Wildfires - An escalating challenge across the globe

A wildfire is an uncontrolled fire that burns in the wildland vegetation, often in rural areas. Wildfires can burn in forests, grasslands, savannas, and other ecosystems, and have been doing so for hundreds of millions of years. They are not limited to a particular continent or environment.

- National Geographic

Wildfire burning at night in Northern Nevada
Credits: Neil Lockhart / Shutterstock

Fire can be incredibly useful for us humans.

However, using fire requires much awareness of safety, because it can also be incredibly dangerous and destructive. Even a single spark in a dry forest can start a wildfire that engulfs hundreds of thousands of acres. Although lightning strikes can cause wildfires, most wildfires are caused by humans: cigarettes, malfunctioning electrical equipment, trash burning, and poorly extinguished campfires are just some ways wildfires can ignite. Depending on the weather, small sparks can wipe out entire forests and cities within days, destroying everything in their path and polluting the air with smoke thick enough to be seen from space.

Aerial photo from space of ecological disaster of fires in the Amazon, South America
Credits: OSORIOartist / Shutterstock

Wildfires are also becoming more intense and more frequent, destroying communities and ecosystems in their path. Recent years have seen record-breaking wildfires across the world from Australia to the Arctic to North and South America. With global temperatures on the rise, the need to reduce wildfire risk is more critical than ever.

Uncontrollable and extreme wildfires can be devastating to people, biodiversity and ecosystems. They can also have a large effect on climate change, contributing significant greenhouse gasses to the atmosphere.

Wildfires and climate change

Across Earth's ecosystems, wildfires are growing in intensity and spreading in range, causing havoc on the environment, wildlife, human health, and infrastructure.

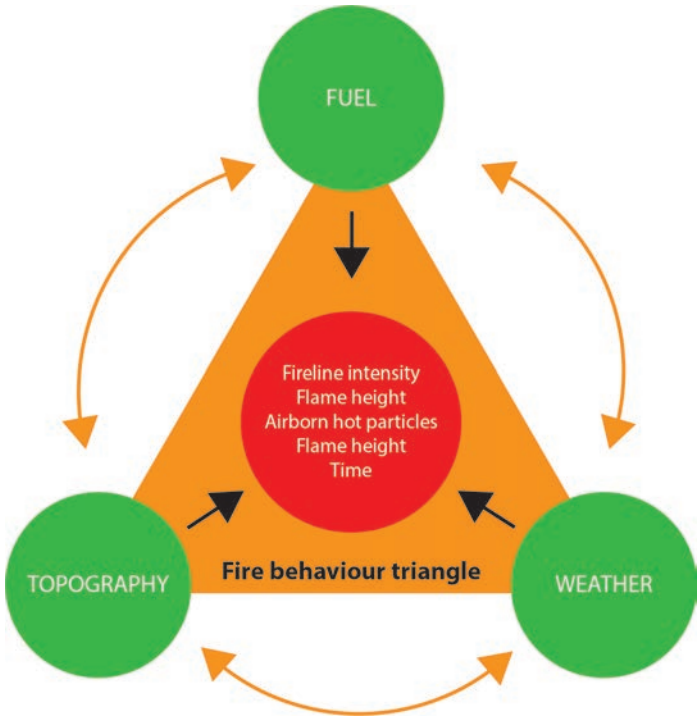
According to the UN environment program report (2022), the Earth has since the industrialisation experienced a long-term warming trend, with an estimated increase in the global mean surface temperature of 1.09°C (IPCC 2021). Some areas of the planet have experienced accelerated warming with an increase of 1.59°C over land and, for example, temperatures in the Arctic rising more than twice as fast as the global average (IPCC 2018; IPCC 2021).

Amazon rainforest burning, enhancing climate change
Credits: Oliver Denker / Shutterstock

Warming has increased the frequency and magnitude of extreme weather conditions that drive the occurrence and spread of wildfires and has caused vegetation that would not usually burn to dry out and combust (e.g., rainforests, permafrost, and peat swamps). A review of 116 articles written since 2013 on climate change and fire concluded that there is a strong consensus that climate change is increasing the likelihood of fire occurrence in many regions (Smith et al. 2020).

