

January 10, 2024

John J. Howard, Director National Institute for Occupational Safety and Health Centers for Disease Control and Prevention Department of Health and Human Services

RE: National Institute for Occupational Safety and Health; Draft Hazard Review: Wildland Fire Smoke Exposure Among Farmworkers and Other Outdoor Workers; Request for Public Comment [Docket ID No. CDC-2024-0065]

Dear Director Howard:

Thank you for the opportunity to provide comments on the Draft Hazard Review: Wildland Fire Smoke Exposure Among Farmworkers and Other Outdoor Workers. As of December 2023, Washington became the third state to enact permanent occupational safety and health rules to protect outdoor workers from wildland fire smoke. Wildfires and wildfire smoke are increasing in frequency and severity across the western U.S. As the Draft Hazard Review notes on p. 56, wildland fires account for nearly half of all PM_{2.5} in the western U.S., and this is expected to substantially increase in the coming decades. Due to the increasing severity and widespread impact of wildfire smoke, it is imperative that NIOSH provide recommendations to protect outdoor workers from wildland fire smoke that meet the immense scale and scope of the harm.

Washington State Departments of Health (DOH) and Labor & Industries (L&I) submit the following comments in response to the Draft Hazard Review, to improve protections for outdoor workers during wildland fire smoke events. This is rooted in our scientific understanding of the health effects of wildland fire smoke exposure and informed by feedback and input we have received from public health, occupational, and air quality partners over many years of engagement:

¹ Burke M, Driscoll A, Heft-Neal S, Xue J, Burney J, Wara M [2021]. The changing risk and burden of wildfire in the United States. Proceedings of the National Academy of Sciences of the United States of America *118*(2):e2011048118, https://doi.org/10.1073/pnas.2011048118.

² Zhang D, Wang W, Xi Y, Bi J, Hang Y, Zhu Q, Pu Q, Chang H, Liu Y [2023]. Wildland fires worsened population exposure to PM2.5 pollution in the contiguous United States. Environ Sci Tech *57*(48):19990–19998, https://doi.org/10.1021/acs.est.3c05143.

³ Sarangi C, Qian Y, Leung LR, Zhang Y, Zou Y, Wang Y [2023]. Projected increases in wildfires may challenge regulatory curtailment of PM 2.5 over the eastern U.S. by 2050. Atmos Chem Phys 23(2):1769–1783, https://doi.org/10.5194/acp-23-1769-2023.

1. Outdoor Workers as a Sensitive Group: In Washington State, several agencies including the Departments of Health, Ecology, and Labor & Industries classify outdoor workers as a sensitive group^{4,5}. At the Federal Level, the U.S. Environmental Protection Agency (EPA)^{6,7} considers outdoor workers to be a sensitive group. As the Draft Hazard Review notes on page iii line 15, this designation is appropriate due to the amount of time spent outside each day and increased respiration from the often-physical labor required for outdoor work. Additionally, outdoor workers are not able to implement exposure reduction recommendations in the same way as the general public, due to the employercontrolled nature of their exposure and subsequent response. This results in a greater inhaled dose of wildfire smoke, increasing the risk of outdoor workers experiencing adverse health effects compared to the general population, regardless of the medical status of the exposed employee.

EPA's Air Quality Index (AQI) recommends all outdoor workers begin taking action at an AQI of 101 (calculated as PM_{2.5} of 35.5 μg/m³ 24-hour average concentration). These recommendations apply to all outdoor workers regardless of underlying medical status.⁸ Further, the stated purpose of the Hazard Review is "to mitigate risks and protect the health and well-being of these essential outdoor workers". We suggest NIOSH update the recommendations in Table 5-1 to include protections for all outdoor workers at 35.5 $\mu g/m^3$, and to add protections at levels below 35.5 $\mu g/m^3$. This is because the vast epidemiologic evidence indicates substantial health impacts at PM_{2.5} levels below 35.5 μg/m³. In particular:

