

2026

Air Treatment Technical Whitepaper

Advanced Air Treatment in a
Changing Regulatory Landscape



Industrial air treatment is entering a period of rapid transformation. Operators across the US, UK and EU face tightening emission limits, expanded monitoring obligations, and growing scrutiny of odour, volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). At the same time, production processes are may become more variable, supply chains more dynamic, and public expectations for transparency significantly higher.

Activated carbon, thermal oxidation, hybrid systems and mobile filtration units remain core technologies. Compliance now requires a lifecycle approach that integrates system design, monitoring, maintenance, spent-media management, and regulatory alignment.



This white paper outlines the technical challenges of industrial air treatment, compares UK, EU and US regulatory frameworks, and explains how operators can future-proof their systems using best-practice engineering and Puragen's lifecycle support model.

The Industrial Air Treatment Challenge

Industrial emissions are inherently difficult to control because they are often non steady state, multi component, and process dependent. Operators must manage:

Variable pollutant concentrations

batch processes, campaign changes, and solvent variability

Changing production campaigns

different solvents, resins, monomers, catalysts

Fluctuating flow, temperature and humidity

impacts adsorption capacity & oxidiser efficiency

Mixed VOC streams

competitive adsorption, breakthrough unpredictability

Low concentration pollutants with strict limits

halogenated VOCs, odorous sulfur compounds

Odour complaints and short term peaks

often diffuse, intermittent, and difficult to capture

Fugitive vs channelled emissions

building extraction tank breathing, solvent handling

Hazardous, corrosive or poorly adsorbed compounds

acids, amines, aldehydes, volatile PFAS related organics

These challenges require robust abatement systems and, increasingly, documented monitoring and management processes that demonstrate regulatory compliance.

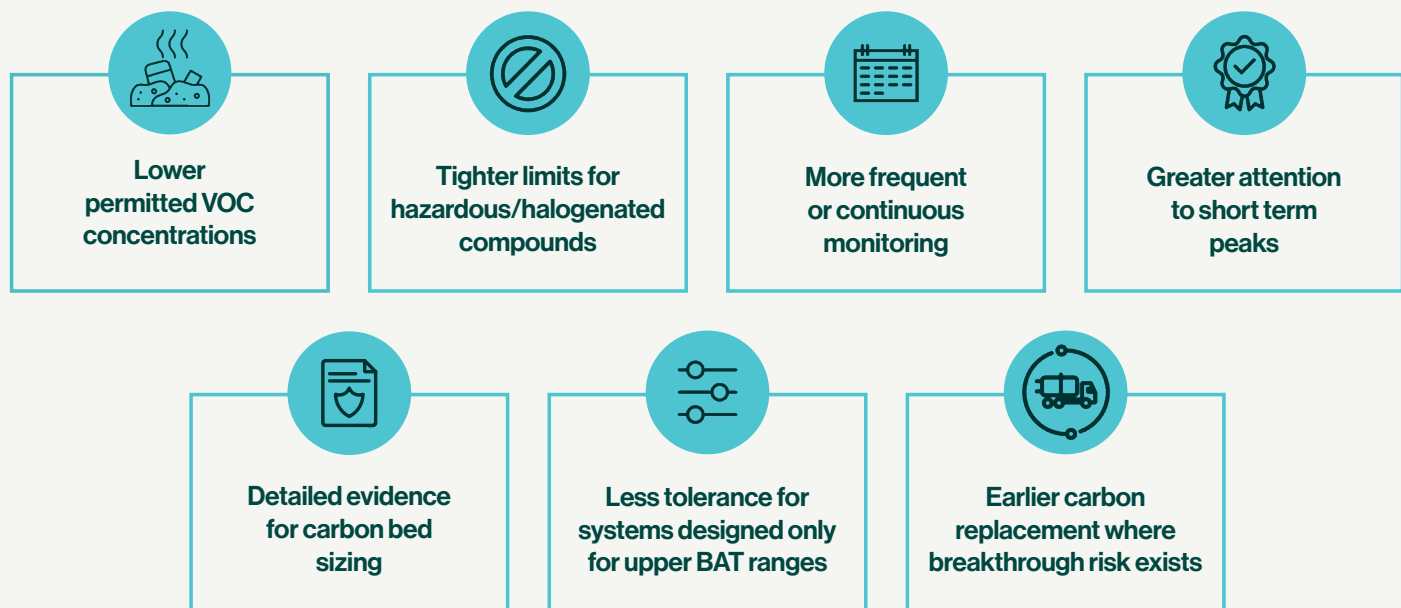
UK and Europe: IED 2.0 and BAT Driven Compliance

