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ADDITIONAL RESOURCES AND LINKS

Active Wildfire Information

AirNow Fire and Smoke Map. https://fire.airnow.gov

CAL FIRE, California Department of Forestry and Fire Protection: http://www.fire.ca.gov

Geographic Area Coordination Center, National Interagency Fire Center: http://gacc.nifc.gov/links/links.htm

InciWeb - Incident Information System: http://inciweb.nwcg.gov provides updates on all national fires, often several times a day.

National Interagency Fire Center Wildland Fire Morning Report**:** https://www.nifc.gov/fire-information/nfn

Satellite Images of Fires and Smoke

GeoMAC Wildland Fire Support, Geospatial Multi-Agency Coordination:

https://geomac.usgs.gov/GeoMACTransition.shtml

NASA Moderate Resolution Imaging Spectroradiometer (MODIS): http://modis.gsfc.nasa.gov

National Interagency Coordination Center National Significant Wildland Fire Potential Outlook: http://www.predictiveservices.nifc.gov/outlooks/outlooks.htm

NOAA Hazard Mapping System Fire and Smoke Product: http://www.ospo.noaa.gov/Products/land/hms.html

Wildland Fire/Air Quality Tools, Wildland Fire Air Quality Response Program: http://tools.airfire.org

Weather

National Weather Service Fire Weather: https://www.weather.gov/fire

National Weather Service Central Region: https://www.weather.gov/crh

National Weather Service Eastern Region: http://www.weather.gov/erh

National Weather Service Southern Region: https://www.weather.gov/srh

National Weather Service Western Region: http://www.wrh.noaa.gov

Information about Wildfire Smoke and Health Effects

Wildfire Guide post-publication updates: https://airnow.gov/wildfire-guide-post-publication-updates

Guide to Smoke from Fires and Your Health: https://www.airnow.gov/air-quality-and-health/how-smoke-from-fires-can-affect-your-health/

AirNow Fires and Your Health: https://www.airnow.gov/air-quality-and-health/fires-and-your-health/

AirNow Smoke Advisories and Forecasts by State: https://www.airnow.gov/air-quality-and-health/fires/smoke-advisories/

AirNow: https://www.airnow.gov

EPA Wildfires and Indoor Air Quality: https://www.epa.gov/indoor-air-quality-iaq/wildfires-and-indoor-air-quality-iaq

APPENDIX A

Available Factsheets as of March 2019

Recognizing the need for credible information to disseminate to the public, authors of this Guide have developed factsheets on topics of high interest for use with the public. The factsheets will be updated as needed and more factsheets are planned. In addition, these factsheets will become available in other languages. So please check the current fires page of AirNow website, where you can find this document and all related factsheets.

- Prepare for Fire Season: https://www.airnow.gov/publications/wildfire-guide-factsheets/prepare-for-fire-season/
- Indoor Air Filtration: https://www.airnow.gov/publications/wildfire-guide-factsheets/wildfire-smoke-indoor-air-filtration-factsheet/
- Reduce Your Smoke Exposure: https://www.airnow.gov/publications/wildfire-guide-factsheets/reduce-your-smoke-exposure/
- Protect Yourself from Ash: https://www.airnow.gov/publications/wildfire-guide-factsheets/protect-yourself-from-ash/
- Protect Your Lungs from Wildfire Smoke or Ash: https://www.airnow.gov/publications/wildfire-guide-factsheets/protect-your-lungs-from-wildfire-smoke/
- Protecting Children from Wildfire Smoke and Ash: https://www.airnow.gov/publications/wildfire-guide-factsheets/protecting-children-from-wildfire-smoke-and-ash/
- Protect Your Pets from Wildfire Smoke: https://www.airnow.gov/publications/wildfire-guide-factsheets/wildfire-smoke-protect-your-pets/
- Protect Your Large Animals and Livestock from Wildfire Smoke: https://www.airnow.gov/publications/wildfire-guide-factsheets/wildfire-smoke-protect-your-large-animals-and-livestock/

APPENDIX B

Identification and Preparation of Cleaner Air Shelters for Protection of the Public from Wildfire Smoke

1. Identify one or more facilities with tight-sealing windows and doors and public access (for example, libraries, school gymnasiums, buildings at public fairgrounds or civic auditoriums). As a rule of thumb, newer buildings will generally be more desirable than older ones. Consider using institutional controls to limit smoke infiltration, such as limited door and window use.
2. At a minimum, a cleaner air shelter should have central air conditioning with filtration that is at least medium or high-efficiency, particularly at the fresh (outdoor) air intake(s). If needed, filters should be upgraded prior to the fire season after assuring that the system can handle the increased airflow resistance. Building managers should ensure that filters are properly fit and sealed to prevent air bypassing the filter media. Filters should be regularly maintained and/or replaced according to the manufacturer's recommendations. Even during smoke events, building managers should continue to ensure that the building is adequately ventilated and that fresh air intakes have high-efficiency (MERV 13 or higher[1]) filters to clean the air entering the building. Reducing or stopping fresh air intake could actually alter the building air-pressure balance and create indoor air quality issues that could offset any benefit of reduced smoke exposure (for more information, refer to Appendix D.
3. Install/inspect room air cleaners where appropriate, such as in cleaner air shelters with separate, smaller rooms (e.g. classrooms, meeting rooms). Choose room air cleaners with sufficient capacity, i.e., a tobacco smoke Clean Air Delivery Rate (CADR) that is at least 2/3 the floor area. Choose an air cleaner with a higher CADR for rooms with ceilings higher than 8ft. Ensure proper maintenance of air cleaners, keep spare filters on hand, and provide instructions on changing the filter to trained personnel.
4. Assure that the facility can handle the increased cooling load due to high occupancy.
5. Install a properly calibrated carbon monoxide alarm that has a digital display and battery backup function (available at most hardware stores).
6. Provide a radio for updates on fire status and access to a telephone in case of emergency.
7. Ensure adequate services such as restroom facilities and garbage disposal/collection.

