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Via email: [jay.withrow@doli.virginia.gov](mailto:jay.withrow@doli.virginia.gov) and [princy.doss@doli.virginia.gov](mailto:princy.doss@doli.virginia.gov)

**RE: Comments Regarding the Proposed Heat Illness Prevention Standard**

Dear Mr. Withrow:

Thank you for the opportunity to serve on the Virginia Heat Illness Prevention Advisory Panel and contribute to the process of creating a comprehensive heat standard that will protect workers from heat illness, injury and death. I would be delighted to continue to help in this process as it progresses.

As you know, Public Citizen is a consumer and health advocacy group with approximately half a million members and supporters nationwide and more than 16,400 members and supporters in Virginia. We applaud the efforts of the Virginia Department of Labor and Industry's Safety and Health Codes Board to implement a much-needed Heat Illness Prevention Standard.

**Heat Stress Is a Significant Risk to Workers**

More than 600,000 Virginians work in outdoor and indoor jobs with heat hazard risks.<sup>1</sup>

When a worker is pushed beyond a safe heat exposure, a range of dangerous illnesses may result, including heat exhaustion, heat syncope, rhabdomyolysis, heat stroke and death. In addition to the acute threats of death and illness, these workers are also likely facing long-term health risks. Heat stress exacerbates existing health problems like asthma and heart disease, possibly shortening workers' lives. And when coupled with dehydration, repetitive heat stress can cause depressed kidney function and chronic kidney disease.<sup>2</sup>

Heat stress causes dizziness, fatigue, distraction, cramps and reduced cognitive performance and decision-making. This, in turn, can cause potentially fatal or debilitating injuries from accidents — such as falling from heights, wounds from power tools or machinery, being struck by a moving vehicle, or mishandling dangerous chemicals. An analysis of more than 11 million

workers' compensation injury reports in California over the past two decades found that high temperatures likely caused about 20,000 additional injuries per year in that state alone.<sup>3</sup>

### **Indoor heat stress**

An analysis of 7 years of worker heat complaints in Virginia reveals a similar pattern. Data from Virginia Occupational Safety and Health (VOSH), the administrator of Virginia's OSHA-approved State Plan, revealed 229 heat complaints, or Unprogrammed Activity (UPA) Notifications, from August 2014 to August 2021, including 50 hospitalizations and four deaths.<sup>4</sup>

Of those cases 142 (62%) involved indoor stress, 21 of which resulted in hospitalizations. The number of indoor heat stress complaints was nearly double the number of outdoor heat stress complaints. Also, four of the UPAs involved jobs with both an indoor and outdoor component and 9 UPAs involved delivery workers/delivery truck drivers. Three of the delivery worker cases resulted in hospitalizations.

### **Heat Stress is Dramatically Exacerbated by the Climate Crisis**

Twenty of the last 21 years were the hottest on record, and extremely high temperatures are projected to increase, as are the frequency, length and intensity of heat waves.<sup>5</sup> Heat waves are particularly dangerous, as the combination of both high daytime and nighttime temperatures keeps the body from cooling down during the night, making each successive day of a heat wave more deadly than the one preceding it.<sup>6</sup>

The summer of 2021 was the hottest in recorded history, just edging out the Dust Bowl of 1936.<sup>7</sup> Virginia set heat records, as well. For example, here have been 53 days when the temperature was above 90°F in Lynchburg this year, exceeding the previous record of 44 days in 1988.<sup>8</sup>

With accelerating global warming, extreme high temperatures are projected to increase, as are the frequency, length and intensity of heat waves.<sup>9</sup>

### **Protecting Workers from Heat Stress Is a Racial Justice Issue**

There is a profound racial and economic injustice component to workplace heat hazard risks. Research shows that the dangers of occupational heat stress are overwhelmingly borne by low-income workers, with the lowest-paid 20% of workers suffering five times as many heat-related injuries as the highest-paid 20%.<sup>10</sup> Heat stress also disproportionately burdens workers of color. A recent review by Columbia Journalism Investigations of records relating to workplace heat injuries -- including workplace inspection reports, death investigation files, depositions, court records, and police reports -- found that since 2010, Hispanics have accounted for a third of all heat fatalities, despite representing only 17% of the U.S. workforce.<sup>11</sup> Among construction workers deaths over the the 25 years covering 1992-2016, Black construction workers were 51% more likely to die from heat exposure and the rate for construction workers born in Mexico was a whopping 91% higher than the average.<sup>12</sup>

