How has Industry 1.0 to 4.0 influenced particulate emissions and monitoring

Part 4: Industry 4.0

Jamie Jeffs, Service and UK Sales Manager ENVEA UK

Introduction

ENVEA have been at the forefront of environmental monitoring and process control over four decades and with the emergence of the industrial Internet of Things (Industry 4.0), ENVEA are yet again providing innovative solutions which harness the potential of this new industrial era.

ENVEA are therefore pleased to announce the release of its latest innovation, the new **DTCi4 Dust Tools Cloud Software for Industry 4.0** which will be formally launched in the UK at Clean Air Technology Expo at the NEC, Birmingham, taking place on 11-12 September.

DTCi4 is the first Cloud software tool for monitoring sensor readings for the compatible range of PCME Particulate and Flow instruments. Accessible via a secure web browser-based portal, it enables the user to access readings from any device with an internet connection.

To support the release of this software ENVEA are also releasing the netController multichannel sensor network device. Cloud enabled, the netController supports the PCME range of particulate and flow sensors providing all the benefits of existing controllers but with the capability to output logged data to the ENVEA Cloud for access via DTCi4 software.

Alongside all the existing features of the ENVEA range supporting Industry 4.0, this exciting new release is the next evolution in data capture, storage and analytics in the world of particulate and flow monitoring. Data is stored securely in the ENVEA CLOUD in partnership with Amazon's AWS service providing users with constant access to their live and historic data.

Industry 4.0 - Industrial Internet of Things (2013-Present)

Before we explore further the new DTCi4 software and the advantages it provides, what is Industry 4.0?

In our previous articles, we have been examining the relationship between industrialisation and particulates through Industry 1.0 to Industry 3.0 and how through these previous industrial revolutions particulate abatement, monitoring and regulation has evolved. Read Part 1, Part 2 and Part 3 here.

Industry 1.0: 1760 Industry 2.0: 1840 Industry 3.0: 1970 Industry 4.0: 2013

Industry 4.0 is underpinned by the concept of “Smart Factories”. Utilising wireless technology and advancements in internet connectivity and speed, the fourth industrial revolution uses the concepts of interconnectivity, Cloud computing and smart technology, now common place in home appliances and in the service sector and applies them to manufacturing processes as a means to revolutionise mass production in industry.

Industry 4.0 was defined in 2013 at the Hannover Fair in Germany following concepts explored by a working group, headed by Henning Kagermann and Siegfried Dais. Tasked with establishing ways to use technology to optimise automation and self diagnostics they established 4 principles.

Interconnectivity of sensors and devices through the Internet of Things (IoT)

Information Transparency, where data from interconnected devices is collated to provide a wider view of the manufacturing process

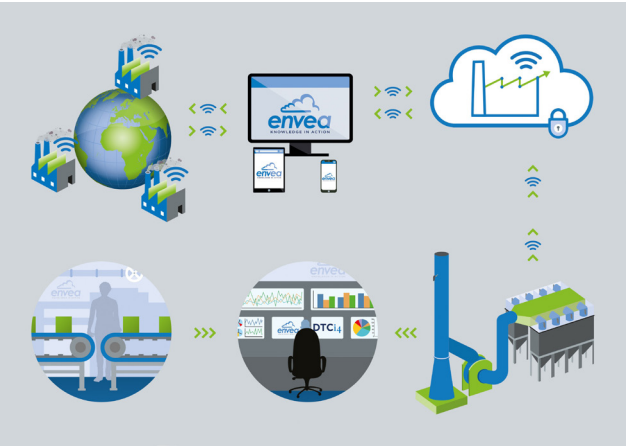
Technical Assistance, where cyber-physical systems and graphical representations support decision making for operators

Decentralised Decisions, where the self-diagnostics within automated devices from the interconnected factory minimise requirements for operator involvement.

These principles, when applied to practical applications within Industrial processes enable companies to optimise the production process. Interconnected and Transparent sensor data across processes provides analytical capabilities not previously possible in real time. Increased response time to plant machinery failure reduces its impact whilst inefficiencies within the process are easily identified, in some cases automatically. The technical assistance provided enables enhanced preventative maintenance capabilities enabling sites to more efficiently manage plant equipment and instrumentation.

Whilst systems such as PLC’s and SCADA have provided capabilities for Industry to implement these principles in the past, the physical infrastructure required to effectively manage the ‘Big Data’ generated in fully interconnected factories limited both technical implementation and the potential return on investment.