[1] Minimum Efficiency Reporting Value as determined by ASHRAE Standard 52.2: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

APPENDIX C

Technical Wildfire and Smoke Resources

The tools in this Appendix may aid public health agencies, communities, and air quality professionals in their technical assessment of wildfires and wildfire smoke. For more information about these tools contact Peter Lahm, U.S. Forest Service, peter.lahm@usda.gov.

Accessing Information about Active Wildfires

It's often difficult to obtain information about brand new or emerging wildfires and good information may take a day or two (or longer) to become available. Until then, the best way to get a little news on a new wildfire may come from scanning social media posts from state fire management agencies, county sheriff departments, and county emergency management. Local news is often quickly onsite and can be another source of information. The National Interagency Fire Center hosts a map that shows various incidents around the US including satellite detected hot spots which may show the location and size estimate of a new wildfire. The map can be accessed here: https://maps.nwcg.gov.

Once a wildfire grows to the point that local fire response agencies can no longer manage it, an Incident Management Team will be ordered. Information on a wildfire is much easier to find once one of these teams has arrived. Detailed information about wildfires can be accessed at the Incident Information System (INCIWEB): https://inciweb.nwcg.gov. Geographic area coordination centers (GACC's) have more localized information about wildfires and are another good source of information. Access your local GACC here: https://gacc.nifc.gov/index.php.

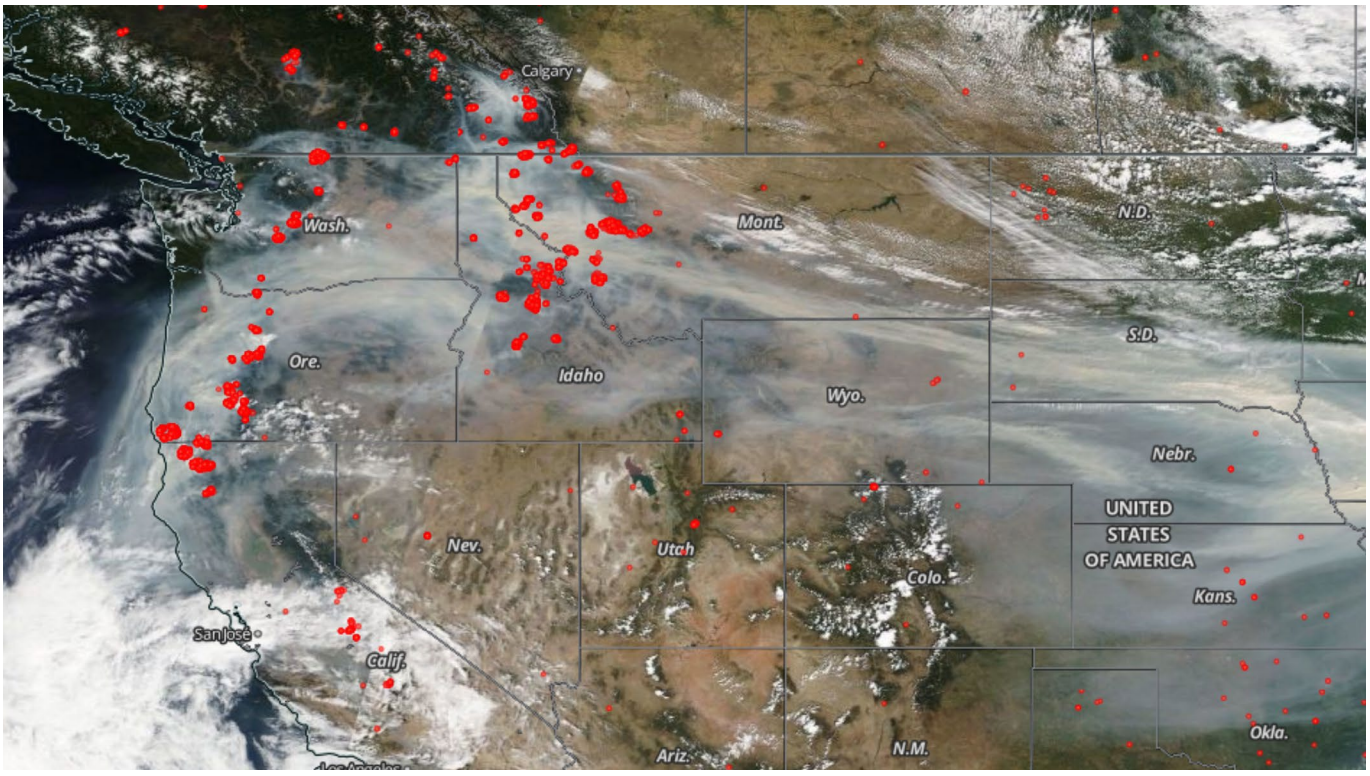

Figure C1. Smoke from many large fires creating haze across the western and central United States. Red dots are satellite fire hot spot detections (NASA WORLDVIEW, September 4, 2017). To learn more, see the NASA Worldview Tutorial by the NASA Health and Air Quality Applied Sciences Team (HAQAST) at https://haqast.org/nasa-tools.

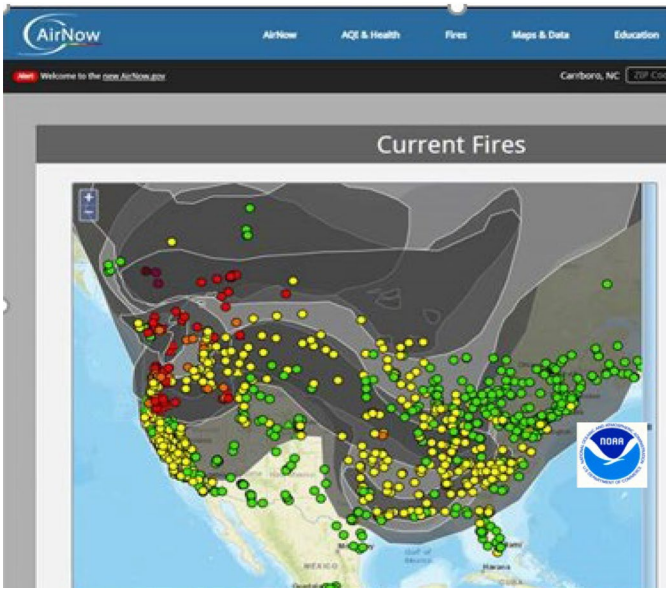

Figure C2. Smoke plumes from NOAA Hazard Mapping System. See more about the NOAA HMS here: https://www.ospo.noaa.gov/Products/land/hms.html.

