Fast response crucial when detoxifying hazardous waste

Temperature measurement helps SAKAB to cleanse the environment of hazardous substances like dioxin and PCBs. From left: Roger Öhman, Hanna Eriksen and Daniel Rodin.

Since the early 1980s, SAKAB has been Sweden's most complete and differentiated processor of hazardous waste. The company's treatment facility is located near Kumla, 200 kilometers west of Stockholm. But even though the facility's smokestack clearly shows that waste incineration is being done there, that is not the company's primary focus.

"We split long chains of molecules into shorter ones in order to transform stable, environmentally hazardous substances into less harmful, biodegradable ones," explains the company's environmental manager Hanna Eriksen.

One of Sweden's biggest environmental struggles in the 1970s was over the building of this processing facility. Opponents, led by Swedish author and environmentalist Björn Gillberg, called the planned facility a 'poison factory'.

"That made the politicians place very tough demands on our operations – something which is now a major advantage for us," Hanna says.

When SAKAB recently celebrated its 40th anniversary, its former opponent, Björn Gillberg, stated that the facility is a success and is necessary in order to detoxify the closed-loop environmental cycle. There must be an end station where environmentally hazardous waste is treated in a safe way, he said.

Response time is crucial

The treatment method involves incinerating the waste in Sweden's only rotating furnace of its kind. When the temperature passes 1100 °C, environmentally hazardous substances such as PCBs and dioxin are rendered harmless. The molecular chains are broken up and the end product is less hazardous and is biodegradable. The incineration residue is subsequently stored at Sweden's only covered Category 1 landfill site.

It is impossible to measure the temperature inside the rotating furnace.

"Instead, we take the readings in the afterburner," explains Roger Öhman, manager of the electrical & instrumentation department.

The temperature inside the afterburner must be at least 1100°C, which means that the temperature inside the furnace itself is between 1200 and 1400°C. In other words, there is a significant safety margin. Measurement accuracy is therefore not the most important factor.

"It's the response time that's crucial for us," Roger says.

IR pyrometers are fast enough

The reason is the varying types of fuel. The fuel shifts from extremes ranging from halon, a non-combustible fire extinguishant, to metal drums filled with waste oil. The temperature can rise by several hundred degrees within a few seconds, and if the process is allowed to continue uncontrolled there is a risk of damage to the furnace.

The solution is to combine the various material flows in order to keep the temperature somewhat stable. But this requires very rapid measurement responses. Originally, thermocouples were used but they have been replaced by two IR pyrometers (infrared) and are now only used as a backup.

"Thermocouples can't keep up with the rapid sequence of events," engineer Daniel Rodin explains, pointing to a computer log of a measurement sequence.

The log shows readings from both the IR pyrometers and the thermocouples. The IR pyrometers record any changes in a fraction of a second. The thermocouples take a couple of minutes to record the processes, by which time the entire thermal shock event is over. As a result, thermocouples are not fast enough to record the temperature peak.

"Without the IR pyrometers we wouldn't know that the furnace was overheating until we did the annual audit," Roger Öhman explains.

Well-planned installation

This is a highly challenging environment for IR pyrometers. Pentronic's equipment has a unique ability to calculate the correct readings when measuring gases. The equipment is also very robust, a property that Daniel Rodin has further improved by designing his own system that uses blasts of compressed air from an accumulator tank to clean away obstructions from in front of the lens system.

"Slag builds up inside the furnace and can obscure the IR pyrometer," he says. "That's why we use two IR pyrometers to complement each other. When the readings drop on one, the other takes over, and meanwhile the system automatically blows the slag away from the lens."

The IR pyrometers guarantee that the temperature is always high enough to incinerate hazardous substances. In addition, the rapid measurements reduce the risk of damage to the facility, thereby also reducing costs.

SAKAB also has a conventional roasting furnace for the combustion of household and business waste. The reason is that the company supplies energy to the district heating network in the nearby municipalities of Kumla, Hallsberg and Örebro, thereby benefiting the environment by replacing fossil fuel consumption.