

NORMAN Joint Programme of Activities (JPA 2026)

List of scientific activities organised by the NORMAN network in 2026

We are proud to present the scientific programme which will be promoted by the NORMAN network in 2026.

The *NORMAN Joint Programme of Activities (JPA)* is defined every year by the Steering Committee, after consultation with the membership (General Assembly meeting and e-mail survey).

The final JPA and the associated budget are approved by the Steering Committee, using the following criteria:

- the level of interest of the members (results of the survey)
- the relevance of the research topic to European environmental policies
- the balance between different sectors / fields of interest
- the relative value of the proposed in-kind contribution vs amount of resources required.

For this JPA the Steering Committee has approved a budget of € 253,900, based on the expected income from membership fees of the Founding and Ordinary members. These resources will be allocated for scientific and coordination activities and regular updating and maintenance of the NORMAN Database System.

The JPA of the NORMAN network is financed by the contributions of its members (membership fees and members' in-kind contributions), always with a view to maximising synergies between research teams in the field of contaminants of emerging concern (CECs) and improving the science-to-policy interface at national, European and international level.

A summary description of each activity is presented in the following sections.

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NORMAN NDS – Maintenance and upgrading

NORMAN Database System (Activity coordinated by EI, slobodnik@ei.sk)

The **NORMAN Database System (NDS)** <https://www.norman-network.com/nds/> is the core infrastructure underpinning NORMAN activities and supporting EU policy frameworks such as the **EU Common Data Platform** and the **One Substance One Assessment (OSOA)** approach. Its strategic importance was further reinforced by major **technical, scientific and organisational achievements in 2025**, which directly justify the scope of work planned for 2026.

Key achievements in 2025

In 2025, the NDS reached a **high level of maturity and international visibility**, recording almost **14 million visits**, the majority via APIs, confirming its role as a global reference platform for environmental chemical data.

The successful upgrade of the NORMAN Database System to NDS 2.0 in 2025 represents a major milestone, aligning the infrastructure with state-of-the-art technologies and modern data standards. The new system is open-source, hosted on GitHub, and designed to enable active contributions from network members. It is built on modern, secure architecture with professional API functionality and robust system management. NDS 2.0 was officially presented at the NORMAN General Assembly in December 2025. During a short transition period, both the legacy system and NDS 2.0 will operate in parallel, with exclusive access to NDS 2.0 from mid-2026 onward.

Significant **content expansion and cooperation achievements** were also delivered in 2025, including:

- major upgrades of the **Suspect List Exchange (SLE)** and growth of the **Substance Database (SusDat)** to over 120,000 substances,
- a successful large-scale **PFAS** data integration into EMPODAT in cooperation with PARC and EU Member States, while identifying critical interoperability gaps in national data systems,
- development and beta release of **new NDS modules (Bioactivity Database <https://www.norman-network.net/nds/badb/>, Hazards and Properties Database, EMPODAT Suspect, Literature Chemical Exposure Database <https://norman-databases.org/literature/home>)**,
- advances in the **Ecotoxicology Database**, including the introduction of model-predicted mammalian toxicity thresholds (PNECs) in cooperation with the TerraChem project and ToxAI,
- development of comprehensive **API documentation** for all NDS modules to support **transparent and efficient data access and reuse**,
- enhancement of the **FAIRness** of the NDS through the development of online user accounts enabling the **assignment of DOIs** to contributed datasets via DataCite. Each dataset contributed to the NDS will thus receive a unique DOI and can be formally cited in peer-reviewed scientific literature.

These achievements generated **substantial new data flows, technical challenges and scientific opportunities**, which form the direct justification for the planned 2026 activities.

Activities in 2026

Building on the 2025 achievements, work in 2026 will focus on **consolidation, scaling and operational use of NDS 2.0**, including the **full phase-out of the legacy system by mid-2026** and continued maintenance, security and FAIR-compliant access.

A major effort will be devoted to **curation, integration and interlinking of large new datasets**, notably:

- incorporation of substances from newly expanded **SLE lists into SusDat** and **strengthening the dynamic linkage** between both systems,
- curation and publication of extensive datasets from **Joint Danube Survey 5 (JDS5)**, including target, non-target and suspect screening, passive sampling and bioassays, to support prioritisation and WG activities (see “NORMAN – ICPDR Joint Danube Survey 5”).

The **EMPODAT and EMPODAT Suspect** databases will be further expanded to manage very large datasets (including new matrices such as passive samplers), while maintaining automated data transfer to IPCHEM and addressing data interoperability shortcomings identified in 2025.

In the **Ecotoxicology Database**, 2026 activities will extend both experimental and model-based toxicity thresholds to cover thousands of substances detected in the environment and diverse endpoints (marine, terrestrial, mammalian), and will seek a common framework to manage the rapidly growing volume of model-predicted PNECs.

Further justification for 2026 work stems from the need to **finalise, populate and operationalise new and beta modules**, enhance **automated prioritisation tools** (including visualisation), and strengthen **FAIRness and transparency** through DOI assignment and improved APIs.

Close collaboration with the newly established **CWG on Data Science and AI** is envisaged with a focus on **preparatory work for future infrastructures**, notably a **Models Training and Validation Datasets Database** to support transparency and reproducibility of AI-based approaches.

Finally, the NDS team will work together with WG-4 to lay the groundwork for the design and potential development of a **Microplastics Database**, aligned with emerging EU monitoring priorities and data harmonisation needs (see **WG-4 – Roadmap and guidelines for the introduction of a Microplastics Database into the NORMAN Database System**).

In summary, the proposed task for maintenance of the NDS and its continuous upgrade in 2026 will include:

- Continuous **upgrade, maintenance of all modules; curation and upload** of newly provided datasets,
- **Curation and interlinking of all NDS modules** with new data inputs.
- **NDS Chemical Occurrence Data (EMPODAT)**: maintenance, upgrading and feeding of new data into the database; sharing the data with IPCHEM.
- **Upload of JDS5 data** into NDS, link to prioritisation modules.
- Upgrade of the **'Hazards and Properties' database for CMR/ED properties** and new datasets, plus interlinking with the prioritisation tools for target and suspect screening (see WG-1 section).
- Support to WG-2 for the upgrade of the **Bioactivity Database**, including the integration of a dedicated tool to enable consistent REP calculations and chem-BEQ applications (see WG-2 section).
- Further development of the **API portal** allowing for automated data sharing with external databases.
- Assigning **DOIs to newly contributed datasets** in the NDS.
- Further development of the **Literature Chemical Exposure Database** (task supported by TerraChem project); upload of already available datasets; establishment of a workflow for automated processing of AI-obtained data into the 'NORMAN format'.
- Further development/upgrade of **visualisation tools** in the NDS and prioritisation tools.
- Finalisation of the **prioritisation tool for suspect screening** data, based on **EMPODAT Suspect** and currently under development (see also EMPODAT Suspect Database - https://norman-databases.org/empodat_suspect/home).
- Upgrade of **EMPODAT Suspect** module to accommodate NTS passive sampling (suspect screening) data from JDS5 as a separate matrix.
- Upload of new data from JDS5 and Black Sea EU4EMBLAS projects into the **ARBs/ARGs module**.
- Upgrade of **Substance Factsheets module in the NDS 2.0**. (link to prioritisation modules).
- Development of the **Models Training and Validation Datasets Database** (if approved, in collaboration with Data Science CWG).
- Preparation for **potential development of the Microplastics Database** (in collaboration with WG-4).

NORMAN Suspect List Exchange (NORMAN-SLE)

NORMAN Suspect List Exchange (Leader: LCSB, Luxembourg emma.schymanski@uni.lu)

The NORMAN Suspect List Exchange (NORMAN-SLE) is an initiative of the 2015 Joint Programme of Activities and is an established central access point for NORMAN members (and beyond) to find suspect lists relevant for their environmental monitoring questions.

The NORMAN-SLE and the compiled suspect list "NORMAN SusDat" have become the cornerstone for all NORMAN Database System (NDS) modules and prioritisation efforts. Both have been very highly prioritised by members in recent JPAs.

The NORMAN-SLE activity involves the addition of new lists to the Suspect List Exchange, which then feed into SusDat, which has become the chemical database behind all NDS modules.

The 2022 NORMAN-SLE publication (DOI: 10.1186/s12302-022-00680-6), with 97 co-authors, demonstrates both the relevance of the initiative and the breadth of community involvement. Since then, NORMAN-SLE has continued to expand, reaching > 133 lists by the end of 2025 and an update publication in preparation.

Activities in 2026 will continue and be further expanded, building on the progress achieved in recent years, including:

- Work together with the NORMAN SusDat team to develop approaches for curation/merging between NORMAN-SLE and NORMAN SusDat.
- Development of a consolidated database to provide updates to NORMAN-SusDat / NDS.
- Website - development of a new interface to “modernise” the SLE (prototypes presented).
- Addition of new lists from external contributors when they become available.
- Addition/update of contents in existing lists as required.
- Addition of new lists strategically selected to fill identified knowledge gaps.
- Addition/update of lists to specifically save/register/link transformation product information.
- Archiving of all datasets on Zenodo (<https://zenodo.org/communities/norman-sle>).
- Deposition of all substances/lists in PubChem – where possible.
- Automation of various aspects of the SLE (statistics, curation, etc.).
- Continuing development of new strategies to deal with UVCBs.
- Further development of strategies to deal with tentative/unknown/related structures.
- Publication: NORMAN-SLE contribution update (update of 2022 article), relaunched website and/or NORMAN-SLE/SusDat database once ready.

Beyond its role as a key input to the Substance Database (SusDat), and consequently as the chemical backbone of all NDS modules, NORMAN-SLE maintains vital links with the Digital Sample Freezing Platform (DSFP). These links are essential to support retrospective screening and early-warning activities, as well as the work of the Prioritisation Working Group and several activities within the Cross-Working Group Activity on Non-Target Screening (CWG-NTS).

Integration of NORMAN substances, annotation content and classification tools into PubChem further supports the development of future NTS tools and advanced classification browsers. There is also considerable overlap with ELIXIR activities, in particular within the ELIXIR Toxicology community. In addition, NORMAN-SLE represents a key component of the PARC initiative, the ZeroPM project and several other EU-funded initiatives.

