State of California
Department of Industrial Relations
Division of Occupational Safety and Health
Memorandum

Date: February 8, 2019

To: Christina Shupe, Executive Officer
Occupational Safety and Health Standards Board
2520 Venture Oaks Way, Suite 350
Sacramento, CA 95833

From: Juliann Sum, Chief
Eric Berg, Deputy Chief, Research and Standards
Division of Occupational Safety and Health

Eric Berg

Re: Evaluation of Petition 573 to add an emergency regulation to protect workers from wildfire smoke

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1.0 INTRODUCTION

On December 20, 2018, the Division of Occupational Safety and Health (Cal/OSHA) received a petition from Mitch Steiger, California Labor Federation; Douglas Parker, Worksafe; and Anne Katten, California Rural Legal Assistance Foundation (petitioners). The petitioners request the addition of an emergency regulation to title 8 to protect outdoor workers from unhealthy levels of wildfire smoke.

Labor Code Section 142.2 permits interested persons to propose new or revised standards concerning occupational safety and health, and requires the Occupational Safety and Health Standards Board (Standards Board) to consider such proposals and render a decision no later than six months following receipt.

California Labor Code section 147 requires the Standards Board to refer to Cal/OSHA for evaluation any proposed occupational safety and health standard. Cal/OSHA is required to submit a report on the proposal within 60 days of receipt.

2.0 EMERGENCY REGULATION REQUESTED BY THE PETITIONERS

The petitioners request that Cal/OSHA develop an emergency regulation to protect employees who work outdoors in areas where the air quality meets or exceeds unhealthy levels of fine particulate matter, known as PM2.5 (particulate matter with an aerodynamic diameter of less than 2.5 micrometers), due to wildfire smoke. Additionally, the petitioners recommend that the emergency regulation

- Be put in place as soon as possible, since wildfires are now occurring during many months of the year.

- Apply to outdoor occupations such as agriculture, construction, landscaping, maintenance, commercial delivery, and other activities not considered to be "first response."

- Follow the model of Cal/OSHA, the California Air Resources Board, and public health advisories and be based on requiring protections when the Air Quality Index (AQI) reaches unhealthful readings due to wildfire smoke.

- Require the implementation of feasible engineering controls such as enclosed structures or vehicle cabs with filtered air for rest and meal breaks.

- Require feasible administrative controls, such as changes in work location and schedules, reduction in work intensity, and additional rest periods.

- Require appropriate respiratory protection.

3.0 INCREASING OCCUPATIONAL HEALTH PROBLEMS FROM WILDFIRE SMOKE

3.1 Wildland Fires Are Increasing in California

On January 8, 2019, Governor Gavin Newsom issued Executive Order N-05-19, declaring that California experienced the most destructive fire season in state history in 2018, with over 7,600 wildfires that burned 1,846,445 acres in total. Six of the top 10 most destructive fires in California history have occurred in the last two years, including the Camp, Tubbs, Woolsey, Carr, Nuns, and Thomas Fires. The 2018 Camp Fire was both the deadliest fire in California history, claiming the lives of 86 people, as well as the most destructive, destroying 18,804 structures.

The executive order further states, "…*the reality of climate change – persistent drought, warmer temperatures and more severe winds – has created conditions that will lead to more frequent and destructive wildfires*."[1]

The U.S. Environmental Protection Agency's wildland fire research is consistent with the executive order, finding that fires are increasing in frequency, size and intensity, creating the potential for greater smoke production and chronic exposures in the United States, particularly in the West.[2,3]

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[1] Gavin Newsom, Governor of California, Executive Order N-05-19. https://www.gov.ca.gov/wp-content/uploads/2019/01/1.8.19-EO-N-05-19.pdf

[2] U.S. EPA. Website accessed 1_7_2019. Wildland Fire Research to Protect Health and the Environment. https://www.epa.gov/air-research/wildland-fire-research-protect-health-and-environment

[3] U.S. EPA. Website accessed 1_7_2019. Wildland Fire Research: Health Effects Research. https://www.epa.gov/air-research/wildland-fire-research-health-effects-research

3.2 Smoke from Wildland Fires Travels Far

The National Oceanic and Atmospheric Administration (NOAA) determined that wildfire smoke can spread thousands of miles from its source.[4,5] Therefore, communities both near and far from wildland fires can be severely impacted by the smoke.[6] Temperature inversions exacerbate pollution from wildfire smoke by trapping unhealthy air close to ground level, preventing dilution with cleaner air from higher elevations.[7] Winds also affect the dispersion pattern of smoke.[8]

This means that in addition to employees who work in close proximity to active wildfires, other employees working outdoors can be exposed to smoke from distant wildfires. This includes employees in agriculture, construction, building maintenance, equipment maintenance, utilities, and landscaping.[9,10] Indoor workers can be exposed to the wildfire smoke if they work in locations where the air is unfiltered or where the workplace is open to the outside. Such indoor workplaces may include warehouses, packing sheds, vehicle repair shops, and similar facilities.

