SENSING EXCELLENCE

Multisensor

CASE STUDY

Monitoring VOC Removal System Performance at a Packaging Company in Japan

Application Dossier: No. XXII

Application

Monitoring the Effectiveness of a VOC Removal System at a Packaging Printing Factory

Product

MS1800 standard version with 4-20 mA output, installed in an insulated cabinet with a condensation trap

MS1800
VOC in Gas Monitor

Application

Online monitoring of the outflow of a VOC removal system to spot process breakthrough.

Customer

Packaging Company, Japan.

Problem

A famous packaging company in Japan uses industrial printing machines for their activities. Being located near a residential area they are under intense scrutiny to monitor their emissions that could affect the local population. The company has a VOC removal system and needed an on-line VOC gas analyser to monitor the performance of their removal system and report to the authorities.

Product

MS1800 standard version with 4-20 mA output, installed in an insulated cabinet with a condensation trap.

Installation Facts

In 2021 DAIKI, the exclusive distributor of Multisensor Systems in Japan, contacted us with this interesting application: monitoring VOCs at the outflow of a VOC removal system in a printing company.

The printing company located at around 100 km north of Tokyo operates a facility where there are multiple large buildings, including factories, warehouses, and offices. Part of their operations includes a VOC (volatile organic compound) treatment system, designed to reduce emissions from gravure printing processes.

VOC gases are captured from printing machines and sent through ducts to the treatment system, where they are heated and processed before being safely vented out.

Operators on the facility have historically used portable handheld VOC detectors to measure emissions. These devices provide readings in terms of toluene concentrations, but the process requires engineers to climb to the treatment outlet up to three times daily for manual measurements. This setup was deemed labour intensive and posed safety challenges.

The handheld device used for spot sampling of VOC concentration is not suited for process optimisation and continuous monitoring.

Local regulations limit VOC concentrations from gravure printing to a maximum of 700 ppmC. Compliance requires consistent monitoring to ensure emissions remain within permissible limits. Beyond regulatory adherence, the company aims to optimise operations by tracking VOC levels throughout the day.

The company expressed the need for a continuous monitoring solution that allows VOC levels at the treatment outlet to be tracked remotely in real-time from their office.

A view of the exhaust tower and the analyser installed on the yellow handrail.

Moreover the customer was looking for:

- Remote Access: data must be accessible from the office, ensuring VOC levels can be monitored without direct exposure to emissions.
- Integration: The system must be compatible with existing infrastructure, with the flexibility to use a PC or other monitoring devices.

- Communication Options: While the company has no prior experience with SCADA, PLC, or 4G systems, they were open to a solution incorporating IoT, Bluetooth, or similar technologies.

The MS1800 VOC analyser is identified as a potential solution, capable of continuously monitoring VOC levels at the treatment outlet. The system was paired by the distributor with a data transmission module to relay measurements to an office-based monitor or PC.

Technical Data

In the table below we can see the list of compounds that were found through standard analysis at the inlet and outlet of the VOC removal system. As we can observe there was a 10x reduction of VOCs thanks to the VOC removal system.

However the removal of VOCs through this system did not produce a fixed output of total VOC but a variable amount depending on the quantity and quality of VOCs at the inlet of the process, thereby the need for an on-line VOC monitor.

