

Environmental Safety

Losing Control of the Indoor Environment

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Far too often we have seen widespread and severe effects related to a loss of control over indoor environmental parameters (IEPs) in various building types, including commercial offices, retail, schools and education facilities, and residential. In such cases, it is of utmost importance to understand how it happened in order to prevent a reoccurrence. Around the clock maintenance of IEPs including outdoor air ventilation, building pressurization, temperatures, and humidity is crucial to providing a clean and prosperous indoor environment, proper indoor air quality, and to preventing damage to interior finishes, furniture and contents. However, quite often the parameters that exist after hours, or even during normal business or occupied hours, are not fully known or are rarely or improperly evaluated. In addition, often the effects of environmental parameters that are out of control are so subtle that impacts to the building structure, interior finishes and contents go unnoticed until significant cost, loss of building use and revenue, and down time become a reality. These issues are commonly related to one underlying cause – the uncontrolled influx of unconditioned outdoor air.

While it is a commonly accepted notion that these problems are more extensive and severe in subtropical climates, they are not limited whatsoever to these regions as many parts of the country or world experience prolonged periods of high heat and humidity. The combination of mechanical system cooling (air conditioning) and outdoor air ventilation can be a recipe under certain circumstances for extensive moisture and microbial damage in indoor environments. But what we have seen is that these problems are often related to a lack of proactive building operations and maintenance programs (O&M) or maintenance and management personnel attempting to gain better humidity control, which is an unfortunate irony. Firstly, though, it is important to note how building ownership or management becomes aware of a problem, which hopefully triggers an assessment by a qualified building scientist or indoor air quality professional.

Some of the more common visible effects that are noticed by building occupants may be slippery floors, wrinkled paper, frequent paper jams in printers, musty odors, rapid buildups of dust-like substances, etc., not to mention illness and allergic-type reactions. To the layperson, these may seem like vastly unconnected conditions that don't point to any one clear problem, but they are and they do.

As buildings age their mechanical systems, if not well maintained, may lose efficiency and their ability to maintain safe IEPs, particularly in warmer or more humid regions or seasons. Sometimes maintenance personnel see the fix for better humidity control as being the elimination of outdoor air intake (and subsequently building ventilation) so the mechanical systems don't have to work as hard to condition a space. Unfortunately, doing this does not take into account overall building pressurization, which is a balance of these make-up air sources and exhaust sources like bathroom fans, commercial kitchen exhaust hoods, and regular and benign

building air leakage. By eliminating or closing outdoor air intakes, the building goes under negative pressure compared to the outdoor environment and instead of bringing in outdoor air through controlled means; it begins to seep in through countless pathways like window and door seals and electrical or plumbing penetrations through the building exterior.

When combined with ongoing air conditioning (cooling) the influx of untreated outdoor air results in widespread condensation, like a cold glass of iced tea on a hot summer day. Condensation is absorbed by paper making it wrinkle and get caught in printers, it forms on cold floors making them slippery, it gives occupants a clammy feeling, and it drives fungal growth on furniture, books, fabrics and many other contents and finish materials, particularly in already dusty areas making occupants think it is simply more dust, all the while creating a musty odor and impacting indoor air quality. By the time the effects become noticeable enough, mold remediation may be needed that is far more extensive and costly than the average water leak or localized flood. In retrospect, it would have been less costly and disruptive to have performed comprehensive maintenance, cleaning or replacement of mechanical system components than to attempt to modify or tinker with these systems to improve efficiency. And this doesn't even account for the effects on occupant or tenant relations.

Along similar lines, building operators may fail to proactively inspect and test mechanical system components at regular intervals, allowing them to deteriorate and fail over the years. One critical point is yet again the function and motion of automated outdoor air dampers. As they rust, freeze or otherwise fail they can no longer cut off outdoor air when mechanical systems reach their cooling target temperatures and cycle off. This results in a serious cyclical effect of cooling followed by spikes in humidity and condensation; all driven by powerful mechanical systems that effectively distribute damage throughout large portions of a building. The resulting damage includes the visible conditions described above, but also commonly includes significant microbial damage to air handling units and ductwork.

These problems occur with notable frequency and often happen when building owners and managers were acting with the best intentions, but they are foreseeable and preventable. A robust building moisture O&M plan coupled with training of building personnel, routine inspections and checklists, healthy dialogue between management and occupants, and other preventative maintenance measures is often the best defense against such losses. Knowing what to look for, knowing how to use tools and meters to identify problems before they get out of hand, and proper response actions and documentation is essential. Having regular professional indoor air quality assessments that may include long-term, 24/7 monitoring of IEPs (using data logger sensors) can be extremely effective in evaluating moisture effects and mechanical system performance, while preventing costly property loss and instilling faith and trust in building occupants.