Essential jobs that experience the highest rates of heat illness are disproportionately held by Black and Brown workers. For example, while Latinx workers make up 17.6% of the entire workforce, they make up 65% of farm laborers, graders, and sorters.<sup>13</sup> Crop workers die from heat stress at a rate 20 times greater than the rest of the U.S. workforce.<sup>14</sup> More than 46% of laborers and freight, stock, and materials movers are Black and Hispanic/Latinx, as are more than 52% of laundry and drycleaning workers, 52% of cooks, and 58% of those working in warehouses and storage.<sup>15</sup> While Black Americans only make up 12.1% of the total workforce, they make up 25% of postal workers and 23% of UPS drivers.<sup>16</sup> They also make up nearly 28% of sanitation workers nationally and account for well over half the waste material collectors in many areas of the country.<sup>17</sup> Grounds maintenance workers are more than 44% Latinx, while roofers are more than 53% Latinx.<sup>18</sup> All of these are high heat risk jobs.

### **Productivity requirements and incentives contribute to heat stress**

Special consideration must be given to the impact of productivity requirements and incentives in developing protective measures. These systems may discourage employees from stopping to get water or take a break. For example, many farmworkers are paid on a piece-rate system, being paid more for picking more.<sup>19</sup> If they take a break, they get paid less. The same systems may discourage workers from drinking necessary water or force workers to take drastic and inhumane measures like wearing diapers to not have to stop for bathroom breaks.<sup>20</sup> To combat this, California requires employers to calculate the piece rate excluding the break time and then use that rate to calculate the rest time rate.<sup>21</sup> Similarly, many workers in factories are subject to a system wherein they receive points or warnings for so-called infractions, which can include taking too much break time.<sup>22</sup> These workers may be wary of taking breaks. The Board should keep these countervailing interests in mind and create ways to ensure workers receive the benefits of the standards.

### **Heat Stress Has Economic Costs – and Workplace Protections Can Mitigate Them**

Leaving workers unprotected from heat has significant and damaging economic effects. In high heat, people work less effectively due to “diminished ability for physical exertion and for completing mental tasks.” This reduces productivity and income for employers and employees, increases the risk of accidents, and drives up medical expenses.<sup>23</sup> These effects can be seen across a spectrum of economic indicators.

Heat stress has reduced labor capacity by 10 percent over the past few decades.<sup>24</sup> In the United States we lose approximately \$100 billion per year per year in lost worker productivity as compare to prior to 1985.<sup>25</sup> Some counties in Virginia lose up 1% of gross value added (GVA)<sup>26</sup> due to heat-related worker productivity losses which can possibly add up to millions of dollars per county.<sup>27</sup> Heat-related injuries and illnesses increase workers’ compensation costs and hospital-related expenses.<sup>28</sup>

The good news is that the economic impacts of heat stress can be mitigated by the same protections that manage its health impacts. For instance, in 2011 a central Texas municipality implemented a heat illness prevention program for outdoor municipal workers that not only resulted in a significant decrease in heat-related illnesses, but decreased workers’ compensation costs by 50%

per heat-related illness.<sup>29</sup> California also saw a significant reduction in workers' compensation claims after putting a state heat standard in place in 2005.<sup>30</sup>

### **Virginia Cannot Wait for OSHA to Develop an Enforceable Heat Standard**

OSHA has had detailed recommendations for a heat standard for nearly five decades. The National Institute of Occupational Safety and Health (NIOSH) issued criteria for a recommended heat standard in 1972, which it updated in 1986 and 2016 using the most recent science.<sup>31</sup> Still, OSHA has not issued a heat standard.

Unable to rely on federal rules Oregon and Washington state were forced to issue Emergency Temporary Standards in July following the June, 2021 Pacific Northwest heat wave. California, Minnesota and Washington have issued permanent heat standards of their own as has the U.S. military. Maryland<sup>32</sup> and Colorado are in the process of writing standards as well. Virginia should protect its workers by joining those states in enacting a heat illness prevention standard.

On September 20, 2021, the White House announced an initiative to address heat stress in the workplace and communities. Among the planned efforts was an announcement of a National Proposed Rulemaking (ANPRM) for an OSHA heat standard.<sup>33</sup> While this is a welcome, long-overdue step forward, but we are still a long way from the finish line. On average, it takes OSHA eight years to promulgate a rule. Even with the support of the White House, we are at least four years away from a final rule from OSHA. Virginia can, and should, move faster to protect Virginia workers from heat illness, injury and death.