FAIR-TPs website (new addition to the NORMAN Database System)

FAIR-TPs (Leader: LCSB, Luxembourg emma.schymanski@uni.lu)

The NORMAN-SLE (see NORMAN-SLE section) contains a wealth of transformation product information that is difficult to appreciate and explore. The FAIR-TPs website (<https://fairtps.lcsb.uni.lu>) was designed to facilitate browsing TP data available in PubChem (much of which comes from the NORMAN-SLE) and provide users with the option to contribute open TP data to expand this knowledgebase.

FAIR-TPs provides advanced visualisation of transformation reactions, including interactive exploration of reaction networks and multi-step pathways. The platform supports image downloads; data exports in CSV, XLSX, patRoon and MetFrag formats to facilitate MS workflows; and access to thumbnails, identifiers, precursor–transformation product (TP) relationships, and compound-level statistics.

An overview of datasets, top mass differences, reaction counts, transformation types, and end-product precursor networks is available at <https://fairtps.lcsb.uni.lu/stats>.

FAIR-TPs links two easily accessible templates: the “transformations” template and the BART template which can both be used to provide data to FAIR-TPs, as described on the website. FAIR-TPs provides an overview of dataset coverage and enables detailed inspection of TP networks and users can explore parent compounds and their transformation products across sources

Activities in 2026

To enable the NORMAN community to fully benefit from these developments, FAIR-TPs will be integrated as an external database within the NORMAN Database System, following an approach similar to that used for MassBank.EU. This integration will extend the scope of the NDS, providing a new, dedicated resource for transformation products, addressing a critical gap in existing NORMAN infrastructures, while avoiding parallel or duplicative development efforts.

FAIR-TPs complements and strengthens established NORMAN databases such as NORMAN-SLE, SusDat and MassBank, while building on content that is already integrated into PubChem, thereby enhancing interoperability and international visibility.

Ongoing discussions with the envPath team aim to ensure complementary rather than overlapping functionality, reflected in the provision of two harmonised template formats. In addition, the possibilities for data submission to

FAIR-TPs will serve as a “test bed” for future data integration workflows, informing and de-risking similar developments for NORMAN-SLE and other NDS components.

As the FAIR-TP platform is already operational, the primary activity under this JPA will focus on its technical integration into the NDS.

MassBank Europe and RMassBank

MassBank Europe / RMassBank - Continuous development of MassBank Europe and related activities (emma.schymanski@uni.lu and anjana.elapavalore@uni.lu LCSB Luxembourg) in co-operation with Tobias Schulze, Steffen Neumann (IPB Halle) and Juliane Hollender / Caro Huber (Eawag). Contact: massbank@massbank.eu

MassBank.EU is one of the key components underpinning the NORMAN Database System (NDS) via collection of mass spectra in an open library that is integrated in many software systems and resources. MassBank is also a core resource in NFDI4Chem and ELIXIR and receives some development funds through these initiatives. This JPA describes the continuous development and upgrade of MassBank.EU and related activities that are relevant for the NORMAN Network following the release of MassBank3 in 2025 (published in *Nucleic Acids Research*, Neumann *et al* (2025) DOI: [10.1093/nar/gkaf1193](https://doi.org/10.1093/nar/gkaf1193)). Strengthening open data infrastructures in Europe is a critical priority, and MassBank.EU is a cornerstone of this effort.

Activities in 2026 will focus on the following items:

- Upload of mass spectra to MassBank. All NORMAN members are welcome to contribute!
- Further maintenance / development of MassBank server platform (e.g. database and applications programming interface, record curation, import/export of records, standardisation of curation rules).
- Improved cross-integration of MassBank and NORMAN-DSFP (see “NORMAN DSFP”).
- Fostering the collaboration with MassBank.JP members, reinitiated in the past years.
- Fostering the integration of MassBank with other mass spectral and metadata platforms (e.g. MoNA, PubChem, GNPS, NDS, MS-DIAL, RforMassSpectrometry, etc. – where possible).
- Fostering the discussion with vendors for better integration of vendors’ software with MassBank.
- Further maintenance / development of RMassBank and other software for contributing spectra to MassBank.
- Prioritising compounds missing in MassBank for measurement (matches to SLE, priority mixtures).
- MassBank.EU contributor publication on top of the update paper with key developers.

NORMAN DSFP (Digital Sample Freezing Platform)

DSFP maintenance and upgrading (Leader: EI alygizakis@ei.sk)

Over the years, the DSFP <https://dsfp.norman-data.eu/> has evolved from a prototype into a production-ready system with advanced informatic capabilities. It enables archiving, processing, analysis, data mining, and rapid retrieval of information for thousands of contaminants of emerging concern (CECs) contained in HRMS datasets. The platform is fully aligned with NORMAN’s strategic objectives (science-to-policy interface), including non-target screening (NTS), risk prioritisation schemes and automated extraction of chemical exposure information for early-warning systems.

As part of the NORMAN Database System (NDS), the DSFP represents a unique, scalable, and continuously expanding repository of HRMS data from environmental samples. It already serves as a key resource for prioritisation exercises supporting scientific and regulatory use. Its continued development is crucial for enabling broader community participation, strengthening interoperability, and meeting the growing needs of NTS-driven environmental pollution assessments in Europe and beyond.

In 2025, DSFP was enriched with thousands of samples, harmonized metadata, publicly accessible meta-data schemas and APIs enabling advanced data discovery, instant search, and interconnection with other NORMAN modules. The next step is to extend DSFP beyond its current capabilities and align it with the accelerating needs of the non-target screening (NTS) community.

Activities in 2026

The 2026 JPA focuses on expanding DSFP into a fully integrated ecosystem for HRMS data archiving, screening, visualisation, interoperability, and early-warning applications. Specific activities for 2026 include:

- Finalisation of the **manuscript** describing the new informatics architecture and upscaling strategy of DSFP.
- Development and validation of the **DSFP Desktop application** for suspect screening, enabling laboratories to run **screening workflows locally** while **connecting to DSFP services via APIs**. This approach will distribute the computational workload across contributing partners, support screening and indexing of all DSFP collections,

and deliver instant search capabilities. The resulting outputs will also enable the continuous and systematic population of EMPODAT-Suspect.

- Release of the **batch import functionality for importing new samples**, finalising the development initiated in 2025.
- Integration of a **chromatographic and spectrometric visualisation module** into the DSFP, based on previous SQUAREF developments (cooperation with INERIS and BRGM), allowing users to inspect chromatograms, spectra, and fragmentation data directly within the platform.
- Exploration of **collaboration opportunities with other major platforms**, with priority on enabling export of MS/MS spectra in MassBank-compatible format and exploring API-level interoperability with the MassBank consortium.
- Implementation of an additional layer of access control, authentication and data-sharing mechanisms, ensuring that **each user is assigned a unique private key to monitor downloads and resource usage**. This will also provide a robust framework for the controlled sharing of sensitive datasets.
- Maintaining and supporting current and future users, including fostering connections with PARC and other EU-funded projects involving NORMAN members.
- Enhancing **interoperability and metadata harmonisation** with national and international initiatives, ensuring alignment with evolving HRMS and FAIR-data standards.

NORMAN BioActivity Database

NORMAN BioActivity Database (BADB) (Leader: INERIS Abd-el-rahman.EL-MAIS@ineris.fr in collaboration with BfG Schuettler@bafg.de, KWR Water Research Institute Astrid.Reus@kwrwater.nl; Miina.Yanagihara@kwrwater.nl, UBA Peter.VonderOhe@uba.de, and EI slobodnik@ei.sk)

A comprehensive chemical bioactivity database is essential to support effect-based monitoring and hazard assessment. Although the current **NORMAN Bioactivity Database** <https://www.norman-network.net/nds/badb/> covers a broad range of compounds (over 1,000 entries across diverse compounds, bioassays, and modes of action), important gaps remain. For example, one of the limitations is the absence of a **tool to calculate Relative Effect Potency (REP) values and quantify the contribution of detected chemicals to observed bioassay responses**, expressed as **Chemical Bio-analytical Equivalents (Chem-BEQ)**.

Within **PARC Task 4.2 (EDC Pilot Study)**, a large-scale assessment was conducted to estimate Chem-BEQ contributions for nearly 170 chemicals detected in surface water, air, and soil. A **tiered strategy** was applied to derive **REP values**, prioritising: (i) in-house EC₁₀/EC₅₀ data generated using the same bioassays as those applied to environmental samples, (ii) values retrieved from the scientific literature, and (iii) re-modelled potency estimates derived from ToxCast raw data following quality control and concentration–response curve fitting.

This approach has been completed for **approximately 170 chemicals across 10 bioassays** targeting key nuclear receptors and thyroid hormone transport.

The exercise demonstrated that an **automated solution** would substantially improve efficiency, consistency, and reproducibility. In particular, experts identified the need for a tool capable of retrieving raw bioassay data, automatically calculating REP values, and integrating Chem-BEQ estimates to assess chemical contributions to observed biological effects. Based on these conclusions, the development of such a tool within the NORMAN Database System is proposed as part of the JPA 2026.

Activities 2026 and beyond

The proposed activity will focus on consolidating, structuring, and expanding chemical bioactivity data to support consistent REP calculations and chem-BEQ applications. Specifically, the goal is to:

1. Improve and harmonise the existing Bioactivity Database:
 - Define and implement mandatory metadata fields (e.g., reference compound, assay conditions, endpoint definitions).
 - Harmonise data formats and quality criteria across existing and new datasets.
2. Enrich the database with the 170 compounds investigated (10 bioassays) within PARC:
 - Integrate EC_x values retrieved from in-house sources or from peer-reviewed literature.
 - Incorporate the newly re-modelled ToxCast EC₅₀ dataset for ~170 compounds across 10 assays.
 - Perform quality control and flag uncertainties where necessary.
3. Develop a user-friendly REP calculation module:
 - Create a tool that allows users to compute REPs by selecting assay type, endpoint (EC₁₀/EC₅₀), and reference compound.
 - Enable export of REP and chem-BEQ outputs for downstream risk assessment workflows.

- Provide documentation and guidance for standardized use across laboratories.

CWG-AI: Data Science and Artificial Intelligence (AI) for Monitoring of Emerging Environmental Substances

CWG-Data Science and AI: Data Science and AI for Monitoring of Emerging Environmental Substances: (Activity coordinated by University of Stockholm anneli.kruve@su.se and UFZ Jana.Schor@ufz.de).

