

Best practices for **Video Fire Detection (VFD)**



When, how, and why to use it

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Best practices for Video Fire Detection

When to use VFD, how to use it and why

PROTECTING PEOPLE, PROPERTY AND PROCESSES

With the advent of video fire detection (VFD), the security and fire safety industry have discovered a new and efficient way to detect fire in a very early stage. VFD makes use of CCTV security cameras and smart video analytics that are able to recognize initiating smoke and flames in the video image.

Today, VFD is especially used in critical infrastructures in order to protect people, property and production processes. VFD technology can prevent serious fire incidents from happening and thus avoid high costs, more specifically:

- The cost of fire damage to infrastructure.
- The cost of human lives.
- The cost of production stops and evacuation during an alarm phase.
- The cost of emergency services.
- The cost of cleaning.
- Image damage and the cost of bad reputation.

VFD is especially beneficial for those environments where conventional technologies fail. In this eBook, you'll discover when you need VFD and why this technology is the best solution for a particular set of customers, applications and environments.



When traditional fire detection falls short

In certain types of critical environments, like chemical plants, waste storage bunkers or production facilities, the impact and the risk of a fire can be very high. That's why companies that operate in such environments need to take the appropriate fire safety measures. However, it is exactly in those environments that conventional fire detection technologies, like beam or point-type detectors, may fall short.

CONVENTIONAL FIRE DETECTION

A wide number of fire detection technologies are available on the market. All of them have proven their value in non-critical environments.

THESE ARE SOME OF THE MOST COMMON TECHNOLOGIES:



Point-based smoke detectors are typically housed in ceiling-mounted plastic enclosures. When smoke reaches this enclosure, smoke can be detected optically (photoelectric), by heat or through a combination of both.



An **optical beam smoke detector** uses a projected beam of light to detect smoke across large areas. Optical beam smoke detectors operate on the principle of light obscuration, where the presence of smoke blocks the light from a light beam. Once a certain percentage of the transmitted light has been blocked by the smoke, a fire is signalled.



Aspirating smoke detectors draw in air through a network of pipes to a central smoke detection unit. The air samples are captured via pipes that have multiple holes and filtered in order to remove any contaminants or dust to avoid unwanted alarms. The samples are then processed by the centralized detection unit.



Infrared (IR) flame detectors monitor the infrared spectral band for specific patterns as radiated by hot gases.

LIMITATIONS OF CONVENTIONAL FIRE DETECTION

Some of the technologies described above are cost-effective and will perform well in non-critical environments like offices or indoor commercial spaces. Others are more advanced and are targeting less common applications. However, the physical environment of critical facilities often imposes high requirements on the performance of fire detectors. The technologies described above may be inadequate in critical environments for at least two reasons:

- The detection is too slow.
- Too many unwanted alarms are generated.

Why these technologies fail, will be further explained in this eBook.

Video Fire Detection is an addition to the current spectrum of fire detection technologies, that is specifically useful for environments where no adequate solution is available today.

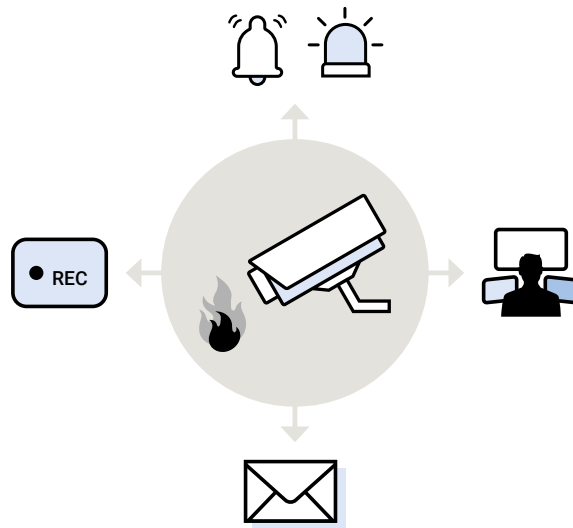
- High-impact / high-risk facilities.
- Harsh environments.
- Indoor spaces with high ceilings.



