Kids Activity Downloads

WILDFIRE RESEARCH FACT SHEET

Fire Spread on Ember-Ignited Decks

Wind-blown embers generated during wildfires are the single biggest hazard wildfires pose to homes, and homeowners should never overlook the potential risk that an attached deck can create. Recent testing by the Insurance Institute for Business & Home Safety (IBHS) offers important findings that can help minimize risk from wind-blown embers to decks.

Nothing that can ignite should be stored under a deck. This action, along with development of effective and well-maintained home ignition zones, will minimize the chance of all but a wind-blown ember exposure to your deck. An ignited deck can result, for example, in the ignition of combustible siding, or glass breakage in a sliding glass door.

ABOUT THE RESEARCH TESTS

IBHS's tests evaluated how an ember-ignited fire on an attached deck can spread to the home, and yielded important guidance to minimize the chance of fire spread to the house. Tests showed that the fire was typically small (Figure 1), sometimes just smoldering (not flaming). It spread slowly, taking more than an hour to travel the 4 to 6 feet from the ignition point to the home. Research from IBHS showed all ember-ignited deck fires occurred in the gaps between deck boards and initially started as a small smoldering fire that transitioned to a flaming fire. Although these small fires self-extinguished during IBHS tests that did not include any wind, wildfires almost always involve elevated wind speeds. During lab tests, even mild wind speeds of 12 mph, enabled fires to spread. Under certain conditions, the small fire did grow, always in the under-deck area (see Figure 2). Our results demonstrated that fire growth occurred in the under-deck area when joist spacing was 8" to 12", less than the typical 16".

Wind blowing against a building has a return flow component, so if fire were able to burn to the home, it would have to travel there as a backing fire, or against the wind. Research shows the "fuel" has to be close together for this to occur. That "fuel" could be the deck boards, or a combination of deck boards and support joists.

HOW DOES THE FIRE SPREAD?

IBHS tests demonstrated that fire spreads both toward, and away from, the house regardless of the deck board's orientation (parallel or perpendicular). When deck boards were perpendicular to the building, the fire would spread in the gap between boards. The 1/8" gap between deck boards was narrow enough for the fire to continue burning into the unburned wood (the fuel), in both directions from the ignition point. The fire spread pattern was more complicated when deck boards were parallel to the test building. In this case, fire could spread parallel to the test building, or directly to it. Fire spread directly to the building included a smoldering mode that occurred in the space between the top of the joist and the bottom of the deck board. Flaming combustion occurred when smoldering reached a gap between deck boards. Lateral flame spread can result in the ignition of joist members, resulting in fire growth.

IMPORTANCE of the HOME IGNITION ZONES

To minimize the possibility of deck ignitions, reduce fuels in the home ignition zones by carefully selecting and positioning vegetation and implementing regular maintenance. Pay particular attention to the area under the footprint of the deck, where storage of combustible materials should be avoided.

Although there are noncombustible deck board and decking options, many of the commercially available deck board products are combustible. IBHS research on deck materials is available at: disastersafety.org/ibhs/wildfire-ignition-potential-decks-subjected-ember-exposure.

CONSTRUCTION RECOMMENDATIONS

IBHS research shows that, for medium density softwood decking products (such as redwood and cedar), which can be vulnerable to ignition from embers, the associated fire spread on the deck can be minimized by the following:

1. Increase the gap between deck boards from 1/8 inch to 1/4 inch.

Fire spread in the gap between deck boards. Note the small flame burned all the way to the test building.

2. Increase joist spacing from 16 inches to 24 inches.

Narrow joist spacing was a condition that could result in fire growth in the under-deck area.

3. Apply a foil-faced self-adhering adhesive flashing tape (foil-faced bitumen tape) on the top of each joist.

Using a foil-faced self-adhering bitumen flashing tape reduces flame spread by removing the joist as a fuel source for both parallel and perpendicular deck board installations.