Over the years, NORMAN has made a substantial contribution to the collection and organisation of data on emerging substances. Its activities include structuring high-resolution mass spectrometry data for known contaminants within MassBank, curating and publishing suspect lists through NORMAN-SLE, enriching the substance universe with unique identifiers via NORMAN SusDat, and collecting and processing data to support substance prioritisation activities, among others. At the same time, new data science tools, often called AI, are changing the search, application, and collection of new data.

In October 2024, a NORMAN network workshop entitled “Artificial Intelligence for environmental monitoring, assessment and prioritisation of chemicals and their mixtures” was held in Leipzig. Building on the outcomes of this workshop and the Joint Programme of Activities (JPA) 2025, discussions were initiated on the establishment of a NORMAN interest group on Data Science for the Monitoring of Emerging Environmental Substances.

To better understand the interests, expertise, and ongoing activities of NORMAN members in this rapidly evolving field, a dedicated survey was conducted in 2025. Preliminary results available at the end of 2025 indicate a strong interest among NORMAN members in jointly formulating research questions and identifying concrete opportunities for collaboration, particularly at the interface between data-driven research and science-policy support.

Activities 2026

Based on these findings, the CWG on Data Science and AI will focus on the following tasks.

- Summarising the **findings from a survey** conducted in 2025 for mapping the interest, experiences, on-going AI based research activities of NORMAN members as well as identifying the areas where NORMAN has most to contribute to the research scene but also at the science-policy interface. A structured overview will be delivered, identifying **priority themes, strengths, gaps, and opportunities for coordinated NORMAN activities** in data science and AI.
- A **short communication on ‘hot topics for AI driven environmental research’** will be written based on the results of the survey.
- A dedicated **match-making event** will be organised to facilitate discussions among NORMAN members interested in developing **joint AI-based research or infrastructure projects**. The event will aim to connect complementary expertise across monitoring, analytical chemistry, effect-based methods, and data science.
- Compiling an **overview of the datasets available through NORMAN** participants that are **relevant for data science and AI applications**. This information will be made accessible through NORMAN channels to allow improved visibility and accessibility of NORMAN-related datasets for AI and data science applications.

The proposed activities have **strong synergies with existing NORMAN infrastructures** and working groups, in particular SusDat, MassBank, and DSFP. AI and data science approaches have significant potential to:

- enhance the use, integration, and curation of data deposited in these databases,
- support the identification of gaps in chemical space coverage, and
- guide future data acquisition efforts.

AI tools will also help direct further activities related to:

- effect-based data (e.g. bioassay endpoints, effect-directed analysis),
- analytical characterisation (e.g. HRMS, chromatography, ion mobility spectrometry), and
- sampling strategies (e.g. biota, marine environments, indoor environments).

Overall, the CWG on Data Science and AI will contribute to strengthening **NORMAN’s role as a hub for data-driven environmental chemical monitoring** and as a bridge between research innovation and science-policy needs.

WG-1 Prioritisation of CECs

Working Group N°1: Prioritisation of CECs (Activity coordinated by INERIS valeria.dulio@ineris.fr in collaboration with EI slobodnik@ei.sk, alygizakis@ei.sk and UBA peter.vonderohe@uba.de).

Better chemicals management, in line with the objectives of the EU Chemicals Strategy for Sustainability and the Zero

Pollution Action Plan, relies on the timely identification and control of chemical risks and environmental pressures through efficient monitoring and knowledge of intrinsic properties, uses and emissions of chemicals. Given the very large number of substances present in the environment, transparent, science-based prioritisation approaches are essential to guide regulators and decision-makers in identifying substances of concern, supporting Early Warning Systems (EWS), and timely risk management actions.

Within this policy and science context, the activities of NORMAN WG-1 aim to strengthen the integrated knowledge base supporting chemical prioritisation, EWS, and OSOA-relevant assessments by:

- ensuring that relevant and policy-relevant information required for the assessment of chemical hazards, exposures, and risks is collected, curated, and regularly updated
- integrating and exploiting available data to derive action-oriented prioritisation lists, where each prioritisation outcome is clearly linked to a specific regulatory, monitoring, or risk management objective
- continuously improving and updating prioritisation methodologies through the integration of innovative approaches and tools (e.g. *suspect and non-target screening, bioassays, etc.*) to enhance the value of the prioritisation work and ensure a more reliable and meaningful interpretation of the results, particularly for the early identification of warning signals.

Activities 2026

Task 1: Support the prioritisation work of the Commission services at European level and provide comment on relevant consultation documents (PARC, EWS, where relevant) (ALL)

NORMAN participates as a stakeholder in the **DG ENV Chemicals Working Group** and intends to further contribute to activities related to the review of the **WFD Priority Substances and Watch List**, now integrated into the OSOA Regulation (Regulation (EU) 2025/2455, in force since January 2026), as well as to the planned Common Data Platform on Chemicals (CDPC) managed by ECHA.

In addition, NORMAN WG-1 is committed to active **collaboration with the PARC** partnership on prioritisation-related topics, in particular the European **Early Warning System**.

Task 2: Collection of raw data and prediction of toxicity and physico-chemical properties in support of prioritisation (UBA / EI / NKUA / DERAC / INERIS) (permanent activity to be pursued in 2026)

WG-1 will work at the **prediction** of physico-chemical and fate & transport parameters (i.e. BCF, Koc) for **B and M classification** of all SUSDAT compounds based on **ToxAI model**.

For the **P classification**, WG-1 will work at the development of a **quantitative model for persistence**, based on a set of **8,000 reported degradation half-lives for the OECD 302 tests**. The model will allow to **predict the DT50 in water and soil for all compounds in SUSDAT** that are covered by the model domain (this activity was suggested in 2025 and will be performed 2026).

As regards **ecotoxicity**, in **2025 experimental ecotoxicity data from model training sets** were collected and made available for uploading in the ECOTOX module. Based on these training sets, new models were developed for 12 fish species, 2 crustaceans and 1 insect species for **acute effects**. The data uploading of the associated predictions in the ECOTOX module will be completed in the first half of 2026.

In addition to the above, the development of **new models for chronic effects in fish, daphnia and algae for aquatic species** started in 2025. The predictions will be available in the ECOTOX module in 2026.

For all predicted data, considerations about the applicability domain and reliability scores are already included as part of the metadata / DCTs in the Hazard properties module. It is therefore proposed to derive a common

Generalised Application Domain for NORMAN models in WG-1, following the OECD principles on QSAR models. **Experts in modelling and machine learning** will be invited to work together to reach **consensus** on the predictive models to be used.

Task 3: Collection of existing hazard classifications and quality targets (e.g. PNECs) and derivation of new ones based on prediction models in support of prioritisation (UBA / NKUA / EcotoxCentre / DERAC / EI) (permanent activity to be pursued in 2026)

The collection and compilation of regulatory quality targets for various matrices, including re-use, soil and marine waters, will be pursued in 2026 (see also WG-5, WG-7 and WG-8).

Building on the approach used in the 'Hazard Properties' module for automated PBMT classification, the current **PNEC derivation module will be enhanced** to enable **automated calculation of the Lowest PNEC**. This upgrade will

incorporate new data entries – particularly predictions based on chronic effect data – and apply the most appropriate (often lower) assessment factors. These improvements will be highly appreciated by regulatory bodies that rely on NORMAN's prioritisation results.

In addition, the upgrade will support the derivation of **more robust marine PNEC values** by integrating chronic data, thereby strengthening prioritisation of compounds in the **marine aquatic environment**. This work will be carried out in collaboration with WG-8 and addresses tasks delayed from previous JPAs.

PNECs for mammals: PBPK models have been developed in 2025 to derive PNECs expressed as internal tissue concentrations (starting with liver as a reference matrix). They will be applied to all compounds in SUSDAT to support the prioritisation of substances in biota in the terrestrial and marine environment.

WG-1 will continue to **promote and coordinate the participation of Ecotoxicity Experts to derive and approve (i.e. vote for) new or revised Lowest PNEC values** for substances of the SusDat list, with a specific focus on substances that were highly prioritised in EU projects using the NORMAN Prioritisation Framework. The aim is to progressively replace predicted PNEC values for substances prioritised in Cat 3 and 5, by experimentally-based PNEC values.

Task 4a: Consolidation of the Phys-Chem and Hazard properties module and integration in the NORMAN Database System and Prioritisation Tool (UBA, INERIS, EI in collaboration with WG-1 partners)

The “Phys-Chem and Hazard” module includes the following components: Phys-Chem (experimental and predicted data collection); Fate & Transport (experimental and predicted data collection); PBMT derivation; PBMT classification; CMR and ED classification (still under development).

The classification system ensures transparency and reliability:

- Automated classification follows the criteria defined in the CLP regulation, but adds new sub-classes (e.g. Suspect B) to better support screening and prioritisation.
- For predicted data, both the applicability domain and the model-defined reliability score are considered for final classification.
- Expert oversight is maintained, allowing manual validation and control over the data.

Plans for 2026:

- The module and its associated features will be finalised to enable full operational use within the Prioritisation Tool.
- A new functionality will be introduced to allow uploading of experimental data (e.g., a new BCF study) to refine hazard classifications. This enhancement will give experts the ability to review and adjust automated classifications generated from model predictions.
- The module's data will be continuously enriched with new data and model predictions, including JANUS data from the VEGA-Hub, PEPPER (Eawag), etc.

Task 4b: Guidance for selecting PMT/PBT Classification Tools (INERIS, RIVM, NIVA, IVL, NILU, IRFMN, UBA)

This task will develop guidance to support decision-makers in selecting appropriate PMT/PBT classification methods for regulatory use, building on existing PBMT tools developed by the research community, including:

- NILU/NIVA PikMe app – incorporating enhanced CompTox data and predictive models (e.g., OPERA)
- IVL Hazard Profiling Tool – providing comprehensive hazard assessment capabilities
- RIVM PMT/PBT Assessment Tool – supporting evaluation of persistence, mobility, and toxicity.

This initiative aims to ensure consistent and informed selection of classification approaches across regulatory and research contexts, in line with the OSOA approach.

Task 5: Compilation of data / information regarding ‘Use categories’ and ‘Chemical Functional Use’ for all SusDat compounds (LCSB, supported by INERIS / UBA / EI)

The aim is to integrate information on the use(s) of the compounds in the NDS to ensure that each substance in SusDat is accompanied with information about uses and functional categories. This information is crucial for exploitation of priority substance lists and should be directly linked and searchable from the Substance Factsheets, SusDat and the Prioritisation tool. The first stage will be coupled with database upgrades behind the scenes of NORMAN-SLE, so that information from existing NORMAN-SLE lists can be integrated within SusDat (see NORMAN-SLE JPA). In a separate activity, a student will work on an interactive chat-bot to help users explore use information for compounds, using the open corpus of use information in PubChem, CompTox and regulatory documents as a basis. This will provide users with an interactive experience, which will be easier for navigating the complex use information for many compounds. Major categories will be stored within SusDat as possible.

