the mold remediation company requested that an indoor air quality professional be contacted.

We were contacted by the senior superintendent at the construction site as an independent third party to conduct visual inspections, moisture surveys, documentation, and limited sampling to assess the amount of mold growth, determine the types of molds present, and provide guidance on appropriate selection of materials, storage techniques, and what remedies should be taken.

During our visual inspection, we documented heavy lumberyard mold/mold growth on wood framing members, ceiling joists, and various other wood studs. Moisture meters were used to measure and document the moisture content of the lumber at the site. Levels as low as 12% and as high as 28% were obtained with the Delmhorst DB 10 moisture instrument. Surface samples were collected in suspect areas that exhibited fungal growth for identification and documentation purposes. Fungi identified included Ceratocystis / Ophistoma type, Aspergillus/Penicillium type, Gliocladium. Gliomastix, Tricoderma, Gonadobotrium, Acremonium and Tricoderma.

Following our inspections at the construction site, the findings were discussed with the parties involved (Project Manager w/Builder, Project Manager w/Framing Company, Vice President w/ Framing Company, Owner of the property, etc…). We provided consultation services as well as offered remediation recommendations to assist in developing and documenting proper techniques that would help a construction project avoid potential fungal issues in the future. We educated the involved parties about the potential for mold problems, proper cleanup methods, personal protection, and when to seek expert advice. To help minimize and prevent the chances of indoor air quality concerns and mold related claims problems in the future, the involved parties at the construction site were proactive with risk management steps to assess, treat mold growth, and document their efforts.
Fungal growth present on lumber installed at the construction site. 

Moisture content of mold contaminated lumber (25-28%).

Penicillium and Gliocladium identified in surface sample collected from lumber.

Gonatobotryum, hyaline hyphae & spores, Penicillium/Aspergillus identified in surface sample collected from lumber.

Lumberyard mold, Acremonium, Gliomastix, Penicillium/Aspergillus and Penicillium identified in surface sample.

Moisture content of mold contaminated lumber (17-19%).

Moisture content of non-contaminated lumber (11-12%).

Construction personnel using abrasive cleaning methods.

Construction personnel inspecting lumber delivered to the site, prior to installation.

Construction personnel wearing respirator, gloves, and eye protection.

Wood products stored off the ground at the construction site.
5. Conclusions and Prevention Methods

- Communication and project management are important practices to help create a proper sequence of work as well as maintain an appropriate delivery schedule for building materials.
- Architects, envelope engineers, mechanical engineers, etc. should be informed of any potential moisture and/or mold related issues.
- Communication and project management is also important in the building material selection process.
- All wood and wood products should be inspected before they leave the lumberyard.
- Building materials delivered to a job site should be stored appropriately.
- Lumber should be stored off the ground and away from moisture sources.
- The use of tarps or plastic sheeting, which allows for air circulation, may sometimes be necessary during storage. Inspection and assessment plans should be implemented in order to address if moldy lumber is delivered to a construction project.
- Risk management steps should be taken to help prevent possible mold and moisture related problems at a construction site.
- These include, but are not limited to, the selection and quality control of materials used, proper storage techniques, moisture control, time schedule management, and when to seek expert advice.
References


Zabel, Robert A. and Jeffrey J. Morrell, 1992, Wood Microbiology, San Diego, CA

Photos except where noted, were taken by Andrew Jordan with ET&T