

# Humidification Systems for Universities

WHITEPAPER

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# Introduction

This whitepaper explores a host of reasons to humidify university campuses and highlights how straight forward and economical humidification on campus can be.

The typical university campus is filled with opportunity to realize the benefits of humidification. Dormitories, lecture halls, cafeterias, science and research laboratories, sports facilities, libraries, archives, and performing arts centers are all examples of places where proper humidification delivers clear returns.

The common theme within these spaces is that people occupy them all.



**Health**  
Living Spaces  
Gathering Areas

**Comfort**  
Living Spaces  
Gathering Areas  
Ice Arenas

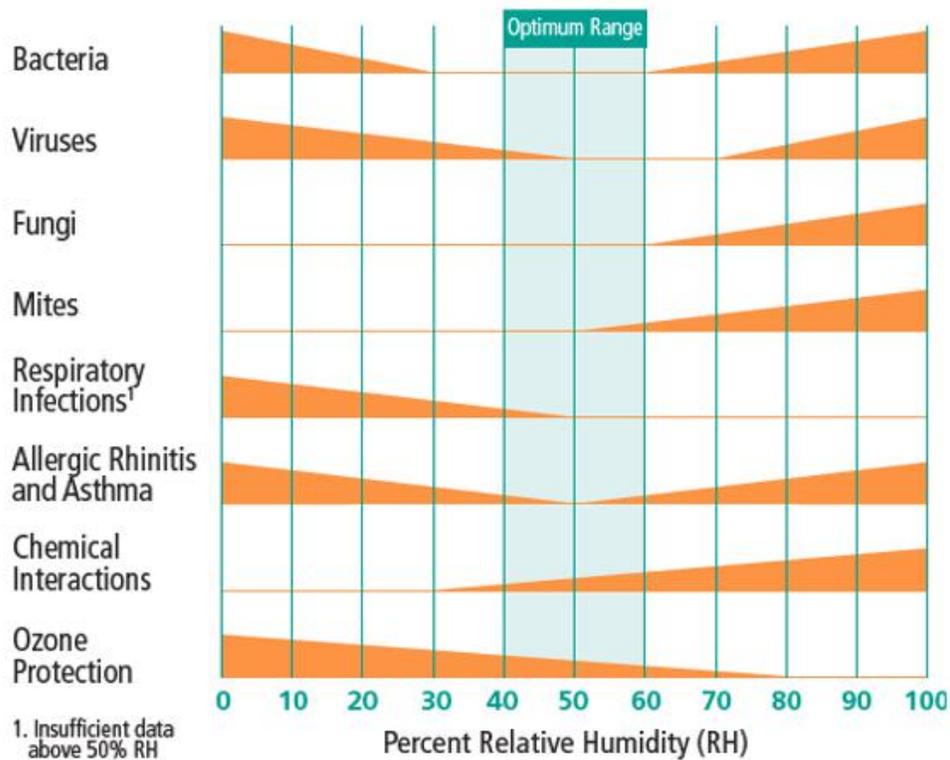
**Preservation**  
Libraries  
Music Rooms  
Performance Halls  
Archives

**Control**  
Laboratories  
Data Centers  
Ice Arenas

Humidification is beneficial to people in promoting health, comfort, preservation, and control of the indoor spaces they occupy.

# Why Humidify Universities?

The Sterling Chart shows how various organisms and processes respond to relative humidity (RH). Note that 40 – 60% RH is the optimal range. The height of bands show favorable or unfavorable conditions for each category.



E.M. Sterling, A. Arundel, and T.D. Sterling, Criteria for Human Exposure to Humidity in Occupied Buildings (ASHRAE Transactions, 1985), Vol. 91, Part 1

## Quick Facts

- Bacteria and viruses spread more easily when the RH level is too low.
- Dry indoor air negatively affects the well-being of faculty and students.
- Dry indoor air causes damage to furnishings, musical instruments, gymnasium floors, lecture hall presentation equipment, and other building components.
- Absences from classes increase during the dry winter months.

# Humidification & Health



## Bacteria and viruses thrive in dry air

NFID Report. Addressing the Challenges of Influenza Vaccination on US College Campuses. May 2016.