Seeing Smoke from Space

Satellites are continually viewing the planet and often see large wildfires and the smoke emanating from them. Satellite views can help determine where smoke is coming from. Is it from a near-by fire, or is it from Canada or even Siberia? It's important to note that the smoke seen from a satellite may be anywhere in the atmosphere, so it could be elevated and not affecting people at ground level. Clouds can generally be distinguished from smoke as they show up as bright white whereas smoke is off-white or beige with a brownish tinge. NASA WORLDVIEW provides access to satellite photos: https://worldview.earthdata.nasa.gov. An optional overlay layer of "fires and thermal anomalies" shows the locations of large fires as red spots (Figure C1)

Sometimes satellite pictures are difficult to interpret, such as when smoke mixes with clouds. Then a human analysis is useful, such as the NOAA Hazard Mapping System (HMS) smoke plume product. The analysis tells you where smoke is light (green), medium (yellow), or heavy (red). The Current Fires page on the AirNow website uses shades of gray to display the smoke plumes from the NOAA HMS (Figure C2).

AirNow-Tech

AirNow has a decision support tool called AirNow-Tech (airnowtech.org), which allows partner agencies to manage, quality control, query, and visualize not only their data but also a national dataset of air quality, meteorological and satellite information. One powerful AirNow-Tech tool for wildfire evaluation is Navigator GIS. Navigator allows the user to overlay meteorological, fire, and satellite data over air quality observations. In addition, users can run trajectories on any point of the display to see air parcel projections or for post wildfire event analysis (Figure C3).

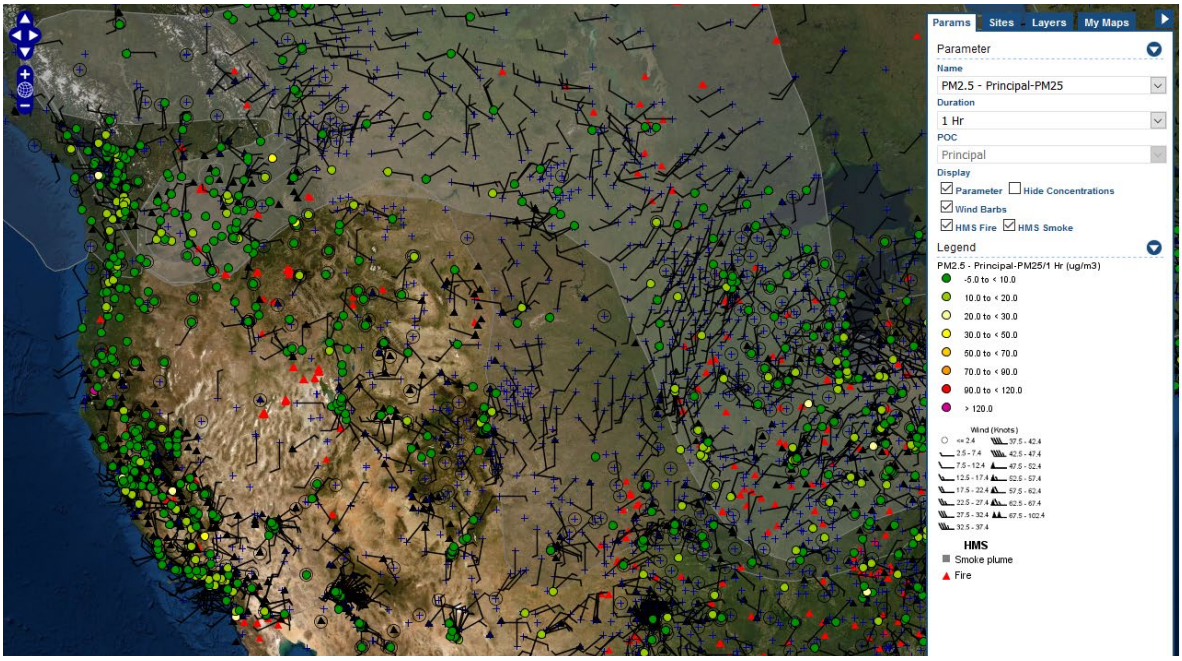

Figure C3. AirNow-Tech Navigator

U.S. Forest Service/Interagency Wildland Fire Air Quality Response Program Tools

The U.S. Forest Service Research AirFire Team and the Wildland Fire Air Quality Response Program have developed a number of tools and on-line resources to aid in summarizing monitoring data and making smoke dispersion predictions. These tools, plus others under development, are available here: https://wildlandfiresmoke.net/tools. These are some of the fundamental tools used by Air Resource Advisors assigned to wildfires.

Particulate ($PM_{2.5}$) Monitoring Website Tool

The Particulates Monitoring Website Tool (https://portal.airfire.org/) provides easy-to-use, rapid access to particulate air quality monitoring data from publicly available permanent monitoring sites across the United States and from temporary monitoring instruments set up during wildland fire incidents. Users

