

FIRE DETECTION: TRACKING THE SOURCE



A huge fire at recycling facility which contained 100,000 tonnes of paper and plastics sent a plume of smoke 1800 metres into the air in Smethwick, UK last year Credit: West Midlands Fire Service

For waste and recycling facilities, fire is a huge danger. Detecting fire hazards before a fire breaks out, and quickly fighting the potential source of fire in a targeted manner can potentially save millions in revenue. Fire protection systems which use infrared thermography can offer significant advantages.

By Dr Jörg Lantzsch

Cement is an important material for the manufacture of concrete, screed and mortar. During the manufacturing process of cement, raw materials (clay and chalk) as well as any necessary additives are ground and burned at around 1450°C to create clinker. This is then mixed with other basic materials and ground to a fine powder. The burning process has a considerable energy requirement, which can often be met with substitute fuels.

This substitute or secondary fuel can often be manufactured from waste. This method conserves valuable primary fuels, such as coal, and thus reduces CO₂ emissions. In Western Europe, substitute fuels used in cement works satisfy between 50% and 70% of the energy requirement.



The finished substitute fuel is transported via a tube belt conveyor directly into the nearby cement works

Substitute fuel for cement works

Ehrenhausen, Austria based ThermoTeam Alternativbrennstoffverwertungs, which produces waste derived substitute fuels at its plant near Graz, supplies a nearby cement works with just such a conditioned substitute fuel.

ThermoTeam was founded in 2002 as a joint venture between the waste disposal firm, Saubermacher, construction materials manufacturer, Lafarge. The plant processes energy-rich waste and uses it to produce conditioned substitute fuel. The input material includes the high calorific fraction of packaging waste from Austrian packaging compliance scheme, Altstoff Recycling Austria, which cannot be materially recycled.

Another source of waste material processed by the company is various types of commercial waste, for example from cellulose production, which also has an appropriately high calorific value.

The first step in the process involves crushing the input materials and feeding them into the sorting line. Here, an overband magnet first separates out all ferrous metals. Then the non-ferrous metals, such as aluminium packaging, are separated. Inert materials are also sorted into another fraction. In addition, parts made of PVC and PET, which can be materially recycled, are selectively removed.

Once the impurities have been removed, the shredders crush the material further and move the fully conditioned substitute fuel to the so-called output store. A tube belt conveyor transports the fuel directly into the nearby cement works.

"The cement works in Retznei operate using only our conditioned substitute fuel", says Josef Kulmer, director at ThermoTeam. "We are therefore already rapidly approaching our goal of largely replacing primary fuels in cement manufacture."

It is for this reason that the company was awarded the Styrian 'Umweltschutzpreis' (environmental protection award) in 2003. ThermoTeam currently processes almost 100,000 tonnes of input material each year and also supplies other cement works with the conditioned substitute fuel.



The plant crushes the material with shredders and separates unwanted components, such as metal and inert materials

Fire - A Serious Risk

Because the plant handles flammable material, fire protection is extremely important. Metal sorting is a particular hazard. For example, batteries that may be included in the metal fraction can cause a short circuit, which may in turn cause a fire.

Back in 2009 a serious fire caused damage worth millions of Euros, and led the company to the decision to improve fire protection. Until then, a conventional fire alarm system was in use, which is essentially based on a smoke aspiration system.

"The smoke aspiration system is extremely high-maintenance, especially in such a difficult environment like ours," says Kulmer.

The system is not triggered in the halls, which are up to 12 metres high, until the fire is already well and truly underway. Because of this and the fact that it can take up to ten minutes between the fire brigade being alerted and arriving on the scene, a considerable amount of damage may be caused.

The aim was to find a system that detects fires earlier and therefore enables a rapid and effective extinguishing operation. That search paid off at the IFAT trade fair in Munich, where Kulmer came across the Infrarot-Systeme from Walluf, Germany based fire detection specialist, Orglmeister.

In PYROsmart, Orglmeister offers an early fire detection system that uses infrared technology. Combining the system with automatic extinguishing activation ensures that fires are extinguished fully automatically. In an ideal situation, it will not even be necessary to alert the fire brigade.