I look forward to assisting in the process of developing that standard.

Sincerely,

Juley Fulcher, J.D., Ph.D.

Please see comments below on the Proposed Heat Illness Prevention Standard draft dated August 30, 2021, as provided to the Virginia Heat Advisory Panel.

## **Virginia Must Implement a Strong Workplace Heat Illness Prevention Standard**

The Virginia Heat Illness Prevention Standard should, at a minimum, include the elements described below, based largely on NIOSH's latest (2016) iteration of its criteria for a recommended standard for occupational exposure to heat.<sup>34</sup>

### **Chapter 210. Heat Illness Prevention Standard**

*Public Citizen strongly encourages the name of the Heat Illness Prevention Standard be changed to the Heat Illness and Injury Prevention Standard*

An analysis of more than 11 million workers' compensation injury reports in California from 2001 through 2018 found that hotter temperatures significantly increase injuries on the job and days with temperatures above 80°F have likely caused about 20,000 additional injuries per year in that state alone.<sup>35</sup> The study demonstrated that working on a day with temperatures above 90°F leads to a 5-9% increase in same-day injury claims, while a day above 100°F leads to a 10-15%.<sup>36</sup> Using Bureau of Labor Statistics workforce estimates and extrapolating from the California data, Virginia may be experiencing more than 4,500 heat-related injuries per year.<sup>37</sup>

Heat-related injuries are a significant problem requiring education, regulation and enforcement. Virginia has the opportunity to do that. Heat-related injuries caused by hot days were cut by 30% in the years following California's issuance of their heat standard in 2005.<sup>38</sup> Thus, an effective heat standard has value.

### **16VAC25-210-10. Purpose, scope, and applicability.**

*Public Citizen strongly supports the proposed trigger temperature of 80°F for applicability of the Heat Illness Prevention Standard.*

There are a number of factors that contribute to heat stress in the body. These include the ambient temperature, humidity, radiant heat (direct sunlight, ovens and other heat-generating machinery, road surfaces, etc.), air movement, the person's metabolic rate (impacted by workload, fitness, and personal risk factors) and clothing that may or may not allow the body to release heat.<sup>39</sup>

Sophisticated measurements and tables are useful in determining when and how adjustments must be made to protect a person from heat illness. However, there are limits to what can be expected of employers in identifying the risks and making the necessary adjustments.

In order to protect workers in a way that's practical and economical for employers, a heat standard must rely on the best estimates of when the risk of heat illnesses, injuries and death increase. Using the simple Heat Index (HI), which combines air temperature and humidity, 80°F HI as a reasonable point to begin taking precautions against heat stress in the workplace. Ninety-six percent of all civilian heat-related deaths occur with a Heat Index of 80°F and above.<sup>40</sup> While some workers may experience heat illness at a lower Heat Index than 80°F, especially when working in direct sunlight doing very strenuous work, this "trigger" point is a reasonable generalization of increased risk for employers to rely upon. The 80°F trigger point is used in the Oregon Emergency Temporary Standard issued in July, 2021 after the deadly Pacific Northwest

heatwave that occurred in late June.<sup>41</sup> It is also used in the California Heat standard that has been in place since 2005.<sup>42</sup>

### **16VAC25-210-40. Drinking water.**

*Public Citizen supports the proposed drinking water requirements, but it is essential to also include a requirement for easily and consistently accessible, clean and safe restrooms.<sup>43</sup>*

In order to keep the body cool, workers must consume lots of water. Making it easily available is essential. However, if employees have limited access to restrooms or the available restrooms are unclean, employees may restrict their own water intake. Additionally if workers feel harassed or unsafe using the restrooms, they may likewise reduce water intake. While other Virginia regulations may address restroom facilities at the workplace, it's important to add clear provisions the the Heat Illness Prevention Standard that may be more effective in encouraging workers to drink sufficient water under high heat conditions.

### **16VAC25-210-70. High heat procedures.**

*Public Citizen supports a Heat Index of 90°F as an appropriate “trigger” for a “high heat” condition requiring additional safety measures. However, we encourage the inclusion of a minimum of a ten (10) minute break every hour in high heat conditions.*

As the environmental heat increases, the risk to workers also increases. Beyond the use of work/rest schedules (described below), employers must take extra actions to protect workers from heat illness, injury and death when the Heat Index reaches highly dangerous levels.

