AN EMPEROR WITHOUT CLOTHES

No Scientific Basis to Rely on NWS Heat Index Chart

By Arthur G. Sapper

An administrative law judge of the independent Occupational Safety and Health Review Commission (OSHRC) has held that OSHA had failed to show a scientific basis of National Weather Service's (NWS) heat index chart, which the agency used to prosecute employers in heat stress cases.

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The holding is expected to reverberate widely, as OSHA and its lawyers have used the chart many times as evidence that employers violated the General Duty Clause of the OSH Act.

Background

Many years ago, NWS published the heat index chart shown in Figure 1. OSHA has relied on the NWS chart to allege that employees had been exposed to excessive levels of heat, in violation of the OSH Act's General Duty Clause. In 2012, OSHA's director of enforcement programs issued an enforcement memorandum stating that an employer could be proven to have "failed to keep the workplace free of a hazard to which its employees were exposed [if] . . . workers were exposed to a HI [heat index value] at or above the danger zone (see HI chart)" (Galassi, 2012). OSHA (n.d.) also published its own version of the chart.

The Postal Service Cases

In 2016 and 2017, OSHA issued five heat stress citations to the U.S. Postal Service (USPS) alleging General Duty Clause violations in San Antonio and Houston, TX; Des Moines, IA; Charleston, WV; and Benton, AR. OSHA introduced the NWS heat index chart into the trial records and pointed to it as evidence.

In developing a defense, USPS's attorneys looked into the validity of the NWS heat index chart, that is, whether the chart's assertion that a heat index value in the orange zone or above represented a "danger" was supported by scientific evidence. (This author was among the attorneys who helped represent USPS.) It was soon found that the chart could be said to consist of two layers of information, only the second of which is important to OSHA prosecutions.

The chart's first layer displays heat index values, identified by the intersection of temperature (°F) values on the horizontal axis and relative humidity (%) values on the vertical axis. The first layer, after removal of the chart's color bands and their corresponding legends, is depicted in Figure 2.

The provenance of the chart's first layer has long been known. It is derived from Table 2 of the 1979 article, "The Assessment of Sultriness. Part I: A Temperature-Humidity Index Based on Human Physiology and Clothing Science," by R.G. Steadman (Oliver, 2005; Rothfusz, 1990). Steadman (1979) sought to state:

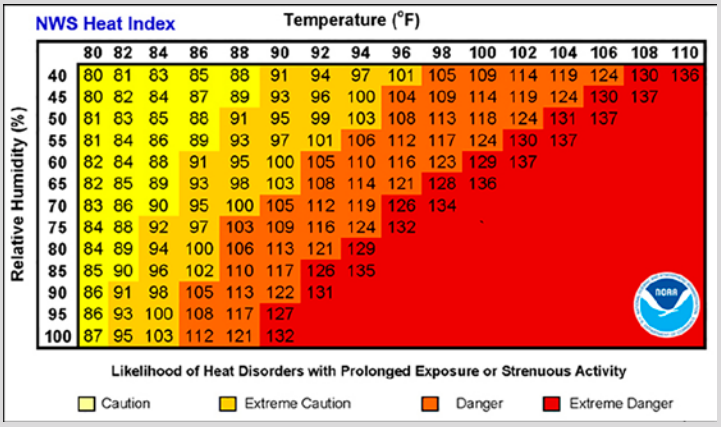
> . . . a single measure of the combined effects of high temperature and humidity. . . . just as a combination of wind and low temperature is referred to as "windchill." . . . The "apparent" temperature . . . is the temperature which a given combination of dry-bulb temperature and vapor pressure "feels like" to the typical human.

Nothing in Steadman's article asserts that any particular heat index value would cause a certain physiological effect or pose a certain risk.

The chart's second layer (Figure 3) does make that assertion, however. It places heat index values in color-coded ranges (i.e., yellow, orange, dark orange, red) and, in a legend entitled, "Likelihood of Heat Disorders With Prolonged Exposure or Strenuous Activity," asserts that those ranges correspond to conditions warranting "caution" or "extreme caution" or posing "danger" or "extreme danger."

