INDUSTRIAL EMISSION DIRECTIVE (IED) IMPLEMENTATION UPDATED WITH FOCUS ON CALIBRATION AND INSTRUMENTATION GASES NECESSARY TO COMPLY WITH THE NEW REGULATORY REQUIREMENTS

Despite the introduction of more and more stringent regulatory requirements in the European Union and in the rest of the World, the level of air pollution remains critical in many places, especially in the urban and industrial areas. So far, the impact of current emission legislations has been significant, but further improvements are still to be expected.

The IED entered into force in November 2010 and covers some 50,000 installations across the European Union e.g. to produce chemicals, power, petrochemical products, cement, glass, metals and to treat/incinerate waste. Requirements under the IED are included in the Best Available Techniques Reference documents (BREFs), agreed within each specific agro-industrial sector. BREFs define the Best Available Techniques (BAT) conclusions that are legally binding also in term of emission monitoring requirements, where calibration and instrumentation gases play an important role. There are in total 36 BREFs, 18 of which have been already reviewed under the IED and published. One of the latest BREF published is about the Large Combustion Plants (LCP).

Air Quality

The emissions of the main pollutants in Europe have declined in the past three decades, from the 28% of ammonia to the 92% of sulfur.

Even though this results in a better air quality, additional measures are still needed to achieve the long-term objectives of air pollution level that do not lead to unacceptable harm to human health and the environment. This is the aim of the European clean air policy, that introduces new measures to reduce harmful emissions from industrial plants, transportation and agriculture. By 2030 the clean air policy package is estimated to prevent thousands of premature deaths and save several km2 of ecosystems, protected areas and forests. Air pollution control measures costs are generally lower than the costs of health and environmental damages.

Industrial processes account for a considerable share of the overall pollution, due to their emissions of air pollutants, discharges of wastewater and the generation of waste. The IED is the main EU instrument regulating pollutant emissions from stationary installations. The IED aims to achieve a high level of protection of human health and the environment by reducing harmful emissions across the EU, through a better application of Best Available Techniques (BAT), an integrated approach to the permits system and a guidance on defining Emission Limit Values (ELVs) for each controlled pollutant.

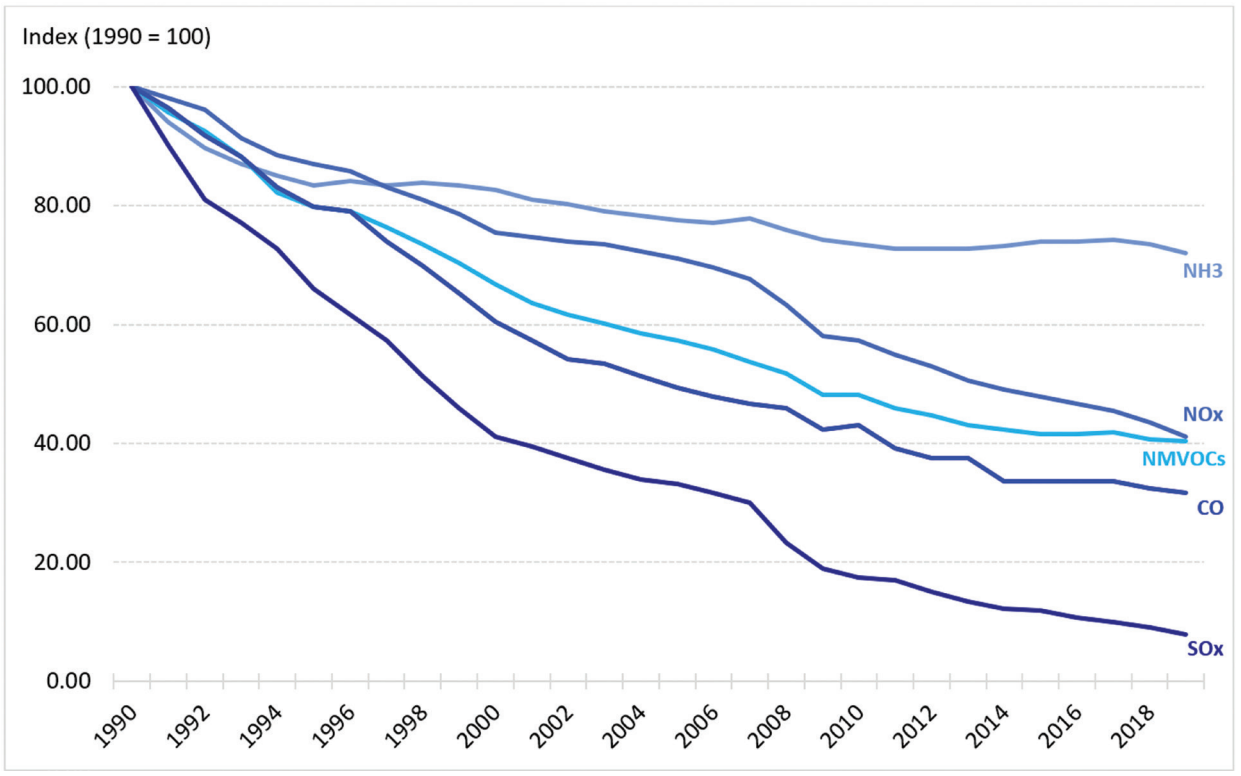

Figure 1 - EU-28 emission trends for the main air pollutants according to the EEA European Union emission inventory report 1990–2019