The Work/Rest Schedules created by the National Institute of Occupational Safety and Health (NIOSH) at the Centers for Disease Control and Prevention (CDC)<sup>44</sup> is one of the simpler charts available to determine safe work/rest schedules. It uses the heat index to recommend appropriate breaks for those doing “light,” “medium” and “heavy” workloads and provides examples of workloads. The chart was developed on an assumption that the relative humidity is 30% and the ambient temperature is measured in the shade. It also assumes workers are physically fit, well-rested, fully hydrated and under age 40 — making the scale optimistic at best for the average worker without even considering things such as caffeine intake, medications, pre existing conditions or lack of air-conditioning in the home. Adjustments for working outdoors on sunny and cloudy days, as well as higher levels of humidity are provided.

Here is some information on the average humidity during hot weather months (May-September) for cities in different parts of Virginia.

City	Relative Humidity Range
Richmond <sup>45</sup>	68%-74%
Norfolk <sup>46</sup>	74%-78%
Charlottesville <sup>47</sup>	71%-76%
Bristol <sup>48</sup>	76%-78%
Manassas <sup>49</sup>	72%-76%
Roanoke <sup>50</sup>	72%-77%

According to the NIOSH Work/Rest Schedules, an additional 9°F should be added to the heat index to determine the appropriate break schedule when the humidity exceeds 60%. An additional 6°F should be added if working outdoors on a cloudy day and 13°F on a sunny day. Though the CDC chart doesn't address it, OSHA recommends adjusting for clothing that make it difficult for the body to release heat, such as double layer clothing or impermeable PPE use to protect workers from a variety of other workplace hazards. Though consistently described throughout NIOSH and OSHA materials, the NIOSH Work/Rest Schedules does not mention adjustments for radiant heat sources, such as ovens, machinery and road surfaces. However, working next to these heat sources would also require an upward adjustment.

Based on these factors a heat index of 90°F in Virginia would be adjusted to 99°F based on humidity alone. Any additional adjustment based on radiant heat or clothing would move it to more than 100°F. Working in direct sunlight would send it up to 112°F, for example. Based on a moderate workload, the NIOSH recommends a minimum of a 15 minute break every hour at a 90°F Heat Index with a Heat Index adjustment for Virginia humidity and any additional adjustments needed.

**A Heat Index of 100°F should trigger an “extreme heat” condition with additional safety requirements.**

Using the NIOSH charts, a heat index of 100°F would be adjusted to 109° based on Virginia humidity alone. At that point, the CDC recommends that even light load workers be taking a 30 minute rest period for every 30 minutes of work. And those doing moderate or heavy work are beyond the point where a modified work/rest schedule can protect workers from the dangers of heat stress, with only extreme caution indicated.

“Extreme heat” should incorporate the requirements of “high heat” conditions and add the additional requirements of

- 1) Signage and alerts - Employers must give verbal alerts and post signage in the languages workers speak alerting employees of the extreme heat risk and need to take extra precautions and carefully monitor themselves and others. The verbal alerts and signage should remind employees to rest in a cool down area if they are feeling any symptoms of heat illness and to inform at least one other employee or supervisor that they are feeling ill.
- 2) Employers shall ensure that each employee take a minimum 30-minute paid preventative rest period in a cool down space for for every 30 minutes of work during the hours of the day when the Heat Index exceeds 100°F.
- 3) Employers shall further reduce the risk of employee heat illness and injury by:
  - a. changing work hours to cooler times of the day, avoiding the hours of (1pm-5pm ET);

- b. changing work responsibilities to have employees work in the shade or inside a space where there is adequate ventilation or air conditioning during the hottest hours of the day;
- c. reducing the metabolic load on employees during the hottest hours of the day by changing work responsibilities to a “light workload” [should be defined] or reducing the pace of work by at least 50%; or
- d. cancelling work for the day.

The “extreme heat” condition should be incorporated in other areas on the proposal where appropriate such as in **16VAC25-210-90. Heat illness prevention plan** and **16VAC25-210-30. Definitions.**

#### **16VAC25-210-100. Training.**

*Information about heat-related injuries and how to avoid them should be included in the required training of employees and supervisors.*

As noted above, injuries in the workplace caused by the symptoms of Heat stress that employees suffer in high heat are a serious concern. How to protect against heat-related injuries is a central element to any effective training program.

