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AIR ASPIRATING DETECTION

EVOLVING TRENDS AND INNOVATIONS

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Air aspirating smoke detection is not a new concept to the fire alarm industry. The applications and capabilities of these systems in areas that are not traditional have changed drastically. The initial market and basis for air aspirating smoke detectors was in the telecommunications and data center applications, as these devices can detect failures of PC board components. These systems are still great for those applications, but in addition, the industry has seen an expansion into different verticals for these units. Now air aspiration units can still be found in the standard “clean environment” applications that have been the foundation for this industry segment, but they are also found in areas that had previously been considered too harsh such as industrial manufacturing and even underground mining facilities.

The major benefit of these systems is the flexibility that has been incorporated into newer systems. As always, you need to check with your system designer and the unit manufacturers.

Fire and loss prevention takes many forms and the best fire is the one we never have. 100% fire prevention is always the goal of everyone but due to many factors this is not always possible. When you refer to the Fire Safety tree in NFPA 550 if you cannot fully prevent the fires you want to keep the incidents you do have as small as possible. The use of air aspiration smoke detection allows you to detect some fires before there may even exhibit an open flame. Then the incident remains small and very easy to control with very low down times and a corresponding low loss of production.

Through design, installation and programming, air aspiration, or air sampling, detection devices can be utilized in many different ways. A system can provide very early warning smoke detection at approximately 200 ft^2 coverage per port, or utilize it for early warning detection at 400 ft^2 a port, and even as a standard coverage type smoke detector at 900ft^2. Some units are rated to cover up to 20,000 ft^2 so there could be a significant reduction in maintenance and testing costs. The coverage with standard response spacing would replace up to 22 spot type smoke detectors. There are applications that may be useful to sample or monitor the covered areas for conditions or hazards other than just smoke. The capability now exists to utilize the air sampling smoke detection hardware including the air pumps and piping to monitor for other conditions. There may be some additional hardware or sensors required, but in at least one instance they simply install inline of the sampling tubes. These sensors can be utilized to monitor oxygen, hydrogen, carbon monoxide or even H_2SO levels for IDLH conditions (immediately dangerous to life and health).

Regarding design, it's important to know some of the properties of these other gasses to determine if the same tubing could be used as in smoke detection. Are they lighter than air or heavier than air? Gas density is an issue because if they are heavier than air the gasses will settle and possibly collect in an area that would not have adequate coverage from a smoke detection standpoint. Most gasses that are lighter than air can utilize the same sampling ports and tubing that have been installed for smoke detection. Gasses heavier than air aren't an issue, although additional ports or sampling tubes may need to be added to ensure that those areas are properly covered as well. It is important to be cognizant that an air sampling detection system will be exhausting air, and what goes in must come out someplace, so remember to return this discharge air back into the areas being sampled to prevent a pressure differential issue, and this also prevents the development of hazardous areas due to the detected gasses being distributed via the detector.

The industry has traditionally utilized CO_2 or special hazards systems in order to protect control equipment, electrical equipment etc., but there can be issues with room integrity, proper fire stopping and personnel in the area of discharge that complicates this fire protection model. Most of these conditions are an ongoing project. When a building or facility is built the passive fire safety systems are in place fully and have been inspected as well for full compliance. These rooms have no issues passing a room integrity test and have near perfect sealing of all portions of the room envelope. The issues with passive fire safety