Large Combustion Plants (LCP)

The LCP BREF was adopted in November 2021 and its scope includes combustion installations with thermal input equal or higher than 50 MW, gasification of coal or other fuels installations with thermal input equal or higher than 20 MW, waste co-incineration plants for non-hazardous waste with capacity higher than 3 tonnes per hour and for hazardous waste with capacity higher than 10 tonnes per day.

The LCP BREF impacts 3,664 plants in Europe, where the installed capacity increased by 4% overall between 2004 and 2017 and the trend reached its maximum in 2012.

The LCP BREF introduced some changes in the emissions measurement requirements, i.e. there are additional pollutants to be monitored and/or changes in the monitoring frequencies. The BAT 4 is about monitoring emissions to air with a given frequency and in accordance with the applicable EN standards. We have for example requirements for ammonia, hydrogen chloride, hydrogen fluoride, total volatile organic compounds, mercury and formaldehyde that require yearly, quarterly or continuous monitoring.

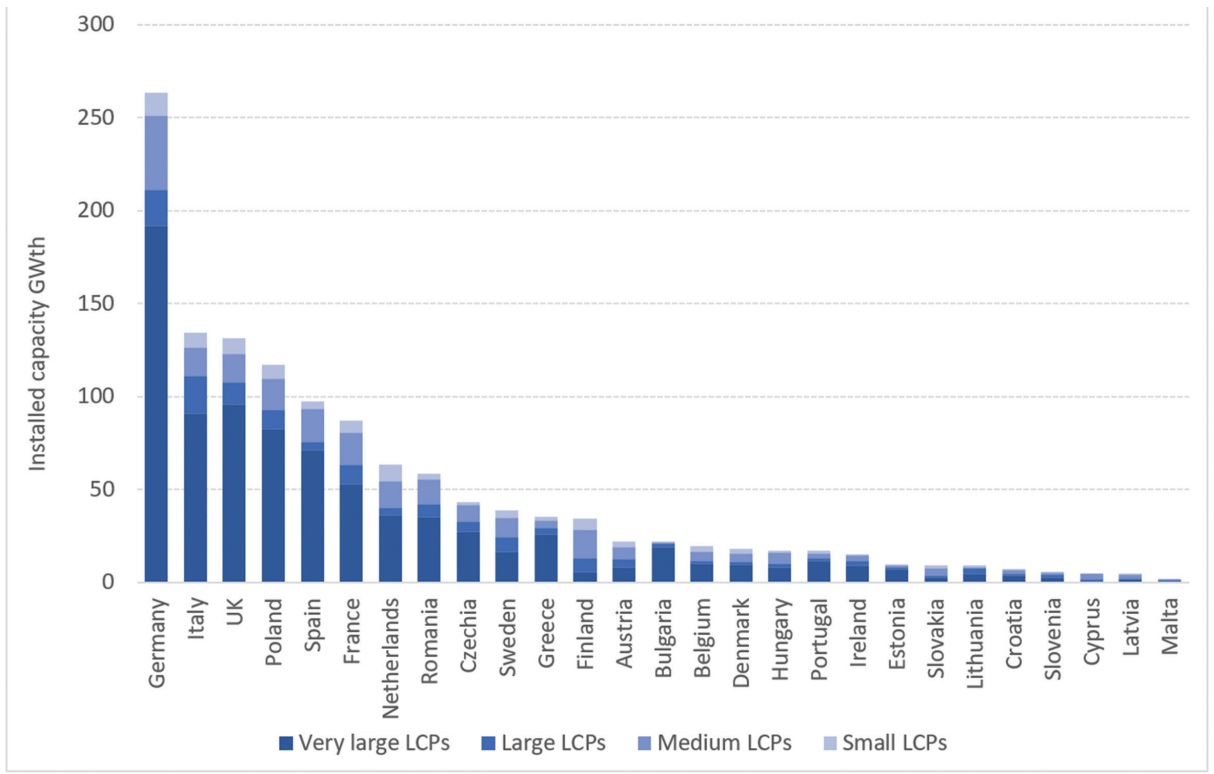

Figure 2 – Installed capacity in 2017 by country according to the European Environment Agency (eea.europa.eu)

