

HEAT STRESS MITIGATION: TOOLS FOR COMPLIANCE AND SAFETY

Warehouses, industrial, and commercial buildings often suffer a common problem – moderate to excessive heat that can impact employee safety and productivity as well as violate federal, state, and local statutes such as OSHA, California Title 24 Part 6, and ASHRAE 55.

As employers increasingly invite workers back to the workplace, safety and comfort can make the difference between retaining talent and having a revolving-

door workforce that chooses to find employment in more comfortable spaces.

This paper looks at the issues impacting employee safety and comfort, and examines mitigation measures industrial site employers, hygienists, facility managers, and operators should consider when evaluating heat mitigation solutions to meet current and emerging regulatory demands.

THE CHANGING INDUSTRIAL WORKPLACE

Industrial workplaces are becoming increasingly mixed-use, with more employees reporting to office and warehouse spaces serving multiple functions.

Large spaces of all kinds – whether industrial or retail, indoor gym or aquatic center, or retail location – all have a common desire to improve indoor air quality and keep temperatures in comfortable ranges within federal, state, and local guidelines. Although newer buildings are increasingly designed

with mixed-use in mind, other buildings may be suffering from the results of climate changes, rising to warmer than anticipated interior temperatures than had been experienced when they were originally designed and constructed.

Furthermore, an increasingly savvy workforce demands a comfortable workplace. Employees or labor unions may demand time off when temperature thresholds are exceeded for any length of time.

THE REGULATORY CHALLENGE

Regulations that govern employee safety and comfort are constantly in flux, so building owners and managers need to check in with jurisdictions and employers must consult with unions representing employee workers on a regular basis to ensure compliance.

Compliance is challenged by multiple jurisdictions, which often have conflicting regulations regarding safety and comfort. As a rule, it is important to comply with the most stringent regulations on the books. There are several specific regulations in place – and proposed – that will

- Protect employee safety in extreme heat conditions

- Preserve environmental quality / carbon footprint of the facility overall
- Ensure buildings are more energy efficient – which can impact the use of A/C as the only way to mitigate heat stress.

Some regulations have multiple factors to consider. For example, Title 8 California Code of Regulations requires cooling when temperatures exceed 87°F or 82°F – depending on application. However, regardless of the governing agency, the overall goal is simple – improved indoor air quality and comfort.



HEAT MITIGATION CHALLENGES

Heat stress impacts an organization's bottom line, and business and enterprises of all sizes are vulnerable to the impact of heat stress. Even logistics and warehouse giants like Amazon have suffered losses when employees had to be carted off with heat exhaustion – an episode that caused Amazon to condition virtually all of its workspaces.

However, A/C alone is expensive, and environmental goals of reducing the energy footprint is often at odds with the need to keep employees safe and comfortable. Not taking action is not an answer either, as regulatory pressure and loss of employee goodwill can deliver a double-whammy of negative impact on the business' bottom line.

How bad can it be? Fortunately we have expert advice, as the impact of heat on productivity is backed up with science and research studies. The chart below shows if temperatures reach 90°F, a corresponding decrease in productivity of nearly 14% can be expected. That's like losing one in seven employees on a given day.

Fig. 1: Relationship of temperature to productivity loss

TEMP °F [°C]	RELATIVE PRODUCTIVITY	PRODUCTIVITY LOSS
50 (10)	63.8%	-36.2%
55 (13)	80.6%	-19.4%
60 (16)	91.6%	-8.4%
65 (18)	97.8%	-2.2%
70 (21)	99.9%	-0.1%
75 (24)	99.0%	-1.0%
80 (27)	95.8%	-4.2%
85 (29)	91.2%	-8.8%
90 (32)	86.2%	-13.8%
95 (35)	81.5%	-18.5%
100 (38)	78.1%	-21.9%
105 (41)	76.9%	-23.1%

Source: Seppänen, O., Fisk, W. J. and Lei, Q. H. (2006)

The overall challenge is how to have a safer, more productive environment while meeting or exceeding current (and future) code requirements. Thermal comfort depends for four environmental factors as defined by ASHRAE Standard 55, namely:

- Air temperature
- Air speed
- Radiant temperature
- Relative humidity



OVERCOMING HEAT STRESS: MITIGATION STRATEGIES

There are several approaches to reducing the impact of heat stress for employees indoors.

Fans: increased air speed takes advantage of the body's natural cooling process to create a cooling effect of up to 10°F through increased evaporative and convective heat rejection. When fans alone can meet the cooling objective, high-volume low-speed (HVLS) fans from Big Ass Fans are the most cost-effective solution.