3.3 Wildfire Smoke Includes Thousands of Components

Wildfire smoke is a complex mixture of vapors, gases, and solid and liquid particulate matter. It contains chemicals such as carbon dioxide, carbon monoxide, nitrogen oxides, water vapor, trace minerals, hydrocarbons, and other organic chemicals. Thousands of chemical compounds are present in wildfire smoke.[11,12]

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[4] NOAA Twitter. https://twitter.com/noaasatellites/status/1032311533668319232?lang=en
[5] NOAA Satellite and Information Service. Website accessed 1_9_2019. https://www.nesdis.noaa.gov/content/amtrak-relies-new-noaa-satellite-smoke-data-protect-passengers-during-dangerous-california
[6] Navarro KM [Fall 2016]. Assessment of Ambient and Occupational Exposures to Air Contaminants from Wildland Fire Smoke. Dissertation. Berkeley, CA: University of California, Berkeley http://digitalassets.lib.berkeley.edu/etd/ucb/text/Navarro_berkeley_0028E_16683.pdf
[7] https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5354046.pdf
[8] http://www.auburn.edu/academic/forestry_wildlife/fire/smoke_guide/smoke_dispersion.htm
[9] Joint Fire Science Program. FINAL REPORT. Wildland Fire Smoke Health Effects on Wildland Firefighters and the Public. JFSP PROJECT ID: 13-1-02-14 June 2017 https://www.firescience.gov/projects/13-1-02-14/project/13-1-02-14_final_report.pdf
[10] Cal/OSHA Protecting Outdoor Workers Exposed to Smoke from Wildfires. https://www.dir.ca.gov/dosh/wildfire/Worker-Protection-from-Wildfire-Smoke.html
[11] U.S. Environmental Protection Agency, U.S. Forest Service, U.S. Centers for Disease Control and Prevention, California Air Resources Board. Wildfire Smoke A Guide for Public Health Officials p7. May 2016. https://www3.epa.gov/airnow/wildfire_may2016.pdf
[12] Joint Fire Science Program. FINAL REPORT. Wildland Fire Smoke Health Effects on Wildland Firefighters and the Public. JFSP PROJECT ID: 13-1-02-14 June 2017 https://www.firescience.gov/projects/13-1-02-14/project/13-1-02-14_final_report.pdf

3.4 Concentrations of PM2.5 Can Increase Dramatically During Wildfire Events

According to the California Air Resources Board (CARB), during catastrophic wildfires, the concentration of PM2.5 pollution drastically increases compared to non-wildfire days.[13] Table 1 below contains PM2.5 data for Chico, California before, during, and after the Camp Fire.

Table 2. PM2.5 Concentrations in Chico, CA, November 2018.[14]

Date	24-hour Average PM2.5 Concentration in µg/m^3	Daily Maximum 1-Hour Average PM2.5 Concentration in µg/m^3
11/1/18	11.8	35.0
11/2/18	18.2	31.0
11/3/18	13.2	77.0
11/4/18	12.3	35.0
11/5/18	5.7	10.0
11/6/18	7.2	21.0
11/7/18	7.2	10.0
11/8/18	27.8	184.0
11/9/18	279.8	995.0*
11/10/18	246.8	769.0
11/11/18	55.6	395.0
11/12/18	125.3	290.0
11/13/18	162.7	332.0
11/14/18	260.5	457.0
11/15/18	306.2	455.0
11/16/18	417.1	585.0
11/17/18	224.0	347.0
11/18/18	143.1	249.0
11/19/18	85.7	128.0
11/20/18	93.3	163.0
11/21/18	39.4	107.0
11/22/18	6.9	21.0
11/23/18	5.9	10.0
11/24/18	8.6	18.0
11/25/18	12.4	23.0
11/26/18	20.8	29.0
11/27/18	18.9	25.0
11/28/18	10.6	28.0
11/29/18	4.9	19.0
11/30/18	9.1	20.0

[13] Phone conversation with J. Austin from ARB on 1/23/2019.
[14] California Air Resources Board. Website accessed 2/2/19. https://www.arb.ca.gov/aqmis2/aqdselect.php

*The air quality monitors are not capable of measuring PM2.5 concentrations greater than 995 µg/m3. The Camp Fire began on November 8 and was 100 percent contained on November 25, 2018, as indicated by shaded areas in the table.

