



Coal Stock Heat Detection

Port of A Coruña, Spain

An innovative bulk handling facility was built in the port of A Coruña, Spain as a coal storage facility. Not only does this enclosed coal handling facility emit zero dust emissions, but the structure itself is architecturally pleasing. Due to its impressive design, the plant is called “la Medusa” which means “the jellyfish”. Its construction utilizes steel sheets on hollow tubes, which prevents the accumulation of a high concentration carbon dust inside the facility. This dust could otherwise create an explosive atmosphere.



La Medusa in Spain, which is operated by Unión Fenosa.

“La Medusa” stores the loads of coal until transportation to the coal power plant of Meirama. The design itself is not based on aesthetics, but on environmental considerations: the structure of the cupola reduces the dust in the air by more than 70 %.

The Incident

In November 2007, an incident occurred due to an undetected hotspot in the accumulated coal. Clouds of smoke left the top of the picturesque enclosure – bringing dust and a pungent smell to the port vicinity. It took four long days, but eventually the fire brigade was able to locate and extinguish the smoldering fire by removing the coal from the interior to the wharves deposit. The lack of ventilation within the enclosure and the late detection were the main causes of this incident. Consequently, Unión Fenosa undertook structural and technical measures to improve the safety of the infrastructure.



Smoldering fire in la Medusa

Lessons learned

The safety measures included several different fire detection systems, such as smoke and gas detectors for NO_x, SO₂ and CO. Eight infrared cameras were installed inside the dome to monitor the upper surface of the accumulated coal, but the most critical area is close to the enclosure annulus. Due to the insufficient ventilation, advanced pressure, and friction, smoldering fires are more likely to occur here. An infrared camera cannot always detect hotspots within the bulk. Therefore, the engineers of Unión Fenosa, together with AP Sensing's partner TASC SE, decided to use the AP Sensing Linear Heat Detection (LHD) system to protect the annulus space of "La Medusa".

Why AP Sensing?

Several unique features led to the selection of this fiber optic-based LHD system as the most appropriate technology for this environment. The AP Sensing LHD is approved according to EN54-5 and provides the lowest laser output power (< 25 mW) in the market, enabling deployment in hazardous areas (EX Zones) without additional measures. The use of the system is inherently safe in all operating conditions, including the unlikely case of a fiber break.

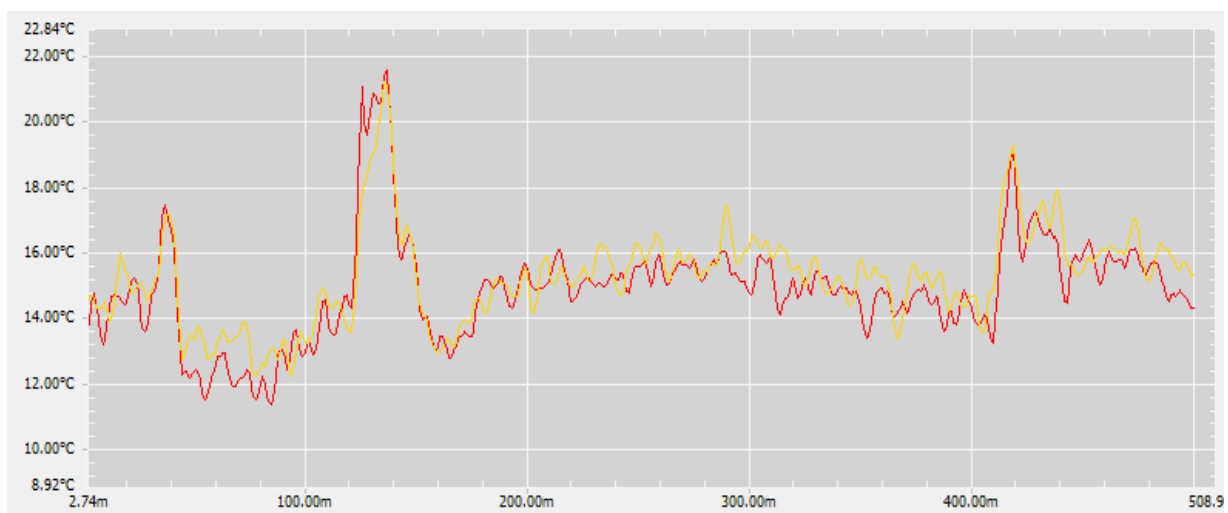
Laser power of more than 35 mW (Class 3B laser sources) can ignite explosive atmospheres (like small coal particles) and are considered a source of danger (IEC 60079-28). Keeping the harsh environment in mind, AP Sensing's sensor cable is made of stainless steel with additional armoring to offer robustness against severe mechanical impacts like crush, shock and tension.

The installation

Three rings of sensor cable are mounted on the concrete wall in the enclosure, at 0.6 m, 1.6 m and 2.5 m. To avoid damage during the loading and unloading procedures, the cable is seated in a cleavage and fixed with special cable anchors. The total length of each ring is about 500 m and is monitored by a separate LHD instrument to offer maximum redundancy in case of a fiber break. Furthermore, the dual ended (loop) measurement capability of the Distributed Temperature Sensing (DTS) is used to calibrate the instrument automatically in the unlikely case of an attenuation of the optical fiber due to substantial mechanical stress.

Each DTS instrument has been configured with 10 sec measurement cycles and 1 m spatial resolution for fast and accurate detection of small smoldering fires. The entire 360° circle is subdivided into 16 alarm zones, providing precise hotspot localization. The DTS can have up to 256 zones; each zone can be defined with one of five alarm criteria (maximum temperature, delta to the zone average, and temperature gradients). The delta to zone average alarm enables a quick localization of small smoldering fires as it adapts to the ambient temperatures, which changes with diurnal and seasonal cycles. If only one point within the zone is 8 °C above the average of the zone, the fire control panel is notified.

With this reliable and robust AP Sensing solution, the customer found a system that will provide protection and security even in harsh environments.



Peaks in the temperature profile caused by direct exposure to sunlight.