Industrial Emissions Directive (IED)

The Industrial Emissions Directive remains the EU's primary framework for controlling industrial pollution. The updated IED 2.0, adopted in 2024 by the EU, expanded the directive's scope, tightened emission limits and significantly increased transparency. Facilities must now meet stricter BAT based emission levels (Best Available Techniques), and the public has greater access to permits and emissions data. Penalties for serious infringements can exceed 3% of EU wide turnover, reflecting a stronger emphasis on accountability.

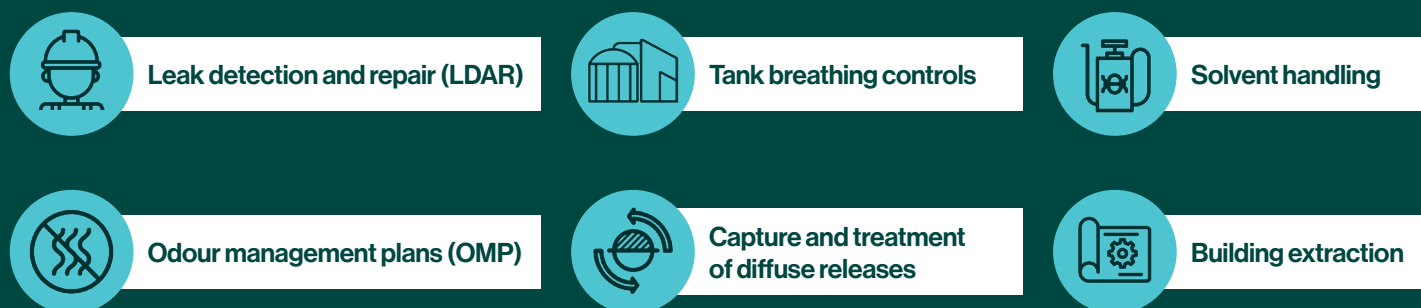
Post July 2026: Stricter Permit Reviews

From July 2026 onwards, new BAT conclusions trigger mandatory permit reviews within four years. For operators, this shift means they must demonstrate that the strictest achievable emission levels are being pursued:



Odour and Diffuse Emissions

IED 2.0 explicitly includes odour as pollution. Odour management plans are becoming standard, and regulators expect operators to demonstrate proactive control rather than reactive mitigation. Operators must strengthen:



Environmental Management Systems (EMS)

By 1 July 2027, all relevant installations must implement an Environmental Management System. The EMS must include environmental objectives, hazardous-substance inventories, emissions-monitoring procedures, non-compliance actions and BAT-aligned performance indicators.

Activated carbon systems must include:



Defined design
criteria



Monitoring
points



Breakthrough
limits



Changeout
procedures



Spent carbon
routes

2030 Transformation Plans

By 30 June 2030, energy-intensive sectors must submit transformation plans (TPs) outlining how they will transition toward a clean, circular and climate-neutral economy between 2030 and 2050. Air-treatment investments must therefore consider future emission limits, modular capacity increases, solvent recovery options, carbon reactivation pathways, energy reduction strategies and compatibility with electrification or feedstock changes.

New Sectors Entering IED Scope

IED 2.0 expands regulatory coverage to include battery manufacturing, selected metal-ore extraction, additional metal-processing activities, intensive pig and poultry farms, and landfills, including PFAS-related emissions.

UK VOC & Odour Control Legislation

In December 2025, the UK Environment Agency (EA) introduced major changes to VOC and odour regulations. Although not directly adopting IED 2.0, regulations align closely with EU BAT conclusions, creating a BAT-driven, risk-based and evidence-heavy compliance environment.