3.5 Exposure to Particulate Matter Can Cause Serious Health Effects

The principal harmful pollutant of concern for persons not in close proximity to wildfires is PM2.5.[15,16,17] The size of particles is directly linked to their potential for causing health problems. Small particles less than 2.5 micrometers in diameter pose the greatest risk, because these particles penetrate deep into the lungs and may enter the bloodstream.[18] In addition, toxic substances such as volatile and semi-volatile organic compounds, polycyclic aromatic compounds, transition metals, reactive gases (ozone and aldehydes), and sulfate and nitrate particles adsorb onto PM2.5.[19] PM2.5 may also cause additional adverse health outcomes through multiple biological mechanisms, such as increased local lung and systemic inflammation, acute and chronic cardiovascular effects, and acute and chronic respiratory effects.[20]

The human health effects associated with short- or long-term exposure to PM2.5 are significant. They can range from eye and respiratory tract irritation to more serious effects, including premature mortality, aggravation of respiratory and cardiovascular disease, and development of chronic respiratory disease.[21,22,23,24] Epidemiological studies show that short-term exposures to PM2.5 can

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[15] Butte County Air Quality Management District. Wildfires and Air Quality. http://bcaqmd.org/resources-education/wildfires/

[16] U.S. Environmental Protection Agency, U.S. Forest Service, U.S. Centers for Disease Control and Prevention, California Air Resources Board. Wildfire Smoke A Guide for Public Health Officials p7. May 2016. https://www3.epa.gov/airnow/wildfire_may2016.pdf

[17] California Air Resources Board. Website accessed 1_9_2019. Inhalable Particulate Matter and Health (PM2.5 and PM10). https://www.arb.ca.gov/research/aaqs/common-pollutants/pm/pm.htm

[18] U.S. EPA. Website accessed 1_19_2019. Health and Environmental Effects of Particulate Matter (PM). https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm

[19] U.S. EPA. Website accessed 1_7_2019. Wildland Fire Research: Health Effects Research. https://www.epa.gov/air-research/wildland-fire-research-health-effects-research

[20] Navarro KM [Fall 2016]. Assessment of Ambient and Occupational Exposures to Air Contaminants from Wildland Fire Smoke. Dissertation. Berkeley, CA: University of California, Berkeley http://digitalassets.lib.berkeley.edu/etd/ucb/text/Navarro_berkeley_0028E_16683.pdf

[21] California Air Resources Board. Website accessed 1_9_2019. Inhalable Particulate Matter and Health (PM2.5 and PM10). https://www.arb.ca.gov/research/aaqs/common-pollutants/pm/pm.htm

[22] U.S. EPA. Federal Register Final Rule- Fine Particulate Matter National Ambient Air Quality Standards Vol. 81 Wednesday, No. 164 August 24, 2016 https://www.govinfo.gov/content/pkg/FR-2016-08-24/pdf/2016-18768.pdf

[23] U.S. EPA. Website accessed 1_7_2019. Wildland Fire Research: Health Effects Research. https://www.epa.gov/air-research/wildland-fire-research-health-effects-research

[24] Cal/OSHA Protecting Outdoor Workers Exposed to Smoke from Wildfires. https://www.dir.ca.gov/dosh/wildfire/Worker-Protection-from-Wildfire-Smoke.html

cause stroke, heart failure, arrhythmias, and myocardial ischemia and infarction.[25,26] Epidemiological studies have found that emergency room admissions for respiratory, cardiovascular, and cerebrovascular illnesses increase during wildfire smoke incidents.[27,28,29,30,31,32]

3.5.1 Vulnerable Employee Populations

Although exposure to PM2.5 can cause adverse effects among all employees, employees with the following conditions or status are at increased risk of harm:

- Asthma and other respiratory diseases
- Cardiovascular disease
- Older adults
- Lower socioeconomic status.[33]

4.0 TITLE 8 REGULATONS APPLICABLE TO WILDFIRE SMOKE EXPOSURE

When employees work outdoors where the air contains wildfire smoke, sections 5141 and 5144 require employers to determine if the smoke is harmful to employees. If conditions constitute a harmful exposure (as defined in section 5140), then employers must take action to protect employees as described in section 5141 and 5144. Note: There is no permissible exposure limit for PM2.5 in section 5155.

