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Wildfires: Planning, Response, and Recovery

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I. Introduction

Throughout the history of the United States, wildfires have played a prominent role in sculpting our natural and built environment. These events have influenced policies affecting land management, firefighting strategies, and building standards. Today, fires continue to damage communities at the urban-wildland interface and challenge us to think about new methods for preventing loss of life and mitigating losses. California endured two successive severe fire seasons in 2017 and 2018. The Washington Post reported that in 2017, in California alone, almost 9,000 wildfires occurred, consuming 1.2 million acres, destroying 10,800 structures, and resulting in the deaths of at least 46 people.¹ It is notable that at the time the article was published several fires that started in 2017 had still not yet been contained and continued to burn for several weeks into the new year. Unfortunately, further wildfire-related devastation affected communities across the state over the course of 2018, including the January 9, 2018, debris flows in Montecito (Santa Barbara County)² and over 7,500 new fires that started across the state in 2018 burned nearly 1.7 million acres.³ The 2018 Camp Fire, which burned over 153,000 acres in the Sierra Foothills of Northern California, was the deadliest fire in California history, killing 86 people, injuring 3 firefighters, and destroying 13,972 homes, 528 commercial structures, and 4,293 other structures.⁴

These recent experiences have prompted many to question the occurrence of these events, to further explore the choice of response methods, and to seek better ways to prepare for the possibility of a wildfire. This paper serves to provide information and resources to individuals in the construction industry as they seek to improve the resilience of their businesses by planning and implementing measures to mitigate risks before, during, and after wildfires.

II. Wildfire

The National Wildfire Coordinating Group (NWCG), a coordinating group comprised of numerous federal agencies, has a working definition of wildfire. They describe this as “an unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fire where the objective is to put the fire out (definition currently under review).”⁵ Additionally, the NWCG defines wildland fire as, “any non-structure fire that occurs in vegetation or natural fuels. Wildland fire includes prescribed fire and wildfire.”⁶ It is also notable that the NWCG defines “wildland” as, “an area in which development is essentially non-existent, except for roads, railroads, powerlines, and similar transportation facilities. Structures, if any, are widely scattered.”⁷ Communities located at the urban-wildland interface or those communities embedded within wildland areas face substantial risks from wildfire.

A. *Cause and Origin of Wildfires*

Wildfires have both natural and manmade causes. Natural causes include lightning strikes or other spontaneous combustion events. Human ignition sources are multifarious. Examples of human activities that are frequently part of construction projects that have the potential for starting a fire include vehicle accidents, electrical or mechanical equipment failure, or hot work (e.g., welding or cutting).⁸ Because everyday construction activities can trigger a fire event, construction companies should be aware of fire risk both from the perspective of taking mitigating measures to avoid starting a fire as well as responding to a fire event that may originate from an external cause. In fact, the US Occupational Safety and Health Administration (OSHA) is collaborating with the National Oceanic and Atmospheric Administration (NOAA) to support employers with information to guide their wildfire risk management.⁹

B. Geographic Wildfire Risk

Oxygen, heat, and fuel are the three necessary ingredients for a fire to occur and spread. Areas of greater wildfire risk include arid and semi-arid regions with ample supplies of dry vegetation. In California, for example, the combination of seasonal drought, winds originating in the inland or desert areas (e.g., Santa Ana, Sundowner, or Diablo winds)^{10,11}, and flammable vegetation (e.g., chaparral, pine, or grassland vegetation classes) create opportunities for wildfires to start and propagate extremely rapidly across the landscape. Wildfire hazard mapping, such as that performed by the U.S. Forest Service, can provide valuable information about the wildfire risks at specific locations across the country.¹²

C. Fire Weather

A number of government agencies publish real-time, near-real-time, or long-range forecasts related to meteorological conditions that increase the potential for wildfires. Most commonly, periods that coincide with drought or combined drought, high-wind, high temperature, and low humidity conditions are the most high-risk time windows for wildfires. There are known periods of time when fire weather and fire risk are prevalent. For example, late summer, fall, and early winter in Southern California tend to have higher fire risk than other times of the year.

Construction companies or law firm staff working in high risk fire areas should be trained to read and monitor fire weather conditions throughout a work day for the duration of a project to make sure that these risks are taken into consideration over the course of a day's work. Weather conditions can change over the course of a day, so it's important for these conditions to be monitored continuously. Severe fire weather conditions may warrant complete project shut- down for a given day or necessitate a change in a day's activities or sequencing of work.