Air Conditioning (A/C): A/C is extremely effective, especially in humid locations. However, utilizing A/C alone is expensive – and very inefficient in large, industrial spaces where stratification can take place

or where airflow from the A/C units is blocked by the internal building layout. Also, the cost and energy use of an all-A/C cooling system can have a big impact on a building's ability to meet energy efficiency requirements

Evaporative coolers: Also known as swamp coolers, these units leverage the vaporization energy of water to rapidly cool air, delivering a 16°F reduction in temperature in a space that is 90°F and 35% relative humidity (RH). Evaporative coolers use substantially less energy than A/C does for a similar amount of cooling, however they are limited by ambient humidity and are therefore less effective in locations where there is a higher RH.

Fig. 2: Airspeed, not CFM determines the cooling effect of fans

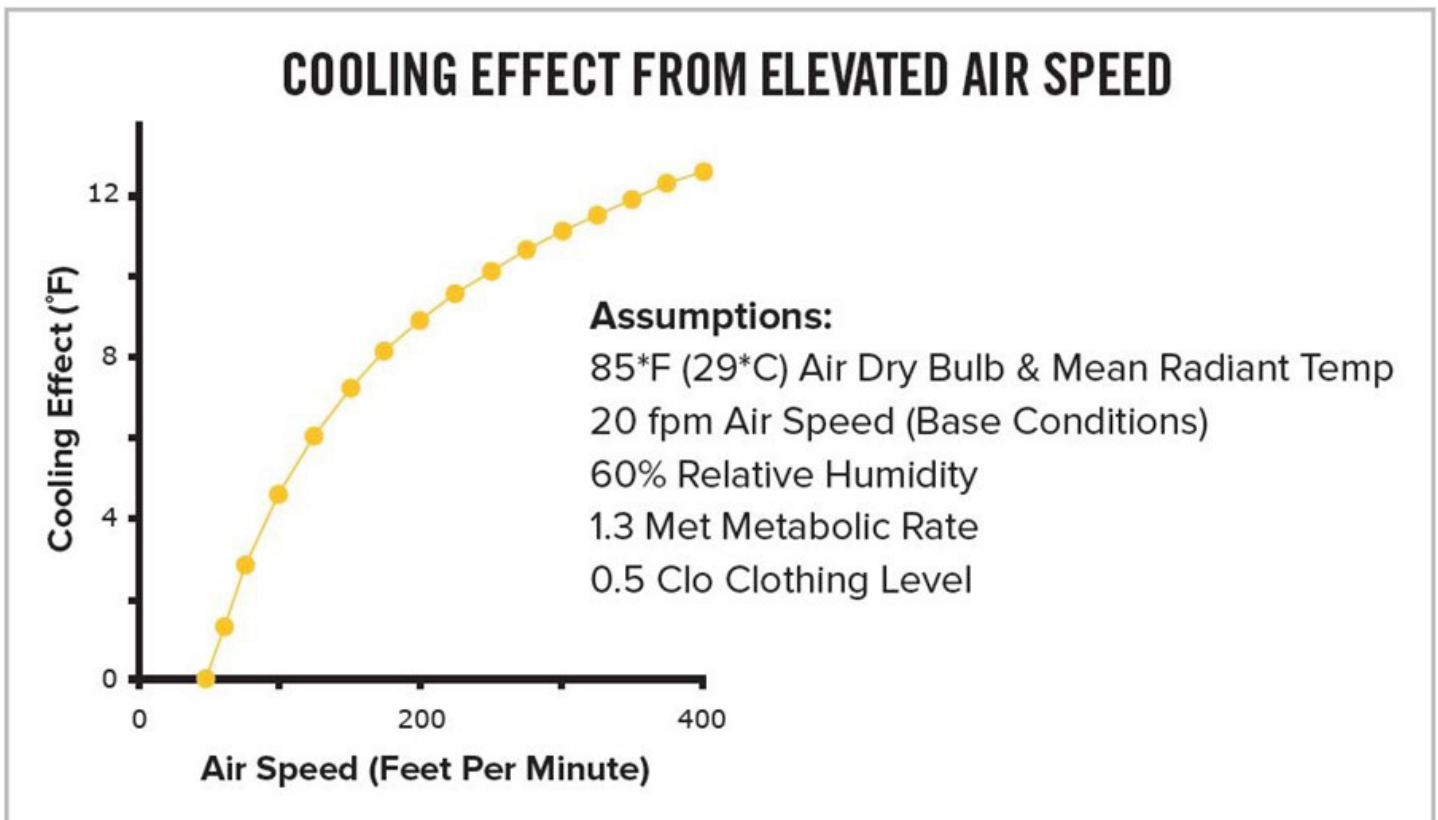
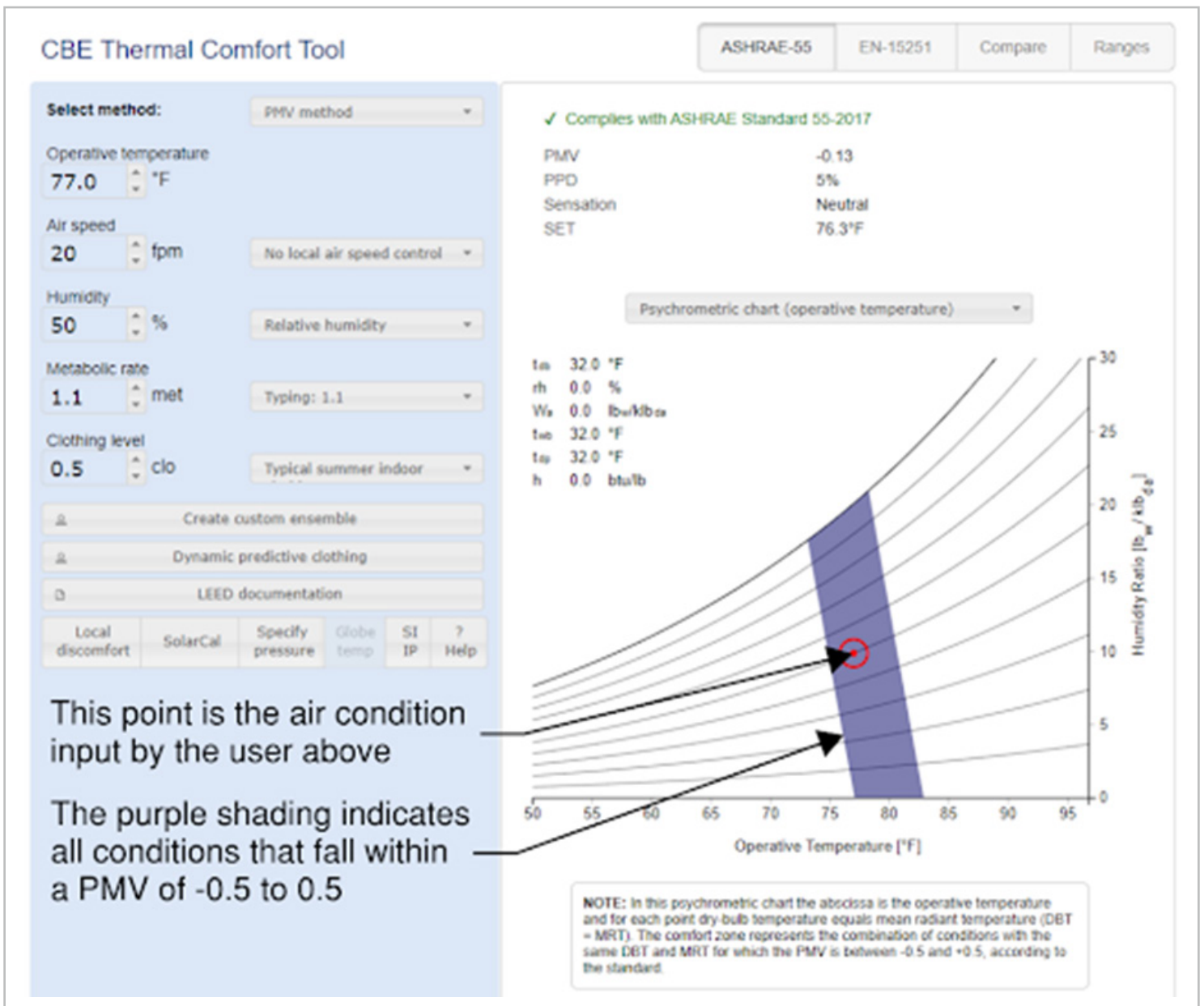