#### **16VAC25-210-110. Discrimination against an employee for exercising rights under this chapter is prohibited.**

*The prohibition of retaliation against a worker for exercising their rights under the Heat Illness Prevention Standard should reflect the realities of employee circumstances and best practices in anti-retaliation language. We support the addition of the following language in sections A. and B.*

No person shall discharge, demote, blacklist, prejudice by any action or lack of action, or otherwise discriminate against in any way (including in the hiring process and including by the threat of any such action or inaction) against an employee, or a family member of such employee who is also an employee, because the employee has exercised rights under the safety and health provisions of this chapter, Title 40.1 of the Code of Virginia, and implementing regulations under 16VAC25-60-110 for themselves or others.



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<sup>1</sup> Based on data from *May 2020 State Occupational Employment and Wage Estimates — Virginia*, BLS (2020) [https://www.bls.gov/oes/current/oes\\_va.htm](https://www.bls.gov/oes/current/oes_va.htm).

<sup>2</sup> Brian Curwin, NIOSH, CHRONIC KIDNEY DISEASE OF UNKNOWN ETIOLOGY: NIOSH PESTICIDE EXPOSURE STUDY IN EL SALVADOR SUGARCANE WORKERS (Sept 27, 2016), <https://bit.ly/3bX3wHf>.

<sup>3</sup> R. Jisung Park, Nora Pankratz & A. Patrick Behrer, *Temperature, Workplace Safety, and Labor Market Inequality*, IZA INSTITUTE OF LABOR ECONOMICS DP No. 14560 3 (July 2021), <https://bit.ly/2V3WriI> [hereinafter R. Jisung Park et al., *Temperature, Workplace Safety, and Labor Market Inequality*]. Injury rates were compared on hot days above 80° with injuries occurring on cooler days and found significantly more injuries on hot days, with injury rates increasing as temperatures rose to 85°, 90°, 95° and 100°.

<sup>4</sup> The data was acquired from the VOSH OSHA Identification System (OIS). Unprogrammed Activity (UPA) Notifications include complaints, referrals, employer reported cases, hospitalizations, deaths. UPAs were identified using the search term “heat” and may not be inclusive of all heat-related cases.

<sup>5</sup> RS Vose, DR Easterling, KE Kunkel, et al., 2017: *Temperature changes in the United States*, CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 1 185 (2017); Umair Irfan, Eliza Barclay & Kavya Sukumar, *Weather 2050*, VOX (July 19, 2020), <http://bit.ly/3fnV3Pp>.

<sup>6</sup> Emma Newburger, *Heat waves are becoming more deadly as nights warm faster than days*, CNBC (Sep. 12, 2020), <https://cnbc.com/3bYqJbY>.

<sup>7</sup> Chris Dolce, *Summer 2021 Was the Hottest on Record in the Contiguous U.S., NOAA Says*, WEATHER.COM (Sep 9, 2021), <https://bit.ly/3nNjk65>; *Assessing the U. S. Climate August 2021*, NOAA (Sep 9, 2021), <https://bit.ly/NOAA921>.

<sup>8</sup> Sydney Welch, *Lynchburg's current full year count for days over 90 is at 53. Summer brings record number of 90-degree days to Central Virginia*, WSET (Sep. 15, 2021), <https://wset.com/weather/weather-extra/summer-2021-record-heat-lynchburg-roanoke-central-virginia>.

<sup>9</sup> RS Vose, DR Easterling, KE Kunkel, et al., 2017: *Temperature changes in the United States*, CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 1 185 (2017); Umair Irfan, Eliza Barclay & Kavya Sukumar, *Weather 2050*, VOX (July 19, 2020), <http://bit.ly/3fnV3Pp>.

<sup>10</sup> R. Jisung Park et al., *Temperature, Workplace Safety, and Labor Market Inequality*, 4.

<sup>11</sup> Julia Shipley et al., *Heat is Killing Workers in the U.S. -- and There Are No Federal Rules to Protect Them*.