III. Planning for Wildfires

Even at the stage of reviewing a request for proposal (RFP) or responding to a bid, construction companies can rely upon abundant sources of information to explore the wildfire potential in the area of a given project site. In addition to the wildfire hazard potential maps prepared by the U.S. Forest Service, state or local government agencies in high fire hazard areas often publish local information that can serve as a guide for hazard assessment and informed decision making. An example of state-specific information is the CalFire California Fire Hazard Severity Zone Project, which publishes a state-wide wildfire hazard classification map.¹³ Since many of the resources are geographically referenced, staff with geographic information system (GIS) experience or map reading experience are strong candidates for working on such an analysis. Since only one spark can trigger a fire, it is important that regardless of a project scale, contractors are aware of the site-specific conditions of a project location, whether that is a single- family custom-home project or construction of a regional piece of infrastructure.

Contractors must be particularly careful to make every effort to prevent starting a wildfire while conducting their work. Significant litigation has stemmed from behavior and practices that have resulted in the ignition of wildfires, especially against utility companies.¹⁴ California case law also has examples of damaged parties claiming damages against contractors who are found to have been responsible for the ignition of the wildfire.¹⁵

A. Key Preparedness Measures

If it is established that a project involves wildfire risks, implementing preparedness measures should be recommended as a best practice. Such measures can be budgeted into the cost of a bid and appropriate protocols and actions can be initiated at the project inception.

It is expected that the necessary steps to prepare for a wildfire will vary depending on the particulars of a project.

i. Insurance

Insurance coverage considerations related to wildfires include potential losses to structures, business property, heavy equipment, and building materials. Additionally, since mandatory evacuation orders during a fire could last weeks, business interruption insurance should also be considered. Detailed discussions should be held with qualified insurance brokers to discuss these and other risks to ensure that comprehensive coverage can be considered upon the purchase of a policy.

The National Oceanic and Atmospheric Administration (NOAA) has estimated that \$24 billion in damages can be attributed to the wildfire events that occurred in the United States in 2018.¹⁶ As such, the extent of the damages that have been caused by these events are currently raising questions regarding the future availability of insurance in areas that are prone to wildfire.¹⁷ This remains to be an area of uncertainty for businesses and property owners in areas that face wildfire risk.

ii. Business Documents and Project Files

Proper measures should be taken to ensure that hard copies and electronic copies of project and business documents be archived at off-site locations. Ideally, paper documents have digital equivalents, and digital files are stored on a secure network location with digital off-site back-up. There are numerous cloud-based online storage solutions that are available, but depending on the sensitivity of business or project information, detailed technical information regarding web security should be scrutinized before commitments are made to use such services. Secure internal networks with robust security measures and local servers with regular

off-site digital back-ups may continue to be warranted. Further network security considerations should be discussed with experienced information technology (IT) staff.

iii. Site-Specific Fire Risk Reduction

Project site layout ideally will take into consideration wildfire risk. For example, chemical or fuel storage locations should be strategically placed to minimize fire risk. Regular placement of fire extinguishers or access to water trucks can also help manage the site's fire risk. Good housekeeping on the project site supports efforts to reduce accidents, which could also reduce fire risk. Regular debris removal and waste management practices should be established to assure the workplace remains clean and tidy.

iv. Safety Talks and Communication with Staff

Frequent safety talks that include a site's wildfire risk should be incorporated in daily or weekly safety discussions. In particular, project staff and guests should be aware of emergency response protocols, how to report incidents or accidents, how to reach first aid and first responders, and how to safely evacuate the site.

v. Site Evacuation

In the event of a wildfire, a prompt decision needs to be taken to evacuate or shelter in- place. Advance planning should take into consideration the means and timeframe necessary to evacuate a project site, to include communication protocols, and means and methods to keep track of on-site staff, such as performing a roll call. In some instances, especially in remote areas, there may not be sufficient time or first responder personnel resources to receive evacuation warnings. As a planning measure, all staff on-site should be trained to maintain a situational awareness of changing conditions when fire weather conditions are present.

Site evacuation plans should be prepared for each phase of a project and tested regularly. Work in remote locations or work that affects the project site's ingress and egress should be taken into consideration upon the preparation of emergency evacuation plans. Sufficient transport resources should be available so that everyone present on the construction site can evacuate in a vehicle, should the need arise.