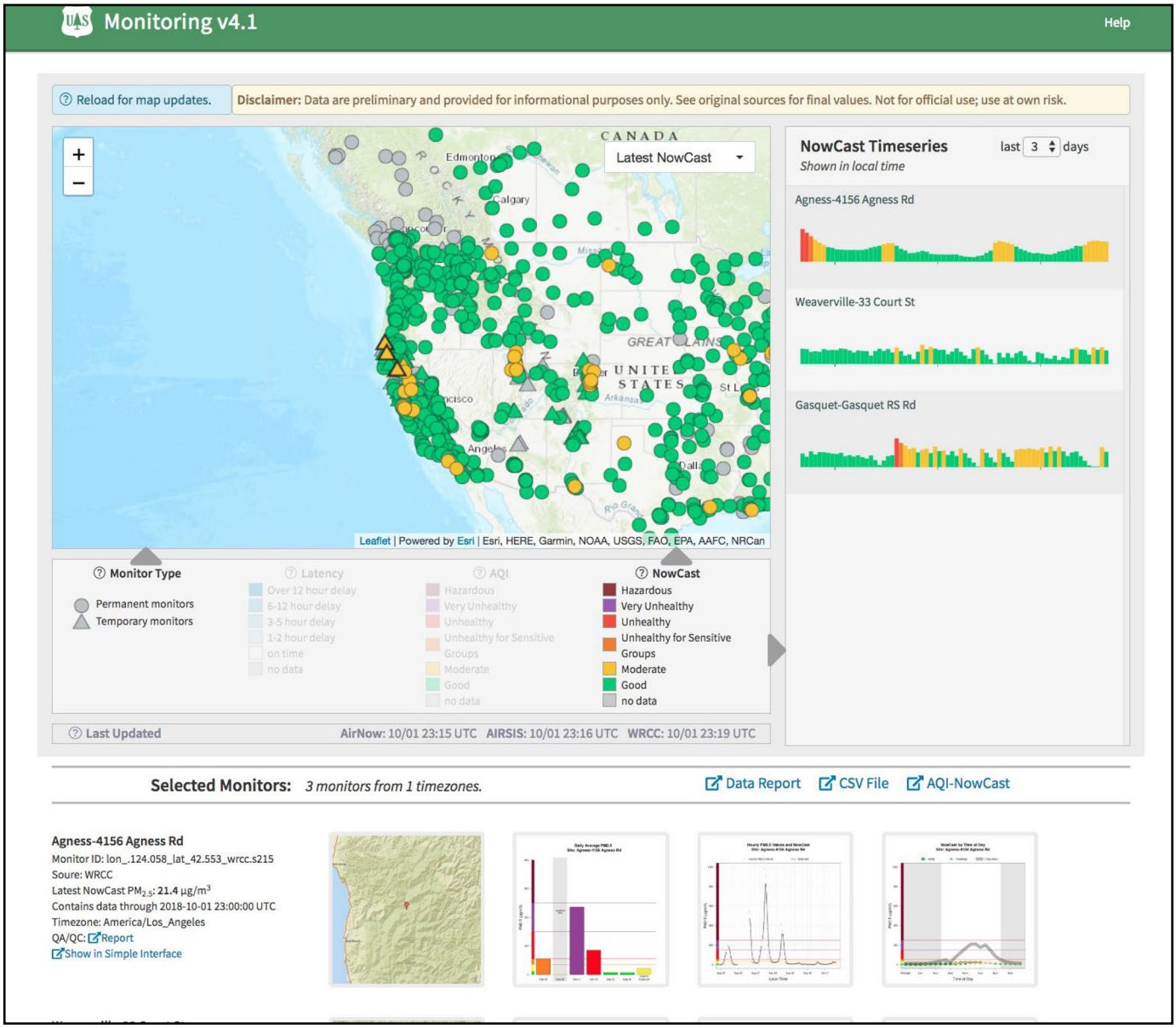

Figure C4. $PM_{2.5}$ monitoring web tool display example. Current fine particulate NowCast conditions are shown on the map. Selecting monitors of interest reveals a multi-day NowCast time series and other graphics. Access at https://fire.airnow.gov/.