Groundwork for NORMAN-SLE upgrades has been done in 2025 and finalization is in progress.

The student worker for 2025 was delayed and will start to work on the chat-bot in January 2026. The budget approved

for 2025 will be used for the JPA 2026.

Task 6: Prioritisation framework: follow-up activities to integrate and test the new workflow as part of the Prioritisation Tool in the NDS (EI, INERIS, UBA, ALL) (ongoing activity to be pursued in 2026)

Thanks to the developed backend infrastructure (DSFP API and data schemas) in 2025, it was possible to start the implementation of the workflow outlined in the prioritisation paper, leveraging both suspect screening and target monitoring data for substance prioritisation. A prototype of the new prioritisation tool was under development at the end of 2025.

Plans for 2026: Complete the development of the prioritisation tool. The tool will be applied on the datasets of the JDS5 monitoring campaign.

Task 7: Improvement of the features of the prioritisation tool (programming activities) (ALL) (EI, INERIS, UBA, UFZ, NKUA, OVAM, DERAC, LCSB, KWR)

A prototype of the visualisation tool was developed in 2024 (<https://norman-data.eu/Priportal>), but follow-up work has not progressed in 2025 due to time constraints and engagement in other tasks of WP1. The objectives of the task remain the same and will be pursued in 2026.

Task 8: Prioritisation of substances from 5th Joint Danube Survey 5 (collaboration with ICPDR) (INERIS, UBA and EI in collaboration with WG-1 partners) (postponed from JPA 2025)

This task will use as basis the JDS5 data generated in 2025 which are expected to be available and stored in the NDS by early 2026.

Prioritisation of contaminants in the Danube River Basin with the following specific objectives:

- Identification of River Basin Specific Pollutants (update)
- Proposal for a candidate Watch List
- Changes / Progress observed from the previous Surveys

The work will be based on the extended NORMAN Prioritisation Framework using target and suspect screening data.

Task 9: Testing state of the environment indicators in the Danube River Basin (NORMAN collaboration with 5th Joint Danube Survey) (UBA, INERIS, EI and ALL) (postponed from JPA 2025)

This task will use as basis the JDS5 data generated in 2025 which are expected to be available and stored in the NDS by early 2026.

The aim is to integrate site-specific risks of individual substances into an overall assessment of mixture toxicity by mapping the co-occurrence of chemical contaminants across European environmental compartments. Indicators such as the number of substances exceeding the lowest PNEC or the total mixture risk at a site (in line with the indicators developed in collaboration with EEA) could support the assessment of environmental quality trends, inform policy decisions, and contribute to the EEA Zero Pollution monitoring.

Task 10: NORMAN contribution to Early Warning System for Europe (UBA, EI, INERIS, KWR, OVAM, EAWAG, SLU, NKUA, NIVA, UFZ) (postponed from JPA 2025)

NORMAN has been working for many years on the topic of an EWS concept, with NormaNEWS, DSFP, prioritisation scheme by action category, etc. and we believe that NORMAN can significantly contribute to the on-going collective efforts together with PARC and the EEA in building an EWS for EU.

NORMAN will pursue the contribution to PARC T8.2 by providing signals obtained from retrospective suspect screening of HRMS data (DSFP) and target monitoring data (EMPODAT) and developing new indicators customised for the identification of early warning signals.

With this proposal, WG-1 intends to contribute to the development of a concept to support for a European EWS, the detection of signals based on non-target and target screening data for compounds in the NDS, as well as through the development of a DCT to compile additional evidence from research papers and other public sources regarding emerging hazards (e.g. new effects), sources (e.g. new products), increasing exposure (e.g. first or increasing detection in DSFP) or observed impacts.

These signals could be compiled and stored in a new EWS module until the Common Data Platform on Chemicals (CDPC) managed by ECHA becomes operational. An online form will allow experts to register their findings in a harmonized way. These "signals" can then be analysed by experts (for specific topics), or by the next generation of large language models (LLM), also known as General Artificial Intelligence (GAI). Even if the next generation models are not yet able to link the multiple lines of evidence from the various signals submitted, NORMAN should start to compile the information needed to be ready once the GAI is.

Task 11: Collaboration with other WGs to support prioritisation of contaminants in new compartments

- Prioritisation of contaminants in soil (see WG-7).
- Prioritisation of contaminants in the marine environment (see WG-8)
- Prioritisation of contaminants in re-used matrices (see WG-5).

WG-2 Bioassays

Working Group N°2: The value of bioassays and biomarkers in water quality monitoring programmes (Activity coordinated by Goethe University Frankfurt, Henner Hollert Hollert@bio.uni-frankfurt.de, Sarah Johann johann@bio.uni-frankfurt.de and Francisco Sylvester sylvester@bio.uni-frankfurt.de)

Task 1: Two-day Workshop on harmonising the NORMAN bioassay battery across environmental compartments

Following discussions at the hybrid WG-2 meeting in November 2025 and the NORMAN General Assembly 2025, it was agreed to organise a two-day workshop in spring 2026 to strengthen joint WG-2 activities and to harmonise the NORMAN bioassay battery for use across different environmental compartments and NORMAN working groups (e.g. WG-3, WG-5, WG-7, WG-8). The workshop will address the integration of additional endpoints (e.g. neurotoxicity, PFAS-related effects) and the implementation of effect-based trigger (EBT) values. Based on the outcomes, a **policy paper** will be developed presenting the **harmonised effect-based methods (EBM) battery and an updated EBT evaluation concept**.

The workshop will also cover related topics, including WG-2 contributions to the **Bioactivity Database**, recent **advances in AI**, links with WG-3 JPA on **Effect-Directed Analysis (EDA)**, innovative **behavioural assays**, **eDNA- and eRNA-based methods** (including transcriptomics), **adverse outcome pathways**, and the further **integration of effect-based methods** into **European** chemical and environmental regulation. Future activities in the field of **-omics**, including the potential establishment of a dedicated subgroup, will also be discussed.

Task 2: Finalisation and publication of the JPA on linking EBMs and EDA for assessment of temporal trends in suspended particulate matter as a joint activity of WG2 and PARC (follow-up JPA 2024 and JPA 2025)

Since 2005, suspended particulate matter (SPM) samples are systematically collected from major German rivers, including Rhine, Elbe and Danube for the German Environmental Specimen Bank (ESB) (<https://umweltprobenbank.de/en/>, Zizka et al 2022, ESEU, <https://doi.org/10.1186/s12302-022-00618-y> and Fliedner et al. 2022, STOTEN, <http://dx.doi.org/10.1016/j.scitotenv.2022.158430>).

The samples have been analysed for a range of inorganic and organic pollutants with target, cumulative and HRMS-based non-target screening methods. In addition, DNA metabarcoding data from the SPM samples are available for fish and macrozoobenthos communities.

Fish and SPM from the Environmental Specimen Bank were also analysed (as part of JPA 2024/25) using effect-based methods and transcriptomics in early life stages of *Danio rerio*. The JPA 2024/25 and a PARC activity from ORU, UBA and SLU could identify severe temporal differences in the effect-patterns of the SPM.

In 2025, a joint NORMAN–PARC workshop was held at Fraunhofer IME in Schmallenberg. Building on this, a joint activity was initiated under the JPA 2025 to investigate suspended particulate matter from the Environmental Specimen Bank using a broad battery of effect-based methods. The aim of this activity is to strengthen collaboration between NORMAN WG-2 and PARC and to improve the understanding of temporal trends in biological effects associated with SPM.

As part of this activity, selected effect-based methods from the NORMAN/SOLUTIONS bioassay battery (Brack et al., 2019, ESEU, <https://doi.org/10.1186/s12302-019-0192-2>; e.g. PFAS, ER, p53, anti-AR CALUX, micro-EROD, FET, Ames) were applied to extracts of SPM.

To identify the drivers of toxicity, the effect-based method results will be compared with existing chemical exposure data, effect-directed analysis results for the same SPM samples, and transcriptomic data from fish stored in the Environmental Specimen Bank. This comparison will be performed using mass-balance approaches and AI-based methods.

In 2025, a subset of five bioassays was applied at GU to identify suitable samples for an interlaboratory comparison study. In 2026, the SPM extracts will be distributed to NORMAN partners to enable comprehensive toxicological profiling. The results will be discussed in a dedicated session held back-to-back with the NORMAN General Assembly meeting in 2026.

Task 3: Blueprint for Linking Ecotoxicity to different Levels of Biodiversity Damage, Building on and Integrating various NORMAN Data Streams (Goethe University Frankfurt, [Fantke@em.uni-frankfurt](mailto:Fantke@em.uni-frankfurt.de) and Hollert@bio.uni-frankfurt.de; UBA, Gabriele.Treu@uba.de in collaboration with RIVM Leo.Posthuma@rivm.nl)

Numerous efforts aim to link chemical toxicity in organisms to damage on biodiversity in order to establish quantitative relationships between chemical exposure and biodiversity impact. Despite the availability of various metrics and data sources, there is currently no consensus on the appropriate metrics or operational workflow for chemical prioritisation based on biodiversity impacts. Consequently, there is an urgent need for a practical, small-scale workflow that demonstrates how data and models can be effectively integrated into a “blueprint” for linking chemical toxicity to one or more levels of biodiversity damage using specific metrics. Such a blueprint could serve as a starting point for larger-scale analyses across different regions, ecosystems, and stressors, providing complementary lines of evidence for early warning systems and chemical prioritisation, while also guiding future data generation and model development.

The main goal of this activity is therefore to illustrate through a small-scale “blueprint” workflow how chemical pollution can be linked to one or more biodiversity measures.

Phase 1 of the project began in 2025 and focused on developing the overall concept. This phase led to the establishment of task-specific working groups, which initiated discussions on the suitability of different biodiversity metrics, compiled an inventory of existing and ongoing studies linking chemical pollution to biodiversity impact, and drafted an outline for a manuscript summarising these efforts.