Another important note is that visibility and air quality can be extremely poor during a wildfire. Staff should be made aware of this as part of their training. Driving conditions can be very difficult as a result of poor visibility. NIOSH-approved N95 respirators can help mitigate the effects of exposure to poor air quality, but individuals with pre-existing health or breathing conditions may experience negative health effects when using respirators.¹⁸

vi. Sheltering In-Place

There are scenarios when sheltering in-place may be the only viable option during a wildfire event. Sheltering in-place is inherently dangerous and should only be used as a last-resort. For example, sheltering in-place may be necessary if a fire overwhelms or surrounds a site rapidly and evacuation routes are severed. In such a case, a sufficiently robust structure or one isolated from combustible materials on the project site may serve as a refuge point.

If sheltering in-place is determined to be a potential course of action because of the remoteness of or access issues at a project site, the site should be equipped with appropriate equipment and supplies that would facilitate such an alternative. Fire resistant clothing, fire hydrants, hoses, buckets, sand, breathing masks, etc. are examples of the equipment that would be needed. Staff should be trained on best practices related to sheltering in-place.

vii. Site Maps and Fire Fighting Access

If a project site is extensive or located in a remote location, consideration should be taken to map out rural roadways, access and evacuation routes, locations of fire hydrants or water tanks, fence lines, gates and gate codes, structures, and refuge points. Such maps should be used to train staff and orient visitors to the site. Additionally, multiple copies of these maps should be stored in accessible and obvious places on the site so that first responders can rely on them if they need to use the project site for firefighting, water supply, or access to adjacent properties.

viii. Emergency Evacuation Kit

Office and construction staff should be prepared to evacuate quickly from a site in the event of an approaching wildfire. If a situation is extremely dire, leaving a site without taking an emergency kit or personal belongings may occur. However, if there are a few minutes available, some potential measures to take could include:

- Closing and securing windows, doors, and other building openings to reduce the chance that embers may fly into structures on the site.
- Opening all locked gates to facilitate easy access for first responders.
- Packing a standard emergency kit, first aid kit, and other supplies such as a flashlight, safety glasses, gloves, and respirator (mask).
- Packing personal items such as wallet with identification, mobile phone, keys, laptop computer, etc.
- Packing water and food.
- Putting on sturdy shoes and fire-resistant clothing.

IV. Wildfire Response

If a wildfire occurs at or near a construction site, immediate action should be taken to secure the site and evacuate. Recent anecdotes of highly dynamic fire behavior during wildfires in Northern California confirm that emergency management and first responder personnel may not always be able to respond to each distress call. This means that people may need to rely upon their skills, training, and wits to survive an extreme wildfire event. For that reason, company leadership or site foremen should be empowered to make conservative decisions related to project site shut down and activate evacuation protocols.

Moreover, recent fires in rural or remote areas have resulted in severe gridlock on limited capacity roadways. There are numerous accounts from fires in Australia, Europe, and the US where people unfortunately perished in their vehicles while attempting to evacuate. For that reason, early evacuation can help staff reach a point of refuge and avoid the risks and hazards of congested roadways.

A. Implementation of the Evacuation Plan

Each evacuation plan will be unique depending on site-specific characteristics and conditions. Of paramount importance is ensuring that all staff receive notification of the need to evacuate. As practical, all means of communication should be utilized. Ideally, an off-site staff member can support the process of communicating with all staff and evacuating staff confirm with off-site staff that they reach a point of refuge. It is important to be aware that cellular phone communications systems tend to become overtaxed or experience interruptions in service during wildfires. As such, communications may become very difficult or impossible for some time after a fire. Companies should explore alternate methods of conducting wellness checks including email and use of landline or emergency contact phone numbers in the aftermath of a wildfire.

B. Monitoring Event Information

Finding accurate information about natural disasters while the event is occurring tends to be very difficult, especially when the fire behavior is highly unpredictable. Numerous city and county agencies have recently established emergency communication systems that send out emergency alerts to cell phones. These systems to-date have mostly been utilized in a manner that only sends messages to active subscribers, so it may be important to consider subscribing to local services to receive such messages based on one's residential and home addresses.

C. Post-Wildfire Recovery

Fires may impart lasting impacts on communities that persist for months and years after the fire is extinguished. Damages to homes, neighborhoods, businesses, and infrastructure interrupt the pace of life in a region until people have had the opportunity to rebuild. In the initial recovery phases, there may be access to federal, state, and non-governmental resources (e.g., Red Cross). However, after several months, these resources are generally demobilized and move on to the next disaster. To the extent that businesses have sufficient insurance resources to re-establish their work, the better.