<sup>12</sup> Xiuwen Sue Dong, Gavin West, Alfreda Holloway-Beth, Xuanwen Wang & Rosemary Sokas, *Heat-Related Deaths Among Construction Workers in the United States*, 62(12) AMERICAN JOURNAL OF INDUSTRIAL MEDICINE 1047-1057 (Dec. 2019), <https://bit.ly/3CWYd6J>.

<sup>13</sup> *Farm Labor*, UNITED STATES DEPARTMENT OF AGRICULTURE ECONOMIC RESEARCH SERVICE (data from 2018), <https://bit.ly/339Ks4F>.

<sup>14</sup> *Heat Related Deaths Among Farmworkers, United States — 1996-2006*, CDC, <https://bit.ly/3i9XgMw>.

<sup>15</sup> *Labor Force Statistics from the Current Population Survey*, BLS (2020), <http://bit.ly/3bV3xvn>; *Labor Force Statistics from the Current Population Survey*, BLS (2020), <http://bit.ly/3hVdRal>.

<sup>16</sup> *Labor Force Statistics from the Current Population Survey*, BLS (2020), <http://bit.ly/3hVdRal>; *Who We Are*, UPS (2015), <https://bit.ly/3n0FKOo>.

<sup>17</sup> *Labor Force Statistics from the Current Population Survey*, BLS (2020), <https://bit.ly/3bV3xvn>; Cole Rosengren and E.A. Crunden, *Risk and Race Concerns Fuel Ongoing Debate around Hazard Pay During Pandemic*, WASTE DIVE (July 9, 2020), <https://bit.ly/2S3Iz39>; Juliana Feliciano Reyes, *Trash is Piling Up but People Aren't Blaming Philly Sanitation Workers*, PHILADELPHIA INQUIRER (Aug. 4, 2020), <https://bit.ly/3kXoV5o>.

<sup>18</sup> *Labor Force Statistics from the Current Population Survey*, BLS (2020), <https://bit.ly/3bV3xvn>.

<sup>19</sup> *Rising Temperatures Intensify Risks for Florida Farmworkers*, CLEO INSTITUTE (May 28, 2021), <https://bit.ly/3FXCBIO>.

<sup>20</sup> *Id.*

<sup>21</sup> CALIFORNIA DEP'T OF INDUS. REL., *Frequently Asked Questions: Piece Rate Compensation - Labor Code § 226.2 (AB 1513)*, [https://www.dir.ca.gov/pieceratebackpayelection/AB\\_1513\\_FAQs.htm](https://www.dir.ca.gov/pieceratebackpayelection/AB_1513_FAQs.htm) (last accessed June 2, 2021).

<sup>22</sup> See, e.g., Annie Palmer, *Amazon Has Resumed Policies That Penalize Workers for Taking Too Many Breaks, Just in Time for Prime Day*, CNBC (Oct. 14, 2020), <https://www.cnbc.com/2020/10/14/amazon-resumes-policy-that-dings-workers-for-taking-too-many-breaks.html> (last accessed June 2, 2021).

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<sup>23</sup> *Climate Change and Labor: Impacts on Health in the Workplace*, UNITED NATIONS DEVELOPMENT PROGRAMME, 27 (Apr. 28, 2016), <http://bit.ly/3hQsnjQ>.

<sup>24</sup> John P. Dunne *et al.*, *Reductions in Labour Capacity from Health Stress under Climate Warming*, NATURE CLIMATE CHANGE 3 6 563-566 (2013); INTERNATIONAL LABOUR ORGANIZATION, WORKING ON A WARMER PLANET: THE IMPACT OF HEAT STRESS ON LABOUR PRODUCTIVITY AND DECENT WORK, 26 (2019), <http://bit.ly/2Sv61JY>.

<sup>25</sup> ATLANTIC COUNCIL: ADRIENNE ARSHT ROCKEFELLER FOUNDATION RESILIENCE CENTER AND VIVID ECONOMICS, EXTREME HEAT: THE ECONOMIC AND SOCIAL CONSEQUENCES FOR THE UNITED STATES (August, 2021), <https://bit.ly/3D8FGDA>, [hereinafter ATLANTIC COUNCIL 2021].

<sup>26</sup> The GVA is a productivity measure that reflects the value of goods and services produced in the area, industry, or sector of the economy. It is the output of the area, industry or sector minus immediate consumption.

<sup>27</sup> ATLANTIC COUNCIL 2021.