New BAT conclusions for waste treatment, intensive farming, food and drink production and large combustion plant (LCP) activities are being introduced, driving a significant tightening of emission standards for UK operators.



Withdrawal of H4 and New Odour Framework

The most significant change was the replacement of the long-standing H4 Odour Guidance, marking the biggest shift in two decades. Operators must demonstrate appropriate measures, supported by robust Odour Management Plans, complaint logs, dispersion modelling and sniff-testing evidence.

The new guidance is less prescriptive, but expectations are more stringent, especially given rising odour related civil claims and group litigation orders.

UK VOC Regulation: BAT Driven, Sector Specific, and Tightening

VOC Control Under EPR 2016 VOC emissions are regulated through:

- BAT AELs (Best Available Techniques Associated Emission Level) in sector specific BAT conclusions
- Monitoring requirements (periodic or continuous)
- Permit conditions for abatement systems
- Pollution Inventory reporting

2026–2027 VOC Regulatory Pressure Points

1. Alignment with EU BAT Conclusions (even post Brexit)

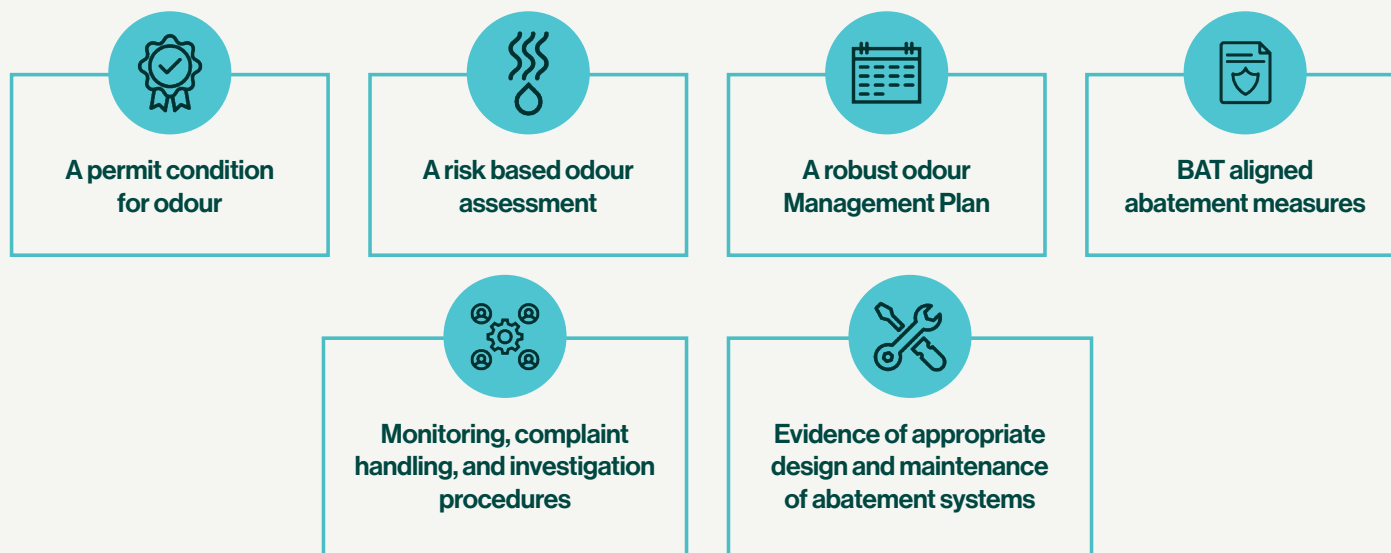
UK regulators continue to track EU BAT conclusions closely. This means UK VOC limits are tightening in line with EU BAT AEL ranges.

2. EA Enforcement Posture

The EA is applying tighter enforcement and higher civil sanctions for non compliance. VOC exceedances, poor monitoring, or inadequate abatement design are now more likely to trigger permit variations or enforcement notices.

UK Odour & VOC Expectations Under the New EA Guidance

Operators must demonstrate:



Odour Litigation Risk

Odour related group litigation orders (GLOs) are increasing, including cases against landfills, composting sites, and meat processing plants. This raises the importance of defensible odour management and monitoring.