## Viruses are more infectious in dry air

Rong, Lijun. (2013 February). High Humidity Leads to Loss of Infectious Virus from Simulated Cough.



Viruses and bacteria are more infectious in low RH environments. When the RH is 23% or less, viruses retain 70-77% infectivity, compared to only 15-22% infectivity where the RH level is greater than or equal to 43%. This means an outbreak is more likely among faculty and students if the RH is low.

Using non-pharmaceutical interventions like humidification is a safe, efficient, and easy way to reduce the spread of viruses and protect staff members and students.



## Increased absences from illness affects academic performance

Villanova University Prevention Points. Focuson Top Impediments to Academic Success. Vol 1, Issue No. 1



## Dry indoor air increases stress levels

Wiley Online Library. Indoor Air – International Journal of Indoor Environment and Health. Wellbuilt for wellbeing: Controlling relative humidity in the workplace matters for our health. 30, October 2020



The human body is uncomfortable in low RH, increasing sensitivity to stress. A study comparing occupants in an environment with RH levels between 30-60% in drier conditions measured a 25% difference in stress response levels.

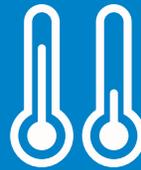
Viruses and bacteria thrive in low RH, leading to increased student absences. Being absent from classes will reduce students' potential for learning, and may reduce student performance as a result.

An assessment administered to Villanova University undergraduate students found 17% of those assessed said cold/flu/sore throats had affected their academic performance.

# Humidification & Comfort



Being outside the thermal comfort zone can be a distraction from learning



Raising the RH allows for a lower temperature set-point

Another consideration is the concept of thermal comfort. Thermal comfort is the condition when someone is not feeling too hot or too cold, and is influenced by several factors, including humidity. Being uncomfortable can be a distraction from learning and influence student performance. Thermal comfort is comprised of both environmental factors (temperature, humidity, air velocity) and personal factors (clothing, activity).

## Human Comfort

Metabolic Rate



Air Temperature



Radiant Temperature



Humidity



Clothing Insulation



Air Velocity

One benefit of proper RH is the opportunity to alter the temperature within the space. For example, a humidified room would still feel comfortable if the temperature was lowered slightly in the winter months, saving on heating costs.

# Humidification & Preservation



Protect instruments, flooring, and furnishings by maintaining RH levels between

**40-60%**



Besides people, low RH can impact the materials within buildings. Musical instruments and wood floors in gyms for example, are made of materials which are sensitive to changes in moisture. Instruments made of wood such as pianos, violins, guitars, cellos, and harps are hygroscopic, which means they expand and shrink with changes in moisture and can be damaged. Wood flooring in gyms and other furnishings are also hygroscopic, and dry air can cause them to warp and become distorted.

Humidification can protect against cracking and splitting of flooring or woodwork, deterioration of fabrics and other materials, damage to finishes and surface distortion, and irritation to vocal chords.

## Dry air causes damage to materials within:



Archives



Performance Halls



Music Rooms



Gymnasiums



Libraries

# Humidification & Control

Controlling the RH within the complex environment of University laboratories, data centers, and ice rinks can prevent many issues such as decreased productivity, inaccurate test results, contamination, shortened life expectancy of equipment, and sublimation.



## Laboratories

Risk of Contamination

A primary concern is the prevention of contamination in laboratories and the potential for growth of microbes and bacteria, which increases in an improperly controlled environment. When humidity levels are too low, the potential for static build-up increases, allowing contaminants to collect. In unfavorable conditions, microbes and bacteria reproduce at an exponential rate. This not only impacts test results but also diminishes the life cycle of expensive equipment.



## Data Centers

Risk of electrostatic discharge (ESD)

Data Centers that have air circulation without humidification have dry air, elevating the risk of electrostatic discharge (ESD). Too much humidity will cause condensation to form, leading to damage, corrosion and eventually equipment failure of motherboards, hard drives and in connecting sockets. Whether too little humidity or too much, both can lead to unexpected downtime. Avoid disruption of critical processes and costly damage to valuable equipment with proper RH.