Fig. 3: Facility is within acceptable range for occupant comfort

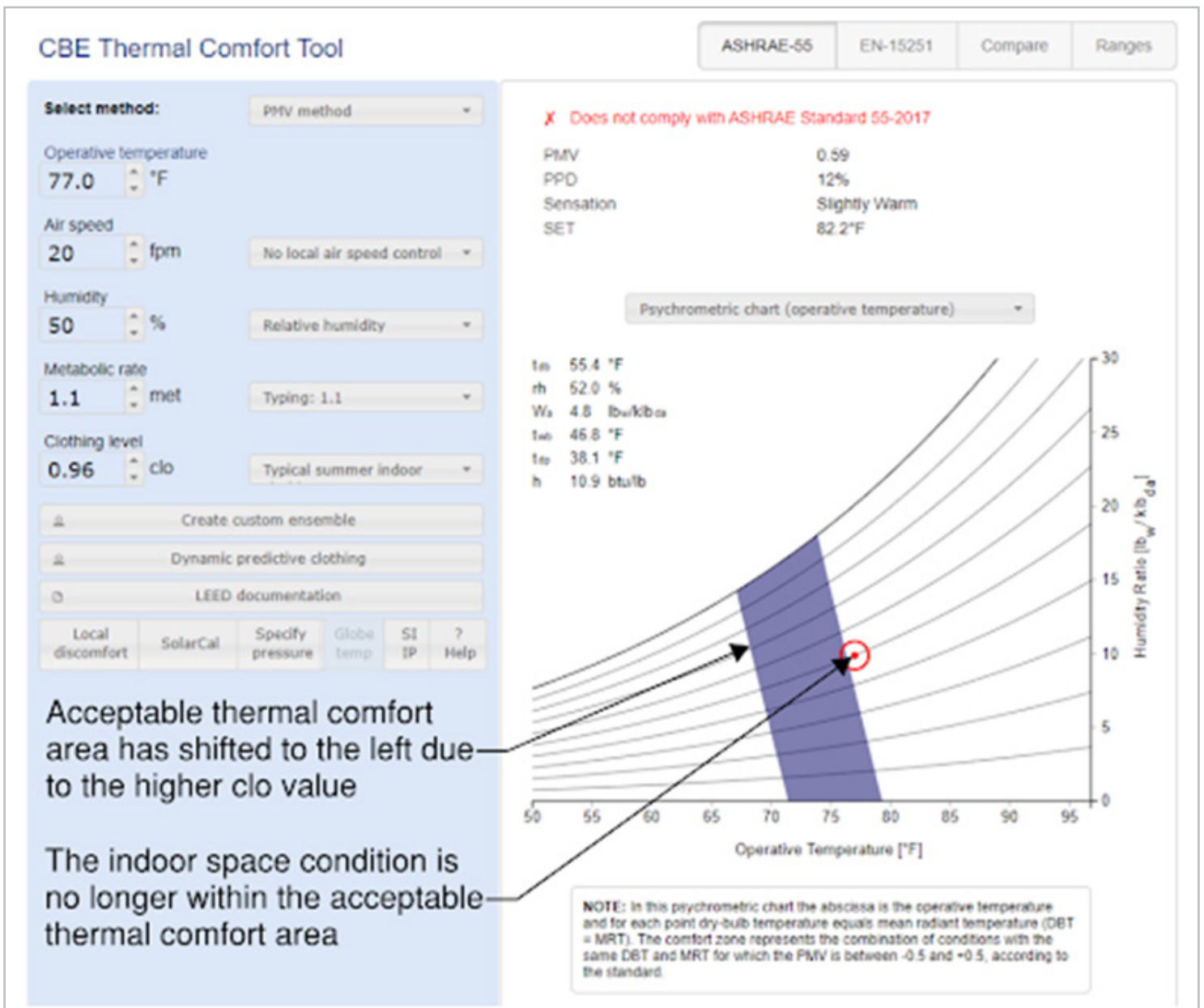


Fortunately, combining multiple cooling solutions can increase cooling effectiveness while reducing energy consumption – offering the best of both worlds.

A/C plus fans: HVLS fans make A/C more effective by providing cooling effects that significantly reduce A/C run-times. These combination systems use just a

fraction of the energy of A/C-only systems and help by delivering cooled air to locations throughout the building where it might not have been able to reach itself. Additionally, there is the perceived cooling benefit achieved by increasing the speed of the cooled air within the facility. Thus, including fans in the overall cooling plan makes energy savings easy and automatic.