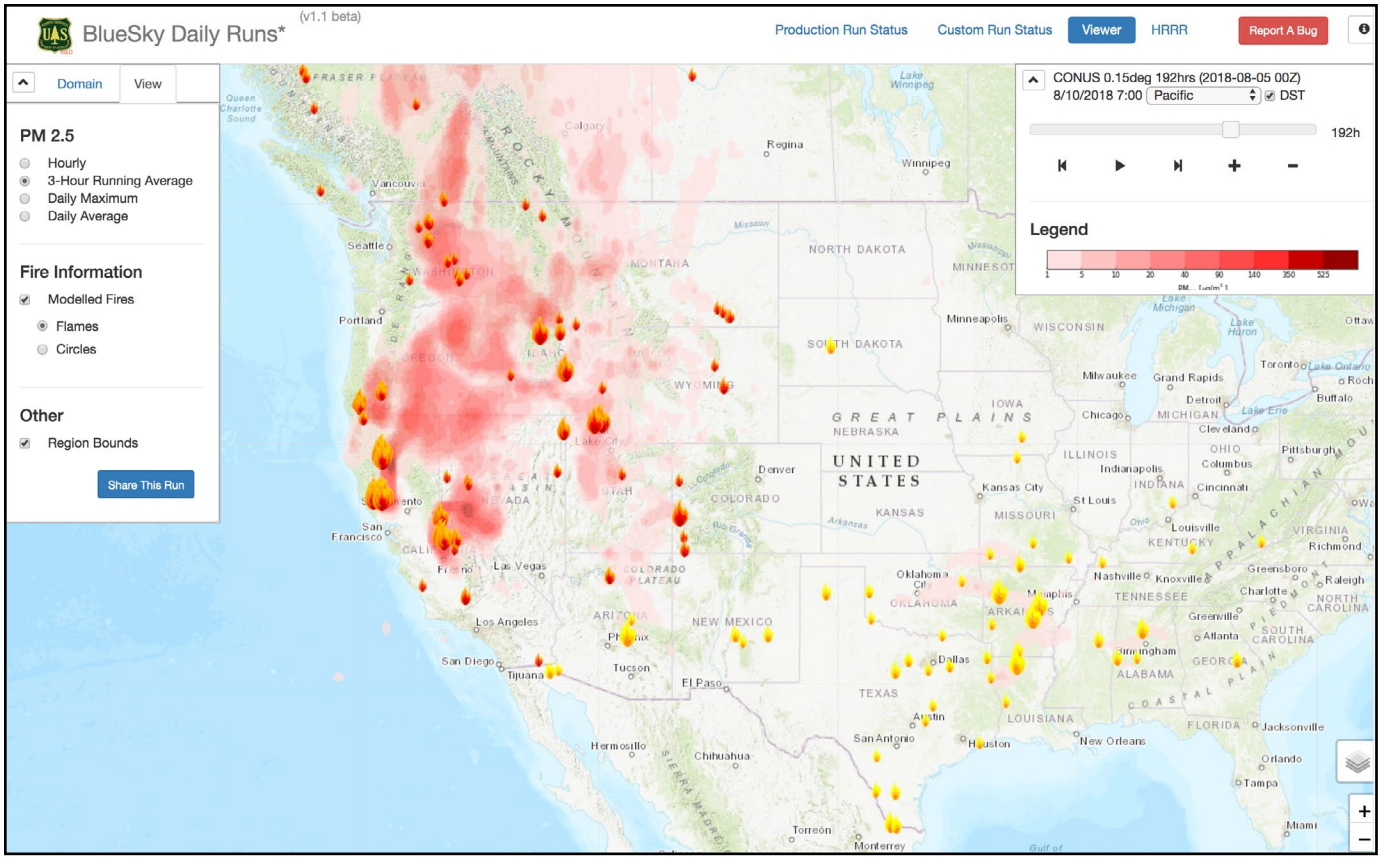

Figure C5. BlueSky daily smoke model run for the Continental United States (CONUS) shown in the web viewer version. KMZ and other output formats are also available at https://tools.airfire.org.

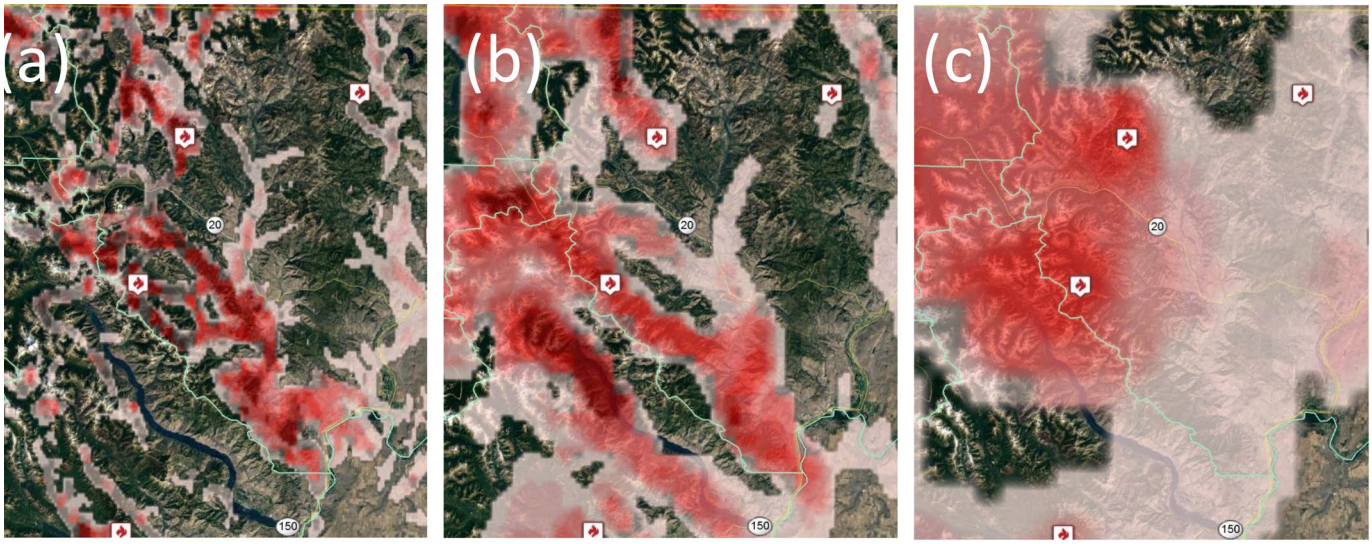

Figure C6. BlueSky hourly average surface smoke predictions at 1am on 8/19/2018 at 3 grid resolutions: (a) 1.33 km, (b) 4 km, and (c) 12 km in north central Washington. Higher resolution versions (a and b) allow the effect of complex terrain to be better reflected in smoke concentration estimates. KML/Google Earth version.

can select monitors from a map and view time-series data in a number of plots showing daily averages, hourly NowCast values, and diurnal smoke impact patterns. Multiple monitors of interest can be selected, and once selected bookmarking the site's URL allows users to share this list with others or to quickly return to this specific set of monitors and view updated air quality measurements.

Currently the tool displays fine particulate measurements ($PM_{2.5}$), but other pollutants may be added in the future. The tool uses public data made available from EPA's AirNow-Tech system (https://airnowtech.org), monitoring data from a national cache of temporary monitors that are deployed during wildfire incidents, plus any additional monitoring data made available by originating agencies as long as the source data has not been tagged as "private"[2] (Figure C4).

BlueSky Daily Smoke Model Runs

Predicting air quality impacts from active wildfires depends on linking together information and models to estimate fire size, fuel type, fuel consumption, smoke plume rise, weather, atmospheric dispersion, and ground-level smoke concentrations. One commonly used smoke tool developed by the Forest Service AirFire Research team is the BlueSky smoke modeling framework. Multiple versions of BlueSky run automatically each day with daily updates of fire and weather information. BlueSky combines basic fire information with available fuels maps (from the USFS Fire Characteristic Classification System [FCCS]) and current fuel moisture conditions (from the USFS Wildfire Information Management System [WIMS]), to compute fuel consumption (via the USFS CONSUME model) and emissions before computing plume rise and dispersion. Two different plume and dispersion models are used - a simple LaGrangian dispersion model with no chemistry (HYSPLIT), and the Community Multiscale Air Quality Modeling System (CMAQ). CMAQ is run in two modes; limited chemistry, or as a full photochemical model with all sources. Multiple geographic domains, weather models, weather model resolutions, and dispersion models combine to result in approximately 30 separate iterations for a user to choose from (Figure C5). All runs can be accessed at https://tools.airfire.org.