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Subchapter 7. General Industry Safety Orders
Group 16. Control of Hazardous Substances
Article 107. Dusts, Fumes, Mists, Vapors and Gases

§5140. Definitions.
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[25] Wettstein Z, Hoshiko S, Fahimi J, Harrison, R., Cascio W., Rappold A. Cardiovascular and Cerebrovascular Emergency Department Visits Associated with Wildfire Smoke Exposure in California in 2015. J Am Heart Assoc. 2018;7:e007492. DOI: 10. 1161/JAHA.117.007492

[26] U.S. EPA. Integrated Science Assessment for Particulate Matter 2_10_2010 file:///C:/Users/Amalia%20Neidhardt/Downloads/PM_ISA_WITHOUT_ANNEXES.PDF

[27] U.S. Environmental Protection Agency, U.S. Forest Service, U.S. Centers for Disease Control and Prevention, California Air Resources Board. Wildfire Smoke. A Guide for Public Health Officials. p7. May 2016. https://www3.epa.gov/airnow/wildfire_may2016.pdf

[28] Delfino R, Brummel S, Wu J, et al The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003 Occupational and Environmental Medicine 2009;66:189-197.

[29] U.S. EPA. Integrated Science Assessment (ISA) for Particulate Matter (Final Report, Dec 2009). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/139F, 2009. https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=216546

[31] Wettstein Z, Hoshiko S, Fahimi J, Harrison, R., Cascio W., Rappold A. Cardiovascular and Cerebrovascular Emergency Department Visits Associated with Wildfire Smoke Exposure in California in 2015. J Am Heart Assoc. 2018;7:e007492. DOI: 10. 1161/JAHA.117.007492

[33] Finkelstein MM, Jerrett M, Sears MR. Environmental inequality and circulatory disease mortality gradients. J Epidemiol Community Health. 2005;59:481–487 [PMC free article] [PubMed]

Harmful exposure. An exposure to dusts, fumes, mists, vapors, or gases:
(a) In excess of any permissible limit prescribed by Section 5155; or
(b) Of such a nature by inhalation as to result in, or have a probability to result in, injury, illness, disease, impairment, or loss of function.

Hazard. A source of risk, danger, or peril capable of causing injury. As used in Article 107, this meaning refers to dusts, fumes, mists, vapors, gases or chemicals capable of producing adverse health effects.
* * * *

§5141. Control of Harmful Exposure to Employees.
(a) Engineering Controls. Harmful exposures shall be prevented by engineering controls whenever feasible.
(b) Administrative Controls. Whenever engineering controls are not feasible or do not achieve full compliance, administrative controls shall be implemented if practicable.
(c) Control by Respiratory Protective Equipment. Respiratory protective equipment, in accordance with Section 5144, shall be used to prevent harmful exposures as follows:
(1) During the time period necessary to install or implement feasible engineering controls;
(2) Where feasible engineering controls and administrative controls fail to achieve full compliance; and
(3) In emergencies.
California Code of Regulations, title 8 Section 5155, Control of Harmful Exposure to Employees.

§5144. Respiratory Protection.
(a) Permissible practice.
(1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section.

(2) Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program which shall include the requirements outlined in subsection (c).
* * * *

(d) Selection of respirators. This subsection requires the employer to evaluate respiratory hazard(s) in the workplace, identify relevant workplace and user factors, and base respirator selection on these factors. The subsection also specifies appropriately protective respirators for use in IDLH atmospheres, and limits the selection and use of air-purifying respirators.

(1) General requirements.

(A) The employer shall select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.
* * * *

(C) The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH.
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5.0 FEDERAL OSHA REGULATIONS APPLICABLE TO WILDFIRE SMOKE EXPOSURE

Federal OSHA requirements for respiratory protection in the Code of Federal Regulations, title 29, section 1910.134, are the same as the corresponding California regulation, section 5144. Like California, federal OSHA does not have a permissible exposure limit for PM2.5.

29 CFR §1910.134 Respiratory Protection.

1910.134(a) Permissible practice.

1910.134(a)(1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section.

1910.134(a)(2) A respirator shall be provided to each employee when such equipment is necessary to protect the health of such employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program, which shall include the requirements outlined in paragraph (c) of this section. The program shall cover each employee required by this section to use a respirator.
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1910.134(d)(1) General requirements.

