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Natural gas humidification in buildings: an effective solution for comfort and health issues!

We are seeing ever-greater concern over the effects of the environment on people. For some of these concerns, research has been done to try to understand how the humidity level in buildings impacts both comfort and health.

Air humidification and health

The overall impact of relative humidity on all aspects of comfort has not yet been established. However, when it comes to thermal comfort, the relationship between temperature and humidity level is well known: to maintain comfort, the ambient temperature must be increased to compensate for a decrease in relative humidity (see ASHRAE standard 55).

Low relative humidity increases evaporation from the throat and nasal membranes and dries out the mucous membranes of the respiratory tract. It also dries the skin and hair. There is often an increase in respiratory complaints during the winter related to low humidity levels.

A presentation given by Dr. Stephanie Taylor at ASHRAE Montréal in 2017 noted a relationship between climate and epidemic outbreaks. Indeed, it was observed in Africa that outbreaks of meningitis occurred more often when the humidity level was low and that they decreased when it was above 40%.

Also, through epidemiological studies, ASHRAE demonstrated that the rate of illness among occupants of buildings with a medium humidity level was lower than the rate among occupants in buildings with a low level. The humidity levels in the adjacent zones are therefore the most detrimental to health, comfort and safety.

Figure 1 shows that the zone from 30% to 60% relative humidity (RH) (at normal ambient temperature) offers the best conditions for human occupancy (Sterling et al., 1985). In this zone, the growth of bacteria and biological organisms and the speed at which chemical interactions occur are reduced to a minimum.

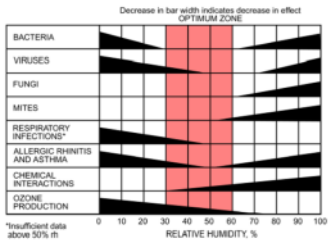

Fig. 1 Optimum Humidity Range for Human Comfort and Health
(Adapted from Sterling et al. 1985)

Figure 1

The relative humidity has a significant impact on controlling infections. At 50% RH, the mortality rate of certain microorganisms is higher and the influenza virus, for example, becomes significantly less virulent. The mortality rate of these organisms decreases both above and below that value. However, high humidity can promote the growth of pathogenic or allergenic elements.

Let's return to Dr. Taylor's presentation. She explained that our bodies are composed of 75% water. We need it for our vital functions and to prevent dehydration throughout our lifetime. In a dry environment, a humid element will tend to lose moisture in order to achieve balance. Our water-rich bodies provide a large exchange surface for the surrounding air (skin, nose, sinus, bronchial tubes, etc.). If the relative humidity is maintained at 20%, the average person will become dehydrated before even feeling thirsty! The symptoms of dehydration include a decline in brain function, reduced natural defences against infections and allergies, and a loss of skin integrity and the ability to heal.

Consequently, **ASHRAE recommends maintaining the relative humidity in living areas at between 30% and 60%.**

Using humidification systems

The installation of humidification equipment is required for many applications. The data collected from humidification equipment distributors in Québec have made it possible to identify some examples of the application of humidification:

- In office buildings located in cold climates, where the occupants can experience discomfort and health problems caused by dry air and where computer hardware can be damaged by static electricity;
- In hospitals;
- In very large education facilities (universities, colleges, very large high schools);
- For certain processes (e.g. paint finishes, microelectronics, pharmaceuticals);
- In museums;
- In certain hotels;
- In areas where dust collectors are used;
- To control odours.

The methods and equipment for humidifying building air

There are two humidification methods: adiabatic and isothermal.

Adiabatic humidification involves vaporizing air using an injector sprayer. This method does not require the aid of an external heat source; the heat required to transform the water into vapour is provided by the air. The air is cooled as a result.

Isothermal humidification instead disperses the vapour into the environment after it has been created by thermal energy from an external energy source. This method tends to raise the air temperature. Isothermal humidification can be produced with natural gas using steam boilers or humidifiers.

Natural gas humidifiers generally operate with steam at atmospheric pressure. Equipment from the following manufacturers is distributed in Québec (a non-exhaustive list): Armstrong, Carel, DriSteem, NEP and Nortec.

Over the past few years, the number of natural gas devices for this application has grown, and they are becoming more and more efficient. One manufacturer, Nortec, recently brought to market one of the first

condensing steam humidifiers. The availability of competitive natural gas humidifiers is encouraging in a market where performance and efficiency are expected.

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Sources:

- Natural Gas Technologies Centre, Natural gas humidification, project no. 140711
- ASHRAE Handbook: HVAC Systems and Equipment, 2016
- Presentation at ASHRAE Montréal, April 10, 2017: “L’importance d’humidification envers la santé,” by Stephanie Taylor, MD, MArch, FRSPH (UK), MCABE.

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