Building on the outcomes of Phase 1, the **ultimate goal** of Phase 2 (2026) is to: (a) integrate existing example datasets, such as biomonitoring data, target and suspect screening results from monitoring programmes, field studies on chemical effects, and toxicity data, into a small-scale operational workflow; (b) provide an overview of suitable biodiversity metrics; (c) formulate specific recommendations for expanding or scaling up the workflow and associated metrics as complementary criteria for chemical prioritisation; and (d) discuss options for quantitatively linking ecotoxicity data to biodiversity damage as a line of evidence for chemical management.

Given the complexity of this task, the initial practical activities of **Phase 2** (starting in 2026) will focus on **compiling relevant metrics, data, models, and tools** to link ecotoxicity and biodiversity aspects, and integrating them into a **scientific article** involving all contributing experts.

Task 4: Testing a NORMAN Roadmap on Chemicals and Biodiversity (Goethe University Frankfurt sylvester@bio.uni-frankfurt.de, UFZ Schor@ufz.de, RWTH pedro.inostroza@rwth-aachen.de, and BfG beckers@bafg.de)

The project aims to use NORMAN's unique interdisciplinary expertise to: (i) identify critical research gaps that need to be addressed to better inform policy, (ii) contribute to a NORMAN research roadmap on chemicals and biodiversity, and (iii) develop a pilot case-study database for hypothesis testing and methodological improvement at the science-policy interface.

More details are provided in the dedicated section (see “Testing a NORMAN roadmap on chemicals and biodiversity”).

Activities from previous JPAs

- **Remobilisation of pollutants during extreme flood events** (ongoing) (Leader: Goethe University Frankfurt Hollert@bio.uni-frankfurt.de). The evaluation, statistical analysis of the results and drafting a manuscript for a joint publication is under preparation by Goethe University. The WG-2 workshop in 2025 provided participating labs the opportunity to meet and discuss the results and the draft for the joint publication as well as the elaboration of proposals for consideration of flood-driven pollutant remobilisation in the implementation of the WFD. A publication is under preparation. Finally, as agreed in the JPA, the project leader will feed the chemical and bioanalytical monitoring data in the NORMAN databases (EMPODAT and bioassays modules).

Task 6: Support the work of the Commission (EBM – CIS WFD Activity) (Leader: Goethe University Frankfurt Hollert@bio.uni-frankfurt.de)

NORMAN WG-2 will continue to support the activities of the Commission as regards the implementation of Effect-Based Methods in the *Recast Water Framework Directive* and other relevant directives.

WG-2 Testing a NORMAN Roadmap on chemicals and biodiversity

Testing a NORMAN roadmap on chemicals and biodiversity (Goethe University Frankfurt sylvester@bio.uni-frankfurt.de, UFZ Schor@ufz.de, RWTH pedro.inostroza@rwth-aachen.de, and BfG beckers@bafg.de)

Chemical pollution is one of the major drivers of global biodiversity change (IPBES 2019). In recent years, regulatory and management instruments have expanded significantly in response to accelerating ecosystem degradation. These

instruments include the European Water Package (the suite of laws governing water management, quality, pollution control, wastewater treatment, groundwater protection, and aquatic ecosystem protection—most notably the [Water Framework Directive](#) and the [2025 European Water Resilience Strategy](#)), the [Zero Pollution Action Plan](#), the European Central Bank research programmes (e.g. [visit here](#)), and the European Sustainability Reporting Standards (ESRS) under the [Corporate Sustainability Reporting Directive \(CSRD\)](#), now under revision through the Omnibus package. Although policy developments have advanced rapidly, scientific research - despite notable exceptions (e.g., Brack et al. 2018, 2019) - remains predominantly technical and often poorly aligned with practical regulatory and management needs (Sylvester et al., in prep a). Biodiversity change and chemical pollution are still frequently studied in isolation within separate scientific subdisciplines (Sylvester et al. 2023), resulting in limited policy-relevant evidence linking chemical pressures to ecological outcomes.

A growing body of conceptual and empirical work has begun to connect **chemical exposures to ecological impacts** (Oginah et al. 2023, 2025). Within NORMAN, recent initiatives – such as the Workshop on Biodiversity Loss and Chemical Pollution (Hollert, Sylvester, Johann, Koschorreck, Dulio; *JPA Biodiversity Workshop*) and the Blueprint for Linking Ecotoxicity to Biodiversity Damage (Fantke, Posthuma, Treu, Hollert; *JPA Blueprint*) – have advanced understanding of the European research landscape (Sylvester et al., in prep. b) and strengthened conceptual and quantitative links between chemical pollution and biodiversity change. However, the **translation of scientific knowledge** into applied **regulatory or corporate contexts** remains insufficient. Key gaps include lack of workflows to connect biodiversity change and chemical exposures to specific activity/ company variables, limited understanding of transmission mechanisms linking chemical exposures to ecological impacts, insufficient integrated databases combining chemical and biological information, and lack of systematic analyses of current research limitations hindering practical guidance.

Building on previous work at the interface of chemical pollution and biodiversity change, WG-2 aims to:

- move beyond the mapping of European research networks conducted in the *JPA Biodiversity Workshop* to identify **concrete research gaps relevant for policy and regulation**,
- extend the scope of the *JPA Blueprint* by not only addressing missing links between chemical pressures and biodiversity damage but also by identifying **broader structural causes** behind the **misalignment between science and policy**,
- using the experience gained through *JPA Blueprint* to develop a tailored **case-study database to test hypotheses**, assess monitoring strategies, and provide a proof of concept for improved regulatory and research workflows.

The work planned for 2026 and 2027 will be structured around the following tasks.

Task 1. Identification of key challenges and research needs

We will build upon the activities and discussions of Breakout Group 2 (“How to link chemicals and biodiversity loss”) from the hybrid 2025 NORMAN WG2 Meeting (Frankfurt, 12–13 November) to identify the main challenges and research needs faced by public policies addressing chemical pollution and biodiversity.

Methods: We will make online secondments of the 2025 NORMAN WG-2 meeting to arrive to a consolidated assessment. We will invite the original participants of Breakout Group 2 but will not be limited to them as there is within NORMAN considerable expertise relevant to the topic. We will make a broad call for participation to complement the expertise and had a view as broad and comprehensive as possible.

Task 2. Assessment of how scientific research and existing databases meet these needs

This task will systematically search for evidence supporting or modifying the assessment obtained in Task 1.

Methods: We will conduct literature searches (e.g., Web of Science, SCOPUS) to characterise past and current research focus areas at the interface of chemical pollution and biodiversity, combined with a screening of open databases to identify common limitations in chemical, ecotoxicological and biodiversity data that constrain effective monitoring, assessment, and policy implementation. To obtain a grasp on the perspective of the stakeholders receiving policy and regulations decisions, we will analyse the landscape of regulatory and reporting obligations affecting companies, the current reporting practices (we will start by a selection of DAX-40 companies, primarily affected by regulations), existing information workflows and missing tools or datasets, and opportunities for scientific research to bridge identified gaps.

Task 3. Case study: Demonstrating the power of joint chemical and biological monitoring (2026 – 2027)

We will couple monitoring efforts by the Hessian Agency for Nature Conservation, Environment and Geology (HLNUG) with NORMAN capabilities to obtain a unique integrated database of biodiversity and chemical exposure for freshwater habitats across Hessen. This initiative will demonstrate how comprehensive chemical monitoring – systematically paired with the extensive biological monitoring already in place – can generate a robust, statistically powerful database

capable of directly linking chemical exposures with the actual occurrence of species (macrozoobenthos, fish, macrophytes, algae). This proof-of-concept study marks the launch of a pioneering evidence base that will reveal the true potential of integrated monitoring to uncover chemical-biodiversity relationships.

Methods: We enhance regular WFD monitoring by integrating comprehensive chemical analyses. This is enabled through close cooperation with HLNUG and the Federal Institute of Hydrology (BfG), alongside state-of-the-art toxicity assessments - including *in vitro* sediment tests - conducted in parallel at the same sites and analysed at GU Frankfurt. Subject to the level of commitment from participants, HLNUG sampling may be complemented with eDNA sampling. With the involvement of additional participating institutions, advanced analytical and computational approaches will be applied to evaluate the resulting data. This will demonstrate the substantial benefits of comprehensive, well-coordinated monitoring and illustrate how such an integrated dataset can generate robust guidance for research, monitoring, and regulatory decision-making.

Given that funding for field and laboratory work is not available, 2026 will be used for planning the sampling campaign and new proposal will be submitted in 2027 to obtain funding or seek other alternative funding.

Expected outcomes

- A joint perspective publication of broad NORMAN authorship (end of 2026).
- A NORMAN presentation or policy-oriented report with conclusions for regulators and policy-makers (end of 2026)
- A joint scientific publication reporting the results of the case study (expected 2027)

WG-3 Effect-directed analysis

Working Group N°3: Effect-directed analysis for hazardous pollutant identification (Activity coordinated by UFZ Iker Alvarez Mora iker.alvarez@ehu.eus and VU Frederic Béen, f.m.been@vu.nl)

Task 1: Evaluation of the performance boundaries and applicability of high-throughput effect-directed analysis (HT-EDA) in the evaluation of receiving water quality

The applicability of high-throughput EDA has been demonstrated in multiple previous studies within the work package. In most successful cases, investigations have focused on matrices with high contaminant loads, such as wastewater. Cleaner samples, such as surface waters or drinking waters, represent a greater challenge for EDA studies, as contaminant concentrations often approach the sensitivity limits of both analytical techniques and bioassays.

This project aims to explore the boundaries of EDA by evaluating the biological activity of receiving water samples through various bioassays, to determine the sensitivity thresholds required for each assay before and after fractionation. In later stages of the project, we will address the analytical limits by implementing techniques that reduce detection limits and expand the detectable chemical space (i.e., complementary ionization approaches and chromatographic separations using different columns). The work will aim to address key questions, including: (i) which bioassays are most suitable for EDA studies in receiving waters; (ii) levels of pre-concentration that can be achieved for each assay; (iii) whether effect drivers can be detected at such low levels; and (iv) for which bioassays toxicity can be reliably predicted using the modelling tools developed by other WPs.

The present project aims to explore the boundaries of EDA by performing activities in two different stages.

Stage 1: Sample extraction and bioassay testing: Evaluation of the bioassay limits of detection

- Sample collection, extraction, and distribution (using large volume devices preferably)
- Development of an inter-laboratory EDA-QA/QC study for fractionation alignment
- Toxicity testing using novel and established bioassays
- Chemical monitoring of all samples and toxicity prediction based on MS2 signal (MLin vitroTox)
- Design tailored fractionation methods to capture toxic chromatographic regions.