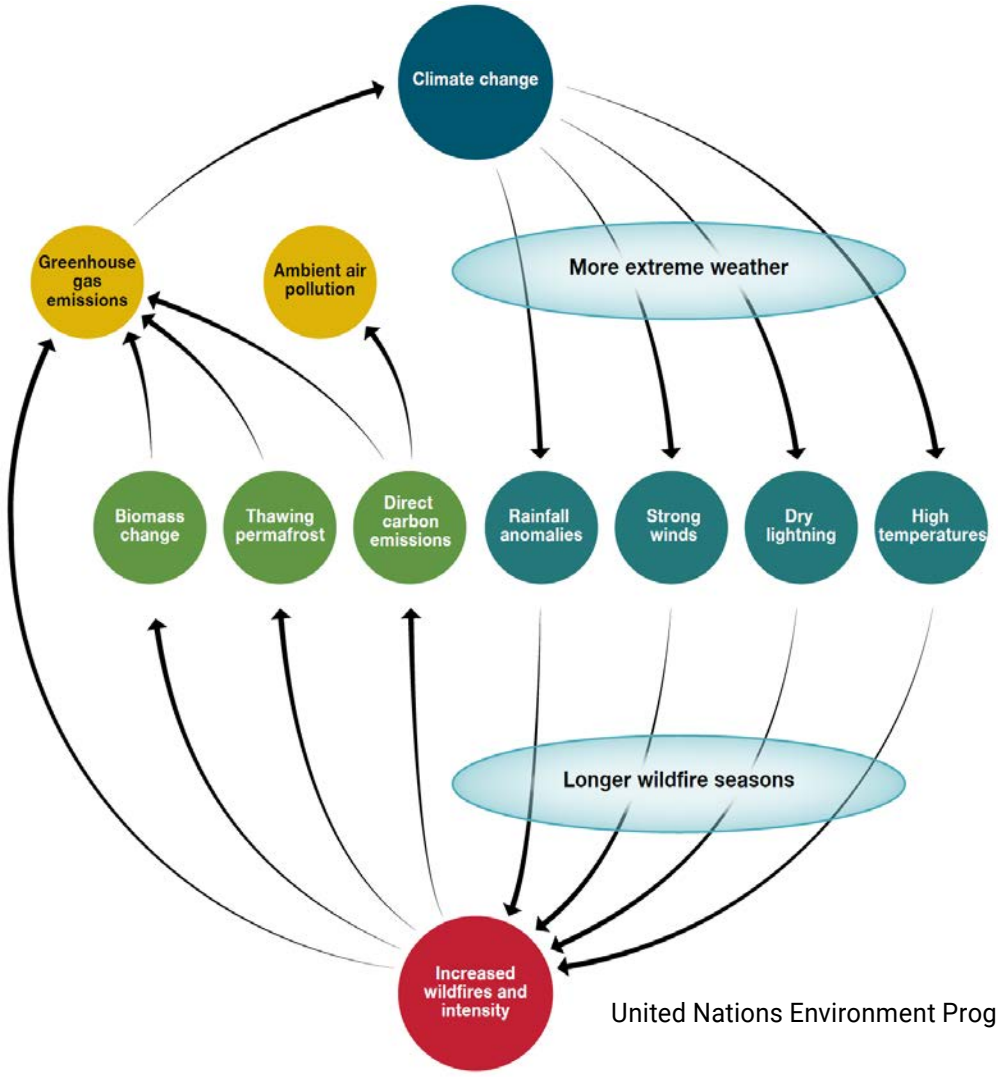
The fire behaviour triangle (Clive Countryman 1972) illustrates the **key variables that affect how a wildfire behaves**. All combustible materials are fuel for the fire, mainly live and dead plant material, and constructions in WUI fires. Weather influences fire through the effects of wind, temperature, and humidity. Topography or land shape can hinder or help the spread of fire and influence the speed of fire and the type and condition of the fuel. Together, these variables influence the behaviours like speed, direction, flame characteristics and intensity of a fire.

Fire behaviour triangle - the key variables that affect how a wildfire behaves



Wildfires and climate change

Potential reinforcing feedback loop of climate change on wildfires



United Nations Environment Program (2022)

Potential reinforcing feedback loop of climate change on wildfires. Climate change will directly affect the frequency and magnitude of extreme weather conducive to the outbreak and spread of wildfires. It will also lead to longer wildfire seasons where the fire season may begin earlier and end later. Increased wildfire activity can positively impact greenhouse gas emissions that reinforce climate change drivers.

Source: **United Nations Environment Program (2022). Spreading like Wildfire – The Rising Threat of Extraordinary Landscape Fires.**

The Spreading like Wildfire report by by UNEP and GRID-Arendal, adresses climate change and wild fires and are very recommended reading to learn more on the subject.