What This Means for VOC & Odour Abatement Systems

Under UK permitting and odour guidance, operators must show:

- Correct carbon selection for VOC /odour profile
- Evidence based carbon bed sizing
- Monitoring points and breakthrough limits
- Changeout procedures
- Safe spent carbon handling
- BAT aligned abatement performance
- Integration with EMS and permit conditions

WGC - UK Implementation Lag

The UK is behind the EU in implementing WGC (Waste Gas Treatment in the Chemicals Sector) requirements. The UK chemical industry has raised concerns about compliance costs, but emission limits are still expected to align with EU BAT levels.

United States Regulatory Framework

The US regulatory landscape differs fundamentally from the EU's integrated approach. Instead of a single permit covering air, water, waste and noise, US operators must navigate multiple overlapping frameworks, including the Clean Air Act (CAA), RCRA, NESHAP/NSPS and state-level permits.

Clean Air Act (CAA)

The CAA sets national emission standards, requires continuous monitoring for major sources and enforces pollutant-specific limits. Hazardous waste combustors, municipal waste combustors and medical waste incinerators must meet strict destruction efficiencies and limits for dioxins, mercury, HCl, chlorine gas, lead and cadmium.

2025–2026 EPA Tightening of Industrial Air Treatment Rules

The EPA (Environmental Protection Agency) is strengthening requirements for leak detection and repair, pressure-relief devices, continuous performance testing for oxidisers and carbon systems, higher-efficiency abatement and preventative maintenance.

Affected sectors include:



**Chemical
Manufacturing**



**VOC/HAP-
intensive processes**



**Facilities
using APCDs***

* (Air Pollution Control Devices, including oxidisers, carbon adsorption, condensers)

2027–2030 RTR Review Cycle

EPA conducts Residual Risk & Technology Reviews every eight years. Upcoming sectors include organic chemical manufacturing, polymer and resin production, surface coating, and printing and packaging.

Future Rulemaking (2028–2032)

EPA has signalled new MACT standards (Maximum Achievable Control Technology) for battery manufacturing, advanced composites and hydrogen production, increasing demand for high-performance VOC abatement and continuous monitoring.

The US regulatory framework is tightening, becoming more sector-specific and increasingly dependent on continuous monitoring and high-efficiency abatement systems. Operators must navigate a complex mix of federal rules, MACT standards, RTR updates and state-level requirements, all of which place greater emphasis on leak control, performance verification and robust VOC/HAP destruction.

With forthcoming MACT developments for batteries, composites and hydrogen production, industrial facilities will need more resilient, better-documented and higher-performing air-treatment systems to remain compliant in the decade ahead.