Stage 2: Fractionation of most active samples and bioassay testing

- Fractionation of selected extracts for bioassay testing, and further chemical evaluation.
- First prioritisation of effect drivers using routine analysis (ESI).

Following Stages 1 and 2, we expect to identify a set of active fractions that will enable progression to a follow-up project (Stage 3). In this stage, the chemical composition of the active fractions will be characterised using a range of complementary analytical tools to expand chemical space coverage. This follow-up project will be conducted in close collaboration with the CWG activity on non-target screening (CWG-NTS).

The development of QA/QC procedures for EDA will enable multiple laboratories to participate in the collaborative

EDA study without the need to centralise all activities in a single laboratory. In particular, the QA/QC framework will support the alignment of retention times across instruments used for fractionation and chemical analysis, as well as the harmonised application of non-target screening workflows for toxicity driver prioritisation.

Although the follow-up project (Stage 3) is not included as an activity within this JPA, it is already planned for the subsequent year and will be carried out in close collaboration with CWG-NTS.

Activities from previous JPAs:

- **Integration of computational toxicity driver prioritisation tools to support non-target screening workflows in HT-EDA – Part II: Designing endpoint-specific fractionation methods based on predicted toxicity** (activity already started in 2024)

Toxicity prediction tools like MLinvitroTox, as shown in previous WG-3 activities, significantly advance HT-EDA. Using these tools, HRMS analysis of a sample provides a preliminary insight into the distribution of potentially active compounds within a chromatographic run.

For certain endpoints with specific receptors (e.g., AR, ER, AhR...), it is common for most potentially active compounds to cluster in specific chromatographic regions (regions of interest). Identifying these regions through toxicity prediction would allow the chromatographic fractionation conditions to be tailored, thereby increasing the likelihood of successfully identifying the effect drivers.

In collaboration with PARC Task 4.3.E01, this approach will be evaluated on effluent samples from ongoing pan-European study. The objective of this study is to test MLinvitroTox to obtain preliminary information that can guide the design of tailored, endpoint-specific chromatographic conditions for fractionation in HT-EDA.

The work will be performed according to the following steps:

Activity 1: Identify the endpoints of interest (primarily those being tested within the ongoing PARC 4.3_E01 project) and define the chromatographic conditions (particularly column types) to be tested in this approach.

Activity 2: Use the analyses conducted within PARC to apply toxicity prediction for the agreed endpoints and identify cases where toxicity distribution is concentrated in regions of interest. This will involve using the NTS workflow developed during the 2024 activities ([Alvarez-Mora et al., 2025](#)), which will also include MS/MS diagnostic information prediction ([Codrean et al., 2023](#)) to improve the applicability of MLinvitroTox.

Activity 3: Fractionate the samples and test them under both the standard HRMS conditions and new conditions adapted to the identified regions of interest. This will allow evaluation of the approach's effectiveness for the selected endpoints.

The analysis of the samples and the preliminary prioritization of the potentially toxic features were carried out during 2025. The identification of regions of interest for endpoints with applicability in the context of the Water Framework Directive will be prioritized and the results of this JPA will be published in a joint publication in combination with the results from Task 1. The benefits of applying toxicity prediction before designing the EDA experiment will be explored.

This activity builds on the initiatives started with the 2024 JPA, aiming to develop efficient workflows that enhance the identification of effect drivers in complex mixtures through HT-EDA, taking it to a new level.

Additionally, it provides an ideal scenario for the application and validation of several tools developed within NORMAN, particularly in the CWG-NTS. Furthermore, in line with the collaboration agreement between NORMAN and PARC, this activity will complement an ongoing project in PARC with new ideas emerging from NORMAN, fostering mutual benefit.

WG-4 Nano- and micro-scale particulate contaminants

Working Group N°4: Nano- and micro-scale particulate contaminants (Activity coordinated by Eawag – Ralf.Kaegi@eawag.ch and NIVA Bert.vanBavel@niva.no and Vilde Kloster Snekkevik vilde.snekkevik@niva.no)

Over the past years, WG-4 has devoted significant effort to improve validation and harmonisation of common measurement methods and monitoring tools for microplastics (MP) in the environment in support of the EU's Green Deal and Plastic Strategy. The effort was made collectively with smart coordination of activities and finding synergies with other EU-funded projects and standardisation bodies. Various interlaboratory studies were organised in collaboration with QUASIMEME, EUROqCHARM and PlasticTrace EU project. Significant steps forward were made thanks to the development and testing of "sandwich filters" specifically designed to disentangle the measurement variations associated to sample preparation from the actual measurement and data processing.

In addition to these QA/QC activities, WG-4 identified the need to explore the feasibility of developing a NORMAN database of (FT)IR spectra for microplastics analysis. Two workshops were organised in 2025 to assess which databases are already available and for which instruments and software applications; to identify needs and requirements from the perspectives of instrument providers, software developers, and researchers (end users); and to explore how such a database could be integrated into and sustainably maintained within the NORMAN network. Building on the conclusions of these workshops, the activities planned for 2026 will further advance this feasibility analysis, as described in the tasks below.

Task 1: A roadmap and guidelines for the introduction of Microplastics Database into the NORMAN Database System (Ralf.Kaegi@eawag.ch (Eawag), Bert.vanBavel@niva.no (NIVA), vilde.snekkevik@niva.no (NIVA), slobodnik@ei.sk (EI), ike.vander.veen@vu.nl (VU))

Accurate particle-based and mass-based quantification of MP in complex matrices (e.g., seawater, freshwater, wastewater, soils, sediments, sewage sludge) depends on harmonised sampling protocols and, in case of particle-based investigations, reliable **matching of experimental spectra with high-quality reference spectra**. However, no central, standardised database currently exists. Available reference spectra are fragmented across instrument manufacturers and software platforms, often incompatible due to differences in spectral resolution, data formats, and material coverage. This lack of harmonisation results in misclassification of MP. Existing databases are often limited in scope, contain spectra of variable quality, rarely include aged or environmentally degraded polymers and often lack relevant metadata - factors that further challenge the interpretation of MP data. Manual spectral comparison is possible for a limited number of spectra, but recent **instrumental developments** (focal plane array detectors, quantum cascade laser-based systems) require **automated processing algorithms**. However, the reliability of any automated classification tools remains constrained by the quality and completeness of the underlying **reference libraries**. Additional complexity is introduced by variances between the TED- and Py-GC-MS mass spectral data.

Further uncertainties in MP assessments arise from non-standardised measurement and processing protocols across laboratories. Regular **updates of harmonised databases** are needed to capture emerging or less common frequently used polymers. These issues became evident during the NORMAN 2024 interlaboratory comparison (ILC) and were reinforced by two workshops held in 2025. The first workshop (μ FT-IR databases and software tools) concluded that harmonised processing pipelines, classifiers, or reference databases for microplastics are currently lacking. The second workshop (storage and use of environmental MP data) revealed the challenges associated with the inclusion of microplastic data into existing environmental databases, which are not designed for microplastics, lack spectral data, are biased toward marine environments, and face major QA/QC challenges with hyperspectral datasets.

Activities 2026

The online workshops held in 2025, demonstrated the need for establishing a harmonised database for microplastics and it was agreed that NORMAN should play an important role in this topic. As a next step, two physical workshops will be organised with the experts in the field to identify and formulate guidelines for including microplastics into the NORMAN Database System.

During 2026, a roadmap, guidelines, and, where feasible, a prototype of an online Microplastics Database will be developed. The database will be designed to host selected datasets from major national and international microplastics screening surveys, including results generated using Raman, FTIR, and TED/Py-GC-MS techniques.

The WG-4 Workshop in November 2025 clearly identified that there are numerous NORMAN members willing to share data on microplastics monitoring. The database will reveal potential for intercomparison of available data. It will also serve as a basis for future harmonisation of sampling and analysis protocols Europe-wide in support of regulatory monitoring of microplastics in the environment.

The objective is to develop a Microplastics Database capable of handling complex spectral datasets, such as particle-based and hyperspectral data, thereby enabling the integration of data from instruments employing different measurement approaches and ensuring long-term comparability.

Task 2: Interlaboratory Study / Developing Exercise on Microplastics in water and sediment (DE17) (WUR/WEPAQUASIMEME (W-Q), NIVA, VU)

WEPAQUASIMEME, in close collaboration with NIVA and VU, has organised several interlaboratory studies in recent years on the quantification of microplastics in water and sediment. The most recent ILS (2024/2025) involved about 50 participants and included three types of microplastics (50–5000 μ m), spiked manually or added as tablets in both matrices.

Overall performance in both matrices is still far from the reliability expected in established ILS, with interlaboratory coefficients of variation ranging from 37% to 226% (only three measurands in sand achieved a CV <20%).

To maintain progress toward achieving reliable quality standards for microplastics analysis in environmental samples, a new ILS will be organized by W-Q, NIVA, and VU for 2026/2027, covering both water and sediment. The aim is to

include six types of microplastics in the 20-500 µm range. However, particularly for the reference-material tablets, the final number of microplastic types may vary depending on the availability of suitable materials on the market that meet the minimum requirements for this ILC.

New reference-material tablets with well-defined particle counts for specific microplastic types will be sought on the market. Microplastic reference materials intended for manual spiking have already been identified and will be purchased – six types of microplastics will be available for this purpose.

Samples will be prepared and shipped to participating laboratories by W-Q. A comprehensive performance assessment report will be prepared after the results-submission deadline and shared with participants. If deemed necessary based on the outcomes of the ILC, a dedicated workshop will be organized. Key outcomes, conclusions, and any recommendations will be provided to NORMAN for the Activity Report of 2027, and at the NORMAN GA meeting 2027.

The expected timeline is as follows:

- Registration: March - 1 September 2026
- Sample preparation: September 2026
- Analysis and submission of results: October 2026 – February 2027
- Performance Assessment Report: March-April 2027
- Workshop (if needed): May or June 2027

Activities from previous JPAs

- **Sourcing of plastic materials of interest for future ILS (Eawag, NIVA)**

To date, interlaboratory comparison studies (ILC) on microplastic particles have mainly focused on relatively simple polymers. However, there is a clear need to include more challenging materials and particle morphologies, such as fibres, paint particles, tire wear particles (TWP), and biodegradable plastic particles (BPP). This activity, initiated in 2025, aimed to source polymeric materials of high interest / concern at European level and perform feasibility tests using sandwich filters or soda tablet approaches (developed in the previous NORMAN JPAs) before proposing the most appropriate materials for upcoming ILCs.