<sup>28</sup> Sidney Shapiro & Katherine Tracy, Public Law and Climate Disasters Occupational Health and Safety Law (Rosemary Lyster *et al.* eds., 1<sup>st</sup> ed., Edward Elgar Pub, 2018), <https://amzn.to/2QTBWxJ>; U.S. GLOBAL CHANGE RESEARCH PROGRAM, *Fourth National Climate Assessment, Volume II* (Nov. 2018), <https://nca2018.globalchange.gov/>.

<sup>29</sup> Ronda McCarthy, Francis Shofer & Judith Green-McKenzie, *Occupational Heat Illness in Outdoor Workers Before and After Implementation of a Heat Stress Awareness Program*, JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINES 75 A505 (April 24, 2018) <https://bit.ly/32j3XFA>.

<sup>30</sup> R. Jisung Park *et al.*, *Temperature, Workplace Safety, and Labor Market Inequality*.

<sup>31</sup> NIOSH [2016]. NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, *et al.* Cincinnati, OH: U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, CENTERS FOR DISEASE CONTROL AND PREVENTION, NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH, DHHS (NIOSH) Publication 2016-106. <https://www.cdc.gov/niosh/docs/2016-106/pdfs/2016-106.pdf>.

<sup>32</sup> MARYLAND GENERAL ASSEMBLY, Labor and Employment – Occupational Safety and Health - Heat Stress Standards (Oct. 1, 2020), <https://bit.ly/2PDpzur>.

<sup>33</sup> <https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/20/fact-sheet-biden-administration-mobilizes-to-protect-workers-and-communities-from-extreme-heat/>.

<sup>34</sup> NIOSH 2016 Criteria Recommendations.

<sup>35</sup> R. Jisung Park *et al.*, *Temperature, Workplace Safety, and Labor Market Inequality* at 2.

<sup>36</sup> *Id.*

<sup>37</sup> According to the Bureau of Labor Statistics, California makes up 11.655% of the U.S. labor force, which is currently estimated to be around 161.35 million, while Virginia makes up approximately 2.632% of the U.S. labor force. Thus, the California labor force is 4.43 times the size of Virginia's. 20,000 divided by 4.43 is just over 4,500.

<sup>38</sup> R. Jisung Park *et al.*, *Temperature, Workplace Safety, and Labor Market Inequality*, 27.

<sup>39</sup> *Id.*

<sup>40</sup> Saw Maung and Aaron W. Tustin, *The Heat Death Line: Proposed Heat Index Alert Threshold for Preventing Heat-related Fatalities in the Civilian Workforce*, NEW SOLUTION: A JOURNAL OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH POLICY (June 17, 2020), <https://bit.ly/2WKWFMs>.

<sup>41</sup> OAR 437-002-0155 and OAR 437-004-1130.

<sup>42</sup> California Code of Regulation §3395

<sup>43</sup> See, e.g., *Bathroom Breaks*, CDC NIOSH SCIENCE BLOG (viewed Oct. 15, 2021), <https://blogs.cdc.gov/niosh-science-blog/2019/11/22/bathroom-breaks/>.

<sup>44</sup> <https://www.cdc.gov/niosh/mining/UserFiles/works/pdfs/2017-127.pdf>

<sup>45</sup> [https://www.weather-us.com/en/virginia-usa/richmond-climate#humidity\\_relative](https://www.weather-us.com/en/virginia-usa/richmond-climate#humidity_relative)

<sup>46</sup> [https://www.weather-us.com/en/virginia-usa/norfolk-climate#humidity\\_relative](https://www.weather-us.com/en/virginia-usa/norfolk-climate#humidity_relative)

<sup>47</sup> [https://www.weather-us.com/en/virginia-usa/charlottesville-climate#humidity\\_relative](https://www.weather-us.com/en/virginia-usa/charlottesville-climate#humidity_relative)

<sup>48</sup> [https://www.weather-us.com/en/virginia-usa/bristol-climate#humidity\\_relative](https://www.weather-us.com/en/virginia-usa/bristol-climate#humidity_relative)

<sup>49</sup> [https://www.weather-us.com/en/virginia-usa/manassas-climate#humidity\\_relative](https://www.weather-us.com/en/virginia-usa/manassas-climate#humidity_relative)

<sup>50</sup> [https://www.weather-us.com/en/virginia-usa/roanoke-climate#humidity\\_relative](https://www.weather-us.com/en/virginia-usa/roanoke-climate#humidity_relative)