Insurance Institute for Business & Home Safety

NFPA FIREWISE USA® RESIDENTS REDUCING WILDFIRE RISKS

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WILDFIRE RESEARCH FACT SHEET

EXTERIOR SPRINKLER SYSTEMS

Are exterior sprinkler systems an option for protecting a home during a wildfire, after residents have evacuated the property?

Functionality and Installation

The function of an exterior sprinkler system is to minimize the opportunity for ignition by wetting the home and surrounding property. Sprinkler systems should be able to protect a home against the three basic wildfire exposures: wind-blown embers, radiant heat and direct flame contact.

Sprinklers systems can be mounted in one or more locations, including:

- The roof (Photo 1).
- Under the eave at the edge of the roof.
- On the property, in which case the sprinklers are directed at the home from multiple locations surrounding it.

Ember ignition of combustibles located on or near the home can result in a radiant and/or flame contact exposure (Photo 2). Water should reach all vulnerable areas for the system to have maximum effect both on and near the home (Photo 3).

Potential Issues

Post-fire assessments have shown exterior sprinkler systems can be effective in helping a home survive a wildfire, but potential issues exist with their use. These issues include:

- The water supply should be adequate to deliver water, when needed, for the time embers could threaten a home. This period could be up to 8 hours.
    - Check with your local fire department if your sprinkler system uses water from a municipal supply; they may have suggestions to help minimize water consumption.
- The effectiveness of a sprinkler system is questionable when a neighboring home is burning, since this would result in an extended radiant heat and/or contact exposure to the home.
- These systems can be activated manually or by an automated device, such as a sensor that detects heat or flame, or by an SMS-enabled cell phone. The ability of these systems to activate based strictly on an ember exposure has not been determined. Since wind-blown embers can be transported for up to a mile from the flame front of a wildfire, this may be a limitation.
- The most threatening wildfires occur during high-wind events and the homeowner should consider how the distribution/transport of water droplets may be influenced by elevated wind speeds.

Recommendations

Given the potential issues regarding performance, it's recommended that use be a supplement to, and not a replacement for, already proven mitigation strategies, such as the reduction of potential fuels throughout the home ignition zones, along with removal of roof and gutter debris, and use of noncombustible and fire/ember-ignition resistant building materials and installation design details.

Photo 1. Roof mounted sprinkler.

Photo 2. In order to be effective, external sprinklers must be able to wet all areas where ignition can occur, or be sufficiently effective in quenching embers that approach the home so they won't have enough energy to ignite combustible items.

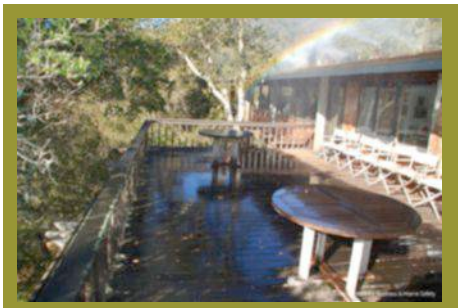

Photo 3. Roof-edge mounted sprinkler. Note these sprinklers did not deliver water in the near-home area. With this scenario, a sufficient number of wind-blown embers would have to be quenched in order to avoid ignition of the siding and decking in this zone, particularly at the deck-to-wall intersection.

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SKYLIGHTS

WILDFIRE RESEARCH FACT SHEET

Skylights can compromise a home's ability to survive a wildfire when precautions are not implemented to prevent them from being an entry point for embers and/or flames.

Construction Materials/Placement

During a wildfire, a skylight can be vulnerable if subjected to an extended radiant heat exposure, or to flames when embers have ignited vegetative debris on top of the skylight. Most guidance recommends using a flat glass skylight rather than a plastic dome style because the plastic is combustible. However, there are situations, based on the slope of the roof, where a flat glass could be more vulnerable.