1910.134(d)(1)(i) The employer shall select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.
* * * *

1910.134(d)(1)(iii) The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH.
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6.0 GUIDANCE AND REQUIREMENTS FROM OTHER GOVERNMENTAL AGENCIES TO LIMIT EXPOSURE TO PM2.5

6.1 U.S. Environmental Protection Agency (EPA)

As required by the Clean Air Act (United States Code, title 42, sections 7401 through 7515), EPA establishes, reviews, and revises the National Ambient Air Quality Standards (NAAQS) for certain air pollutants to protect public health. The current standard set by EPA to protect public health from PM2.5 air pollution is 12 micrograms of PM2.5 per cubic meter of air (12 μg/m^3) as an annual average, and 35 micrograms of PM2.5 per cubic meter of air (35 μg/m^3) as a 24-hour average.[34]

The Clean Air Act requires EPA to periodically review the NAAQS and their scientific basis. To comply with this requirement for PM2.5, EPA developed and published "*Integrated Science Assessment (ISA) for Particulate Matter,*" which is a comprehensive review of the published scientific literature on the health effects of particulate matter, including PM2.5.[35,36]

In addition to the NAAQS, EPA developed the Air Quality Index (AQI), based on available scientific evidence to provide real-time information to the public on local air quality throughout United States. The AQI is available through EPA's AirNow website and AirNow mobile applications. EPA has divided the AQI into six categories to indicate increasing levels of health concern (from good to hazardous). As an alternative to micrograms of PM2.5 per cubic meter, EPA uses the AQI and the six AQI categories to communicate air quality conditions in a simple and clear manner.[37,38,39]

Table 1 below shows the AQI values for PM2.5.

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[34] U.S. EPA. Federal Register Final Rule- Fine Particulate Matter National Ambient Air Quality Standards Vol. 81 Wednesday, No. 164 August 24, 2016 https://www.govinfo.gov/content/pkg/FR-2016-08-24/pdf/2016-18768.pdf

[35] U.S. EPA. Integrated Science Assessment (ISA) for Particulate Matter (Final Report, Dec 2009). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/139F, 2009. https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=216546

[36] U.S. EPA. Integrated Science Assessment (ISA) for Particulate Matter (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-18/179, 2018. https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=341593

[37] U.S. EPA AirNow website. Accessed on 2/27/19. https://airnow.gov

[38] U.S. Environmental Protection Agency. Air Quality Index - A Guide to Air Quality and Your Health. February 2014. https://www3.epa.gov/airnow/aqi_brochure_02_14.pdf

[39] U.S. EPA. 40 CFR Part 58 Air Quality Index Reporting; Final Rule (August 4, 1999) https://www3.epa.gov/airnow/40cfrpt58_aqi-reporting.pdf

Table 1. Air Quality Index for PM2.5 [40,41]

Air Quality Category/ Levels of Health Concern	AQI Numerical Value	PM2.5 concentration in µg/m3	Meaning
Good	0 to 50	0 to 12	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	12.1 to 35.4	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	35.5 to 55.4	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	55.5 to 150.4	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	150.5 to 250.4	Health alert: everyone may experience more serious health effects.
Hazardous	301 to 500	250.5 to 500.4	**Everyone**: *Avoid all* physical activity outdoors. **Sensitive groups:** Remain indoors and keep activity levels low. Follow tips for keeping particle levels low indoors.

Multiple agencies — including EPA, National Oceanic and Atmospheric Administration, National Park Service, tribal governments, California state agencies, and local agencies monitor, collect, and report the air quality index (AQI) for locations across the US. This information is collected using EPA reference methods or equivalent monitoring techniques, and then used to map, model, and generate real-time forecast data for air quality. EPA oversight of the reporting system ensures quality control, national reporting consistency, access to automated mapping methods, and data distribution to the public and other data systems.[42,43]

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[40] U.S. Environmental Protection Agency. Air Quality Index (AQI) Basics. https://airnow.gov/index.cfm?action=aqibasics.aqi.
[41] U.S. Environmental Protection Agency. AQI Calculator. https://airnow.gov/index.cfm?action=airnow.calculator
[42] US EPA Air Now.Gov Website. Air Quality Index (AQI) Basics https://airnow.gov/index.cfm?action=aqibasics.aqi
[43] Air Monitoring Methods - Criteria Pollutants. https://www.epa.gov/amtic/air-monitoring-methods-criteria-pollutants

6.2 California Air Resources Board (CARB) and Local Air Pollution Control Districts

CARB establishes regulations to protect the public from the harmful effects of air pollution and maintains an air monitoring network. In addition to CARB, 35 local air pollution control districts regulate air emissions and maintain air monitoring networks.