- a. We recommend, at a minimum, employers provide all outdoor workers the means to follow recommendations to reduce exposure when the EPA's Air Quality Index (AQI) category is Unhealthy for Sensitive Groups (USG) or above, which starts approximately at a 1-hour average PM_{2.5} concentration of 35.5 µg/m³. ¹⁰ This includes implementing feasible engineering, and administrative controls, and provision of NIOSH approved respirators for employee use.
- b. Additionally, NIOSH suggests in section 5.1.2.1 to communicate to sensitive groups. We agree; however, this relies on employees disclosing why they are

⁹ Page iii

⁴ Washington State Department of Health, June 2024, accessed January 2025. Washington Air Quality Guide for Particle Pollution. https://doh.wa.gov/sites/default/files/2024-06/821-174.pdf.

⁵ P. 14-15, Chapter 296-820 WAC Wildfire Smoke. https://www.lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-820.pdf.

⁶For example, the response to EPA's prompt "Which Populations Experience Greater Risks of Adverse Health Effects Resulting from Wildfire Smoke Exposure?" (https://www.epa.gov/wildfire-smoke-course/which-populations-experience-greater-risksadverse-health-effects-resulting accessed Dec 2024) appropriately includes the entirety of outdoor workers as an at risk class:

[&]quot;Rationale: Extended periods of time exposed to high concentrations of wildfire smoke. Potential health effects: Greater exposure to wildfire smoke can lead to increased risks of experiencing the range of health effects described above."

⁷ https://document.airnow.gov/air-quality-guide-for-particle-pollution.pdf; accessed December 2024

https://document.airnow.gov/air-quality-guide-for-particle-pollution.pdf; accessed December 2024.

¹⁰ No variant of the AQI exists based on one-hour time-averaged mass concentration of PM2.5, so determining an AQI value based on a single-hour of PM_{2.5} data is necessarily imprecise, and is at best an approximation of the true one-hour averaged mass concentration.

- especially sensitive, or employers making assumptions about employee sensitivity to wildfire smoke. This is unnecessary, and neither equitable nor respectful of employee privacy. Rather, it is appropriate for employers to apply protections to all outdoor workers simply because all outdoor workers are sensitive regardless of whether they have health conditions.
- c. Linguistically and culturally relevant messaging to all employees should include information about particularly high-risk groups without targeting specific employees. Thus, all employees will be informed and can take additional precautions at lower levels of exposure if they choose. For example, the National Agricultural Workers Survey from 2019-2020 reported 68% of farmworkers indicated they could speak English "a little" or less¹¹, and the Bureau of Labor Statistics found 25% of construction workers are foreign born¹², indicating a large need for messaging in languages other than English in both industries.

Further, in recognition of the universal susceptibility outdoor workers have to the hazard of wildfire smoke exposure, during the development of the Washington Wildfire Smoke rule L&I declined to implement requirements or recommendations that required workers to declare underlying health conditions, or other additional status that would otherwise cause them to be considered a distinctly sensitive group. Instead, Washington requires feasible engineering and administrative controls be implemented, and NIOSH approved respirators be provided to all outdoor workers at 35.5 µg/m³ (AQI 101), regardless of underlying health conditions. Washington additionally recommends, but does not require, that employers make those same controls and personal protective equipment (PPE) available to workers upon request, to account for the understanding that some workers will have additional conditions that would make them sensitive to the effects of wildfire smoke exposure on top of their increased exposure due to being an outdoor worker.

2. **Health Guidance at Lower Levels of Exposure:** NIOSH asks in the Request for Public Comments "How can the recommendation in Chapter 4 to use the air quality index (AQI) for PM_{2.5} to define exposure control categories be better explained and supported from both a scientific and health communications standpoint? Please provide scientific evidence to support your response as necessary."

Washington State continues to believe EPA in 2024 set the current annual and 24-hour PM_{2.5} National Ambient Air Quality Standards (NAAQS) higher than the scientific basis required, given the known and ongoing harm these small particles cause.¹³ EPA uses

¹¹ Department of Labor, 2022. Findings from the National Agricultural Workers Survey (NAWS) 2019-2020. https://www.dol.gov/sites/dolgov/files/ETA/naws/pdfs/NAWS%20Research%20Report%2016.pdf.