BlueSky relies on meteorological models with high resolution grids in order to better estimate local smoke effects. Currently the most fine-scale meteorological models used by BlueSky on a daily basis have a resolution of 1.33 km enabling predictions of smoke movement to reflect the effects of complex terrain (Figure C6). High resolution versions of BlueSky are available for the Pacific Northwest, California/Nevada, Arizona, and Alaska. National grids at 3-km resolution are available, as are combined Canada/CONUS grids. Movable, high-resolution meteorological grids (1.27 km) can be placed over areas of concern during the western wildfire season when made available by the National Weather Service. All model runs are viewable on a simple web map with options for 1-hour, 3-hour, and daily (24-hour) smoke estimates. Typical forecasts extend for 2–3 days into the future. KMZ files for use in Google Earth are available for download.

[2] Occasionally states set up special purpose monitoring studies where the data is not publicly available.

APPENDIX D

Guidance on Protecting Workers in Offices and Similar Indoor Workplaces from Wildfire Smoke (Adapted from Cal/OSHA)

Wildfire smoke can be a hazard for people who work in office and commercial buildings many miles from evacuation zones. Environmental and public health agencies have advised people to consider setting air conditioners in their homes to recirculation mode, if possible, in order to reduce the intake of pollutants. Subsequently, people have asked whether to apply this advice to limit the introduction of outdoor air applies to office and commercial buildings. Eliminating or substantially reducing the outdoor air supply in office buildings and other indoor workplaces as a first step to reduce exposure to smoke is generally not recommended.

The ventilation systems in office buildings and other commercial buildings are more complicated than home air-conditioning systems. Changing the outdoor air supply in public and commercial buildings can adversely affect other essential functions of the building. These buildings typically have heating, ventilating and air conditioning systems (HVAC systems) that bring outside air into the building through filters, blend it with building return air, and thermally condition the air before distributing it throughout the building. These buildings also have exhaust air systems for restrooms and kitchens, and may also have local exhaust systems for garages, laboratory fume hoods, or other operations. These exhaust systems require makeup air (outdoor air) in order to function properly. Also, without an adequate supply of outdoor air, these systems may create negative pressure in the building. Negative pressure will increase the movement of unfiltered air into the building through any openings, such as plumbing/sewer vents, doors, windows, junctions between building surfaces, or cracks. In general, buildings should be operated at slight positive pressure in order to keep contaminants out, and to help exhaust air systems function properly.

HVAC systems should be operated continuously while occupied in order to provide the minimum quantity of outdoor air for ventilation, as required by the standards or building codes to which the building was designed. For many office buildings, this is often in the range of 15–20 cubic feet per minute (cfm) per person, although it could be less in older buildings.[3]

Using the HVAC System(s) to Protect Building Occupants from Smoke

As a first step to protect building occupants from outdoor air pollution, including the hazardous conditions resulting from wildfire smoke, building managers and employers should ensure that the HVAC system's filters are not dirty, damaged, dislodged, or leaking around the edges. Before the wildfire season, or during smoke events if necessary, employers and building operators should ensure that a qualified technician inspects the HVAC systems, makes necessary repairs, and conducts appropriate maintenance. Filters should fit snugly in their frames, and should have gaskets or sealants on all perimeter edges to ensure that air does not leak around the filters.

Building operators should consider installation of the highest efficiency filters that do not exceed the static pressure limits of the HVAC systems, as specified by the manufacturer or system designer[4]. Pressure gauges

[3] Cal/OSHA regulations (8 CCR 5142) require that HVAC systems be operated continuously while occupied in order to provide the minimum quantity of outdoor air required by the state building code at the time the building permit was issued. These regulations are currently found in the California Code of Regulations, Title 24, Section 121. For most buildings, this quantity is 15 cubic feet per minute (cfm) per person.

[4] Many existing HVAC systems should be able to accommodate pleated, medium-efficiency filters with particle removal ratings of MERV 5 to 12, and some may be able to use high-efficiency filters with ratings of MERV 13 or higher. Consider a low-pressure HEPA filter (MERV 17 plus) if the building occupants have respiratory or heart

should be installed across the filter to indicate when the filter needs replacing, especially in very smoky or dusty areas. Indoor contaminants can be further reduced by using stand-alone high-efficiency particulate air (HEPA) filtering units. For more information on air cleaners, see the California Air Resources Board webpage at: https://www.arb.ca.gov/research/indoor/aircleaners/consumers.htm.

In some circumstances it may be helpful to reduce the amount of outdoor air in order to reduce smoke pollution inside the building, while still maintaining positive pressure in the building. Temporary reductions in outdoor air flow rates might be considered when all of the following conditions are met:

1. The local outdoor air quality for particulate matter meets the EPA Air Quality Index definition of Unhealthy, Very Unhealthy, or Hazardous due to wildfire smoke.
2. A qualified HVAC technician has inspected the HVAC systems and ensured that the filters are functioning properly, that the filter bank is in good repair, and that the highest feasible level of filtration has been provided. This should be documented in writing.
3. A qualified HVAC technician or engineer has assessed the building mechanical systems and determined, in writing, the amount of outside air necessary to prevent negative pressurization of the building, and to sufficiently ventilate any hazardous processes in the building (such as enclosed parking garages or laboratory operations).
4. The HVAC systems are operated continuously while the building is occupied to provide at least the minimum quantity of outdoor air needed, as determined by the HVAC technician or engineer in Item 3 above.

The employer or building operator ensures that the systems are restored to maintain the minimum quantity of outdoor air for ventilation, as required by the standards or building codes to which the building was designed, no later than 48 hours after the particulate matter levels fall below the levels designated by the EPA as Unhealthy.

Other Actions to Protect Employees from Wildfire Smoke

In addition to assessing and if necessary modifying the function of the HVAC system, employers are encouraged to take other reasonable steps to reduce employee exposure to smoke, including alternate work assignments or relocation and telecommuting. Some buildings rely on open windows, doors, and vents for outdoor air, and some may have mechanical ventilation systems that lack a functioning filtration system to remove airborne particles. In these cases, the employees may need to be relocated to a safer location. Employees with asthma, other respiratory diseases, or cardiovascular diseases, should be advised to consult their physician for appropriate measures to minimize health risks.

Respirators, such as N95s and other filtering facepiece respirators, may provide additional protection to some employees against environmental smoke. Employees whose work assignments require the use of respirators must be included in a respiratory protection program (including training, medical evaluations, and fit testing).