6.2.1 CARB Ambient Air Quality Standards

Health and Safety Code section 39602.5 requires the California Air Resources Board (CARB) to establish Ambient Air Quality Standards (similar to the NAAQS set by EPA) under the federal Clean Air Act. These air quality standards define the maximum amount of pollutant averaged over a specified period of time that can be present in outdoor air without harming human health. In June 2002, CARB adopted an Ambient Air Quality Standard for PM2.5 of 12 µg/m3 (equivalent to an AQI of 50) as an annual average.[44,45]

6.2.2 CARB Monitoring of Air Quality During Wildfires

CARB and the local air pollution control districts collect accurate, real-time measurements of ambient pollutants, including PM2.5, throughout California. CARB provides additional emergency air monitoring during wildfire events using mobile air monitors and advanced modeling tools to alert the public regarding air quality emergencies. The data collected by CARB and the local pollution control districts is available on their websites and EPA's AirNow website.[46]

7.0 PETITIONERS' BASIS FOR AN EMERGENCY REGULATION

The petitioners point out that wildfires across California in recent years demonstrate an urgent need to protect employees who work outdoors where the air quality is unhealthy or worse from wildfire smoke. According to the petitioner, an emergency regulation is needed for the following reasons:

- Wildfires now occur during many months of the year.
- Wildfire smoke contains high levels of PM2.5.
- Exposure to PM2.5 can reduce lung function, worsen heart and lung conditions, and cause coughing, wheezing, and difficulty breathing.

8.0 ANALYSIS: THE PETITION HAS MERITS

The petitioners' proposal would require employers to take the following actions during a wildfire when their employees are exposed to wildfire smoke:

- Monitor the AQI for PM2.5 where employees are present and exposed to unfiltered outdoor air; and

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[44] California Air Resources Board. Website accessed 1/9/2019. California Ambient Air Quality Standards (CAAQS). https://www.arb.ca.gov/research/aaqs/caaqs/caaqs.htm

[45] California Air Resources Board. Website accessed 1/9/2019. Inhalable Particulate Matter and Health (PM2.5 and PM10). https://www.arb.ca.gov/research/aaqs/common-pollutants/pm/pm.htm

[46] California Air Resources Board. Website accessed 2/3/2019. Wildfire Deployments. https://ww2.arb.ca.gov/our-work/programs/incident-air-monitoring/wildfire-deployments

- When the AQI is greater than 150 (unhealthy or worse), protect employees by using feasible engineering and administrative controls and providing appropriate respiratory protection.

The proposal would not cover emergency workers such as firefighters and first responders.

8.1 Petitioners' Proposal Would Make Existing Requirements More Specific and Straightforward

Based on the many calls and complaints received by Cal/OSHA regarding wildfire smoke, many employers do not know what protective measures to use and when to use them.

The current title 8 regulations lack sufficient specificity as to when protections are required for employees exposed to wildfire smoke. The problem is exacerbated by the sudden and dynamic nature of smoke events. Often these events do not allow for sufficient time to evaluate the hazards created by the presence wildfire smoke.

The petitioners' proposal would create a simple method for determining employee exposures, provide a clear demarcation of when protective measures are necessary, and specify what protective measures are needed.

8.1.1 Petitioner's Proposal Would Make the Requirements to Identify and Evaluate Wildfire Smoke Hazards Straightforward

Section 5144(d)(1)(C) requires employers to identify the chemical and physical state of airborne contaminants and then estimate employee exposures to the contaminants. For wildfire smoke, this requirement is difficult for employers to follow due to the large number of components in wildfire smoke and the different physical states of the components.

The petitioner's proposal would simplify and clarify the employer's duty to identify and evaluate wildfire smoke hazards. The proposal would assist employers by identifying the main contaminant of concern in wildfire smoke (PM2.5) and provide an easy method for employers to estimate employee exposures (using the AQI). Both employers and employees can determine the AQI for PM2.5 for any area in California where employees are located using EPA's AirNow website or mobile applications.