In 2025, the planned materials, i.e. fibres (Q1), tire particles (Q2), and biodegradable microplastics (Q3), were successfully sourced and tested. Paint particles proved unsuitable for an interlaboratory comparison at this stage, and their testing, originally planned for Q4 2025, has been postponed to Q2 2026. For tire wear particles, Py GC/MS quantification requires a different approach, which will be presented at the MICRO 2026 conference in Brisbane. As the upcoming ILC will focus on particle counting and spectroscopic methods, tire wear particles will not be included.

The results of the feasibility experiments will be summarised in a report, including recommendations on the most suitable materials for an ILC to be organised in 2026 (see Task 2 above).

- **(Micro)plastics – leaching of additives and non-intentionally added substances (NIAS)** (Leader: TNO andrea.brunner@tno.nl . NKUA, nalygizakis@chem.uoa.gr). This task is organised as of NTS-CWG in collaboration with WG-4).

WG-5 Water reuse and policy support

Working Group N°5: Water reuse and policy support (Activity coordinated by DERAC, France genevieve.deville@derac.eu in collaboration with LTU, Sweden lian.lundy@ltu.se and EI, Slovakia alygizakis@ei.sk).

In response to growing challenges related to water scarcity and waste management, treated wastewater and sewage sludge are increasingly recognised as reliable alternative resources for a wide range of applications (e.g. agriculture, aquifer recharge, urban and recreational activities, construction, land restoration). More recently, interest has also expanded to the use of urban stormwater as a locally sourced alternative water supply. While water reuse practices offer substantial benefits, they have also led to increased demand for data on chemical and biological contaminants of emerging concern (CECs) associated with reuse.

This growing interest is closely linked to EU policy developments, notably the Circular Economy and Zero Pollution Action Plans, which emphasise resource efficiency and pollution prevention. More recently, the EU Water Resilience Strategy (2025) identified the use of non-conventional water sources as a key measure to strengthen water resilience and an area with significant growth potential. In parallel, recent regulatory developments - including the EU Regulation on water reuse for agricultural irrigation, the revised Urban Wastewater Treatment Directive, and the ongoing evaluation of the Sewage Sludge Directive - further promote reuse as a means to enhance water security. However, the lack of locally relevant data on CECs has been identified as a major barrier to the wider implementation of reuse

practices.

Key challenges include the presence of chemical and biological contaminants - such as viral genetic material (including SARS-CoV-2), antibiotic resistance genes, and bacteria - their potential impacts on receiving ecosystems and human health through environmental exposure, and the identification of effective technologies for their removal. Addressing these challenges is essential to support safe and sustainable water reuse.

In line with WG-5's mandate, and building on activities carried out in previous years, the work planned for 2026 will be structured around the following tasks.

Task 1: The Antibiotic Resistance Bacteria and Genes (ARB&ARG) Database

The NORMAN ARB&ARG database was launched in 2021 as an open-access platform for the exchange of data on the occurrence of antibiotic-resistant bacteria (ARB) and antibiotic resistance genes (ARGs), as well as related analytical methods. Since its establishment, the database has been populated with 3,741 data points from 11 countries, covering multiple environmental matrices: 1,240 wastewater, 958 surface water, 705 groundwater, 415 soil, 43 sewage sludge, and 380 other matrices. A detailed overview of the database structure, functionalities, data extraction procedures, and data contributions was presented in the publication "Making Waves: The NORMAN Antibiotic Resistant Bacteria and Resistance Genes Database (NORMAN ARB&ARG) - an invitation for collaboration to tackle antibiotic resistance." Open-science ARG occurrence datasets have been identified in 2025.

In addition to data collection and database enhancement, a literature review was initiated in 2025 to identify indicators for risk assessment of ARGs, relevant for the creation of a NORMAN Prioritisation Framework for ARGs.

The goal in 2026 is:

- To continue efforts to collect, harmonise, and upload ARB & ARGs data from key scientific publications and research project datasets, including JDS5 and other community-based open-access resources;
- To pursue the development of the Prioritisation Framework for risk assessment of ARGs tailored to address different protection goals.

Task 2: Scoping potential for stormwater reuse

A key impact of climate change is the alteration of rainfall patterns, with much of north-western Europe projected to experience more frequent summer droughts alongside more intense winter rainfall events. This presents a particular challenge for urban areas, where largely impermeable surfaces limit groundwater recharge - contributing to water scarcity - while simultaneously increasing surface runoff, thereby exacerbating flood risks and degrading water quality. As a result, urban areas can become hotspots for both droughts and floods, raising a critical question: can stormwater be used to meet non-potable water demands?

While regulations and policies are already in place to facilitate wastewater reuse, the potential to collect, treat, and store stormwater at the urban scale has not yet been robustly assessed. This new activity builds on the stormwater reuse component of the reuse-focused article currently being developed under Task 3 (see below).

An online WG-5 meeting in March 2025 confirmed interest in carrying out an international stormwater monitoring campaign. However, only one partner was monitoring stormwater.

The objective for 2026 is to design and prepare the technical specifications for a stormwater monitoring campaign to be implemented in 2027. The tasks will include: (1) identifying partners capable of collecting stormwater samples in at least 10 countries; (2) developing a harmonised sampling methodology; (3) agreeing on a common extraction protocol, including support for partners able to collect samples but not perform extraction; and (4) defining the list of target substances to be analysed, along with associated QA/QC protocols and logistical arrangements.

Task 3: Databases for CEC risk characterisation in reused environmental matrices

The risks associated with chemical contaminants in reused matrices such as water and sewage sludge remain largely unknown, largely due to gaps in occurrence data and the limited availability of quality targets or threshold values needed for risk characterisation and prioritisation. To address this, WG-5 has identified the collection and dissemination of such data as a key priority, with the aim of supporting research activities, policy development, and environmental management. In parallel, the development of new methodologies to improve risk assessment has been identified as an emerging priority.

In this context, upgrading the existing NORMAN databases - EMPODAT for occurrence data and the Ecotoxicology Database for quality targets (hazard data) - was identified in 2021 as the most relevant approach to systematically collect data on chemical contaminants in reused matrices and to characterise their risks in line with the WG-1 prioritisation framework.

In 2025, stormwater data were first added to the EMPODAT database, risk assessments of CECs in sewage sludge for soil ecosystems were conducted using case studies from Belgium and Sweden, and potential risks were identified for certain substances (after one sludge application). In parallel, a peer-review publication was initiated to compare CEC risks in conventional and non-conventional water sources for agriculture and aquifer recharge, supported by extensive occurrence data and threshold values to be finalised by the end of 2026.

These activities will be pursued in 2026 with a focus on:

- Collection and publication of new occurrence data on stormwater, reclaimed water and/or sewage sludge in EMPODAT.
- Collection and publication of new quality targets on soil and conversion into quality targets for the use of sewage sludge for agricultural fertilisation (to be uploaded in the NORMAN Ecotoxicology database).
- Development of a methodology to assess the risk of CECs in sewage sludge after several years of application on agricultural soils.
- Submission of a paper on the risk characterisation and prioritisation of CECs in reused waters including stormwater and reclaimed water in a peer-review journal.

WG-6 CECs in the indoor environment

Working Group N°6: CECs in the indoor environment (Activity coordinated by RECETOX lisa.melymuk@recetox.muni.cz in collaboration with Vrije Universiteit Amsterdam pim.leonards@vu.nl and University of Antwerp adrian.covaci@uantwerpen.be).

The activities of WG-6 focus on investigating contaminants of emerging concern in both, the indoor environment (i.e. indoor air and dust) and outdoor air.

Task 1: Hazardous Chemicals at the Nexus of Environment and Public Health - Combining Wastewater-Based Epidemiology and indoor dust analysis for comprehensive evaluation of chemical exposure risks in indoor environment (Leader: University of Bath, Barbara Kasprzyk-Hordern bkh20@bath.ac.uk, UFZ, saskia.finckh@ufz.de, Sara Castiglioni, Istituto Mario Negri, sara.castiglioni@marionegri.it, RECETOX, Lisa Emily Melymuk, lisa.melymuk@recetox.muni.cz) (study already approved under JPA 2024)

Wastewater can be considered a fingerprint of a city's metabolism, as it represents a complex mixture of substances of both biological and chemical origin, including community-level stressors arising from indoor environments, such as hazardous chemicals and their human transformation products. Because these substances are continuously pooled within urban water systems, their quantitative analysis can provide valuable evidence of community-wide exposure to chemical contaminants.

While wastewater is traditionally viewed within NORMAN as a pathway for environmental pollution, extending wastewater screening as a proxy for domestic and indoor exposure offers significant added value for the identification and prioritisation of hazardous chemicals - one of NORMAN's core objectives. This approach strengthens links between WG-6 on Indoor Environment and water-related activities within NORMAN, while also generating relevant data for NORMAN databases. Water-based chemical mining, also known as wastewater-based epidemiology (WBE), uses population-level metabolic biomarkers of exposure and effect that ultimately enter urban water systems, providing a timely and complementary tool to traditional biomonitoring approaches. In parallel, chemicals emitted indoors are also present in indoor air and dust, which constitute additional key matrices for assessing human chemical exposure.

The aim of this project is to develop a holistic framework for understanding human exposure to hazardous chemical mixtures originating from indoor environments, in line with the One Health approach. This work builds on and integrates three major ongoing European initiatives: (i) the pan-European WBE monitoring programme planned under PARC (4.3_E01: Mining chemical information in wastewater for human community and environmental exposure assessment); (ii) annual WBE monitoring campaigns coordinated through the SCORE network; and (iii) activities of NORMAN WG-6 on indoor environments and ambient air.

This activity was initiated under the 2024-2025 JPA. During this period, progress was made in refining objectives, clarifying methodological needs, and reviewing the scientific literature to assess existing WBE and dust datasets, with a focus on identifying common chemical targets and geographical coverage. In parallel, a core group was established to develop an outline for a scientific paper addressing the interface between environmental and public health monitoring of hazardous chemicals.

For 2026, the work will be organised around the following activities:

- prepare and submit a scientific paper addressing the interface between environmental and public health monitoring of hazardous chemicals;

- identify suitable case studies for assessing exposure to hazardous chemicals at the environment–human health interface;
- develop a study design for a future integrated monitoring programme.