FIGURE 1

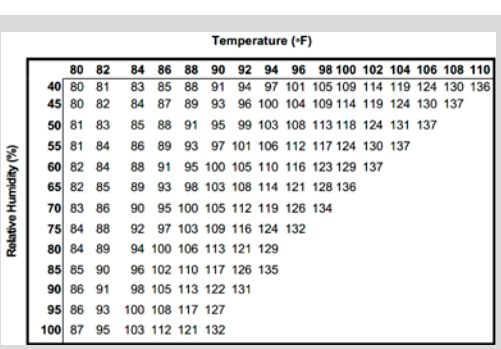
NWS HEAT INDEX CHART



Note. Reprinted from "Heat Index," by National Weather Service, n.d., www.weather.gov/safety/heat-index.

FIGURE 2

NWS CHART: FIRST LAYER



For many years, the provenance of the chart's second layer, its attribution of certain "heat disorders" to certain heat index values, was not widely known. NWS had not publicly disclosed its source, and a recent academic study of the chart had failed to find one. The study stated that "the rationale for these levels [denoted by the color-coding] was not found during review of the literature" (Iheanacho, 2014).

During the litigation of the USPS cases, however, an expert witness for OSHA stated during his deposition that the source of the chart's second layer was an article in a popular magazine on weather and climatology by Quayle and Doehring (1981), "Heat Stress: A Comparison of Indices." The source within that article for the chart's second layer was a small table, not attributed to any source, inset into the corner of a much larger graph. The small inset table is recreated in Figure 4 in enlarged form.

Inasmuch as the assertions in this table that certain heat index values indicated "caution," "extreme caution," "danger" and "extreme danger" were not supported by any cited source, USPS argued that the second layer of NWS's heat index chart lacked a scientific basis and should be disregarded. USPS also pointed out that the coauthors of the article, a meteorologist and a climatologist, were not known to have any qualifications in human physiology. USPS also introduced expert testimony rebutting the idea that the chart had any scientific validity.

The Judge's Decision

On July 15, 2020, Judge Sharon Calhoun of the independent OSHRC agreed with USPS that "no evidence was presented to establish the scientific basis for the risk categories depicted on the NWS heat index chart." Despite the prominence of the issue at the hearing, Judge Calhoun found that OSHA had failed to provide any "supporting data . . . for why the levels of risk [indicated by the chart's color coding and legend] are attributed to their respective temperatures." Partly as a result, she vacated all five citations.

OSHA recently acceded to Judge Calhoun's finding. Although OSHA's appeal papers, which were filed in late August, asked the full commission to review the judge's decisions, OSHA expressly states there that it is not seeking review of the judge's holding that the second layer of the NWS chart lacks scientific support. Although the judge's holding will technically not be binding on other judges or the commission, it is highly likely to be influential. Judge Calhoun (a former supervisory lawyer for OSHA) is known and widely respected as a judge who is highly experienced in OSH law. That her decisions on this point are well reasoned and have now gone unchallenged by OSHA in a high profile series of cases likely spell the end of OSHA's ability to rely on the NWS heat index chart. **PSJ**

References

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FIGURE 3

NWS CHART: SECOND LAYER

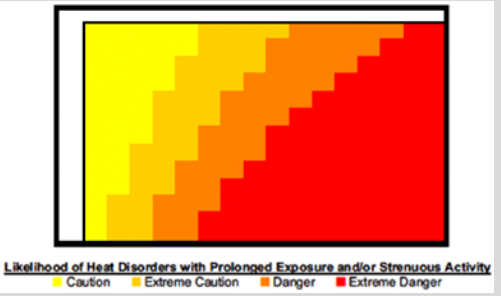

FIGURE 4

SECOND LAYER SOURCE

The matrix below (replicated from the original) shows the source for the NWS chart's second layer: A small table, not attributed to any source, inset into the corner of a much larger graph within the Quayle and Doehring (1981) article.

GENERAL HEAT STRESS INDEX

Danger category	Apparent temperature (°F)	Heat syndrome
IV. Extreme danger	Greater than 130	Heat stroke or sunstroke imminent
III. Danger	105 to 130	Sunstroke, heat cramps or heat exhaustion likely. Heat stroke possible with prolonged exposure and physical activity.
II. Extreme caution	90 to 105	Sun stroke, heat cramps and heat exhaustion possible with prolonged exposure and physical activity.
I. Caution	80 to 90	Fatigue possible with prolonged exposure and physical activity.

Note: Degree of heat stress may vary with age, health and body characteristics.

Note. Adapted from "Heat Stress: A Comparison of Indices," by R. Quayle and F. Doehring, 1981, *Weatherwise, 34*(3), 120-124.