How does Video Fire Detection work?

THE COMPONENTS OF A VIDEO FIRE DETECTION SYSTEM

- ① **The camera**
Video Fire Detection systems rely on the resolution and image quality of a standard network security camera.
- ② **Video analytics software**
Carefully developed software algorithms installed on the camera scan the environment and continuously analyse it in real time to exactly locate any fire incident.
- ③ **Connection to the Fire Alarm Control Panel**
In case of an event, an alarm output is sent to the fire alarm control panel.
- ④ **Connection to the BMS or VMS**
For a smooth surveillance and monitoring experience, a video detection system can be connected to a building management system (BMS) or video management system (VMS) in order to provide control room operators with 24/7 situational awareness and recording of the incident video.



The power of the image

The benefits of Video Fire Detection

Video Fire Detection (VFD) is a reliable and failsafe solution to protect people, property and production process.

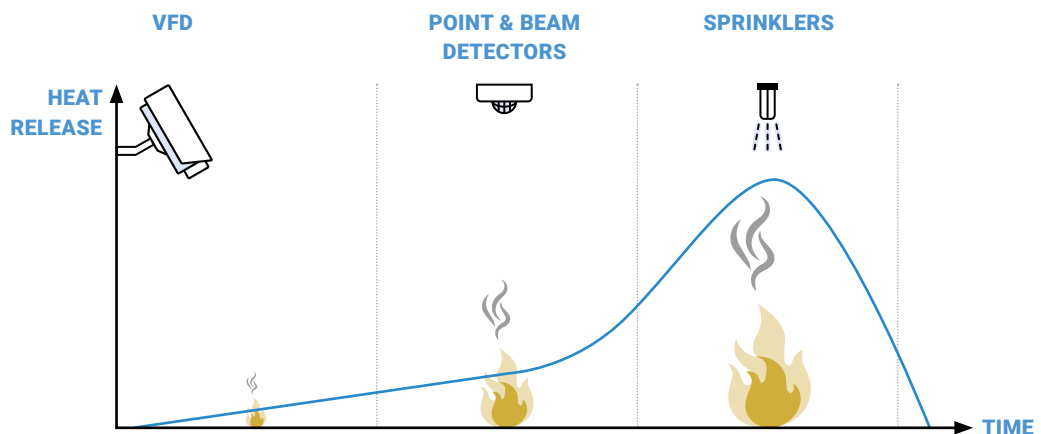
It's accurate.

VFD is very accurate and thus the unwanted alarm rate will be extremely low. These unwanted alarms can be very costly. Just think of the time lost when a production line needs to be stopped or imagine the cost of an erroneously called emergency team. Business interruption losses are not always covered by insurance policies either.

Video Fire Detection systems will efficiently analyse the video image to make a distinction between starting smoke or flames and other phenomena, such as people walking in the field of view, animals, vehicles, flashlights, rotating beacons, etc.

It's fast.

In fire safety, speed is crucial. Video Fire Detection systems will spot initiating fires much faster than conventional systems. VFD makes efficient use of CCTV, so it is able to see dangers from a very large distance. Therefore, unlike many other fire detection technologies, video analytics do not need to make physical contact with the smoke or heat. VFD immediately 'sees' the danger at the source, when and where it originates.



It's visual

Control room operators can monitor CCTV video images in real time. This allows them to assess the nature and severity of a fire as well as the stage it is in. They can see whether people are present at the place of the incident, and they can better assess the overall situation. This helps to make a more efficient use of the emergency resources. After the incident, the recorded video footage can be used for risk analysis and prevention of future incidents.

Validated as primary detector

Some of the VFD solutions are qualified according to local regulations in some countries, e.g. BOSEC (Belgium) and CNPP (France). Those solutions can be connected to a standard fire alarm control panel and function as any other qualified fire detector: reliable and accurate.