¹² Bureau of Labor Statistics, 2022. The construction industry: characteristics of the employed, 2003-20. Spotlight on Statistics. https://www.bls.gov/spotlight/2022/the-construction-industry-labor-force-2003-to-2020/home.htm.

¹³ See Washington State comments on the NIOSH Outdoor Workers Exposed to Wildland Fire Smoke Request for Information, May 13, 2024: https://www.regulations.gov/comment/CDC-2024-0019-0011; and Washington State comments on EPA's Reconsideration of the National Ambient Air Quality Standards for Particulate Matter, March 27, 2023: https://www.regulations.gov/comment/EPA-HQ-OAR-2015-0072-2000.

these regulatory thresholds for defining the start of the "Moderate" and "Unhealthy for Sensitive Groups" categories of the AQI. The method EPA uses to set the annual and 24-hour NAAQS for PM_{2.5} is not exclusively based on the extant scientific evidence, but instead reflects a host of other inputs that are necessarily part of the policymaking process for EPA's regulatory purposes. We recommend NIOSH set appropriate thresholds for action for outdoor workers based first and foremost on the published epidemiologic and toxicologic evidence around health impacts of PM_{2.5} exposure. Specifically, we recommend health guidance and messaging begin at lower levels of exposure, rather than relying on the AQI health messages directly. Substantial epidemiologic evidence from general population studies indicates there is no safe level of exposure to PM_{2.5}, ^{14,15} and indeed, most adverse health outcomes occur at concentrations below what the AQI deems 'Unhealthy for Sensitive Groups'. ¹⁶

Further, outdoor workers are exposed to wildfire smoke for far longer periods than the general population, as discussed above. Thus, we expect impacts on outdoor workers to be greater than the epidemiologic evidence for the general public suggests, highlighting the need for guidance, requirements, and exposure reduction steps below the USG threshold of $35.5~\mu g/m^3$. We recommend NIOSH adopt exposure thresholds that reflect the epidemiologic evidence and the fact that outdoor workers are exposed to wildfire smoke for far longer periods than the general population.

For example, L&I's Wildfire Smoke rule requires training, and a written wildfire smoke response plan before employees are exposed to a $PM_{2.5}$ of 20.5 $\mu g/m^3$, which is in the Moderate AQI category. At $PM_{2.5}$ concentrations between 20.5 and 35.5 $\mu g/m^3$, L&I's rules recommend, but do not require employers to provide respirators and to implement feasible engineering and administrative controls. L&I's 20.5 $\mu g/m^3$ threshold is based on the Washington Air Quality Advisory (WAQA),¹⁷ which was previously used in Washington instead of the AQI, as it more directly aligned with the epidemiologic evidence on the health impacts of $PM_{2.5}$. Under the WAQA, 20.5 $\mu g/m^3$ was the threshold between Moderate and USG. However, there is still harm below this threshold, as referenced above, substantial epidemiologic evidence from general population studies indicates there is no safe level of exposure to $PM_{2.5}$.

¹⁴ Lars Perlmutt, David Stieb, and Kevin Cromar. "Accuracy of quantification of risk using a single-pollutant Air Quality Index". In: *Journal of Exposure Science & Environmental Epidemiology* 27.1 (2017), pp. 24–32. DOI: 10.1038/jes.2015.43.

¹⁵ Sarah B. Henderson, Phuong D.M. Nguyen, Jiayun Angela Yao, Michael J. Lee. The public health paradox of wildfire smoke. *BCMJ*, Vol. 66, No. 3, April 2024, Page(s) 93,95 - BC Centre for Disease Control.

¹⁶ Ibid.

¹⁷ WA DOH; WA ECY. WAQA: Washington air quality advisory. Available from: https://fortress.wa.gov/ecy/publications/documents/1802024.pdf

¹⁸ The WAQA also provided a convenient and pragmatic basis for defining when PM_{2.5} excursions during wildfire smoke season were more likely to be from wildfires in Washington as opposed to other sources of ambient air pollution.

