PREVENTION OF MOISTURE AND MOLD GROWTH PROBLEMS

a) Introduction

As part of the campus priority for sustainable buildings, energy conservation and indoor air quality are critically important. In the past, building designs have facilitated one or the other criteria but rarely have both aspects been achieved simultaneously.

For renovations and new construction projects, during the schematic design phase, the Designer shall evaluate quantitatively the potential for moisture and vapor intrusion within and through the building envelope. The control of indoor relative humidity, surface temperatures, and moisture migration are the primary means of minimizing microbial growth in buildings. Generally, room air and near surface relative humidity levels less than 60% will preclude mold growth. When excess moisture does enter the building, a design which allows rapid moisture/vapor removal is essential for long term mold prevention within the structure. In addition to the potential to degrade indoor air quality, moisture/mold problems present significant impact on building deterioration and lifespan.

While the University is not located in the geographic region defined by ASHRAE as hot-humid climate, it is located in the part of the country where moisture related indoor air quality problems frequently occur in buildings. Thus it is imperative that the design considerations presented in this document and references be considered for all major building projects.

b) Requirements for moisture control

(1) Proper Building Pressurization: The movement of unconditioned moist air into a structure is one of leading problems that causes moisture and mold growth in buildings. To address this issue, buildings should be designed to operate under net positive pressure with respect to the outdoors. Building layout, mechanical systems (HVAC, exhaust), and air infiltration are the key elements that must be considered in building pressurization.

(2) Minimization of Air Infiltration: Incorporate the use of air barriers and seals to deter infiltration. The design must specify the maximum infiltration rate to which the building will be constructed.

(3) Control of Moisture: a) Reduce the potential for moisture accumulation, including condensation, and provide for the egress of water that may accidentally enter the envelope and have an effective drainage plane within the wall assemblies to drain rain water. b) Prevent penetration of both surface water and groundwater, including capillary water movement through materials.

(4) Control of Vapor Diffusion: While the materials ordinarily used in the building envelope may perform as an adequate vapor retarder, certain buildings may require colder-than-normal interior temperatures that may warrant a special vapor retarder. If vapor diffusion material is required, careful consideration must be given to the permeance rating and location of the vapor retarder. The use of materials with very low permeance rating, such as polyethylene, aluminum foil, and vinyl wallpaper should be avoided.

(5) Provide Dehumidification: It is important to properly size the HVAC systems. Over sizing of HVAC systems can result in short-cycling which reduces the sensible heat but not the latent heat which holds the moisture in the space. Also, energy management control systems must be programmed such that HVAC set backs do not result in an increase in building humidity above allowable limits (generally 60%)

HVAC controls shall include humidity sensors as well as temperature and differential carbon dioxide (CO_2) sensors (indoor/outdoor). Variable fan speed controls tied to the humidistats allow for dynamic control of humidity as well as temperature and outside air requirements

(CO2). These 3 parameters are most critical for offices, auditoriums, classrooms and residential spaces where exhaust air is not the predominant feature. Indoor CO2 levels should not exceed 700 parts per million (ppm) above outdoor levels.

In laboratories spaces with single-pass air flow, temperature and humidity controls and the capture and exhausting of chemicals are the greater challenges without the need for special attention to CO2 concentrations.

(6) Materials of Construction: In general, inorganic construction materials do not support mold growth and are the preferred products wherever practical. In shower rooms and other areas subject to high moisture levels, products such as dens board (Georgia Pacific) have been used successfully. Interior insulation in duct systems must not be used. Also, carpeting and wall gypsum board extending to a concrete slab below grade are discouraged due to moisture and accidental flooding issues.

(7) Site Selections, Grading, and Landscaping Issues: Grading and Landscaping should be designed to shed water away from the foundation. Sprinkler spray patterns must be directed away from the façade and foundation areas.

(8) Scheduling Construction to Minimize Moisture/Mold:

Specifications should be written to require that building materials subject to mold growth are kept dry throughout construction including sheetrock, thermal insulation, wood products, carpets, ceiling tiles etc. Any wetted materials must be replaced at the contractor’s expense.

HVAC duct systems must be protected from the collection of dust and debris within the ducts during construction. However, once the dusty operations are concluded, operating the HVAC to remove trapped humidity within the building would be advantageous assuming that the windows and doors are kept closed.

(9) Special Considerations for Historic and Old Buildings: An engineering assessment is required to determine the projected impacts of renovation activities on moisture control within the structure. This assessment should include considerations of below grade, at grade and above grade differences, the tightness of the envelope and the deterioration of or lack of moisture and vapor barriers and retarders.

(10) Commissioning:

The building envelope including the roof and windows and wall structures should be tested for water leakage by using pressure hoses on the outside and inspectors on the inside of the building.

The final building structure should be tested for air leaks by pressurizing the building and measuring the leakage rate. The observed air leakage shall not exceed the design infiltration rate used in sizing the HVAC and humidity control systems.

c) Suggested References for Guidance on Design Considerations

(1) Preventing Indoor Air Quality Problems in Educational Facilities: Guidelines for Hot Humid Climates, CH2M HILL and Disney Development Company, Prepared by J. David Odom and George DuBose, Orlando, Florida, 1997

(2) *Mold, Moisture, & Indoor Air Quality: A Guide for Designers, Builders, and Building Owners, Joseph W. Lstiburek, Building Science Corporations, Westford, MA. 1994*

(3) *Hold the Line: Controlling Unwanted Moisture in Historic Buildings, Preservation Brief, National Park Service, Sharon C. Park, AIA, www.cr.nps.gov/hps/tps/briefs/brief39.htm October 1996*

(4) *ASTM: Moisture Control in Buildings, H. Trechsel, Ed. American Society for Testing and Materials, Philadelphia, PA 1994*

(5) *Ventilation for Acceptable Indoor Air Quality: ASHRAE Standard 62.1-2010. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Atlanta, GA 2010*

(6) *Control of Moisture Problems Affecting Biological Indoor Air Quality, TFI—1996, International Society of Indoor Air Quality and Climate, Ottawa, Ontario, Canada, 1996*

(7) *ASHRAE: Humidity Control Design Guide for Commercial and Institutional Buildings, Harriman, Brundrett & Kittler, Atlanta, GA 2002*

(8) *ACGIH: Bioaerosols: Assessment and Control: Editor: Janet Macher, American Conference of Governmental Industrial Hygienists, Cincinnati, OH 1999.*