## Ice Rinks

Risk of sublimation

Ice Rinks can be at risk from a phenomenon called sublimation, or evaporation of the ice. The result of this is rough, brittle ice that becomes even worse when skated on. Not only does proper RH within an ice arena reduce the effect of ice sublimation, but controlling the humidity also slows the evaporation of moisture from building occupants' skin, leaving occupants feeling warmer, without an arena needing more heat pumped in.

# Evidence

## *The Importance of Proper Humidification for Wellness*

There are many studies referencing the importance of proper RH and its role in the wellness of building occupants.

Below ~30% RH conditions, the skin becomes dry<sup>1</sup>

1. Sunwoo Y, Physiological and Subjective Responses to Low Relative Humidity in Young and Elderly Men, (*J Physio Anthropol*, 2006 May), 25(3):229-38.  
2. J.E. Laviana, F.H. Rohles, Jr. and P.E. Bullock, Humidity Comfort and Contact Lenses (ASHRAE, 1988) 94(1), 3-11.

Discomfort to the eye increases with time if the dew point is below 26 °F<sup>2</sup>

Humidity below 30% RH can irritate vocal chords<sup>3</sup>

3. National Institute on Deafness and Other Communication Disorders, Taking Care of Your Voice, [www.nidcd.nih.gov/health/taking-care-your-voice](http://www.nidcd.nih.gov/health/taking-care-your-voice) (December 14, 2016)  
4. ASHRAE Guideline 10-2016, Interactions Affecting the Achievement of Acceptable Indoor Environments

Low humidity results in breathing smaller air particles<sup>4</sup>



As referenced in the study "Physiological and Subjective Responses to Low Relative Humidity in Young and Elderly Men," RH below 30% causes the skin to become dry and crack. Humidity above 30% RH is also needed for the mucous membranes in the nose to properly filter the air we breathe.

In the study "Humidity Comfort and Contact Lenses," it is said that discomfort to the eyes increases with time if the dew point is below 26 degrees Fahrenheit.

The National Institute of Deafness and Other Communication Disorders notes that humidity below 30% RH can irritate vocal chords.

And the ASHRAE guideline, "Interactions Affecting the Achievement of Acceptable Indoor Environments," explains that low humidity results in breathing smaller particles, and can increase the creation of smaller exhaled breath aerosols, which can retransmit microbes.

# Evidence

## Humidification & Health

The human body is ~65% water – but our bodies do not sense moisture well.

### Quick Facts

#### Humidity and respiratory infections:

- 💧 Evidence of link between moisture and cold/flu transmission
- 💧 Clinical trials between 1963 and 1985 showed significant reduction of respiratory infections when mid-range humidity was maintained<sup>1-5</sup>
- 💧 NIOSH/CDC Research in 2013 showed reduced infectivity of flu virus aerosols with mid-range air humidity levels<sup>6</sup>



Two-thirds of the human body is composed of water, which causes our bodies to be sensitive to any changes in moisture in the environment. We tend to notice the effects of too much or too little moisture in the air.

The human body is better able to protect itself when not under stress and kept within a mid-range RH. In addition, mid-range RH is less favorable to viruses and bacteria. Combining these two factors has shown in studies that fewer transmissions and infections occur in this mid-range RH.

1. Ritzel G, Sozialmedizinische Erhebung zur Pathogenese und Prophylaxe von Erkältungskrankheiten, sog. «Kindergartenstudie» Zeitschrift für Präventivmedizin 1966, 11. 9-16  
2. Sale C, Humidification to Reduce Respiratory Illnesses in Nursery School Children, Southern Medical Journal, July 1972, Vol 65  
3. Green GH, Winter humidity and related absenteeism in Canadian hospitals, Digest of the 3rd. CMBES  
4. Green GH, The effect of indoor relative humidity on absenteeism and colds in schools, ASHRAE Trans., Vol. 80, Part II  
5. Gelperin A, Humidification and upper respiratory infection incidence, Heating, Piping and Air Conditioning, 45:3, 1973  
6. Noti JD et. al, High Humidity Leads to Loss of Infections Influenza Virus from Simulated Coughs, PLoS ONE 8(2): e57485, 2013