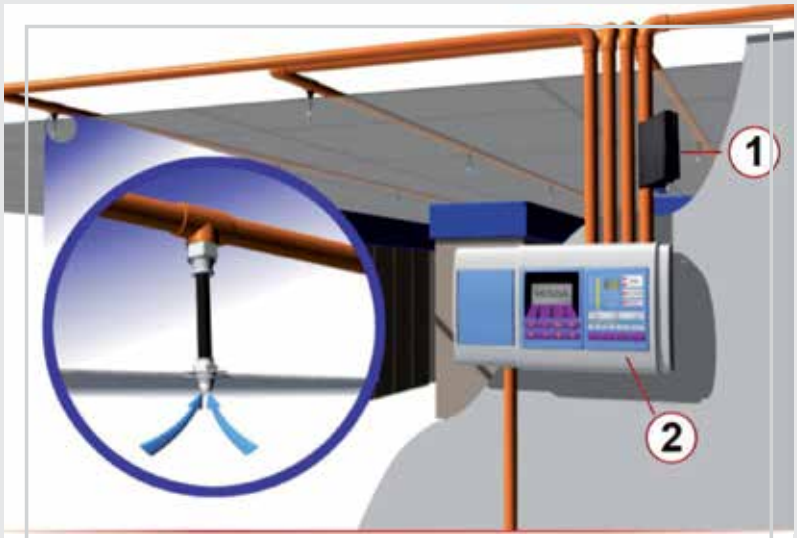

Figure 1. *Air Sampling Smoke and Gas Detection System*

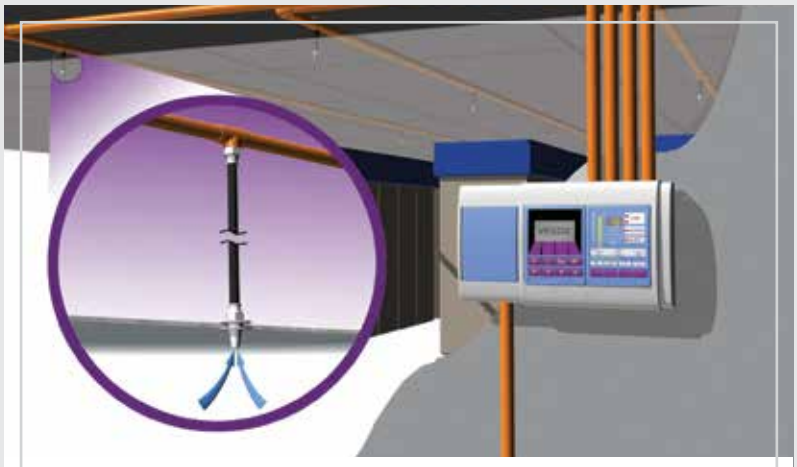

Figure 2. *Air Sampling Smoke Detector*

Figure 3. *Air aspirating detection providing fire protection and monitoring hydrogen levels in the battery room*

features and systems is an ongoing process and these must be maintained through both major and minor projects. This is easy to accomplish but will require a program and mindset of diligence to maintain these features. In areas or facilities that do not maintain these sealed rooms, the gas being utilized for the fire suppression cannot remain in the room for the required hold time. This can cause other issues when dealing with CO_2 due to the properties of the gas being heavier than air if it leaks from the protected areas it can cause suffocation and oxygen displacement in low lying areas.

Next, determine the purpose of the fire protection systems. They are traditionally the protection of life, then property, newly developed plans include business continuity in that list as well, but the protection of life is always paramount. Air sampling detectors may be used to activate exhaust fans to negate a hazard prior to allowing levels in a detection area to reach a hazardous level. Additionally, multiple levels of detection can be obtained where additional time can be utilized to investigate incidents while the impacted area is still minimal.

One design model provides for very early warning detection systems in electrical equipment and motor control centers. This model offers detection at an early level thus allowing the facility time to determine the exact unit having an issue and being able to provide fire suppression via handheld extinguishers. These extinguishers are normally clean agent units to allow for both electrical safety and limited clean up. This minimalistic approach not only creates cost savings that can be utilized to offset the installation costs of the detection systems but also minimizes the facilities downtime. Other fire protection strategies traditionally utilized in these areas would include fire sprinklers and possibly even some type of interlocked sprinkler system.

Both of these two protection schemes include two major limiting issues. First, they require an amount of heat to be collected at the sprinkler to fuse or activate the element. Secondly, they utilize water as the suppression media, which conducts electricity. This conduction creates an electrical safety – electrocution hazard, which causes additional damage to equipment and increases the facility downtime. This downtime can be extensive because many industrial control systems and components are not stock items and must be made to order.

The testing and inspection procedures for air aspirating systems are very simple as well. NFPA defines inspections as visual activities. A simple walk through the facility to ensure the sampling ports are free from debris and have not been damaged is all that needs to be done. As a function of the detector flow, rates are constantly sampled, and the detection unit should go into a trouble condition if there is a reduction of airflow, as would be the case with an obstructed sampling port, or too much air which could indicate a broken or disconnected sampling tube. NFPA 72 requires this visual inspection to be conducted semi-annually. The manufacturer's recommendations must also be consulted, as well as the conditions that exist in the area that's being protected.

Due to local site conditions, it may be prudent to conduct these visual inspections at a higher frequency. The actual function testing of the detectors is required by NFPA 72 at least once a year. Systems are tested by following the manufacturer's instructions. The general direction according to NFPA 72 is to inject a listed smoke product at the end of the sampling tube. By injecting a listed smoke product, it would create a "worst case" scenario due to the transportation time for the smoke to travel through the entire piping system back to the detector. With some proper planning and design considerations, these test ports can be located so that they are accessible from the floor level, or if there are issues due to multiple considerations, they could even be located adjacent to the protected area. One example of this "remote" location of the sampling port could be in a clean room environment; the system could be function-tested without having to enter that area. This is also important if you are providing protection in areas that may have been inerted or has had the oxygen taken out to prevent fires.

The applications for these detectors have expanded from how they started many years ago, primarily in telecommunications. Now these systems can be utilized for not only detection of smoke, but also for other hazards and conditions. One system to test, inspect and maintain, as well as possibly reduce, the initial construction costs of installing multiple systems. ■