Policy Brief

Integration of AquaSPICE Solutions into the Industrial Emissions Directive Mechanisms of the Best Available Techniques Reference Documents

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AquaSPICE is an EU-funded project (Horizon 2020) that brings together 27 partners from 12 countries and aims at implementing circular water use in European process industries, fostering awareness in resource-efficiency and delivering compact solutions for industrial application. The project aims to reach this objective through the development and validation of water efficiency management and optimisation methodologies, technologies and tools; the creation of a water-specific cyber-physical system; and the definition of effective methodological, regulatory and business frameworks.

1.1. Introduction

AquaSPICE aims to enhance industrial water efficiency through innovative solutions, aligning with the principles of the circular economy and industrial symbiosis. This last policy brief focuses on the potential integration of AquaSPICE solutions into the Industrial Emissions Directive (IED) mechanisms within the Best Available Techniques (BAT) Reference Documents (BREFs).

The implementation of the IED presents an opportunity for AquaSPICE to contribute significantly to improving water management practices within the BREF framework. By incorporating AquaSPICE technologies into these guidelines, the project can strengthen compliance with EU water policies while promoting more sustainable and resource-efficient industrial operations.
The following sections examine how AquaSPICE can be beneficial to the following three BREFs:

1. Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector (BREF, 2016)
2. Monitoring of Emissions to Air and Water from IED Installations (BREF, 2018)
3. Industrial Cooling Systems (BREF, 2001)

Each section will analyse the policy context, existing BATs, and the role AquaSPICE can play in enhancing water reuse, pollution control, and industrial symbiosis.

Therefore, AquaSPICE recommends to the EU Commission and the Joint Research Centre (JRC) consider the project's outcomes and integrate them in the following BREFs when they will be open for revision. Integrating AquaSPICE solutions into the Best Available Techniques (BAT) framework of the IED can significantly enhance water efficiency and sustainability in European process industries[1].

[1] For more detailed, please look at the report D7.10 European Policies and industry recommendations – project legacy, 2025

1.2. Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector (BREF, 2016)

1.2.1. Current BATs and identified gaps

The 2016 BREF on Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector outlines several BATs for wastewater management in the chemical industry, emphasizing:

- Wastewater segregation and treatment
- Reduction of hazardous substance discharges
- Use of biological, chemical, and physical treatment techniques

However, water reuse and resource recovery are not strongly emphasised, leading to a gap in the integration of circular economy principles in line with the objectives of the European Commission to leverage water reuse in industry.

1.2.2. How AquaSPICE Solutions can improve BATs

AquaSPICE introduces advanced digital tools and water-smart industrial symbiosis, which can be incorporated as BATs in the chemical sector through:

- **Water Efficiency Enhancement Applications Framework**: Provides methodologies and approaches to assess and optimally apply best practices for water recovery and reuse.
- **Advanced Industrial Water Technologies**: Supports the application of technologies enabling industrial water recovery and treatment, facilitating the reuse of treated wastewater within industrial processes.
- **Water-Specific Cyber-Physical System (WaterCPS)**: Ensures continuous and secure acquisition of dynamic data, enabling real-time monitoring and optimization of water use and treatment processes.

1.3. Monitoring of Emissions to Air and Water from IED Installations (BREF, 2018)

1.3.1. Current BATs and identified gaps

The 2018 BREF on Monitoring of Emissions to Air and Water from IED Installations defines monitoring techniques for industrial emissions to air and water, with the focus on:

- Continuous and periodic monitoring of pollutants
- Establishing reference methodologies
- Implementation of control and reporting mechanisms

However, this BREF does not fully integrate real-time digital monitoring solutions and predictive analytics, which are crucial for effective water management.

1.3.2. How AquaSPICE solutions can improve BATs

AquaSPICE aligns with this BREF by introducing advanced digital monitoring technologies, enhancing compliance and efficiency through:

- **Real-Time Monitoring Platform**: Ensures continuous acquisition of reliable, cyber-secure, and homogenized dynamic data, facilitating immediate detection of deviations in water quality.
- **Virtualization of Water Processes (Digital Twin)**: Provides a digital representation of water use-recovery-reuse processes, enabling simulation and optimization of water management strategies.
- **Intelligent Water-Aware Cyber-Physical System (WaterCPS)**: Integrates real-time data with predictive analytics to optimize water-related processes contributing to the reduction of emissions.

1.4. Industrial Cooling Systems (BREF, 2001)

1.4.1. Current BATs and identified gaps

The 2001 BREF on Industrial Cooling Systems provides guidance on efficient cooling technologies, focusing on:

- Energy and water efficiency in cooling systems
- Reduction of thermal pollution
- Use of closed-loop and hybrid cooling techniques

Despite its relevance, this BREF is outdated, and does not fully reflect emerging water-efficient cooling technologies of the last two decades. Therefore, AquaSPICE strongly recommends that the relevant European institutions revise this document and consider the outcomes of AquaSPICE and other relevant EU research projects to enhance water sustainability in industrial cooling systems.

1.4.2. How AquaSPICE solutions can improve BATs

In this case, AquaSPICE can contribute to this BREF by modernising industrial cooling water management through:

- **Water Treatment and Reuse Technologies**: Implements advanced treatment methods to enable the use of alternative water sources for cooling purposes, reducing reliance on freshwater[2].
- **Real-Time Monitoring and Management Systems**: Deploys systems to monitor water quality and operational parameters, optimizing cooling processes and minimizing water consumption.

[2] For an example, c.f. case study 3 : Sustainable and robust water system for the industrial zone of Antwerp. https://aquaspice.eu/case-study-3/

- Integration of Alternative Water Sources: Facilitates the use of treated wastewater, cooling tower blowdown or other non-traditional water sources in cooling systems, promoting circular water use and resource efficiency, and reducing environmental discharge and freshwater needs.

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