The report can be downloaded from **unep.org**.

Recent research published in the journal Forests following two large wildfires in California showed that a large part of the carbon stored in trees was still there after the fire.

If the amount of combusted biomass is much lower than original thought, it may change the general impression on how much carbon that is released during fires.

The research shows that combustion rates differs dependent on the type of landscape and emission will greatly vary if the burned trees will decompose slowly or are logged after the fire to serve as energy-producing biomass.

More study is needed on the subject.

Wildfires and biodiversity

Not all fires fires need to be extinguished as they serve important ecological purpose. In some areas regular conflagrations play a key role in driving and maintaining the area's biodiversity. Plants can be dependent on fire and some animals depend on those plants, other animals depend on that animal and so on. There is an entire structure of dependency.

After a fire, the open space in a forest and additional sunlight makes trees and plants grow and nutrients are returned to the soil through the ashes of vegetation.

Controlled burning can also prevent destructive wildfires by removing dead materials that would act as fuel to a fire.

The idea is that some wildfires are allowed to burn because of their positive effect on biodiversity.

Koala bear escape from australian bushfire.
Credits: Benny Marty / Shutterstock

Australian plants regenerating after catastrophic fires.
Credits: DMV Photography / Shutterstock

Honeybee on a mint plant.
Credits: Benny Marty / Shutterstock

However, wildfires that burn for weeks and that may affect millions of people over thousands of square kilometres present a major challenge. Wildfires are burning longer and hotter in places they have always occurred, and are flaring up in unexpected places, like drying peatlands and in permafrost areas. These large fires can be really devastating for important biodiversity areas, that might never fully recover again.

Not only can wildfires contribute to a climate change feedback loop by emitting huge quantities of greenhouse gases into the atmosphere, but also greatly reduce biodiversity.

Fire in Transbaikal forest.
Credits: Lu Yago / Shutterstock

Forest fires could result in an irreversible degradation of permafrost. It may take decades or even centuries for the fire-disturbed ecosystems and permafrost environment to return to pre-fire conditions, if ever possible. In boreal forest, the thickness of organic layer has a key influence on changes in permafrost and vegetation.

Wildfires in Norway in the middle of the winter

During 11 days in January, three of the largest fires in Norway in recent times occurred. On the evening of 18 January, a fire broke out in a residential house in Lærdal. The fire spread quickly in the strong wind. 40 buildings, of which 17 residential houses were lost. This was not a wildfire, but strong wind and embers was a key factor in this large fire spread. On 27 January, sparks from a power line crashed into the dry grass in Flatanger municipality. Strong winds caused the fire to spread over large parts of the peninsula. 64 buildings where lost. On January 29, a heather fire spread in Frøya municipality. Only one building was lost, but an area of about 10 km2 with heather and grass burned.

WUI fire in Flatanger.
Credits: Ove Magne Ribsskog / Flatangernytt

Common to all these was that they started in the middle of winter. A time when wildfires and wild urban interface fires are not expected to spread in Norway.

Impacts of wildfires on people and the built enviroment

Wildfires can have a large negative impact on people, infrastructure, climate and ecosystems.

It can threaten lives and people's livelihoods, affect national economies, and have other long-lasting impacts on life and health. Wildfires can destroy infrastructure, and degrade ecosystem services, such as water supply, nutrition, biodiversity, and carbon storage.

Impacts on life and human health

Wildfires can, in the worst case, lead to loss of human life and secondly it can lead to acute and chronic health issues. Air pollution can spread for very long distances and be extremely harmful to the lungs. One easily forgotten consequence of wildfires is the trauma and mental health effects it can have for those experiencing it.

Consequences of wildfire can also be destruction of infrastructure like power and communication lines, water supply, roads, and railways disrupting transport and supply chains and affect businesses and economies. This will indirectly affect people's daily life.

Impacts on construction and the built environment

Wildfires that spread into communities, often referred to as **Wildland-Urban Interface (WUI)** fires, can destroy communities and are an emerging problem in fire safety science.

The wildland-urban interface (WUI) is the area where houses and wildland vegetation meet or intermingle, and where wildfire problems are most pronounced.

In many cases these urban areas and construction techniques used are not designed with wildfires in mind and buildings can contribute to a fire by becoming the dominant fuel for the fire and the main source for embers igniting other buildings.

Choice of materials and design techniques are important, but the condition of the surrounding areas is also important and should not be forgotten.

Once a wildland fire reaches a community and ignites structures, structure-to-structure fire spread can occur under similar mechanisms as in urban fire spread.