Vegetative debris can more easily land and stay on a low-slope roof, leading to increased risks. As seen in **Photos 1 and 2** of a low-slope roof, debris is more likely to accumulate on top of a flat glass skylight, and less likely to accumulate on a plastic dome skylight. Typical flame temperatures resulting from a wind-blown ember ignition of the debris would be high enough to break even tempered glass, the type of glass commonly used as the outer pane in a flat glass skylight.

Steep-Slope Roofs

Flat skylights are less vulnerable on a steep-slope roof because vegetative debris is less likely to accumulate. A steep-slope roof will act more like an exterior wall in terms of its response to a radiant heat exposure. Because of this increased resistance of glass over plastic to a radiant heat exposure, a glass skylight is a better choice on steep-slope roofs. The vulnerability of a domed skylight will depend on the potential for an extended radiant heat exposure, which in turn depends on the amount of vegetation and other combustibles near it **(Photo 3)**.

Dual-Pane Glass Benefits

Newer skylights feature dual-pane systems, like multi-pane windows in an exterior wall. The outer pane uses tempered glass and the inner pane uses laminated safety glass. This type of skylight is less likely to fail.

Maintenance

Both domed and flat skylights have similar framing systems (bases). Each uses a metal flashing to protect the wood framing members from both moisture- and ember-related damage **(Photo 4)**. This flashing helps the skylight survive when threatened, but should be maintained to avoid risks.

Prior to an Evacuation

Similar to windows, skylights that can open should be closed when a wildfire threatens. They also should incorporate a screen to resist the intrusion of embers in case the skylight happens to be left open **(Photo 5)**.

Photo 1. Accumulation of vegetative debris on top of a glass-type skylight on a low-slope roof.

Photo 2. Minimal accumulation of vegetative debris accumulated on these dome-type skylights on this low-slope roof.

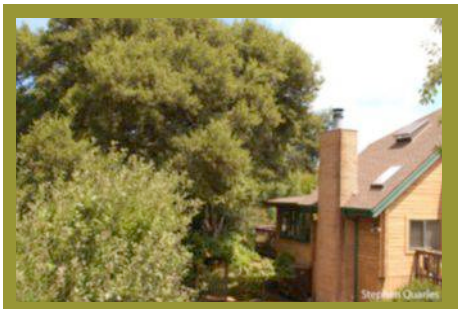

Photo 3. The vulnerability of skylights on a steep-slope roof will depend on the potential for an extended radiant heat exposure to the roof and skylight unit.

Photo 4. Metal flashing protects the framing members of a skylight from moisture, a direct ember ignition, or flames from ember-ignited vegetation debris.

Photo 5. Operable skylights should be closed when a wildfire threatens. Similar to windows, they should incorporate a screen to resist the intrusion of embers (also good for insects!).

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Residents reducing wildfire risks

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WILDFIRE RESEARCH FACT SHEET

Under-Eave Construction

The under-eave area of a house is often overlooked when addressing vulnerabilities that can cause damage or loss during a wildfire. Neglecting this structural component increases susceptibility to heat from flames, which can become trapped, allowing fire to spread through attic vents and into the attic. Embers lodged in gaps between blocking and joists can also result in ignition and fire entry into the attic.

TYPES OF UNDER-EAVE CONSTRUCTION

Open-Eave Construction: Roof rafters visibly extend out beyond the exterior wall. This option is typically less expensive and is commonly found in many parts of the U.S.

Soffited-Eave Construction: Material connecting and enclosing the space between the edge of the roof and the exterior wall.