With the expansion of wireless technology and the emergence of high-speed internet connectivity, the technological capability now exists to deliver these principles.



Industrial Internet of Things

The internet of things is a wide-reaching term to describe devices connected to and communicating via the web. The output from these devices can soon accumulate into billions of data points creating thousands of Gigabytes of data storage. By utilising Cloud computing models businesses can now securely store and access this data via the CLOUD without the need to create large scale server networks and all the associated maintenance and security implications that comes with it.

Identifying the need for 'big data' storage on an industrial scale, major corporations such as Amazon and Microsoft, amongst others, have created Cloud storage services for Industry. Through their networks of remote servers, they offer a vast data storage capability with unrivalled disaster recovery and security capabilities. Such is the trust in their Cloud security their customers include some of the biggest corporations in the world and even international intelligence agencies.

As the capabilities for Industry 4.0 expand, new applications are emerging that utilise IIoT. With greater interconnectivity and greater automation, concepts such as machine learning, artificial intelligence and neural networking are being established as a means to create the smart factories of the future.

Particulate Emissions Monitoring in Industry 4.0

In 2019, Particulate Emissions from Industry are closely regulated with legislation and international standards governing the methods of abatement, permissible emission limits, monitoring and reporting of particulate matter (PM). The implications of fine particles in the atmosphere are well understood and governments and regulators globally are responding with ever decreasing emission limits across all sectors.

This can be seen in the recent BAT-AEL's (Best Available Techniques – Associated Emission Levels) set within the EU for waste management where particulate limits are set to fall to 2-5 mg/m^3.

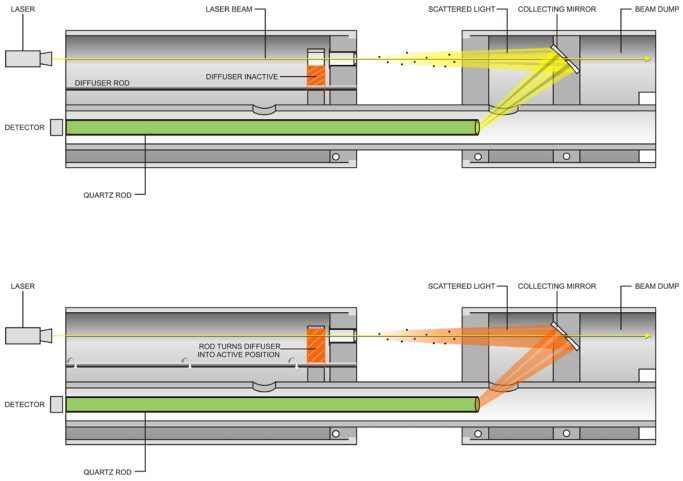
Whilst regulation has driven the development of increasingly advanced technologies for monitoring particulate continuously at low levels, these recent announcements pose challenges for industries being required to show ongoing compliance against these lower limits.

Whilst abatement technologies, such as baghouses, and continuous emission monitors (CEMS), such as the range from ENVEA, have evolved to operate in these conditions, the levels of uncertainty associated with the standard reference method (SRM), isokinetic sampling, used within the calibration of continuous particulate monitors are significantly higher at very low concentrations. The requirements for adequate calibration of these instruments, governed under European standard EN14181 requires a level of uncertainty from the SRM which is difficult to achieve during commissioning (QAL2) or annual surveillance (AST) of the instruments using the existing methods (e.g. number and duration of sample runs) for the levels being emitted. Without being able to demonstrate a verified calibration this also poses challenges to sites in providing the required Total Particulate Matter (TPM) required in their operating permits.

As these limits represent a relatively small increase in concentrations compared to normal operating levels, even greater control of process is required with close scrutiny of trends and instantaneous access to crucial PM levels from the CEMS. There is also an even greater need to manage the effectiveness of abatement systems, being able to identify potential increased emission events and prevent them by managing the performance of abatement systems (eg filter media within a baghouse).

ENVEA ElectroDynamic™ sensor installation for multi-compartment baghouse performance monitoring

Whilst CEMS and associated software is currently available to help achieve this level of control, the benefits associated with Industry 4.0 technologies are well placed to support the level of data capture, storage and analytics required in current day particulate monitoring.