Companies face not just an interruption in their business, but also issues that affect the ability for their staff to return to work. Shortage in labor may result if a wildfire impacts the broad region surrounding a construction site, affecting the lives and personal property of staff working on the project. Construction companies have also faced many challenges in the aftermath of wildfires in recent years because of high demand for reconstruction services, depleted housing stock, challenges in receiving timely building permits, and rising wages and supply costs that result from the changed market conditions.

Unfortunately, after a wildfire, these are not the only challenges that businesses and communities face. There are additional environmental and natural hazards that must be contended with.

D. Post-Wildfire Hazards

There is a possibility for many lingering hazards to remain after a wildfire. After evacuation orders are lifted, it is advised that a team of qualified staff return to the project site to assess the situation at the site and investigate the possibility for additional hazards. It is important that company leadership perform a preliminary investigation before re-opening a site for operations. Examples of some areas to evaluate for hazards include:

- Evaluate the ground conditions across the property, looking for hot spots, which may be present in multiple places such as tree stumps, areas where construction debris was located, or other areas that may not have been completely extinguished.
- Search for any remaining embers on the property or on the structures. Embers can smolder in attics, under eaves, or within other roof or building openings.
- Evaluate the soundness of the structures on site to verify if they have structural damage. If any structural damage is obviously observed (e.g., scorch marks, distressed concrete, wall or foundation cracking, damaged beams, etc.), registered professional engineers should be called on the scene to investigate further. Staff should not occupy a fire-damaged building.
- Overhead utility lines and trees in the vicinity of the project site might be damaged as a result of a fire. Fire-damaged utility poles and trees are fall hazards and should be removed before a site is occupied by staff.

E. Post-Fire Watershed Impacts

Properties located within the burn area, at the urban-wildland interface, or downslope of the burn area are vulnerable to post-fire debris flow and flood hazards that may emanate from the burned areas during storm events. Even relatively modest rain events can trigger devastating debris flow and floods that impact downslope communities in deadly ways. This occurs because landscape changes that occur during a fire change the hydrologic response of a burned watershed making it possible for significant quantities of soil, rock, ash, burned vegetation, and water to flow downhill and impact lives, homes, and infrastructure.

The U.S. Geological Survey (USGS), Federal Burned Area Response Teams (BAER), and sometimes local environmental resource teams survey and analyze the burned landscape to prepare hazard profiles for burned areas. The information prepared by these agencies can be extremely valuable to inform communities, businesses, and landowners of the post-fire hazards that they face. Because of the severity of the potential impacts of post-fire debris flow and flood hazards, residents and business owners should heed evacuation advisories and orders in advance of rain events that may persist for several years after a wildfire until the burned slopes have had a chance to recover.

Often, there is limited time available between fire containment and the first post-fire storm events. Preventive measures that can be taken to attempt to mitigate flood and debris flow damages at a property during such limited time windows include:

- Removing valuables or personal property located in the vicinity of burned slopes or water courses that can convey runoff and debris from a burned area. Stockpiled construction materials, construction equipment, computers, project files, or business documents are examples of the types of items to remove.

- Secure or reinforce building openings using plastic sheeting and plywood to protect areas that could be impacted by flooding and debris.
- Using sandbags around entry ways to buildings that could be impacted by flooding and debris.
- Evaluate culvert crossings and/or bridges to clear them of sediment or debris before and after each storm event to support drainage conditions.

Because of the nature of post-fire debris flows and floods, these measures may not be sufficient to mitigate or prevent damages. And, it is valuable to consult with professional engineers to prepare damage mitigation strategies that are consistent with best practices and drainage law. Avoidance of the hazard is the best measure to prevent human casualties that could result from post-fire debris flows or floods.

V. Closing Thoughts

At this time, there is uncertainty regarding the long-term implications that the impacts of recent wildfire seasons may have with respect to building codes and standards, city and land use planning, and availability of insurance in areas that are prone to wildfire. For this reason, seeking education about the types of wildfire hazards that a business faces and working alongside experienced technical staff who can provide strategic insights regarding how to prepare for and mitigate those risks will continue to be an important set of considerations for businesses.