Additional Information

The Lawrence Berkeley National Laboratory has produced a multi-page summary on air cleaning and its effects on health and perceived air quality, which can be found at: https://iaqscience.lbl.gov/air-summary

disease conditions, or if the building experiences frequent wildfire episodes.

APPENDIX E

Hazards during Cleanup Work Following Wildfires from National Institute for Occupational Safety and Health (NIOSH)

The purpose of this section is to discuss some of the health and safety hazards that homeowners and workers may encounter after a wildland fire. This document is not designed to address health and safety for fire fighters or other emergency response workers during a wildfire or other emergency event.

After a wildfire has ended, cleanup and recovery activities are often needed. These activities may pose health and safety hazards that require necessary precautions. In most cases, it may be more appropriate for professional cleanup and disaster restoration companies, rather than homeowners or volunteers, to conduct this work. Although the types of hazards may be different for each wildland fire, some common hazards include:

1. Contact with fire.

   After a wildfire, trained fire fighters will make sure the fire is completely out. If there is any chance the wildfire could reignite, leave immediately and notify emergency personnel.

2. Burnt and unstable structures.

   Be aware of unstable and damaged houses and other structures after a wildfire. Do not assume that these areas are safe or stable because damage may not be noticeable and can create a risk for serious injuries from slips, falls, punctures, or being struck by collapsing materials.

   Safety Measures

   To prevent injuries from burnt and unstable structures:

   - Conduct a thorough inspection and identify and eliminate hazards before conducting any work. Avoid work around fire-damaged structures, including stairs, floors, and roofs, until an engineer or architect examines and certifies the structure is safe.
   - Wear personal protective equipment, including long sleeved shirts and pants, hard hats, safety glasses, leather gloves, and steel toe boots, to reduce the risk of injury.
   - Leave immediately if a structure shifts or makes an unusual noise that could signal a possible collapse.

3. Burnt and unstable trees. Another common hazard after a wildfire is unstable trees, known as 'snags' or 'hazard trees,' which can fall and injure homeowners and workers. It is important to assess the stability of all trees before working and driving around them.

   Safety Measures

   - Always contact a professional to evaluate a tree's stability and to safely remove any suspected hazardous trees from the property and along roadways before conducting cleanup work.
   - For more information about potential hazards from tree removal, see: Preventing Chain Saw Injuries During Tree Removal After a Disaster (https://www.cdc.gov/disasters/chainsaws.html).

4. Carbon monoxide.

   - Wildland fire cleanup activities may involve the use of gasoline or diesel powered pumps, generators, and pressure washers. This equipment releases carbon monoxide (CO), a deadly, colorless, odorless gas. It is important that homeowners and workers protect themselves from CO poisoning.

   ### *Safety Measures*

   To avoid the risk of CO poisoning:

   - Never bring gas or diesel powered machines indoors.
   - Only operate these machines in well-ventilated areas.
   - Do not work near exhaust gases (CO poisoning can occur even outdoors near exhaust from engines that generate high concentrations of CO).
   - Shut off the equipment immediately and seek medical attention if you experience symptoms of CO poisoning.
   - To learn more, visit NIOSH's webpages: Carbon Monoxide (https://www.cdc.gov/niosh/topics/co-comp/) or Carbon Monoxide Hazards from Small Gasoline Powered Engines (https://www.cdc.gov/niosh/topics/co/).

5. Confined spaces.

   A confined space is an area that has limited openings for entry or exit, has limited air flow and is not designed for human occupancy. Examples of confined spaces include septic tanks, storage tanks, utility vaults and wells. These spaces may contain toxic gases, may not have oxygen, or may be explosive. In many cases, these hazards are not easily recognized without proper training and equipment.

   ### *Safety Measures*

   - Never enter a confined space without proper training and equipment, not even to rescue a fellow worker. Contact the local fire department for help.
   - To learn more, visit NIOSH's webpage: Confined Spaces (https://www.cdc.gov/niosh/topics/confined-space/).

6. Fatigue and stress.

   A homeowner may experience emotional stress and mental and physical fatigue from cleanup and from loss of personal property or valuables. Fatigue and stress may increase the risk of injury and illness.

   ### *Safety Measures*

   After a fire, homeowners or other workers may need to:

   - Seek emotional support from family members, neighbors, and local mental health care workers to help prevent more serious stress-related problems.
   - Set priorities for cleanup tasks and pace work over days or weeks to avoid physical exhaustion.
   - Rest and take frequent breaks to avoid exhaustion.
   - Begin a normal sleep and eating schedule as quickly as possible.
   - Take advantage of disaster relief programs and services in the community.
   - Understand physical and mental limitations.

- To learn more, visit NIOSH's webpages: Traumatic Incident Stress: Information For Emergency Response Workers (https://www.cdc.gov/niosh/mining/works/coversheet643.html) and Stress at Work (https://www.cdc.gov/niosh/topics/stress/).

7. Electrical dangers.

   One common danger after a fire is a downed/damaged power pole with potentially energized power lines laying on the ground or hanging from the pole. Any type of work with power lines or other electrical sources must only be conducted by trained professionals, such as electricians and utility workers. If a potential electrical danger or a downed power line is identified, avoid all electrical hazards by stopping work and immediately notifying the local utility company.

   ### *Safety Measures*

   When working near power lines, it is important to follow these steps to prevent electrical injuries:

   - Do not work or enter any area with any potential for electrocution from a power line or other electrical hazards.
   - Treat all power lines and cables as energized until proven otherwise.
   - When the power is off, never restore power until a professional inspects and ensures the integrity of the electrical system.
   - Do not use electrical equipment that has been exposed to heat from a fire until checked by an electrician.
   - Unless power is off, never enter flooded areas or touch electrical equipment if the ground is wet.
   - Use extreme caution when equipment is moved near overhead power lines. For example, contact between metal ladders and overhead power lines can cause serious and often fatal injuries.
   - Do not stand or work in areas with thick smoke. Smoke hides electrical lines and equipment.
   - To learn more, visit NIOSH's Electrical Safety page: (https://www.cdc.gov/niosh/topics/electrical/).