3. **Guidance for Co-Exposures:** NIOSH asks whether "...the recommendations in Chapter 5 adequately address the protection of potentially disadvantaged or at-risk outdoor workers, such as persons with pre-existing health conditions (*e.g.*, asthma, cardiovascular disease), migrant workers, persons of lower socioeconomic status, and elderly or minor workers? If not, how could the recommendations be changed to better protect these populations? Are there additional recommendations to consider to protect these at-risk workers?"

While we consider all outdoor workers to be at-risk from wildfire smoke, we recommend NIOSH strengthen the recommendations in the Hazard Review to better address the needs of disadvantaged or especially at-risk outdoor workers. In our changing climate, people are increasingly exposed to several hazards at the same time. This is especially true for outdoor workers, who are often exposed to compounding climate and weather extremes, ¹⁹ in addition to workplace-specific exposures, and infectious disease. This increases the risk of poor outcomes in wildfire-smoke-exposed outdoor workers, consistent with their class-wide status as a "sensitive group". We suggest NIOSH add to the recommendations in Chapter 5, including in the employee training section, information related to the heightened health risks of co-exposure, and how to protect outdoor workers who are exposed to multiple hazards including, but not limited to: wildfire smoke, heat, and infectious disease (including SARS-CoV-2, influenza, and Highly Pathogenic Avian Influenza). Specific guidance for co-exposures is important, as the epidemiologic literature indicates exposure to two hazards is often worse than the sum of each individual hazard. In other words, during a simultaneous wildfire smoke and heat event, for example, evidence indicates people experience symptoms at lower levels, and/or experience worse symptoms than if they had only been exposed to one hazard alone. 20 Guidance on heat co-exposures is particularly important absent federal heat rules and specific training and protections related to heat exposure in many states. Because the AQI does not contemplate combined risks in this way, addressing co-exposures, including heat and infectious diseases, would also be helpful information for this population of workers when considering the unmodified risk categories and health messaging communications of the AQI.

L&I provides the following specific recommendations:

1. Averaging Times: Section 1.4.3.4, and throughout the draft hazard review, NIOSH references the "AQI" and the "AQI for PM_{2.5}" both as used by EPA in relation to National Ambient Air Quality Standards (NAAQS), and public health communication, and as thresholds for occupational health standards in states such as California, Oregon,

¹⁹ Elena Austin et al. 2021. Combined burden of heat and particulate matter air quality in WA agriculture. *J Agromedicine*. Jan; 26(1): 18-27. 10.1080/1059924X.2020.1795032

²⁰ Chen, C., Schwarz, L., Rosenthal, N., Marlier, M. E., & Benmarhnia, T. (2024). Exploring spatial heterogeneity in synergistic effects of compound climate hazards: Extreme heat and wildfire smoke on cardiorespiratory hospitalizations in California. *Science Advances*, 10(5). https://doi.org/10.1126/sciadv.adj7264

and Washington. The draft hazard review does not differentiate between the three variants of the AOI: The AOI forecast (prospective only), the retrospective daily AOI (24-hour average), and the NowCast AQI, which while also retrospective has a shorter averaging time between 3 and 12 hours²¹. We recommend NIOSH specify the time averaging intended throughout the Hazard Review such as the NowCast AQI for PM_{2.5} for use in occupational exposure thresholds, or the 24-hour average AQI used for ambient air quality standards. We are unaware of any AQI variant that is constructed on the basis of one-hour time-averaged mass concentrations of PM_{2.5}, and recommend NIOSH review and edit the Hazard Review to avoid implying equivalence between the NowCast AQI and instantaneous or time-averaged mass concentrations of PM_{2.5} that use something other than EPA's NowCast time-averaging algorithm.