Report

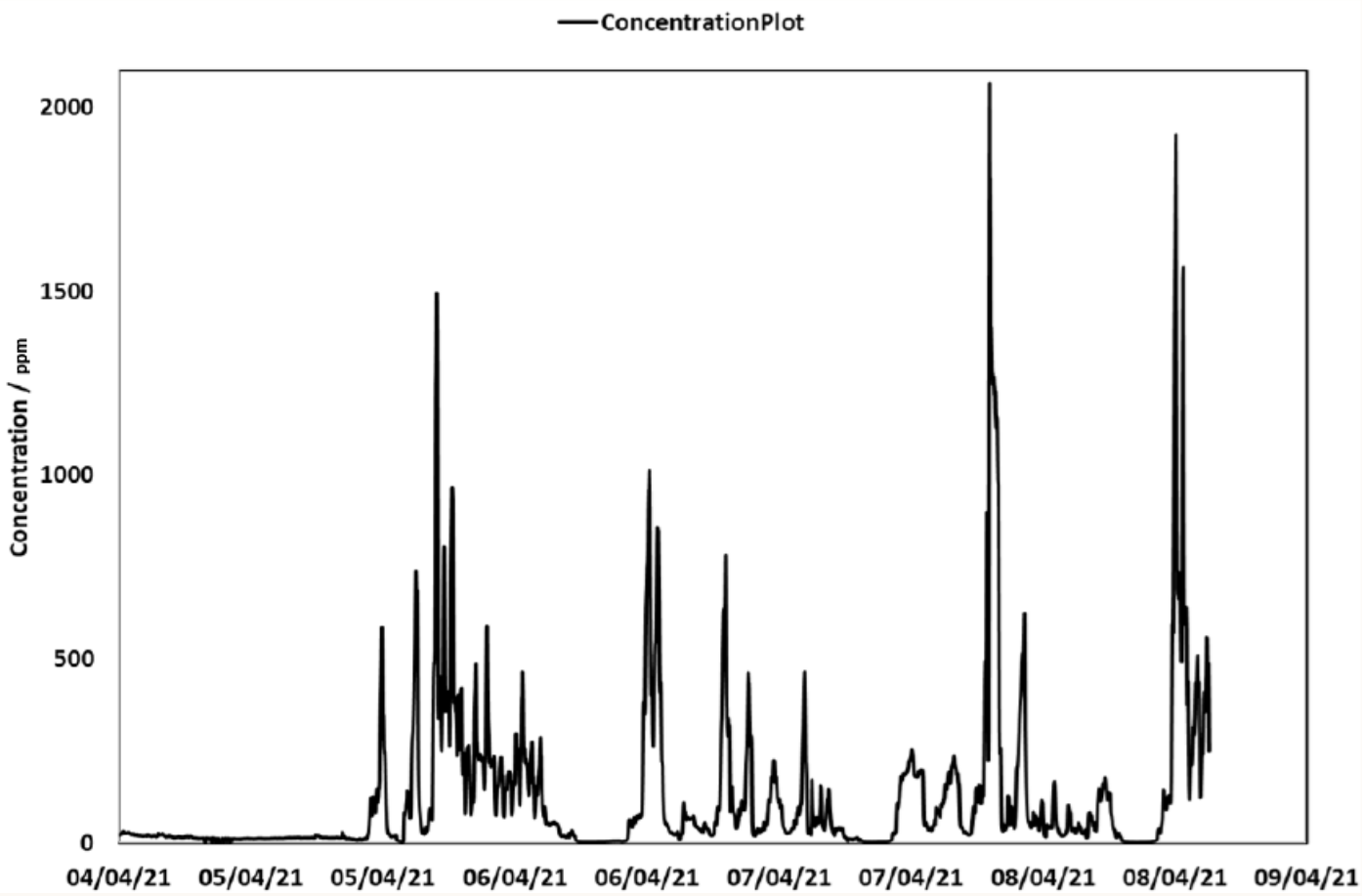
The graph in the following page shows the total VOC concentration measured by the instrument every 2 minutes over a 4 day period.

Organic Substances Detected from Samples

(Gases detected at inlet and outlet of the processing equipment)

unit: mg/m 3

No.	Substance	In	Out
1	Propionaldehyde	0.04	0.04
2	Acetone	0.78	0.16
3	Ethyl acetate	120	4.4
4	Methyl ethyl ketone (MKE)	27	3.5
5	Formic acid propyl	-	0.06
6	Isopropyl alcohol (IPA)	100	2.7
7	Propyl acetate	110	12
8	Toluene	66	15
9	1-propanol	24	0.85
10	Butyl acetate	18	0.59
11	1-methoxy-2-propanone	-	0.02
12	1-methoxy-2-propanol	12	0.62
13	1-butanol	-	0.03
14	1-methoxy-2-propyl acetate	0.09	0.01
15	Cyclohexanone	0.11	<0.01
16	2-propoxy ethanol	5.8	0.74
17	Acetic acid	0.16	0.05
	Total volume of organic substances	499	40



The instrument updates the 4-20 mA output every 2 seconds but logs the value in the on board memory every 2 minutes. The concentrations have frequently exceeded the range of the instrument, which is 500 ppm total VOC in gas. Values reported above the range are subject to large errors and should not be relied upon.

The concentration plot shows a very clear trend. Very low VOC values are reported during the weekend and overnight periods. These are followed by significant spikes of high VOC concentrations during the working hours. This trend has been seen over the entire period in which the instrument has been installed.

Final Observations

As it can be observed in the next page a condensation trap system was added by the distributor to avoid droplets entering the MS1800 VOC Gas analyser.