# Guidance

## Recommended Design Conditions For Schools<sup>1</sup>

| Category   | Relative Humidity | Winter Temperature (°F) |
|------------|-------------------|-------------------------|
| Classrooms | 30%               | 72.2 to 79.1            |
|            | 40%               | 72.2 to 78.5            |
|            | 50%               | 71.8 to 78.0            |
|            | 60%               | 71.3 to 77.5            |
| Gymnasium  | 30 to 60%         | 68.5 to 74.0            |
| Cafeteria  | 20 to 30%         | 70.0 to 73.5            |

1. ASHRAE Handbook – HVAC Applications – 2019

ASHRAE is an organization of engineers who help establish best practices for design of HVAC systems for buildings. In regards to schools, ASHRAE recommends the RH and temperatures for the spaces above depending on use. Going back to concept of thermal comfort, you will see a lower temperature setpoint depending on higher RH.



## Payback of Optimal Humidity

Improved productivity through well being<sup>2</sup>

-  Reduced eye strain
-  Reduced allergy & asthma impact
-  Mental acuity
-  Reduced vocal strain
-  Increased performance
-  Improved perceived comfort ("humidex")

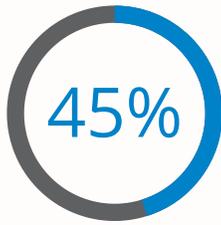
In addition to the consequences of low RH, there are several benefits to having the right RH. According to the article "Air Humidity in the Office Workplace," the benefits improve productivity through improved well-being. While these benefits pertain to comfort and may be difficult to quantify, they do influence how people feel within a space.

2. Rief S and Juric M, Air Humidity in the Office Workplace, Fraunhofer IAO, 2014

# Incorporating Humidification

## Know Your Space

### Site Survey



**A target of 45% RH** is generally recognized as providing positive benefits.

Coordinating with your University's facilities team will help you understand what the current infrastructure is, and understand which options are available. Then, what's the best way to integrate this humidification system into the existing equipment? Taking RH readings with a hygrometer in enclosed spaces will determine the RH within the space. A hygrometer is an instrument for measuring the humidity of the air.



If there is already a humidifier, check to see if it is operating



Adjust/raise setpoint if required



Work with local DriSteem expert to explore options for additional capacity/equipment

## Getting There Quickly

Commercial grade humidification systems provide the control you need to maintain proper RH levels.

Working with not just the facilities teams to understand what's there, it's also potentially working with a local DriSteem expert to get an idea of the solutions available. A humidification system typically requires water, power, and a drain. Depending on the available energy sources, you may need a boiler or gas humidifier. It is important to look at the utilities you have available and determine where you can place these systems. Your local DriSteem representative can help address that and review how much additional humidification you will need to reach that ideal 40 to 60% RH range.



Simple access to power, water, and drain is all you need to get a system operational – think of anyplace there is a sink nearby



Local DriSteem expert can determine appropriate size and type of equipment in as little as a day.



With DriSteem's local US manufacturing and expedite capacity a solution can be rapidly implemented.



Equipment can be ordered and on site in just a few weeks (sometimes even faster) and installed in a day or two.



You can count on a system from DriSteem to provide superior performance protecting your faculty and students and your investment.

# Why Choose DriSteem?

## ***DriSteem Network of Experts***

Keeping indoor humidity levels at 40 – 60% RH is a safe, easy and efficient way to reduce the spread of viruses that cause respiratory illnesses in your campus buildings and protect the health of students, faculty, and staff. Preserving processes and materials is also important and can be accomplished through humidification. The addition of humidity to an indoor space can be incorporated through supplementary humidification systems, which can be quickly installed on a wall, and will start to immediately add moisture to the indoor environment. A larger humidification system can be incorporated into a facility's HVAC system in the mechanical room or on the roof, and can keep an entire building humidified. University's facilities team's should work with a local DriSteem representative to evaluate current system and spaces to humidify.



### *Committed to Quality*

DriSteem has been designing and building world-class humidification systems for more than 50 years and is committed to making the best products in the HVAC industry.



### *Support & Reliability*

DriSteem Representatives offer depth of experience and expertise in all types of environments.



### *Case Studies & Research*

Support your business case with data – DriSteem is continually adding to our collection of white papers and case studies.



## **Website**

[www.dristeem.com/applications/universities](http://www.dristeem.com/applications/universities)