- 2. Basis of Washington Wildfire Smoke Rule: In section 1.4.3.3, and throughout the draft hazard review, NIOSH incorrectly states that the Washington Wildfire Smoke rules are "linked to levels of EPA's AQI for PM_{2.5}". This is untrue as the thresholds in the Washington rule are tied directly to the 1-hour average PM_{2.5} concentrations. The rule lists the NowCast AQI for PM_{2.5} thresholds that employers are permitted to use as approximations of the rule's PM_{2.5} thresholds, consistent with EPA's position that the agency declines to provide guidance for regulatory use of the AQI, for the AQI was not developed to be a regulatory tool²². The NowCast AQI for PM_{2.5} is not equivalent to the 1-hour average PM_{2.5} that forms the basis of the Washington Wildfire Smoke rules due to the differences in averaging times. This became especially relevant after the EPA updated the AOI breakpoints in May of 2024, as the AOI values in the Washington Wildfire Smoke rules needed to be updated to reflect the change. We request that NIOSH correct the draft hazard review to state that the Washington Wildfire Smoke rule thresholds are based on 1-hour average PM_{2.5}.
- 3. **AQI Threshold:** In section 1.4.3.3, and 5.2.3, NIOSH incorrectly states that the lowest AOI threshold that requires employers to take action in Washington is 69. The Washington Wildfire Smoke rules are based on a 1-hour average PM_{2.5}, and the lowest threshold is 20.5 µg/m³. This approximately corresponds to a NowCast AQI for PM_{2.5} of 72 as an approximation of this threshold under the revised EPA AQI^{23} .
- 4. PM_{2.5} and Particulates not otherwise regulated (PNOR): Section 1.5 notes that L&I contrasted the existing occupational health standards for particulates not otherwise regulated (PNOR), with the hazard of PM_{2.5}. The section goes on to state that the only difference between the two is the size fraction. While this is true when considering only the definitions of PM_{2.5} and respirable fraction in isolation, average outdoor PM_{2.5} was only found to exceed 20.4 µg/m³ due to wildfire smoke during the wildfire season in

²¹ https://www.airnow.gov/aqi/aqi-basics/using-air-quality-index/; accessed December 2024

²² 88 FR 5638

²³ Proposed rule update https://www.lni.wa.gov/rulemaking-activity/AO24-11/2411CR102Proposal.pdf

Washington State²⁴. Washington's rule uses $PM_{2.5}$ as a proxy measurement for wildfire smoke with the understanding that outdoor $PM_{2.5}$ at the concentrations in the rule can be assumed to contain wildfire smoke even without a component analysis. Even though wildfire smoke does not have a permissible exposure limit (PEL) under Washington's airborne contaminants rule, $PM_{2.5}$ does not meet the definition of "nuisance dust" or "inert dust" in WAC 296-841-099, and thus the corresponding permissible exposure limit of 5000 μ g/m³ is not applicable to $PM_{2.5}$.

Washington's rule does differ from the Federal OSHA rule in that the PNOR category specifically does not apply when an airborne contaminant requires a lower permissible exposure limit (PEL), even if a lower PEL is not listed, and we request that NIOSH modify the draft document²⁵ to reflect these differences in the discussion that cites Washington's Air Contaminants rules.²⁶ As the L&I Wildfire Smoke Rule Cost Benefit Analysis states "Given the diverse array of adverse health effects caused by PM_{2.5} exposure from wildfire smoke, this regulatory threshold [of 5000 μ g/m³] is not appropriate to address the hazard caused by particulate pollution from wildfire smoke".²⁷

DOH additionally provides the following specific recommendations:

- 1. **Describe Exposure Averaging Time in the Literature**: In section 3.2.2 on Epidemiologic Evidence, we suggest distinguishing between health impacts in the literature by exposure averaging time. This is mentioned in the description of included studies but could be further discussed in the different health impacts sections. For the cited studies, include whether the exposure was modeled as 24-hour average, sub-daily or hourly average, or long-term average. For the acute health effects studies, describe the lag structure used, if any.
- 2. **Health Equity Research**: We recommend NIOSH include the following health equity research question as a needed area of research and implementation: How can policies be designed to mitigate the financial impact of lost work from wildfire smoke and other climate hazards (including heat, floods, etc.) among outdoor workers? This could include wage replacement from lost work due to climate hazards, among other policy solutions. Research is needed to understand what policies may be effective, so workers don't have to choose between protecting their health and receiving wages.
- 3. **Off-Shift Worker Exposure**: In Section 5.1.2.5, we agree that workers should be advised on how to reduce exposure to wildfire smoke in their off-shift time. However, it is

