BSR/ASHRAE Addendum e
to ANSI/ASHRAE Standard 55-2020

Public Review Draft

Proposed Addendum e to Standard 55-2020, Thermal Environmental Conditions for Human Occupancy

First Public Review (April 2021)
(Draft shows Proposed Changes to Current Standard)

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FOREWORD

Addendum e to Standard 55-2020 proposes changes to the paragraph which describes the basis for the calculation of prevailing mean temperature in Section 5.4.2.1. This change eliminates an equation that is easily misused and leaves a functionally equivalent equation that cannot be misused.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum e to 55-2020

Revise Informative Appendix J as shown below. The remainder of Informative Appendix J is unchanged.

INFORMATIVE APPENDIX J
OCCUPANT-CONTROLLED NATURALLY CONDITIONED SPACES

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The input variable in the adaptive model in Figure 5-8 is prevailing mean outdoor air temperature $\overline{tpma(out)}$. This temperature is based on the arithmetic average of the mean daily outdoor temperatures over some period of days. It represents the broader external climatic environment to which building occupants have become physiologically, behaviorally, and psychologically adapted. At its simplest, $\overline{tpma(out)}$ can be approximated by the climatically normal monthly mean air temperature from the most representative local meteorological station available. ~~When being used in conjunction with dynamic thermal simulation software in which outdoor weather data is formatted as a TMY, the preferred expression for $\overline{tpma(out)}$ is an exponentially weighted, running mean of a sequence of mean daily outdoor temperatures prior to the day in question.~~ However, since d~~D~~ays in the more remote past have less influence on the building occupants' comfort temperature than more recent days Equation J-1 should be used to calculate $\overline{tpma(out)}$~~, and this can be reflected by attaching exponentially decaying weights to the sequence of mean daily outdoor temperatures. This can be written as follows:~~

~~$$\overline{t_{pma(out)}} = (1 - \alpha)\,[t_{e(d-1)} + \alpha\, t_{e(d-2)} + \alpha^2 t_{e(d-3)} + \alpha^3 t_{e(d-4)} + \ldots\ldots] \quad \text{(J-1)}$$~~

$$\overline{t_{pma(out)}} = (1 - \alpha)\, t_{e(n-1)} + \alpha\, t_{rm(n-1)} \qquad \text{(J-1)}$$

where $t_{e(n-1)}$ is the mean daily outdoor temperature for the day before the day in question, and $t_{rm(n-1)}$ is the running mean temperature for the day before the day in question (n –1), and α is a constant between 0 and 1 that controls the speed at which the running mean responds to changes in weather (outdoor temperature). Recommended values for α are between 0.9 and 0.6, corresponding to a slow- and fast-response running mean respectively. Adaptive comfort theory suggests that a slow-response running mean (α = 0.9) could be more appropriate for climates in which synoptic-scale (day-today) temperature dynamics are relatively minor, such as the humid tropics. But for mid-latitude climates where people are more familiar with synoptic-scale weather variability, a lower value of α could be more appropriate. ~~In Equation J-1, $t_{e(d-1)}$ represents the mean daily outdoor temperature for the~~

~~previous day, $t_{e(d-2)}$ is the mean daily outdoor temperature for the day before that, and so on. The equation contains a sum to infinity, but is reducible to this more convenient form:~~

$$\overline{t_{pma(out)}} = (1-\alpha)\, t_{e(n-1)} + \alpha\, t_{rm(n-1)} \quad \text{(J-2)}$$

~~where $t_{e(n-1)}$ is the mean daily outdoor temperature for the day before the day in question, and $t_{rm(n-1)}$ is the running mean temperature for the day before the day in question ($n-1$).~~ For example, if α = 0.7, the prevailing mean outdoor temperature for today would be 30% of yesterday's mean daily outdoor temperature plus 70% of yesterday's running mean outdoor temperature. This form of the equation advances the value of the running mean from one day to the next and is convenient both for computer algorithms and for manual calculations. A value for running mean temperature has to be assumed for day one in order to seed the sequence, but from then onwards it can be calculated with Equation J-~~2~~1. The running mean may be initiated seven days prior to the start of the period of interest, and the actual daily mean outdoor temperature can be used for that first day to seed the sequence.

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