The Role of Activated Carbon in Modern Air Treatment

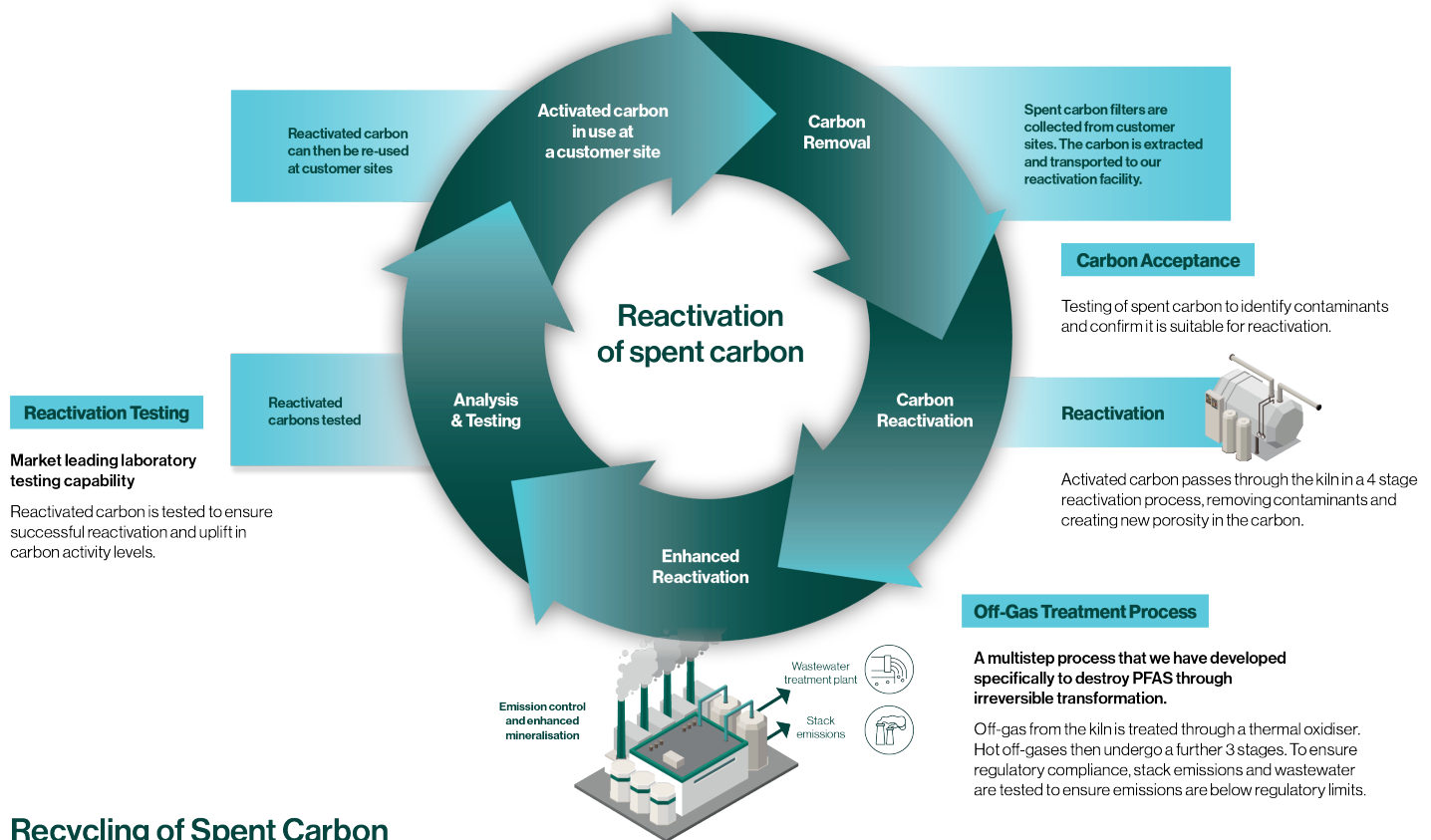
Activated carbon remains one of the most versatile and effective technologies for industrial air treatment. Its ability to capture a wide spectrum of VOCs, odorous compounds, hazardous organics, heavy metals and trace contaminants makes it indispensable across chemical manufacturing, food and drink processing, waste treatment, battery material production and landfill gas applications.

Today, effective activated carbon based abatement is no longer just a matter of choosing a media grade. Regulators expect operators to demonstrate evidence based bed sizing, defined emissions limits, continuous or frequent monitoring, and documented spent carbon changeout procedures that align with BAT and permit conditions. This shift elevates activated carbon from a consumable to a critical compliance asset.



Puragen supports operators throughout this lifecycle.

Puragen supports operators throughout this lifecycle. The process begins with carbon selection, informed by contaminant profiles, process conditions and regulatory requirements. Puragen has in house laboratory capabilities that can be utilised to validate and optimise system design and performance. Puragen tailored solutions ensure carbon beds are correctly sized and integrated into wider abatement strategies, as well as providing guidance on results from real time customer monitoring. VOCSorber® mobile carbon filters add operational flexibility, offering short-term rental options as well as long-term deployment.



Recycling of Spent Carbon via Thermal Activation

Puragen provides carbon supply, safe media changeout, and spent-carbon management, including award-winning carbon reactivation. This closed-loop approach reduces waste, lowers carbon footprint and supports long-term compliance, as well as reducing the requirement for replacement virgin media.

Puragen works as a technical partner, helping operators interpret regulatory changes, prepare for permit reviews, and demonstrate BAT-aligned performance. Puragen's integrated approach ensures operators have not only the right carbon, but also the right systems, evidence and lifecycle management to remain compliant in a rapidly evolving regulatory landscape.