Fig. 4: Changing one parameter (clothing level) puts occupants outside of comfort area



Evaporative coolers plus fans: This combination provides effective cooling without the need for air conditioning. The natural synergy between HVLS fans and evaporative cooling are achieved because evaporative coolers – which can

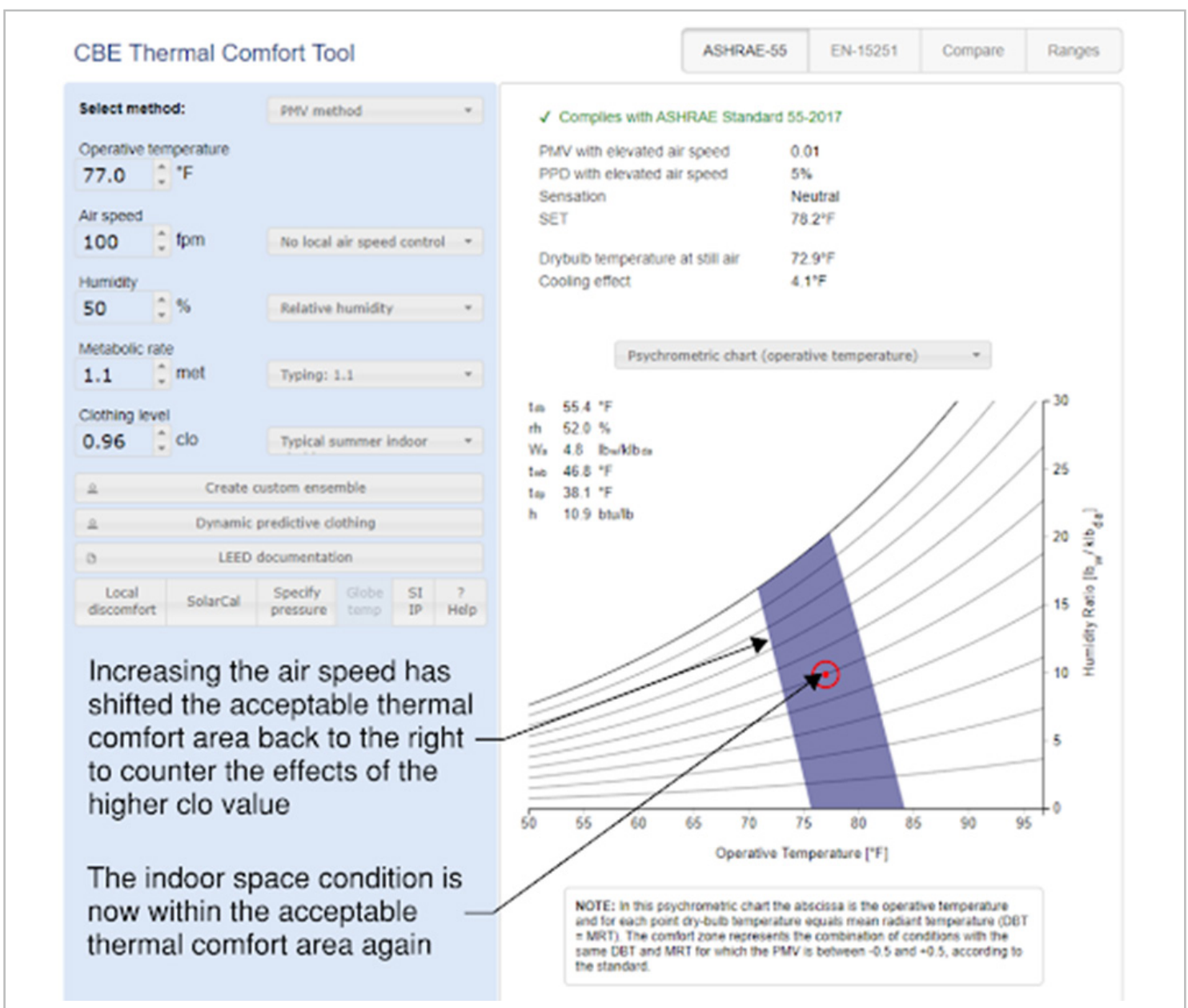
be very portable and focused – provide dramatically lower air temperatures precisely where they are needed, and the addition of HVLS fans then distributes the cool air throughout the space as needed.

WHAT'S AT STAKE?

Heat stress mitigation is wonderful, but it doesn't help at all if it is cooling the wrong spot. The combination of cooling – either A/C or evaporative – AND HVLS fans helps solve heat problems in novel ways. But to be successful, building operators or employers must model where in the facility the employees are

actually working, and how high above the floor they are to ensure that cool air doesn't sink below where the workers can perceive it. For example, if all the A/C is doing is cooling the air below the knees, employees may not perceive any of its benefits.