In the control room, the early fire detection system provides employees with a rapid overview

Infrared technology

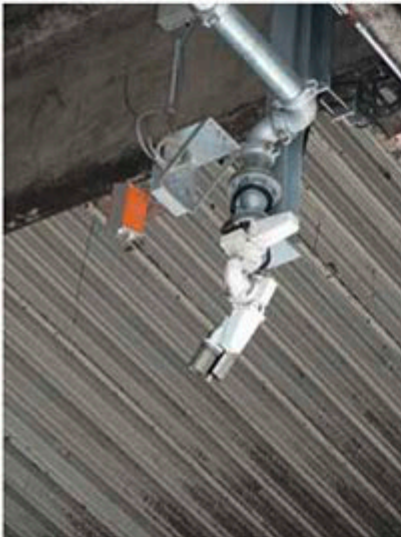
All objects emit electromagnetic radiation which lies primarily in the infrared range. The exact spectral distribution of this infrared radiation, which was first described by the German physicist Max Planck in 1900, is dependent on the temperature of the object. Measuring the infrared radiation enables a very precise temperature measurement to be taken. With modern infrared cameras, you can view an exact infrared image of the selected area - a so-called thermal image.

This technology is used typically in the building industry to expose weaknesses in building insulation, or when maintaining machines and damaged ball bearings are revealed, for example, as a result of excessive heat build-up. In terms of fire protection, infrared technology makes it possible to detect fires very early, when the temperature threshold is still below the ignition temperature.

The early fire detection system consists of a high-resolution infrared camera, which constantly scans the area being monitored. Panorama thermal imaging is initiated in this way and used, along with the video images from a second camera, to create a full-screen video panorama image. The thermal image provides highly precise and accurate temperature information about the entire monitored area. The panorama video image ensures fast and clear identification of the hazard area.

At the ThermoTeam facility images from three PYROsmart systems are displayed in the plant's control room. The operator can detect the temperatures of the various areas at any time using a false colour display of the infrared panorama image, by moving the mouse over the relevant section. The system also indicates the location currently exhibiting the highest temperature in the monitored area, thereby giving the operator a rapid overview.

The patented early fire detection system is fitted to a special high precision pan/tilt drive, and can therefore provide full monitoring of even very large areas. Thanks to the infrared technology, smoke and dust in the monitored area cannot cause incorrect measurements. To prevent the lenses of the two cameras from becoming dirty, there is a monitored compressed-air flushing system integrated in the housing.



The PYROsmart system detects fires early and triggers automatic and targeted fire fighting using the integrated extinguishers

Targeted fire fighting

The system does not just record and display temperature values. If the temperature exceeds a specified limit at one location, an alarm is triggered. This alarm is raised long before the smoke aspiration system would be able to detect the fire. As automatic extinguishing systems are each controlled by the three systems, a fire can then also be fought in a direct, targeted manner.

At the ThermoTeam facility, RM15C extinguishers made by Austrian firefighting equipment manufacturer Rosenbauer are used. These are coupled directly to the early fire detection system.

"With this automation, fires can be fought as soon as they break out, quickly and in a targeted manner before they can spread and cause significant damage", explains Kulmer.

This is possible because the early fire detection system determines the exact position of the fire and uses this information to specifically target the source of the fire. This targeted firefighting method keeps the quantity of quench water required, and therefore the damage caused, to a minimum.

The integrated control system is also capable of recognising whether a fire does indeed exist or whether there is another heat source within the monitored area. As the exhaust pipes of the wheel loaders used in the input area or of the trucks that deliver the material, for example, can become very hot, care must be taken to ensure that a false alarm is not triggered. To avoid this, it is possible to define attributes of disturbance variables within the system control, which are then not considered in the alarm values thanks to the intelligent software algorithms.

If the alarm is not acknowledged on the system by an employee, then the alarm is also automatically triggered at the fire brigade regional warning/ alarm centre. In the event of a fire, upon arrival at the plant the fire brigade can use the extinguishers directly. For this, remote controls are installed on the outside of the building which allow the extinguishers to be operated manually. The joystick controls on the extinguishers correspond to those used in modern fire engines.



The high calorific fraction of residual packaging waste means it is susceptible to the threat of fire

In service

Orglmeister delivered and commissioned the three PYROsmart systems in 2012. The commissioning process involved setting up the system and gaining approval from the responsible authorities. The early fire detection system has been in continuous operation since summer 2012. Kulmer is very happy with the plant's new early fire detection system, which he says "has already extinguished three fires in their early stages near the impurity sorter."

"We are certain that relatively large fires can be reliably prevented with the new early fire detection system," adds Kulmer.

To date no maintenance or repair work has been required, only the annual inspection of the extinguishing system and fire alarm system has had to be carried out.



The extinguishers can also be operated manually via a remote-controlled joystick