SOFFITED-EAVE CONSTRUCTION IS BEST FOR HOMES WITH A WILDFIRE RISK

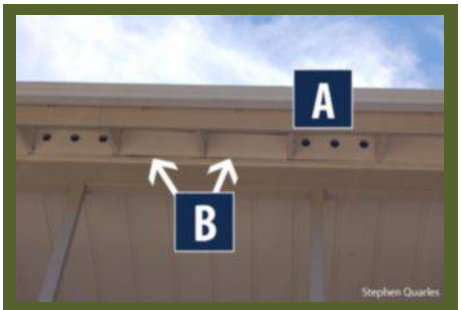
Wildfire research conducted by IBHS supports the use of soffited-eave construction. Additional research and guidance (e.g., FEMA P-737, Home Builder's Guide to Construction in Wildfire Zones - Fact Sheet No.6 https://www.fema.gov/media-library-data/20130726-1652-20490-2869/fema_p_737_fs_6.pdf) also suggests a soffited design as the best option. Vents located in the under-eave area can be entry points for embers and flames when limited effort has occurred to reduce risks in the home ignition zones (particularly in the near-home zone). Embers entering an attic can ignite stored combustible materials. Research has shown that open-eaves are more vulnerable to both ember entry and direct flame contact exposures, relative to soffited-eaves.

With open eaves, use a sealant (such as caulking) to cover gaps, or enclose the underside of the roof overhang. In open-eave construction, embers can and do accumulate between blocking and joists and can ignite these members if sufficient accumulation occurs.

The open-eave blocking likely included vents, so remember to add an adequate amount of soffit vents as part of the project. Make sure the vent area ratio (vent into the enclosed soffit and enclosed soffit into the attic) follows the requirements of local building codes.

Time-to-ignition is faster with under-eave construction and lateral flame spread is quicker, exposing other areas along the length of the home. (Using the recommended 0 to 5-foot noncombustible near-home zone minimizes the likelihood of an ignition at the base of the exterior wall.)

Using noncombustible or ignition-resistant materials to enclose the eave is recommended. The enclosure should extend from the roof edge horizontally back to the exterior wall. The horizontal soffit member is attached to a ledger board that is itself attached to the exterior wall.



Open-eave construction with vents in blocking (A), and gaps between blocking and other wood members in the under-eave area (B).

Flame impingement exposure to the underside of the eave, and time-to-ignition of the joists, blocking and fascia was quicker; and lateral flame spread faster, when an open-eave design was used in research experiments.

Lateral flame spread was reduced when a combustible soffit material ignited in this test of a soffited-eave with a combustible soffit material.

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Wildfires: Interesting Facts and F.A.Q.

- Lightning strikes the Earth over 100,000 times a day. Of these, 10-20% cause a fire.
- Man-made causes such as arson or plain carelessness (like smoking in forested areas or improperly extinguishing campfires) by individuals is the biggest cause of wildfires in the U.S.
- More than four out of every five wildfires are caused by people.
- An average of 1.2 million acres of U.S. woodland burn every year.
- A large wildfire, or conflagration, is often capable of modifying the local weather conditions or producing “its own weather."
- Lodgepole pines and their closely related jack pines have cones that release their seeds only when they are opened by fire.
- Naturally occurring fires, as well as controlled burns, clear out underbrush and help prevent even greater wildfires.
- Many animals in the food chain benefit when patches of forest are transformed by wildfires into clearings.
- Forest fires move faster uphill than downhill! The steeper the slope, the faster the fire travels. If you live on a hill, you might want to leave your house if a wildfire is near.

Q. Why is wildfire smoke bad for me?
Smoke is a mixture of gases and fine particles (particulate) released when things burn. In addition to burning your eyes, these fine particles and gases can be inhaled deep into your lungs. This makes it harder to breathe and may worsen other chronic health conditions such as asthma or heart disease.

Fortunately, most people who are exposed to smoke will not have lasting health problems. How much and how long you are exposed to the smoke, as well as your age and health status, helps determine whether or not you will experience smoke-related problems.

If you are experiencing serious medical problems for any reason, seek medical treatment immediately.

Q. What chemicals are in smoke from wildfires?
Wildfire smoke contains carbon monoxide, a colorless, odorless and toxic gas. Firefighters working near the fire are at greatest risk for high doses of carbon monoxide. Areas even a few hundred yards downwind of the fire where there are high particulate smoke levels typically don’t have high levels of carbon monoxide. Signs of high carbon monoxide levels in the blood include headaches, dizziness, nausea and decreased mental functioning.

