**Mold Fast Facts**

* Thousands of species of molds (multicellular filamentous) and *yeasts* (single cell)
* Molds are ‘ubiquitous’ (found throughout) the environment (except for clean room environments, they are present indoors)
* All molds require moisture for growth, but vary in requirements
* All Mold spores (asexual reproductive structures) are potential allergens
* Molds (fungi) produce odorous, irritating volatile compounds. These may affect eyes, respiratory tract, mucous membranes, skin, and can be associated with headache, nausea, transitory nervous system effects, and other systemic health effects.
* Molds produce toxins. *Toxic effects though wide-ranging, are most often associated with environmental conditions and heavy exposure (agricultural or frequent/ significant).*
* Some molds are ‘opportunistic pathogens’ (can *infect* immune-compromised persons such as the elderly, those in cancer treatment, or otherwise weakened immune systems)
* Limited mold growth (visible) on a surface – does not equate to an unacceptable exposure risk.
* Mold growth in a building or within building systems DOES degrade materials and indoor environmental quality
* Mold growth in porous structures or materials, may not in all cases be eradicated
* *Mold-related symptoms though transient, may have significant operating impact:*
* *Mold-related building problems lead to significant employee concerns, AND*

*trigger time-sensitive response expectations. – Can lead to perception of failed or lacking response.*

* *Can lead to formal OSHA Complaints*
* *OSHA Complaints readily necessitate > 40 man-hours, and can lead to significantly higher response time commitments.*
* Mold and relative humidity:
* Airborne relative humidity routinely exceeding 65% significantly increases likelihood of indoor mold growth
* %RH < 60% will significantly reduce potential mold growth
* Optimum %RH range for occupant comfort is 30 – 60%.

**Design/ Construction Practices and Mold**

Design and construction practices have a profound impact on the potential for mold growth in a building or structure, …*or the elimination of those potentials.*

**Unfortunate Scenarios –** *Do any of these sound familiar?*

* O/A intakes located within mechanical- or window-wells (prone to poor rainwater drainage, accumulating leaf litter/biomass), OR surrounded by water-sorptive plant material
* Construction leaks leading to wetted HVAC duct/liner materials
* HVAC design or operability issues (individually or in combination):
* Inadequate or ineffective HVAC re-heat and associated spatial condensation or high humidity
* Inadequate spatial temperature sensing and air movement
* Ineffective or faulty HVAC system filtration (type or fit)
* Inadequate cleaning of heat exchange coils, or effective drainage
* Controls planning to compensate for intermittent sensible heat load
* Inadequate fresh air exchange (systematic sweeping)
* Porous interior duct insulation liner/ systems (should require):
* Excellent, continuous filtration
* Excellent reheat/ humidity control
* Longevity of microbial-resistant coating
* Planned, periodic preventive maintenance cleaning

- Scheduled cleaning each 5 years in absence of other guides

- Elastomeric spray-back to support future cleaning

* Preferred alternate lining should include closed cell foam (PS D&C 23 31 00).
* Interior building biological sources or standing moisture sources
* Porous materials/fabrics in areas prone to intermittent high humidity
* Building pressure imbalances supporting moisture build-up
* Inadequate roof ventilation/design permitting ceiling or plenum condensation

**Project Planning & Management Considerations**

Ensure Architects and Engineers familiarity with pertinent Penn State D&C Standards (ex):

01 50 00 – Temporary Facilities and Controls

23 00 00 – HVAC Air Distribution

23 31 00 – HVAC Ducts and Casings (and subsections)

23 41 00 – Particulate Air Filtration

* Avoid mismatches of finishes and building humidity control
* Commission buildings to ensure proper air balancing, other system aspects
* Q/C critical features to ensure appropriate considerations are not value-engineered from projects
* Ensure commissioning turnover operating manuals include recommendations for suitable preventive maintenance
* Manage construction to protect against temporary water infiltration
* Refer to ASHRAE Standards

**Resources and Reference Information**

Mold Prevention & Indoor Air Quality in Building/HVAC Design & Construction

* ACGIH *Bioaerosols: Assessment and Control; Ch. 10 – Prevention and Control of Microbial Contamination*, pp. 10-1 – 10-11 (include References section 10.8); American Conference of Governmental Industrial Hygienists, Cincinnatti, OH 1999.
* ASHRAE Standards (ex.)
* 62.1-2010 – *Ventilation for Acceptable Indoor Air Quality* (2010) or updated
* 55-2010 – *Thermal Environmental Conditions for Human Occupancy* (2010)
* 0-2013 – *The Commissioning Process* (2013 or updated)
* 188-2015 – *Legionellosis: Risk Management for Building Water Systems* (2015)

Duct Cleaning/Preventive Maintenance

* ACR – The NADCA Standard for Inspection, Cleaning, and Restoration of HVAC Systems (2013). <http://acrstandard.nadca.com/>

Mold Remediation

* *Institute of Inspection, Cleaning, and Restoration Certification (IICRC)*

– Certifications:

* Mold Removal Specialist
* Applied Microbial Restoration Technician

– Standards:

* Mold Remediation (S520)
* Commercial Structural Drying (S550)
* Commercial Built-Environment Cleaning and Restoration (S400)
* American Council for Accredited Certifications (ACAC)
* *Certified Mold Remediator* (CMR)

Penn State EHS Resources: <https://ehs.psu.edu/indoor-air-quality/requirements-guidelines>

* *Indoor Air Quality Standard Procedures* (2014)
* *Mold Standard Operating Procedure* (2014)
* *Water Incursion Guide* (2012)