VI. Bibliography

Examples of information resources to monitor fire weather conditions include:

- National Significant Wildfire Fire Potential Outlook: <https://www.predictiveservices.nifc.gov/outlooks/outlooks.htm>
- National Weather Service Fire Weather Map: <https://www.weather.gov/fire/>
- National Interagency Fire Center – National Significant Wildland Fire Potential Outlook: https://www.predictiveservices.nifc.gov/outlooks/monthly_seasonal_outlook.pdf
- NOAA’s National Weather Service Storm Prediction Center: https://www.spc.noaa.gov/products/fire_wx/

Summary of Wildfire Preparedness Resources

While many of the wildfire planning or preparation information sources present content for homeowners and families, the guidance and information are broadly relevant to businesses and the construction industry. Examples of information regarding wildfire preparation from national, state, or local resources include:

- The National Fire Protection Association (NFPA) wildfire preparedness (information for residents and businesses): <https://www.nfpa.org>
- Federal Emergency Management Agency (FEMA) wildfire preparedness (information for residents and businesses): https://www.fema.gov/media-library-data/1409003859391-0e8ad1ed42c129f11fbc23d008d1ee85/how_to_prepare_wildfire_033014_508.pdf
- U.S. Fire Administration (USFA) wildfire preparedness (information for residents and businesses): <https://www.usfa.fema.gov/prevention/outreach/wildfire.html>
- Ready.gov wildfire preparedness (information for residents and businesses): <https://www.ready.gov/wildfires>

- U.S. Department of Labor OSHA (information for employers):
<https://www.osha.gov/dts/wildfires/preparedness.html>
- U.S. Environmental Protection Agency (US EPA) wildfire preparedness (information for residents and businesses): <https://www.epa.gov/sites/production/files/2015-06/documents/wildfire.pdf>
- Los Angeles Fire Department wildfire preparedness (information for residents and businesses): <https://www.lafd.org/safety/education/ready-set-go>
- Los Angeles County wildfire preparedness (information for residents and businesses): <https://fire.lacounty.gov/ready-set-go.pdf>
- Cal Fire wildfire preparedness (information for residents and businesses): <http://www.readyforwildfire.org/Prepare-For-Wildfire/>

Sources of information for near-real-time information include:

- USDA Forest Service Active Fire Mapping Program: <https://fsapps.nwcg.gov>
- Inciweb (fire information resource for active and historical fires):
<https://inciweb.nwcg.gov>
- Cal Fire (wildfire incident information system for wildfires in Cal Fire's jurisdiction):
http://www.fire.ca.gov/current_incidents
- Text-based emergency alert subscriptions. See for example, Los Angeles County Emergency Alert System: <https://www.lacounty.gov/emergency/alert-la/>

Post-Wildfire Information Resources

- CalFire. Post-Wildfire Recovery: <http://www.readyforwildfire.org/After-a-Wildfire/>
- County of San Diego. What To Do After a Wildfire: https://www.sandiegocounty.gov/content/dam/sdc/deh/fhd/food/pdf/publications_firerecovery_whattodoafterawildfire.pdf
- USGS Emergency Assessment of Post-Fire Debris-Flow Hazards: https://landslides.usgs.gov/hazards/postfire_debrisflow/
- U.S. Forest Service BAER Program (information source to obtain information regarding landscape damage and natural hazards following a wildfire): <https://www.fs.fed.us/naturalresources/watershed/burnedareas-background.shtml>
- LA County Public Works Homeowner's Guide for Flood, Debris, and Erosion Control: <https://dpw.lacounty.gov/landing/em/docs/HOMEOWNERS-GUIDE-201810-ENG.pdf>

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- 10 Fovell, Robert, The Santa Ana Winds, <http://people.atmos.ucla.edu/fovell/ASoother/mm5/SantaAna/winds.html> (last visited Feb. 25, 2019).
- 11 Santa Ana, sundowner, or diablo winds are colloquial terms for winds that originate as a result of a high pressure system that forms over the Great Basin, which creates a clockwise circulation of air over the basin. This circulation pattern forces air toward coastal areas, and as the air moves across and through the mountain ranges in California, the air is compressed, heats up, and results in a drop in relative humidity. The winds occur episodically and are most likely to form from September through May in California.
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- 15 *Martin Kelly v. CB&I Constructors, Inc.*, 179 Cal.App.4th 442, 102 Cal. Rptr. 3d 32 (2009).
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