WUI: Wildfire burning near buildings in Northern Nevada.
Credits: Neil Lockhart / Shutterstock

There are several measures that can be done to protect houses from wildfires.

Research and experience show that embers and small flames are the main cause for igniting houses during wildfires, so minimizing the likelihood of this reaching the house and minimizing the damage they can do to the structure is important.

Measures like protecting your roof with non-combustible materials, securing the perimeter by removing combustible materials and organic materials like plants and trees away from the house, securing the emergency responder access, evacuation plans, etc, is very important, but here we will focus on ways to keep embers and flames out of gaps and openings in the house.

The Almeda Wildfire in Southern Oregon Talent Phoenix Northern California destroyd many people's livelihoods and changed their lives after fire had blown through town.
Credits: Neil Lockhart / Shutterstock

THE DANGER OF EMBERS

When you picture a wildfire, you probably visualise this huge walls of flames engulfing homes. But in reality most homes do not ignite from direct contact with a flame front. According to Insurance Institute for Business & Home Safety (IBHS) up to 90% of homes are destroyed indirectly by wind-borne embers that are carried ahead of the fire perimeter. When high heat from a wildfire is combined with wind, small burning embers can travel several miles away from the fire perimeter.

The danger of embers

An ember or a firebrand as they are also known as, are small, smoldering pieces of wood and other vegetation that precedes wildfires.

They are light enough to be carried by the wind for very long distances without being extinguished and are the primary reason properties go up in flames whenever a wildfire is nearby.

When thousands of embers cluster together, it's called an ember attack and the most dangerous situations occur when embers from a wildfire starts cascading down into densely built neighborhoods.

Ember attack.
Credits: IBHS / NFPA

But aside from an ember attack, even just one ember is enough to start a fire in a construction.

Embers have a way of finding weaknesses in buildings and often spread through ventilation channels, under eaves to the attic, and in the air gap behind ventilated façade cladding. For property owners everywhere, being ember-aware and ember-protected is more crucial than ever.

The Woolsey fire lights up the night along Venice Beach coastline.
Credits: Max Dunlap / Shutterstock

On November 8 in 2018 a destructive wildfire started in Woolsey Canyon, between Los Angeles and Ventura counties in the U.S.

The fire burned 96,949 acres (392.3 km2) of land, led to the evacuation of more than 295,000 people, 3 people dying and 1 643 structures was destroyed.

The extensive amount of embers emanating from the fire in combination with the famous Santa Ana winds made the fire spread to large areas eventually reaching more densely populated areas.

On the same day a camp fire in Northern California destroyed most of the town of Paradise, killing 85 people, burned an area of 153,336 acres (620.5 km2), and destroyed more than 18 000 structures.

A misconceptions about home loss during wildfires is that the loss occurs as the main body of the fire passes.

The main flame front moves through an area in a very short period of time and houses do not spontaneously ignite.

They start to burn as a result of the growth of initially small fires, as from embers.

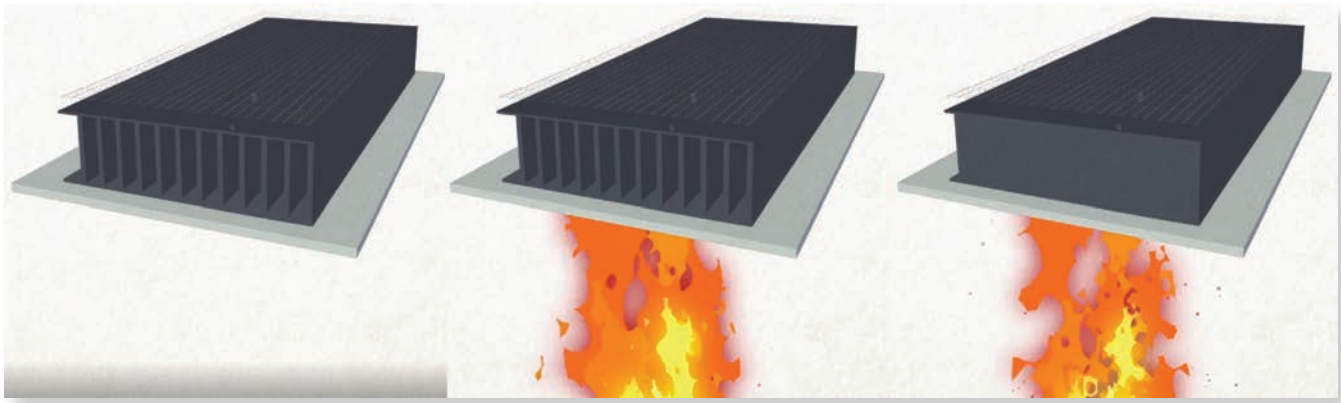
Protecting against embers with Firebreather®

Our cavity barriers and air vents all use the patented Firebreather® technology. They have the unique feature of **blocking the spread of flames and embers instantly**.