²⁴ Doubleday A, Schulte J, Sheppard L, Kadlec M, Dhammapala R, Fox J, Busch Isaksen T. (2020). Mortality associated with wildfire smoke exposure in Washington State, 2006-2017: A case-crossover study. Environmental Health 19(1) doi: 10.1186/s12940-020-0559-2

²⁵ P. 28, NIOSH Draft Hazard Review: Wildland Fire Smoke Exposure Among Farmworkers and Other Outdoor Workers. ²⁶ WAC 296-841-20025(7)

²⁷ https://www.lni.wa.gov/rulemaking-activity/AO20-29/2029FCBA.pdf accessed December 2024

unreasonable to expect that workers can relocate to areas with minimal to no smoke exposure, particularly if they are required to report to work on site each day. Thus, wildfire smoke protections should be carried out under the assumption that workers will be exposed to wildfire smoke for the remainder of the day when they are not at the workplace.

- 4. Respirators: We recommend the including information on ensuring culturally appropriate training in multiple languages on the use of respirators. Additionally, in Table 5-1, we recommend NIOSH increase clarity around when and which respirators are recommended. Specifically, indicate when an N95 or equivalent is recommended, when something better than an N95 is recommended, and when a full Respiratory Protection Program (RPP) is recommended. We additionally note the following recommendations around respirator guidance:
 - a. Evidence suggests that substantial leakage occurs in the absence of fit testing, ²⁸ and a National Academies report entitled 'Frameworks for Protecting Workers and the Public from Inhalation Hazards', indicates that "users who are unable to perform respirator fit testing should expect lower respirator performance relative to the devices' use in an RPP that includes fit testing." Thus, we suggest NIOSH include a recommendation that employers provide access to fit testing for those employees who wish to voluntarily wear tight-fitting respirators. This would help ensure respirators fit properly when voluntarily worn, and it would also increase the availability of fit testing services for non-occupationally exposed outdoor individuals who similarly need fit testing for their respirators to work reliably. Making fit testing more widely available when respirators are voluntarily worn, especially in outdoor work settings, will improve health for all, not just for those occupationally exposed.
- 5. **Error in Figure 2-2 text.** Figure 2-2 on p.47 of the Draft Hazard Review contains an error. The Figure is based on Figure 5 from Bian et al.,³⁰ which indicates that "the SE has larger fine-mode particles (volume mode diameter is 0.39 μm), than the PW and SW (volume mode diameter: 0.30 μm both regions)." However, in the draft document, the text indicates: "The mode of sub-micrometer particle diameter distribution was about 300 nm for the Southwest and Southeast, whereas the modal diameter was around 400 nm for the Pacific West." Please switch 'Pacific West' and 'Southeast' in the description to be consistent with the Bian et al paper.

²⁸ Coffey, C., and C. Miller. 2019. The respirator fit capability test: Enhancing the efficacy of filtering facepiece respirators. *Synergist* 9.

²⁹ National Academies of Sciences, Engineering, and Medicine 2022. *Frameworks for Protecting Workers and the Public from Inhalation Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/26372. P. 102.

³⁰ Bian, Q., Ford, B., Pierce, J. R., & Kreidenweis, S. M. (2020). A decadal climatology of chemical, physical, and optical properties of ambient smoke in the western and southeastern United States. Journal of Geophysical Research: Atmospheres, 125, e2019JD031372. https://doi.org/10.1029/2019JD031372.

Thank you for considering our response to your request for comment. If you have any questions, please contact WA-DOH's Federal and Regulatory Affairs Director, Michael Ellsworth at Michael.Ellsworth@doh.wa.gov, L&I's Policy Director, Maggie Leland at maggie.leland@lni.wa.gov or Governor Inslee's Director of Federal & Inter-State Affairs, Rose Minor at minor@gov.wa.gov

Sincerely,

Craig Blackwood Assistant Director

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