Wildfire smoke contains other chemicals,many of which cause irritation to eyes, noses and throats. Find more detailed information on chemicals found in smoke in this publication from the Washington State Department of Ecology.

Q. What other natural disasters happen with wildfires?
The aftermath of a wildfire can be as disastrous, if not more so, than the fire. A particularly destructive fire burns away plants and trees that prevent erosion. If heavy rains occur after such a fire, landslides, ash floes, and flash floods can occur. This can result in property damage outside the immediate fire area, and can affect the water quality of streams, rivers and lakes.

Q. What can be done to reduce wildfires and/or damage?
Several methods, including so-called prescribed burning and thinning of trees, are being used in California and elsewhere to remove the buildup of vegetation that could become kindling for wildfires.

Keeley says we can't prevent wildfires and so should instead "adapt our lifestyle to them." He added, "What these fires tell us is that we need to recognize on these landscapes we're never going to get rid of fire. We cannot eliminate these fires."

He suggests urban planning can help to reduce the spread and damage caused by wildfires. For instance, some lawn vegetation such as palm trees and eucalyptus make for efficient wildfire fuel, as these plants hold on to their dead biomass longer than other plants.

Other measures: Some major wildfires have been started by downed power lines. Keeley suggests burying the lines underground. He added that small roadside barriers could reduce the spread of wildfires, which often get their start along roadsides.

Q. At what temperatures do forest fires burn?
An average surface fire on the forest floor might have flames reaching 1 meter in height and can reach temperatures of 800°C (1,472° F) or more. Under extreme conditions a fire can give off 10,000 kilowatts or more per meter of fire front. This would mean flame heights of 50 meters or more and flame temperatures exceeding 1200°C (2,192° F).

Q. What is a “prescribed fire”?
These are sometimes called prescribed burns, or controlled burns, but the term that most land management agencies use is “prescribed fire”. It is the process of treating land by using carefully and skillfully applied fire to burn some of the vegetation. When applied correctly by professionals, it is only done after writing a prescribed fire plan that addresses the specific characteristics of the tract of land being treated. It will include a “prescription” that requires that many different weather, environmental, and vegetation factors be within carefully defined parameters. The plan will also specify how the fire will be applied, by whom, and what fire control people and equipment must be on scene before the first match is lit. The reasons for using prescribed fire can be many, but they can often include: to replicate natural conditions, restore fire to the landscape, reduce unnaturally high accumulations of vegetation due to fire exclusion, reduce the fire hazard around structures or communities, enhance the habitat of animals, and control exotic species. The smoke from a prescribed fire can be a nuisance, but it is much less than would be created if the same area burned as an unplanned and uncontrolled wildfire. Fire is a natural part of most ecosystems. It is not a question of IF the land will burn, but WHEN and under what conditions…controlled, or uncontrolled.

One thing that can be confusing is that the media usually uses the term “controlled burn”, which for them can be anything from someone burning trash in their back yard to a federal agency conducting a 5,000-acre prescribed fire that has been planned for four years.

Q. How can I obtain certification so that I can use prescribed fire on my own land?
Check with your state forestry or wildland fire agency and ask if they have a program for land owners to use prescribed fire. For example, Texas has a law, HB 2599, that guarantees landowners the right to burn on their own property, then sets up a prescribed burn manager certification system administered by the Texas Department of Agriculture under the direction of the Prescribed Burning Board. For a fire department employee to become qualified as a prescribed fire burn boss requires many years of experience and training. There are numerous prerequisite positions and courses that are required. As they move up from one position to the next, the firefighter must document satisfactory performance on a fire or prescribed fire in each position. It can take 10 to 20 years of full time employment as a firefighter to move up from being a firefighter to a prescribed fire burn boss.

Keep in mind that the use of fire as a tool requires a great deal of knowledge and experience, and it is as much an art as a science. Many things can go wrong that can have catastrophic consequences. Anyone setting fire to the landscape, a private landowner or a government employee, should have liability insurance.