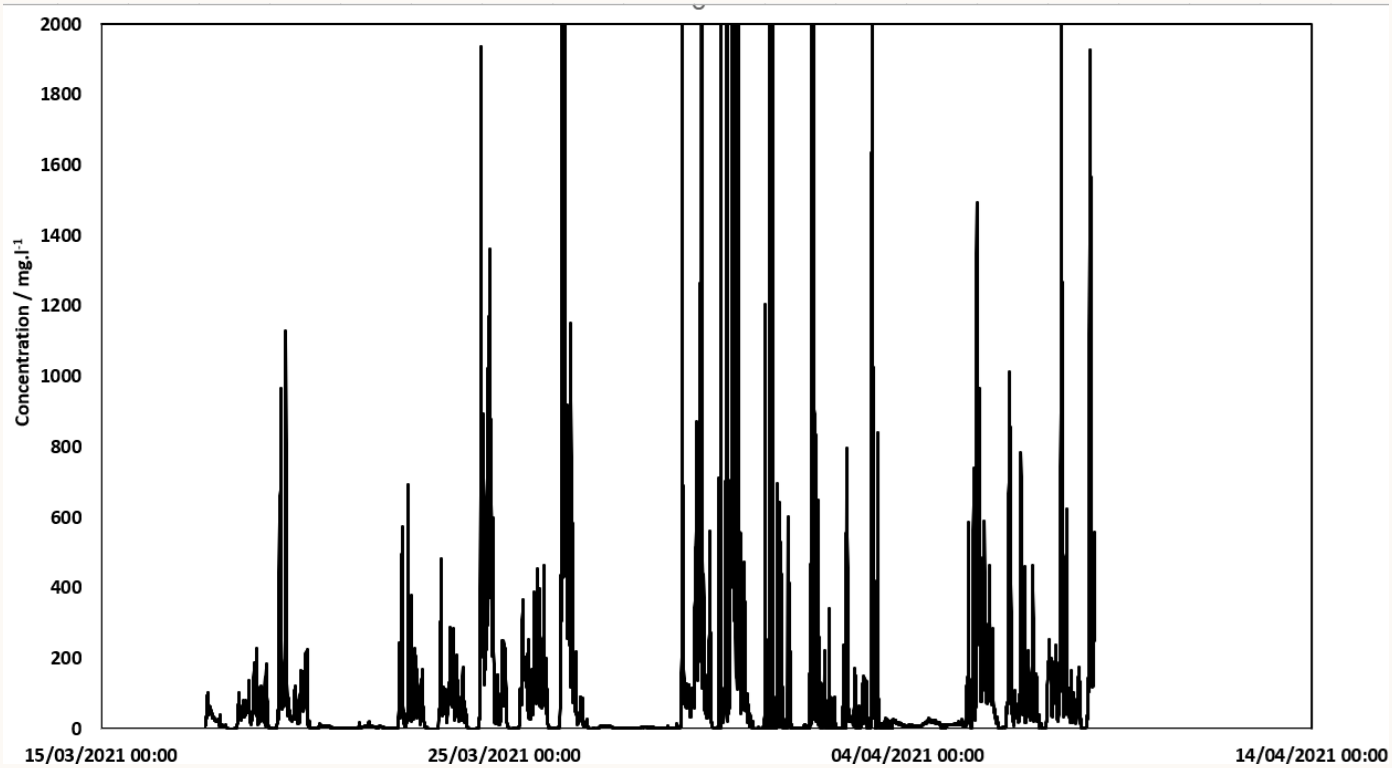
With some simple additional protection, the instrument can be installed in outdoor environments, for example, using a cabinet to provide protection from the elements.

Following this installation the customer kept the instrument for some more time and collected valuable information about their process and how to optimise it.

Analyser installed at site; following this first installation a more solid installation was performed.

Condensation trap developed by Daiki to ensure the removal of droplets from the gas coming out from the process at high temperature.

Full view of the VOC removal unit; one of the main issues was to climb over the tower several times a way to take a sample. The sample usually was taken from an opening on the side of the main tower.



The graph above shows the entirity of the data for the period of the first test that allowed the customer to assess the instrument and gain an in-depth understanding of their own process.

Did you know?

Volatile organic compounds (VOCs) are widely present in packaging printing processes, primarily as solvents and additives in inks, adhesives, and cleaning agents. Commonly found VOCs in these applications include toluene, xylene, ethanol, isopropanol, ethyl acetate, and acetone. These compounds play essential roles, such as enhancing the flow and drying properties of inks or ensuring the proper adhesion of adhesives. However, during the printing process, VOCs can evaporate into the air, contributing to occupational exposure for workers and emissions that affect the surrounding environment.

The health risks associated with VOC exposure in packaging printing environments are significant. Many VOCs are classified as irritants to the eyes, skin, and respiratory system, and chronic exposure can lead to more severe conditions. For instance, toluene and xylene are known to cause neurological effects, including headaches, dizziness, and cognitive impairments, when inhaled in high concentrations over time. Long-term exposure to certain VOCs, such as benzene, which may be present as an impurity in solvents, is linked to more severe risks, including cancer. Moreover, workers in poorly ventilated spaces are at heightened risk of inhaling concentrated levels of these hazardous substances. For these reasons VOC removal systems are extremely important.

Why Multisensor?

The customer was looking for a reliable system to get a better understanding of their own processes and legal obligations towards the community.

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For more information

Visit: www.multisensor.co.uk
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Front Image Credit: DAIKI

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Multisensor Systems is a developer and supplier of Water and Gas Analysers specialising in oil in water and hydrocarbon analysers, oil in water detectors, VOC monitors and THM analysers based in the United Kingdom.

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CHANGELOG

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