Fig. 5: Increasing airtspeed mitigates change and puts occupants back in comfort zone



THE BIG ASS FANS DIFFERENCE

There is one company uniquely positioned to help improve the efficiency of cooling systems – as well as heating systems in the wintertime – and that is Big Ass Fans. The pioneer in HVLS fans, Big Ass Fans offers everything to compliment HVAC including HVLS fans, evaporative coolers, and even heaters.

Since cooling is a science and needs to be backed with ROI calculations, the first step is to create a comprehensive cooling model using SpecLab, a cloud-based modeling tool that demonstrates the benefits of each element of a complete system – which will be different for every location where employees work in a facility from office to warehouse.

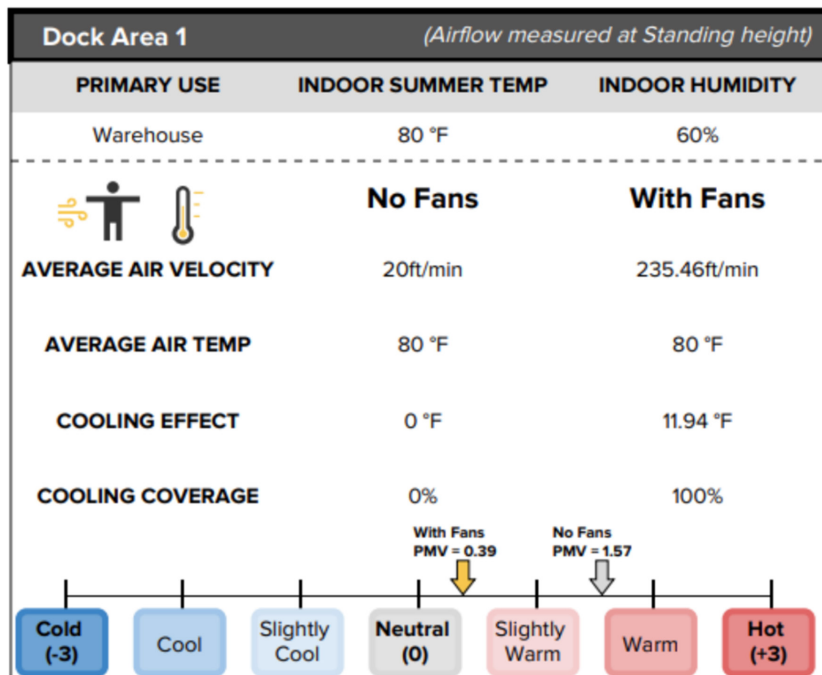
Add in [OSHA's Safety Pays calculations](#) for a single heat prostration event at approximately \$80,000 of cost to an employer, and the ROI potential is quickly realized.

Big Ass Fans deliver a means of sustainable comfort by reducing the carbon footprint and dependency on larger, unnecessary energy-heavy solutions resulting in greenhouse gas emissions – all while keeping employees comfortable and safe by employing variable speed fans that deliver the right air speed at the right spot based on SpecLab analysis.

During the winter months, the same solution can improve energy efficiency by destratifying air and circulating warmed air that has risen to the ceiling and move it down to floor level where employees are working.

As the pioneer in HVLS, Big Ass Fans has the best performing, most efficient fans capable of creating safer, healthier environments.

Fig. 6: Fans contribute greatly to comfort



Big Ass Fans are built with safety in mind and make the workplace safer in many ways including

- Unique retainer clips that prevent fan blades from falling and causing injury
- Elimination of critical welds to eliminate possible metal fatigue that could cause failure
- Leading the industry in safety, power consumption, and fan longevity
- A preventive maintenance program to ensure fans continue to operate as expected and minimize unscheduled maintenance that can lead to expensive downtime

Our world is heating up, and the impact is global. Until recently the EU marketplace didn't consider ceiling fans as part of an overall cooling strategy – until Paris, France hit 98°F and fans were nowhere to be had as demand soared literally overnight. In many cases, building owners and employers did not know fans could help solve their heat stress problems, and Big Ass Fans can help combat problems that many did not know they actually had.

So whether you're in a small facility, a large facility, coastal or inland, hot and dry or warm and humid, know there's a company dedicated to helping you solve your biggest heat stress problems and ready to assist with a simple click below.

LEARN MORE

[Click here](#) to learn more about how to keep your team cool and OSHA compliant.