Q. How do I keep my home from burning in a wildfire?
Briefly, your home needs to be “fire safe”. That is, the flammable vegetation within 100 feet of the structures must be reduced to the point where fire can not easily spread from the natural vegetation to your home. And the structures must be of fire-resistant materials and design. Firewise.org has much more information.

Q. What types of airplanes and helicopters are used to put out fires?
Well, first, aircraft don’t put out fires. The best they can do is to slow down a fire to allow firefighters on the ground to get in close and actually put out the fire by applying water from hoses or to physically cut the vegetation away at the perimeter of the fire with hand tools so the fire runs out of fuel to burn.

Q. What is defensible space? And how do I create a defensible space?
Defensible space is an area at least 30 feet of lean, clean and green space surrounding your home. This space gives firefighters room to fight fires. Make your yard firewise by pruning shrubs and tree branches within 15 feet of your chimney or stovepipe. Remove dead tree branches that extend over the roof. Make your yard clean by raking leaves and removing dead tree limbs and twigs. Stack firewood at least 100 feet away from your home. Make your yard green by removing flammable vegetation and replacing it with fire-resistant plants.

Oregon Health Authority



FACT SHEET

Public Health Guidance for School Outdoor Activities During Wildfire Events

Check the local Air Quality Index (AQI) online (www.deq.state.or.us/aqi/index.aspx) and do a visual inspection outside.* Compare the AQI and visibility test to determine the air conditions in your community. Then, use the guide below to determine activity level for your students.

Air Quality Index	Visibility Scale	Recess (15 min)	P.E. (1 hr)	Athletic Events and Practices (2–3 hrs)
Good	Over 15 miles	Great day to be active outdoors!	Great day to be active outdoors!	Great day to be active outdoors!
Moderate	5–15 miles	It is a good day for students to be active outside. Watch students who are unusually sensitive to air pollution for symptoms of shortness of breath or coughing.	Watch students who are unusually sensitive to air pollution. Look for symptoms of shortness of breath or coughing. Monitor symptoms and reduce or cease activity if symptoms arise.	Watch students who are unusually sensitive to air pollution. Look for symptoms of shortness of breath or coughing. Increase rest periods and make substitutions for these students as needed. Monitor symptoms and reduce or cease activity if symptoms arise.
Unhealthy for Sensitive Groups	3–5 miles	It is an OK day for students to be active outside. Allow students who are unusually sensitive to air pollution to stay indoors if they'd like.	Move activities for students sensitive to air pollution indoors. Limit other students to light outdoor activities or move them indoors. Increase rest periods and make substitutions. Monitor symptoms and reduce or cease activities if symptoms arise.	Move activities for students sensitive to air pollution indoors. Limit other students to light outdoor activities or move them indoors. Increase rest periods and make substitutions. Monitor symptoms and reduce or cease activities if symptoms arise.
Unhealthy	1–3 miles	Consider keeping all students indoors or allowing only light outdoor activity. Move activities for students sensitive to air pollution indoors.	Move activities for students sensitive to air pollution indoors. Consider moving all activities indoors. Limit all students to light activities. Increase rest periods and make substitutions.	Consider any of the following: cancel the event. Move the event indoors. Postpone the event. Move the event to an area with "good" air quality.
Very Unhealthy/ Hazardous	1 mile or less	Keep all students indoors.	Move all activities indoors. Limit all students to light activities. Increase rest periods and make substitutions.	Do any of the following: cancel the event. Move the event indoors. Postpone the event. Move the event to an area with "good" air quality.

*If you get conflicting results when you compare the AQI to your visual inspection, err on the side of caution. Follow the recommendations for the worse of the two assessments.
**Students with asthma action plans should follow them closely. They should monitor their breathing and exposure to wildfire smoke. Anyone experiencing symptoms should contact a health care provider for further advice. They should call 911 in an emergency.