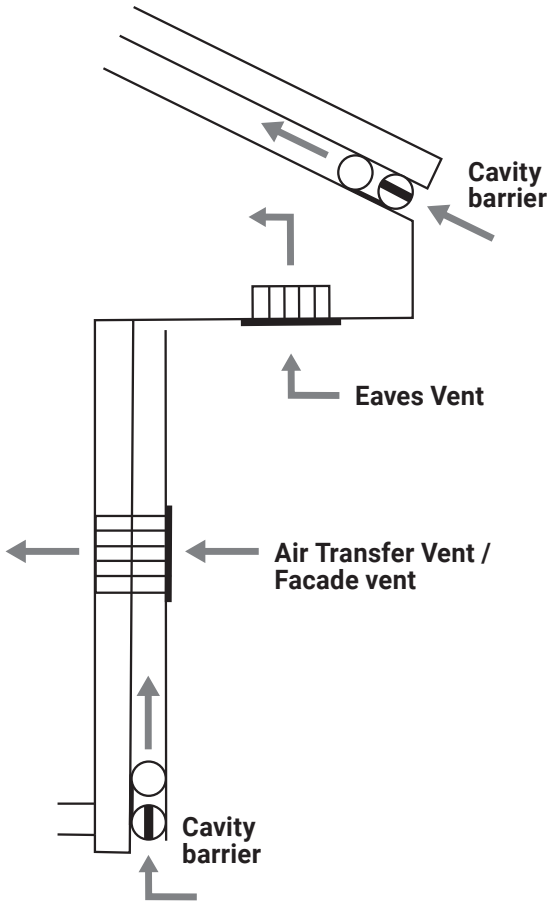
The Firebreather® technology combines several principles resulting in stopping flames and embers from the first second.

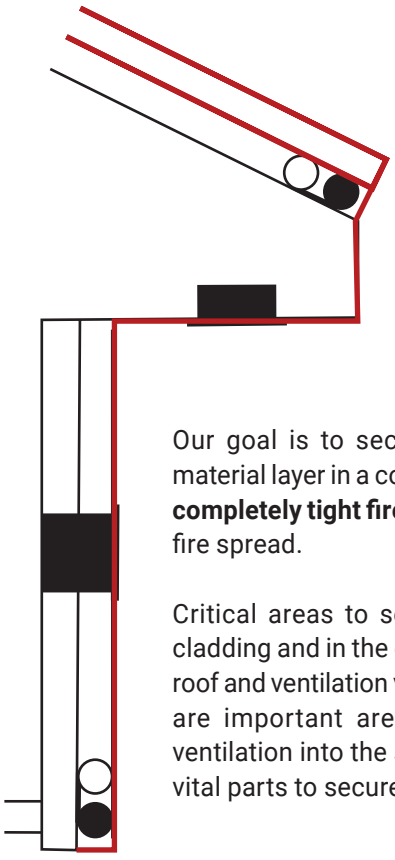
That is an essential property to have products labeled “Open state fire resistance rated”.

The 100% passive solution maintain normal ventilation when it’s not burning and prevent fire from spreading from the first second in the event of a fire.



Firebreather Eaves Vent with expanding intumescent

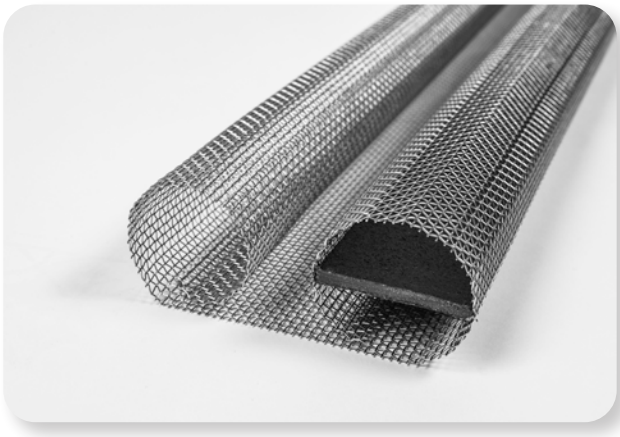




Our goal is to secure weak points in the outer material layer in a construction so that we achieve a **completely tight fire envelope** and prevent outdoor fire spread.