8. Hazardous and other potentially dangerous materials.

   Many homes and other structures may contain or store hazardous materials and chemicals. Some common materials include asbestos, lead, pesticides, propane, and gasoline. These materials may cause health effects, may be explosive, or may react with other chemicals. Before beginning cleanup activities, contact a professional who is familiar with hazardous materials to determine the different types of hazards that are present and how to safely clean up and dispose of them in accordance with local and state laws.

   ### *Safety Measures*

   To reduce the chance of exposure to hazardous and other dangerous materials:

   - Be cautious of chemicals, propane tanks, and other dangerous materials.
   - Wear protective clothing and gear when handling hazardous materials.
   - If exposed to hazardous materials, wash the affected area (e.g., skin, eyes) and contact your local poison control center or the American Association of Poison Control Centers at 1 (800) 222-1222. Seek medical care immediately if the exposure is severe or you experience symptoms.
   - Homes built before 1980 may contain asbestos and lead. Contact your county health department to learn about local laws and regulations. Because disturbing lead and asbestos may result in serious health consequences, it is recommended that only trained professionals test for and clean up materials that contain lead or asbestos.

- Fires may also damage tanks, drums, pipes, or equipment that may contain hazardous materials, such as pesticides, gasoline, or propane. Before opening or removing containers that may contain hazardous materials, contact the local fire department or a hazardous materials team to help assess and remove hazardous waste.
- To learn more about chemical safety, visit NIOSH webpages: Pocket Guide to Chemical Hazards (https://www.cdc.gov/niosh/npg/) and Chemical Safety (https://www.cdc.gov/niosh/topics/chemical-safety/default.html).

9. Hot environments.

While working in hot weather, homeowners and cleanup workers could be at risk for heat-related illnesses, such as heat stress, heat rash, heat cramps, and heat stroke. It is important to be aware of the symptoms of heat related illness, how the illness can affect health and safety, and how it can be prevented.

Safety Measures

To reduce the potential for heat related illnesses, it is important to follow some basic work practices, such as:

- Wearing lightweight, light-colored, loose-fitting clothes,
- If possible, blocking out direct sun or other heat sources,
- Taking frequent breaks in cool, dry areas,
- Acclimatizing before working (getting used to weather conditions),
- Working during the cooler hours of the day when possible, and
- Maintaining hydration by drinking plenty of water and other fluids.
- If a homeowner or worker displays any signs of heat related illness, it is important to immediately go to a cool, shaded place, sit or lie down, and drink water. If possible, cool water may be poured over the homeowner's or worker's head and body. Seek medical attention immediately if the symptoms do not subside.
- To learn more, visit NIOSH's webpage: Heat Stress (https://www.cdc.gov/niosh/topics/heatstress/).

10. Musculoskeletal injuries.

Homeowners and workers who may be involved in cleanup activities are at risk for developing stress, strain, and potential musculoskeletal injuries, which are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, or spinal discs. These common injuries can occur when moving debris and materials, using hand-held equipment (e.g., chainsaws) due to repetition, force, vibration, or awkward postures.

Safety Measures

Some useful tips to prevent these injuries:

- Use teams of two or more to move bulky objects.
- Take breaks when conducting repetitive work, especially if experiencing fatigue.
- Avoid working in unusual or constricting postures.
- Use correct tools and equipment for the job and use them properly.

- Do not lift material weighing 50 pounds or more and use automated lifting devices for heavier objects.
- Be sure the area is clear of slip, trip and fall hazards.
- To learn more, visit NIOSH's webpage: Ergonomics and Musculoskeletal Disorders (https://www.cdc.gov/niosh/topics/ergonomics/).

11. Wildfire smoke and ash

Smoke from a wildland fire can pose health risks. Older adults, young children or individuals with underlying heart or lung disease are the most likely to be affected by inhaling wildland fire smoke. Healthy individuals may also experience short-term respiratory irritation symptoms, such as burning eyes and runny nose. If there is smoke in the area, homeowners and cleanup workers who are at-risk of experiencing a smoke-related health effect should consider leaving the area until the smoke clears.

Ash from wildland fires can be deposited on indoor and outdoor surfaces in areas around the fire and can be irritating to the skin, nose and throat, and may cause coughing.

Safety Measures

To minimize the health effects that may occur due to exposure to smoke and ash:

- Always wear proper personal protective equipment (long sleeve shirts, pants, gloves and safety glasses) when working around ash. If you do get ash on your skin, wash it off as soon as possible.
- Do not use leaf blowers or take other actions (e.g., dry sweeping) that will put ash into the air. Shop vacuums and other common vacuum cleaners do not filter out small particles, but rather blow the particles out the exhaust into the air. To clean up ash, use vacuums equipped with High Efficiency Particulate Air (HEPA) filters.
- Do not consume any food, beverages, or medication that has been exposed to burn debris or ash.
- Well-fitting respirators may provide some protection during cleanup. Please visit NIOSH's Respirator Trusted-Source Information web site at: http://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/RespSource.html.
- If the presence of asbestos, lead, CO or other hazardous material is suspected, do not disturb the area. Dust masks or filtering facepiece respirators do not protect against asbestos or gases such as CO.
- Avoid burned items that may contain hazardous chemicals, such as cleaning products, paint and solvent containers.
- Avoid ash from wooden decks, fences, and retaining walls pressure treated with chromated copper arsenate (CCA) as it may contain lethal amounts of arsenic.

12. Working with and around heavy equipment.

Do not operate heavy equipment, such as bulldozers, backhoes, and tractors, unless you are properly trained. Serious and fatal injuries can occur when equipment is used improperly. To learn more about motor vehicle safety, visit NIOSH's webpages: Motor Vehicle Safety (https://www.cdc.gov/niosh/motorvehicle/default.html) and Fatality Assessment Control and Evaluation (https://www.cdc.gov/niosh/face/default.html).

13. First aid

First aid, even for minor cuts and burns, is extremely important as workers are exposed to smoke and burned materials. For more information, please visit NIOSH's webpage: NIOSH's First Aid Procedures (https://www.cdc.gov/niosh/npg/firstaid.html).

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