8.1.2 Petitioners' Proposal Would Simplify the Requirement to Determine When Protections Are Needed

Section 5141 requires employers to protect employees from harmful exposures. Section 5140 defines harmful exposure as an exposure greater than a permissible exposure limit established in section 5155 or an inhalation hazard that results in, or has a probability to result in, injury, illness, disease, impairment, or loss of function. There is no permissible exposure limit for PM2.5.

To determine if wildfire smoke is harmful to employees under existing regulations, employers must take several factors into consideration, such as the following:

- Concentration of contaminants in the air where employees are located
- Duration workers are outside

- Level of physical exertion made by employees
- Symptoms exhibited by employees that are consistent with exposure to wildfire smoke
- Pre-existing medical conditions.

The petitioners' proposal would simplify and clarify the employer's duty to determine when protection is needed. When the AQI for PM2.5 is 151 or greater (unhealthy air or worse), the proposal would require the employer to implement employee protections.

8.1.3 Petitioners' Proposal Would Specify the Types of Employee Protection that Must Be Used

When exposures are harmful, section 5141 currently requires employers implement a hierarchy of controls to protect employees. The controls must be implemented in order of effectiveness to maximize employee protection. Engineering controls are required first, followed by administrative controls, and then respiratory protection.

The petitioners' proposal would maintain the same hierarchy of controls and would also specify the engineering and administrative controls to protect workers from wildfire smoke. In addition, it would require respiratory protection.

8.2 Petitioners' Proposal Would Apply During a Limited Number of Days per Year

The petitioner's proposal would only apply during wildfires when smoke from the fires results in an AQI of greater than 150. For selected major fires, the number of days when the AQI exceeded 150 is listed in Table 2 below.

Table 2: Air Quality Index (24-hour Average) in Select Locations during Select Dates

Date Range (Name of Major Fire or Fires during the date range)	**Location**	**Days AQI Unhealthy (>150 and <201)**	**Days AQI Very Unhealthy (>200 and <301)**	**Days AQI Hazardous (>300)**	**Total days AQI > 150**
11/8/2018 to 11/25/2018 (Camp Fire)	Chico	5	3	4	12
	Sacramento	8	2	1	11
	SF/Oakland	9	3	0	12
	Contra Costa County	9	2	0	11
	Yolo County	7	2	0	9
	Yuba City	4	5	1	10
	Butte County	5	3	4	12
11/8/2018 to 11/21/18 (Woolsey Fire)	Ventura County	0	0	0	0
	Oxnard/ Thousand Oaks	0	0	0	0
	LA/Long Beach/Anaheim	0	0	0	0
	Riverside/San Bernardino/Ontario	0	0	0	0

07/23/18 to 08/30/18 (Carr Fire)	Shasta County	4	0	0	4
	Chico	4	0	0	4
	Yuba City	3	0	0	3
	Butte County	4	0	0	4
	Trinity County	5	0	0	5
	Yolo County	0	0	0	0
	Redding	4	0	0	4
	Red Bluff	9	0	0	9
12/4/17 to 01/12/18 (Thomas Fire)	Santa Barbara/Santa Maria	9	1	0	10
	Oxnard	5	3	2	10
	LA/Long Beach/Anaheim	4	0	0	4
	Bakersfield	15	0	0	15
10/8/17 to 10/31/17 (Atlas Fire, Nuns Fire, Tubbs Fire, et al.)	Sonoma County	2	0	0	2
	Contra Costa	4	0	0	4
	Napa	5	2	0	7
	Colusa County	1	0	0	1
	SF/Oakland	5	0	0	5

Based on experience of the largest fires from the past two years, the petitioner's proposal would be expected to impact a region for 2 weeks or less for each major fire. If future wildfires increase in quantity, duration, or frequency, the impact of the proposed regulation will be greater.

8.3 Petitioner's Proposal Is Necessary to Protect Employee Health

Labor Code section 144.6 requires that title 8 regulations dealing with toxic materials adequately ensure that no employee will suffer material impairment of health or functional capacity, even if an employee has regular exposure to the hazard for the working period of their life.

> Labor Code 144.6. Criteria considered in adoption of standards concerning toxic materials or harmful physical agents.
>
> In promulgating standards dealing with toxic materials or harmful physical agents, the board shall adopt that standard which most adequately assures, to the extent feasible, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to a hazard regulated by such standard for the period of his working life. Development of standards under this section shall be based upon research, demonstrations, experiments, and such other information as may be appropriate. In addition to the attainment of the highest degree of health and safety protection for the employee, other considerations shall be the latest available scientific data in the field, the reasonableness of the standards, and experience gained under this and other health and safety laws. Whenever practicable, the standard promulgated shall be expressed in terms of objective criteria and of the performance desired.