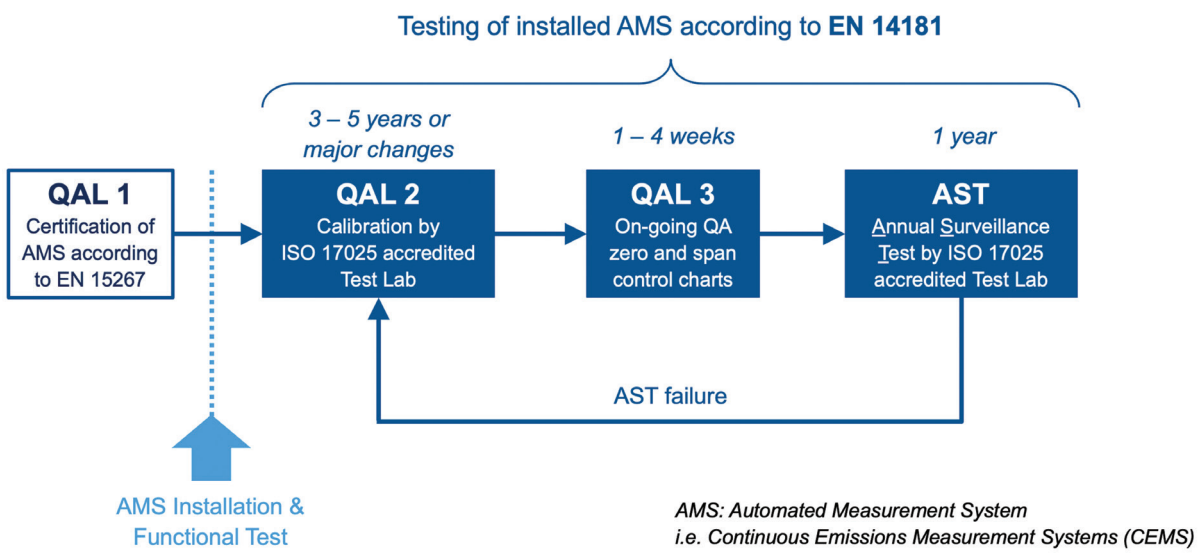

Figure 3 – The quality assurance procedures according to EN 14181

Quality Assurance Procedures

The key EN standards to refer to are the EN 15267 about the certification of Automated Measuring Systems (AMS) and the EN 14181 about the quality assurance of AMS that identify three different quality assurance levels – QAL 1, QAL 2 and QAL 3 – and an annual surveillance test.

QAL 1 procedure ensures that the AMS is suitable for the defined measuring tasks. The certification according to EN 15267 shall prove that the total uncertainty of the AMS results meet the uncertainty specification stated in the applicable regulations (IED and BREF). In QAL 2 the AMS is calibrated and validated by using a parallel measurement with the relevant Standard Reference Method (SRM) – e.g. SRM for NOx and SO2 are defined in EN 14211 and EN 14212. QAL 3 demonstrates that the requirements for the stated zero and span repeatability and drift values are met during ongoing operation and the AMS is maintained in the same operational condition as when it was installed and calibrated in QAL 2. This procedure is repeated more often than QAL 2 to identify as soon as possible potential random and systematic deviations. Finally, the purpose of the Annual Surveillance Test (AST) is to verify whether the calibration function of the AMS is still valid and its precision is still within the required limits. In case of test failure, the QAL 2 step needs to be repeated.

Calibration and Instrumentation Gases

The AMS certification is typically carried out by the equipment manufacturer, while the calibration curve, the linearity check and the yearly validation are usually carried out by an ISO 17025 accredited laboratory and accredited calibration gases might be required. The composition of the calibration gases is defined according to the certification range for QAL 1 (e.g. the EN 15267-3 requires for LCP that the certification range is not greater than 2.5 times the daily ELV) and to the calibration range for QAL 2 and AST. The on-going quality assurance procedure under QAL 3 is typically carried out internally under the responsibility of the plant manager. In this case the composition of the calibration gases is defined according to the measuring range at which the AMS is set to operate. Certified calibration mixtures – e.g. prepared according to ISO 6142 – are usually sufficient for zero and span checks.

The instrumentation gases should meet the purity and maximum impurities content requirements, depending on the instrumentation in use. In general, higher the purity and lower the content of critical impurities, higher the accuracy of the measurements.

Calibration and instrumentation gases place demands on components for distribution, control and monitoring. This is either because the analytical methods require that the gas shall maintain its high purity though to the point of use or the chemical and physical properties require special design of the equipment e.g. compatibility with the use with reactive components.

Innovative technologies from the gas companies can support the industry to meet the new requirements. An example is the HiQ® Multimix gas diluter based on the principle of dynamic preparation of calibration gas mixtures described in ISO 6145-6. Thanks to its 1/100 dilution factor, the portable diluter can generate multiple points calibration curves and mixtures with low concentration (ppb-range) of reactive components such as ammonia, sulfur dioxide, nitric oxide.

Figure 4 – HiQ® Multimix gas diluter based on two ECOCYL® cylinders

Conclusions

In the context of the air quality, continued improvements in air pollution levels are expected under current and future legislation. The IED has been introducing more stringent requirements via the BREF documents related to specific industry (e.g. LCP) and agriculture sectors. In all cases robust quality assurance procedures are required to ensure that emission measurements are always accurate and reliable. Proper calibration, instrumentation gases and specialty equipment are crucial to ensure compliance and efforts from the gas suppliers are necessary to continuously support the industry meeting the new requirements.

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