QAL 181 self-checks

Continuous logging of automated instrument self checks (as with the PCME ProScatter range) ensure data is stored automatically in the Envea Cloud providing continuous tracking of instruments performance as well as providing the requirements under QAL3 and PS-11 regulations for changes in instrument span and zero readings. As well as remote access to sensor readings via the web-browser portal for DTCi4, warning and limit alarms can be monitored allowing operators to mange both their processes and the instruments providing the monitoring.

The sensor capabilities in and around particulate abatement are well established and the data analytics that assist operators in identifying performance issues are provided within the current range of ENVEA process instruments (Such as the PCME LEAK LOCATE system). The networking of these sensors into a single control system and subsequent analytics provided by the available software also provide the tools for operators to manage maintenance scheduling and replacement of filter media to improve efficiencies within the management of their bag house. Utilizing the valuable pulse data provided, sites operating with a complete ENVEA process and compliance system can interrogate the performance of their system and affect significant cost savings whilst demonstrating process control.

These benefits are enhanced with the release of the DTCi4 software and netController multichannel system which enable the users to expand the data capture and analytics of pulse logs which are logged automatically within the ENVEA CLOUD and are not restricted by traditional hard disk memory constraints

Multi-channel controller for particulate and flow sensors with Cloud-enabled data storage

Networked systems are now commonplace for industrial processes and this is applied equally to the particulate and flow monitors used to measure PM emissions and process performance. Networking the compatible range of particulate and flow sensors through the new netController, users can now access data from the range of sensors installed. For sites with both pre and post abatement PM measurement sensors alongside indicative leak locate devices, the DTCi4 software enables comparative analytics across all sensors and provide a live and historic view of all available channels. Analysing this data gives the operator a complete view of their process performance and ability to pinpoint any issues or inefficiencies from a centralised location without the requirement to download data separately. Indeed, this analysis can be performed anywhere as access is not restricted to onsite PC's or within the sites network. Through the secure portal to the ENVEA Cloud authorised users can, for the first time, perform analysis on live data remote from the site.

Taking this concept further, the Cloud storage provided by the ENVEA Cloud also enables operators or Environmental Managers for multiple sites to monitor, analyse and report on data for multiple sites regardless of their location. By moving data away from the server room and into the CLOUD particulate monitoring and process control can now be performed securely anywhere with an internet connection.

Dust Tools Cloud for Industry 4.0 (DTCi4)

ENVEA will be launching DTCi4 at Clean Air Technology Expo NEC, Birmingham, 11-12 September. Available initially within the UK, the Cloud-based storage and analytical software is fully backwards compatible with the range of PCME dust and flow measurement sensors when connected via a net-Controller system device.

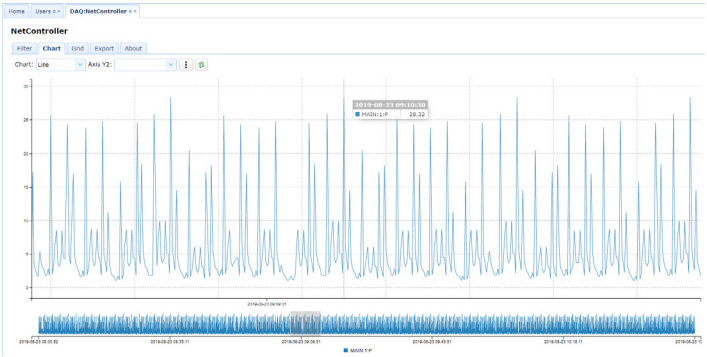
All netControllers are supplied CLOUD enabled. For those subscribed to the DTCi4 software, data will begin being logged as soon as it is connected to a suitable internet connection. It continues to provide all the features and benefits of previous multi-channel controllers, including additional 4-20mA and RS485 communication with Ethernet connectivity as standard. For users connected to the Cloud, the option of remote firmware upgrades is also available.

The software automatically detects all the sensors and associated channels available, logging pulse, short term and long-term logs directly to the Cloud.

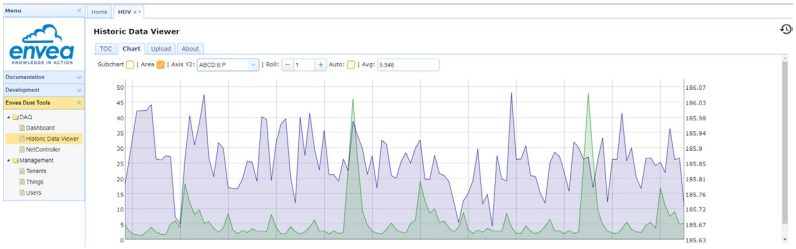
Secure user access is provided via web browser with the option of 2-step verification for login available for extra security. There are no limits to the number of users requested and unlimited storage of sensor data is available during the subscription period.