When to use Video Fire Detection

#1: HIGH-IMPACT ENVIRONMENTS

When detection speed and visual feedback is crucial.

In some environments, such as chemical plants, even a small fire can cause huge damage. In these high-impact and high-risk environments, conventional fire detectors may be useless, because these might only get activated when the damage is already done.

Video Fire Detection (VFD) has a number of significant benefits that make it the ideal detection technology for high-impact and high-risk environments:

- The high detection speed of VFD will dramatically reduce the impact and the risk of a fire outbreak.
- The accuracy of detection will bring down the false alarm rate to an extremely low level.
- The visual nature of VFD will allow control room operators to monitor any irregularity very meticulously. VFD almost rules out any uncertainty and enables operators to immediately see the problem so they can make well-founded decisions in case of alarm.



#2: HARSH ENVIRONMENTS

Where conventional fire detectors generate too many unwanted alarms.

Fire detection systems that generate too many unwanted alarms are not only very annoying, but they are also quite costly. In production facilities, alarms will require the production lines to be stopped. Unwanted alarms also lead to the unavailability of emergency teams in case of real fires. In some cases, users of these detection systems might decide to deactivate the detectors altogether, just to avoid the above-mentioned problems. In harsh environments, where chemicals, dust or vapor are present every day, conventional fire detectors will generate a lot of unwanted alarms.

- **Humidity:** A high degree of humidity in the air can activate a conventional point or beam-type smoke detector. Humidity can be created by processes where steam is involved, but detectors can also be activated by very humid weather.
- **Chemicals:** Smoke detectors can be set off by strong chemicals like ammonia, paint fumes or volatile sprays.
- **Dust:** A conventional smoke detector will handle dust in the same way as smoke particles, which can set off the alarm. Dust is also one of the reasons why a conventional smoke detector will degrade very fast.
- **Heat:** Infrared flame detectors may be triggered by heat dissipation from machines or industrial ovens.

Because of its visual nature, Video Fire Detection will be able to analyze the above-mentioned phenomena in a more intelligent way through the use of smart video analytics. This will heavily reduce the number of unwanted alarms. That is why Video Fire Detection is an ideal technology for use in harsh environments, such as chemical plants, waste recycling plants, wood processing companies or in the oil and gas industry.



#3: GREAT HEIGHTS

Where conventional technologies will not detect or will detect too late.

Video Fire Detection is ideal for use in tall buildings or large indoor spaces. In these environments, smoke might never reach a traditional smoke detector, because of a process called stratification, which stops the upward movement of smoke.

The smoke stratification phenomenon

High or voluminous buildings with heights of 10 m or more have issues with the stratification of smoke, whereby smoke will not rise high enough or quickly enough to reach ceiling mounted point or beam detectors. This is the case for example in aircraft hangars, airport passenger terminals, factory production halls, warehouses, retail areas, museums and many historical buildings.

In atrium halls or in large spaces where the roof heated by the sun is poorly insulated, a layer of hot air will form under the ceiling. On the other hand, the more smoke rises, the more its temperature will decrease. So, when the smoke plume's average temperature is less than the upper hot air layer, this layer will prevent the smoke from actually reaching the ceiling.

Conventional point-type and beam-type detectors are not sensitive enough to provide early warning of smoke in large open spaces or tall buildings, because stratification will prevent the smoke to make physical contact with the detector in time. By the time smoke is detected by such systems, a fire would have to be very large, creating sufficient heat and smoke to rise up to the ceiling.

In contrast, Video Fire Detection does not need to make physical contact with the smoke. The initial smoke can be seen from a large distance, right at the source, allowing for early detection.

Practical requirements for a Video Fire Detection installation

A Video Fire Detection system will not operate flawlessly under just any condition. For the best Video Fire Detection performance, a number of practical requirements need to be taken into account.



Indoor or roofed areas

In order to minimize the effect of various types of weather conditions, Video Fire Detection systems will perform best in indoor or roofed areas. A Video Fire Detection camera installed indoors will not be affected by direct sunlight shining into the lens or by reflections of the sun. Most video detection systems will also find it difficult to cope with various types of precipitation, including rain, snow or mist.