Critical areas to secure are cavities behind the cladding and in the eaves, cavities under ventilated roof and ventilation vents in foundation walls. These are important areas for maintaining adequate ventilation into the structure, but at the same time vital parts to secure.

Firebreather® products



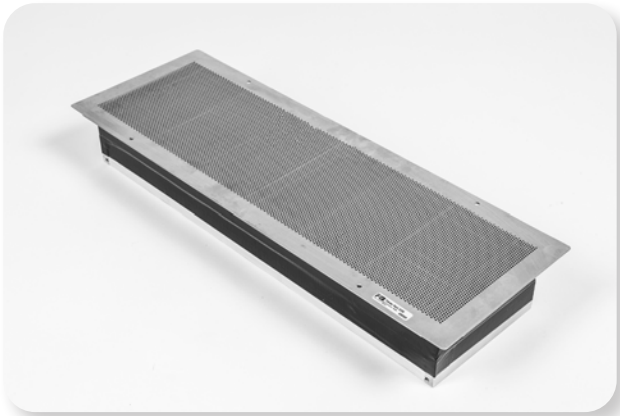
Firebreather® Cavity Barrier

Cavity barriers are passive firestop solutions installed in the façade cavity and sometimes at roof level.

The airgap behind cladding acts like an open chimney and allows very fast vertically fire spread. 'Open State' cavity barriers are designed to maintain an open ventilated cavity in normal conditions but will rapidly expand to seal off the gap in the event of a fire.

Other open state cavity barriers let flames and hot gasses pass between 1 to 5 minutes before completely closing the cavity depending on the intensity of the fire. They might even never close the cavity for ember spread as there is no heath before the construction is burning on the inside.

Firebreather® Cavity barrier do not let flames, hot gases, nor embers pass at any time, from the first second and during the fire rating time specified, while ensuring ventilation of the cavity in normal time.



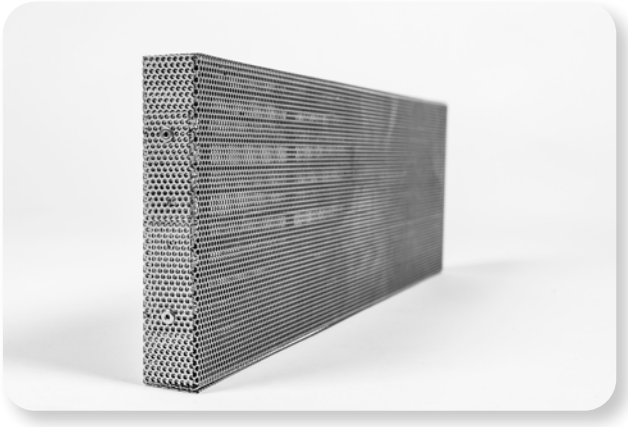
Firebreather® Eaves Vent

Firebreather® Eaves Vent is a simple and safe solution that both meets the need for venting through the eaves while effectively preventing the spread of fire.

For the construction of new buildings, this means that one can achieve effective fire safety and still use the principle of cold roof and venting through eaves. For existing buildings with cold ceilings, sealing of the eaves and installing the Firebreather Eaves Vent is a suitable measure to achieve efficient fire safety without extensive building adaption.

Like the other Firebreather® products, the Eaves Vent also instantly close of for flames, hot gasses and embers in the case of fire.

Firebreather® products



Firebreather® Air Transfer Grille

The fire resistant air transfer grilles are developed to allow the free circulation of air through construction elements (walls, doors etc.) while at the same time offering effective protection against flames, hot gasses and embers in case of fire.

Firebreather® Facade Vent

In fire rated walls a conflict between venting and fire protection often occurs because venting is required/ desired, but openable windows will compromise the fire rating of a wall.

This problem is often encountered, for example, in buildings where there are external walkways and the walkway is the escape way and therefore require a fire limiting structure without openings where fire can spread.

The Firebreather Façade Vent solves this problem by offering both venting and fire rating. This is the best and cheapest method to fulfil the requirements for the fire rated construction.

The Firebreather® technology is a patented concept for the development of passive ventilation grilles and cavity barriers with the unique feature of **blocking the spread of flames, heat and embers instantly in case of fire.**

By Tronn Røtvoll
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