As discussed in part 3 of this evaluation, PM2.5 and other components of wildfire smoke are toxic. EPA established the AQIs for PM2.5 based on a thorough evaluation of scientific studies on the health effects PM2.5. An AQI greater than 100 can be harmful to sensitive populations and an AQI greater

than 150 can be harmful to the general population. Based on this information, the petitioners have established the necessity of their proposal.

In addition, outdoor employees and indoor employees in areas where the air is unfiltered are likely to have greater exposures than the general public. Due to their duties, employees generally cannot do the following:

- Heed public warnings to remain indoors where the air is filtered.
- Control the environmental conditions they work in.
- Change the length of their shifts or amount of physical exertion required for their job.

8.4 An Emergency Regulation Is Necessary to Protect Employee Health in 2019 and 2020

Regulations in California are usually adopted through regular rulemaking or emergency rulemaking. Emergency rulemaking is substantially shorter than regular rulemaking. The petitioners' request that a regulation to protect employees from wildfire smoke be adopted through emergency rulemaking since wildfires occur during many months of the year.

An emergency, for rulemaking purposes, is defined in the California Government Code as the following:

> Government Code
> ARTICLE 2. Definitions
> §11342.545. "Emergency" means a situation that calls for immediate action to avoid serious harm to the public peace, health, safety, or general welfare.
> * * * *

To adopt an occupational safety and health emergency regulation, the Standards Board must make a finding of emergency as described in Government Code section 11346.1(b)(2):

> ARTICLE 5. Public Participation: Procedure for Adoption of Regulations.
> §11346.1.
> * * * *
> (b)(2) Any finding of an emergency shall include a written statement that contains the information required by paragraphs (2) to (6), inclusive, of subdivision (a) of Section 11346.5 and a description of the specific facts demonstrating the existence of an emergency and the need for immediate action, and demonstrating, by substantial evidence, the need for the proposed regulation to effectuate the statute being implemented, interpreted, or made specific and to address only the demonstrated emergency. The finding of emergency shall also identify each technical, theoretical, and empirical study, report, or similar document, if any, upon which the agency relies. The enactment of an urgency statute shall not, in and of itself, constitute a need for immediate action.
> * * * *

Thus, the Standards Board must demonstrate (1) the existence of an emergency, (2) the need for immediate action, (3) the need for the proposed regulation, and (4) the technical, theoretical, and empirical basis for the regulation.

8.4.1 Emergency Conditions Exist

Employee exposures to wildfire smoke constitute an emergency based on the following facts (refer to part 3 of this evaluation for details).

- The impact of wildfires has worsened over the past two years, and environmental factors have created conditions that will lead to more frequent and destructive fires.
- Wildfires are no longer limited to summer and early fall and can now occur throughout the year.
- Wildfire smoke can spread far and affect many workers.
- Inhalation of wildfire smoke may cause serious adverse health impacts, including increased mortality.

8.4.2 Immediate Action Is Needed

Based on current and recent occupational health rulemaking projects, such as medical services and first aid, housekeeping in the hotel and hospitality industry, and workplace violence in healthcare, regular rulemaking to protect employees from wildfire smoke would take approximately 3 to 5 years. Emergency rulemaking is necessary to protect employees from wildfire smoke in 2019 and 2020.

8.4.3 Petitioners' Proposal Should Be Enacted as a Regulation

As discussed in part 8.1 of this evaluation, existing regulations are not sufficiently specific as to what employers are required to do during wildfire events. This results in many employees not being protected. A clear and straightforward regulation is needed to ensure better protection of employees.

8.4.4 The Proposal Is Supported by Scientific Evidence

The air quality index for PM2.5, used as the basis for the proposal, was established after EPA conducted a thorough evaluation of scientific studies of the health effects of PM2.5.

9.0 CONCLUSION: THE PETITION SHOULD BE APPROVED

Wildfire smoke is harmful to the health of outdoor workers and certain indoor workers. Due to the seriousness and destructiveness of the wildfires experienced in California in recent years, Cal/OSHA believes that action must be taken quickly to ensure the protection of outdoor and certain indoor workers.

Cal/OSHA recommends that the Standards Board

- Grant the petition
- Request Cal/OSHA to develop language for an emergency regulation
- Undertake emergency rulemaking
- Follow up on the emergency rulemaking with regular rulemaking to establish a permanent regulation

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