Sufficient light

For Video Fire Detection systems to detect smoke, a minimum of light should be present, as specified by the manufacturer for each solution. Flame detection on the other hand does not require any ambient light.



A clear field of view

A Video Fire Detection system can only provide good detection results for areas that can be seen by the camera. Obstacles in the field of view will limit the performance. Therefore, effective camera positioning is of utmost importance.

Use case #1: chemical plant

Fire safety in chemical plants is a major issue. In these environments, working with highly flammable chemical contaminants puts extra pressure on fire safety professionals and high requirements on fire safety technology. Fire detectors need to be very reliable and accurate, and they often need to be able to cope with the presence of dust, vapor or chemicals.



Why video fire detection is ideal for chemical plants:

Low false alarm rate

Beam and point detectors usually have a lot of difficulty coping with dust and chemicals. These types of detectors will treat such anomalies just like smoke, which will result in a lot of unwanted alarms. Video Fire Detection on the other hand can analyse these phenomena in a much more intelligent way and will be able to make a distinction between a smoke plume on the one hand and chemicals or vapor on the other hand.

Detection speed

Even the smallest fires can have big consequences in chemical plants. Usually, the first five minutes are crucial in a developing fire. After 7-10 minutes, the fire is already so widespread and temperatures so high that the risk of personal incidents and damaged infrastructure is very high. But in chemical plants, there might not even be that much time. Depending on the environment, Video Fire Detection will react within 10 to 60 seconds of either smoke or a flame appearing in the detection field of view. This enables fast reaction and fast interventions in the first minutes when the fire is still in a controllable stage.

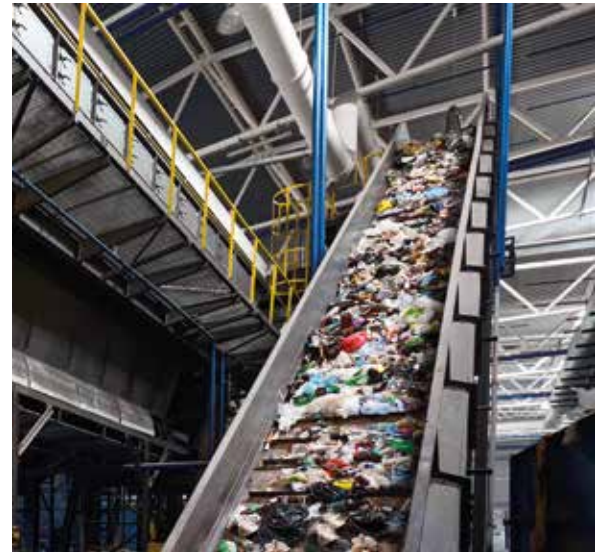
100% visual control

The consequential damage and cost of downtime in a chemical production plant can be very high. To avoid unnecessary interruptions, the number of unwanted alarms needs to be reduced to a minimum, so that the flow is not interrupted unnecessarily. But even in cases where a real incident is detected and an alarm is set off, it is sometimes deemed more efficient not to interrupt the production flow and just isolate and control the incident while production line is running.

In order to make proactive, well-founded decisions, operators need to have full control and an efficient overview. Because Video Fire Detection uses the company's CCTV system, operators can always visually verify an incident immediately and then decide on the measures they need to take.

Use case #2: waste recycling

Fires in waste storage bunkers are a frequent and well-known problem. These fires can be caused by spontaneous combustion, in which a hidden source of heat resulting from biological decomposition or the chemical oxidation processes generates a rise in temperature. If the waste mass cannot dissipate the heat faster than it is generated, then spontaneous combustion can occur.



Why video fire detection is ideal for waste plants:

Harsh environment

Damp from spontaneous combustion, dust or waste flying around caused by loaders, machines and vehicles with rotating beacons: a waste plant is the casebook example of a harsh environment. To make an accurate distinction between these phenomena and smoke of flames from a fire, there is a need for intelligent detection technology. Because of its visual nature and pattern-based analytics, Video Fire Detection can accurately detect starting fires without generating unwanted alarms.