Live data is accessible from the dashboard giving operators a real time view of sensors readings.

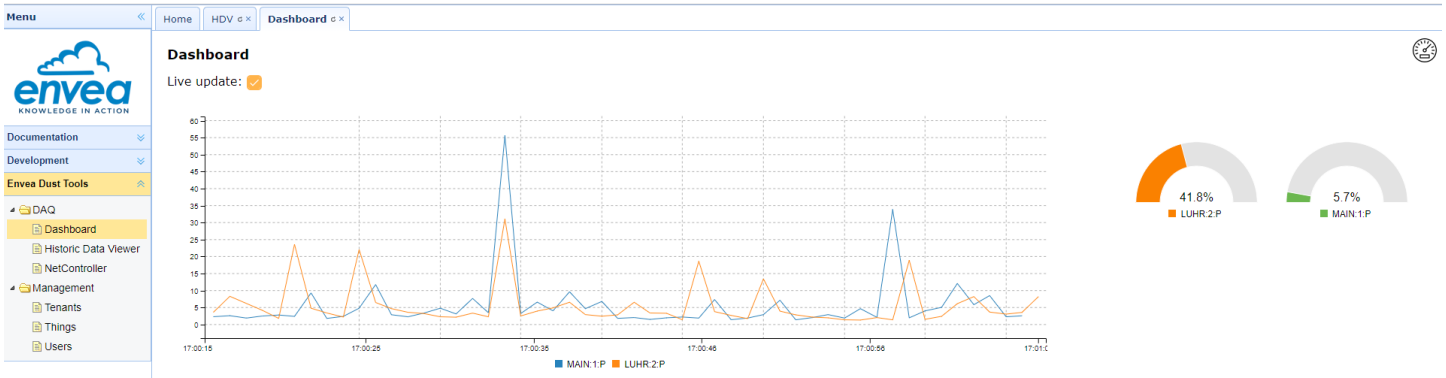
Historical logs can be uploaded for users previously using PC-ME DUST TOOLS software and logs of all data stored within the netController are available as soon as it is connected to the ENVEA Cloud. Alarm and event logs can be accessed and all data can be downloaded into CSV format at any time.



Review filter performance



View historic data



Display real-time sensor readings

DTCi4

ENVEA Cloud have partnered with Amazons AWS service to provide the most secure and reliable service possible. Secure data storage via a global network of remote servers provide assurance that data will be accessible, with industry leading SLA's for system up time, and continuously updated security protocols ensure data is stored securely.

Data packages sent to the Cloud are encrypted with secure license keys controlling access to the device and the Cloud with the capability to isolate the connection within site networks via a demilitarised zone (DMZ) if required.

In the unlikely event that connection is lost to the Cloud, data will automatically be sent to the Cloud as soon as connection is re-established. As additional back up, the netController also contains hard memory which will store long term data for up to 48 months.

Advanced graphical displays enable various options to view and analyse the data, whether the user requires long term averages over several months or up to the minute individual pulse logs to analyse bag filter performance by individual row or compartment.

On screen averaging provides the user with options to mange compliance requirements for average results over set time frames and multiple channels can be layered within each graph to allow comparative analysis of all available channels.

As additional features and further advancements are released, those subscribing to DTCi4 will receive these updates automatically ensuring they have the latest developments to Industry 4.0 from ENVEA.

The system provides the secure storage, data analytics and interconnectivity required in the modern-day world of particulate emissions monitoring in industry

DTCi4 delivers on the principles set out for Industry 4.0 as well as helping industry meet the challenges of particulate monitoring in 2019. The platform is set for further development synonymous with emerging "Smart Factories" and beyond.

To learn more about the launch of these new products visit us on stand 138 at Clean Air Technology Expo alongside our seminar examining Industry 1.0 - 4.0 in particulate monitoring.

ENVEA UK
Clearview Building 60 Edison Road
St. Ives / Cambs - UK PE27 3GH
+44 (0)1480 468200
contact.gb@envea.global