Height

Waste storage bunkers usually have tall ceilings. Therefore, conventional point or beam type detectors would be very inefficient. Video Fire Detection cameras on the other hand can be installed high up attached to the bunker walls to ensure a good overview of the entire bunker. The distance between the camera and the waste pile is no problem since the video image can be accurately analysed from practically any distance.

High-risk

Due to the phenomenon of spontaneous combustion, there is always a high, actual risk of fire. The damage caused by fire can result in various financial losses, including loss of energy resources, loss in productivity, possible collateral damage, as well as the costs for fire extinguishing measures and cleanup - not to mention the risk of injury or even loss of life. In these cases, accurate, fast detection with a visual reference for the operator is of crucial importance.

Use case #3: critical operation hotspots

The application of Video Fire Detection technology is not merely restricted to large companies. Practically any production or engineering company has one or more hotspots or specific places that are critical to the company's daily operations. Installations like battery charging stations, incinerators or boiler rooms need to be in good shape 24/7. But at the same time, these installations can cause great damage in case of a fire and therefore, they need extra monitoring for fire safety.



Why video fire detection is ideal for critical company hotspots:

Risk reduction

Company owners want to reduce the risk of a fire as much as possible. Whenever a fire starts to develop, it is essential for them to react fast and reduce the impact as much as possible. A minimal investment for one or two Video Fire Detection cameras directed towards the hotspot can already give company owners full visual control and a way to make fast and well-founded decisions.

Low false alarm rate

Video Fire Detection will be able to make an accurate distinction between actual fire and other irregularities in the video image, like vapor, rotating beacons or even people walking in the camera's field of view. As a result, the number of unwanted alarms will be extremely low.

Video Fire Detection for critical environments

Conclusion

Critical environments where the impact and the risk of a fire can be very high, need to take the appropriate fire safety measures. But it's exactly in environments like these that conventional smoke detection technologies, like beam or point-type detectors, will be ineffective.

Managing fire safety and fire detection more specifically means striking a difficult balance between detecting every irregularity there is in time and avoiding too many costly unwanted alarms. Video Fire Detection is probably the only detection technology out there today that strikes that balance extremely well.

Detection at the source

Video Fire Detection has a number of benefits that conventional technologies lack: detection speed, accuracy, robustness and visual operator feedback. This makes it the ultimate detection technology for critical environments that want to reduce the risk and impact of a fire 24/7.

Because of its visual nature, Video Fire Detection can spot initiating fires directly at the source, practically from any distance. This is a huge speed advantage compared to detection technologies that need to make physical contact with the smoke or heat. With Video Fire Detection, there is no need to wait until the smoke has reached the ceiling or until the flames hit the roof. This is time gained for anyone who needs to make tough decisions about the required actions that need to be taken to avoid further damage.

A detection system that generates too many unwanted alarms will become useless and ignored in the long run. Video Fire Detection technology on the other hand can effectively filter out unwanted events that are so typical of critical environments.

Enabling better decisions

Unwanted alarm or not, probably the biggest advantage of Video Fire Detection technology is that it gives the operator more time and capabilities to understand the situation. Since it is so fast and since it allows for visual verification, VFD provides the operator with valuable time and information to make a well-founded decision.

That decision could be calling the emergency services and avoid further damage or human suffering. But bearing in mind the cost of an alarm, it could also be ignoring the alarm in favour of isolating and controlling the fire event to prevent the entire operation from closing down.

Certified solutions

Some VFD solutions are certified according to country-specific regulations and can operate as primary fire detector. They can be connected to standard fire alarm control panels and trigger the building safety alarm as needed.



About Araani

Founded in 2014, Araani is a Belgian company specializing in video analytics for people, property and process protection.

Araani FireCatcher is an advanced video fire detection solution that has been designed for critical infrastructure protection.

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