Activities from previous JPAs

- **Updating indoor data collection templates and harmonising metadata in support of indoor environment projects** (Leader: RECETOX, Lisa Emily Melymuk, lisa.melymuk@recetox.muni.cz): this activity initiated under JPA 2025 – aimed to bring together key stakeholders in the generation and harmonisation of indoor data to critically evaluate the indoor data structures in the NORMAN indoor database and update metadata structures and data collection templates where needed. This was identified as a need, given the increasing number of projects and growing interest in indoor environments and the need to ensure that the NORMAN database system remains a relevant repository of newly generated indoor data, from NORMAN projects as well as other indoor projects in which NORMAN partners are involved. WG-6 leading team started in 2025 with a practical evaluation and testing of existing NORMAN indoor data structures and DCTs in the context of newly generated indoor in collaboration with PARC WP-7. The workshop and the planned publication did not take place. This work is ongoing, and additional relevant stakeholders identified in the first year of the activity are being consulted to ensure broad applicability of the DCTs, and alignment across multiple projects (e.g., IDEAL cluster, PARC).
- **CT on Passive air sampling and wide-scope suspect/non-target screening for organic substances in air (in collaboration with PS-CWG)** (Action leader: adria.sunyer@aces.su.se ; jon.martin@aces.su.se Stockholm University): The laboratories were invited to participate in the study in June 2024 and the deployment of the passive PDMS foam sampler adsorbents was organised during summer. A preparatory workshop took place on 10 October 2024 before distribution of the exposed samplers to the participants in November 2024 together with the SOP and reporting templates for LC and GC. The results were received in September 2025, with contributions from 13 participants, comprising 11 LC-HRMS datasets and 5 GC-HRMS datasets, including three participants who submitted both. Data curation and result processing were completed in February 2026. All participants will be invited to attend a follow-up workshop planned for April 2026, during which the results and outcomes of the collaborative trial (CT) will be presented and discussed. A final report compiling the individual laboratory results will be provided to all participants. Following curation, the datasets will be uploaded to the NORMAN Suspect List Exchange (NORMAN-SLE) to contribute harmonized data on airborne organic substances. The workshop will also include discussion of next steps toward a potential joint publication summarizing the principal findings and methodological insights from the trial.
- **CT on dust sampling methods** (Action leader: pim.leonards@vu.nl Vrije Universiteit Amsterdam): The plan was to analyse selected chemical groups (chlorinated paraffins, POPs, plasticisers, and OPFRs) and complete the study with a publication. In 2021, two datasets were finalised – chlorinated paraffins and POPs. However, the samples assigned for analysis of plasticisers and PFRs by the University of Antwerp are still pending dispatch from Vrije Universiteit Amsterdam (2024). It is envisaged to complete this study and publish the results in peer-reviewed paper.

WG-7 Soil and terrestrial environment

Working Group N°7: CECs in the terrestrial environment (Activity coordinated by UBA Annegret.Biegel-Engler@uba.de) and OVAM Laetitia Six laetitia.six@ovam.be

Soil pollution remains a major challenge across the EU, with recent studies showing that 60–70% of soils are not in a healthy condition. To address this, the Soil Monitoring and Resilience Law (SML), which entered into force on 16 December 2025, establishes an EU-wide framework for assessing and monitoring soil health, with the objective of achieving healthy soils across Europe by 2050.

The SML is structured around three pillars: (1) an EU soil monitoring framework to assess soil health; (2) sustainable soil management; and (3) risk assessment and management of contaminated sites.

The activities of WG-7 contribute to the first pillar on soil monitoring. They focus on protecting soils from pollution by contaminants of emerging concern (CECs), which can pose significant risks to human and animal health and spread to air, surface water, and groundwater, as well as on developing mechanisms to detect and assess these substances.

In 2026, WG-7 activities will build on the work initiated under the previous JPA, with a focus on the following tasks.

Task 1: Recommendations for the definition of a watch list for monitoring of the soil contamination

In 2025, WG-7 organised a series of expert group meetings and a two-day workshop (OVAM, February 2025) to develop recommendations for defining a Soil Watch List, i.e. priority list of contaminants relevant for monitoring in soil.

Substance selection is based on scientific evidence, with particular emphasis on analytical feasibility – such as the

availability of harmonised methods and limits of quantification achievable by routine laboratories – as well as economic considerations.

Several classes of contaminants, including pesticides, biocides, industrial chemicals, phthalates, and flame retardants, were evaluated. For each group, information was compiled from the scientific literature and, where available, regulatory sources, covering hazardous properties, occurrence in soils, and available analytical methods.

This evidence base will support the selection of substances for inclusion in the Soil Watch List. Experts are currently defining consensus criteria for substance selection and prioritisation, balancing well-established regulated substances with emerging contaminants that may address monitoring gaps and strengthen soil risk assessment.

This work will continue in 2026, with the Soil Watch List expected to be finalised and submitted to the Commission in early 2026.

Task 2: Definition of a prioritisation framework for contaminants in soil

Unlike the previous task, this is a long-term activity in which WG-7 aims to develop a prioritisation mechanism for soil contaminants to support future updates of the SMLL priority lists across different protection objectives.

The work started in 2025 with several expert group meetings. Within this task, the JRC collaborates with the NORMAN network. The JRC leads the development of a framework to be proposed to Member States, thereby addressing short-term regulatory needs. In parallel, NORMAN follows a more science-driven approach, considering a broader range of protection goals, such as human exposure via soil, groundwater protection, and terrestrial ecosystems. This approach includes the identification of knowledge gaps and the integration of criteria reflecting these gaps into the prioritisation process.

While collaborating with the JRC, NORMAN will remain independent. NORMAN's work may inform the JRC proposal, while also providing a complementary long-term perspective.

The work will continue in 2026.

Task 3: Workshop on non-target screening in soil samples

In 2025 and 2026, WG-7 activities focus on prioritising substances for soil monitoring under the Soil Monitoring Law. Due to limited exposure data, current prioritisation approaches often rely on intrinsic substance properties, such as toxicity and persistence. As a result, several relevant substances may be overlooked.

Non-target screening plays a key role in addressing this gap by providing a “reality check” for theoretical monitoring lists. It helps identify contaminants that may not have been prioritised but are actually present in soils across the EU. In this context, WG-7 aims to assess whether currently prioritised substances are indeed problematic and prevalent in soils, and to identify additional substances that occur widely but are not yet included in monitoring programmes.

In 2026, WG-7 and the CWG-NTS plan to organise a joint workshop to explore innovative approaches for monitoring soil contaminants. This workshop will lay the groundwork for joint activities planned for 2027 and beyond.

WG-8 Marine environment

Working Group N°8: Marine environment (Leader: DCU fiona.regan@dcu.ie in collaboration with Marine Institute Brendan.McHugh@Marine.ie)

With its rich multi-disciplinary community of experts from academia and environmental agencies, WG-8 has set out a work programme towards an improved knowledge of the occurrence and risk of contaminants of emerging concern in the marine environment. The primary work areas for WG-8 in 2026 (and particularly in collaboration with WG-1) will include:

- 1) Ongoing development of **prioritisation** listing (with WG-1) which has been instrumental in support of the implementation of **OSPAR and HELCOM marine contaminant strategies** and the Marine Strategy Framework Directive (MSFD), working towards Prioritisation of sea-specific contaminants for the four European Sea Regions;
- 2) Continued development of the 5-year roadmap and associated **scoping paper**, defining the strategy of the WG regarding the priority topics to be addressed in the coming years and identifying the links with the other NORMAN WGs and communities outside the network;
- 3) **Collaboration** with **OSPAR and HELCOM** on monitoring trends and effects of substances in the marine environment;
- 4) Organisation of a survey on the availability of **marine-specific bioassays** within the NORMAN network and beyond in collaboration with WG-2 as a starting point to develop capacity in the area of marine ecotoxicology;
- 5) Assessment of **interlaboratory study (ILS) needs within the marine community**, with active contribution to the organisation and promotion of relevant studies in collaboration with the annual WEPAL-QUASIMEME (W-Q) ILS

programme, operated as a proficiency testing programme open to laboratories worldwide.

To deliver on the above main focal points the following sub tasks are proposed. Each task will involve coordinated and collaborative work with WG-1 and WG-2.

Task 1: WG Coordination and communication

- Continue with regular full WG-8 meetings (with the collaboration of WG-1) to ensure communication and transparency in delivery of 2026 aims. All NORMAN members will be informed and will have the opportunity to participate.
- Continue the work on the WG-8 5-years roadmap covering all relevant topics identified by the WG and links with other WGs, in particular on key aspects such as prioritisation / identification of sea-specific contaminants, mixtures risk assessment, microplastics, status indicators to monitor the changes of the marine environment, optimisation of monitoring strategies (use of non-target screening, bioassays, passive sampling). Sub-groups for working will be established and will meet as needed.

Task 2: Prioritisation of sea-specific contaminants for European Sea Regions (follow-up from JPA 2025)

- In partnership with WG-1, and with support from the Netherlands and Sweden, WG-8 will continue efforts to finalise a list of sea-specific contaminants for the Baltic Sea and the North-East Atlantic, alongside the development of marine-specific indicators to support policy-relevant prioritisation.
- In close cooperation with WG-1, WG-8 will contribute to the development of scenario-based testing of the revised NORMAN Prioritisation Tool, with a specific focus on PBMT parameters. This includes options for assigning weighting factors to individual parameters (e.g. increasing the weight of persistence and bioaccumulation in the final hazard score for the marine environment; see also JPA 2026 – NORMAN Database System and WG-1 activities).
- The prioritisation tool will incorporate marine mammal toxicity threshold values predicted by ToxAI (EC50/LC50), converted into concentration threshold values ($\mu\text{g}/\text{kg}$ wet weight, e.g. in liver or other tissues), as well as wide-scope target (EMPODAT) and suspect screening data (EMPODAT Suspect) for assessing chemical occurrence (see JPA 2026 – NORMAN Database System).
- The WG will investigate adjustments to the prioritisation scheme to account for the specific characteristics of the marine environment. In particular, alternative indicators reflecting persistence and bioaccumulation properties will be explored for integration into a marine-specific prioritisation framework (in alignment with developments in WG-1).
- Continued engagement with HELCOM and OSPAR initiatives in the field of ecotoxicology will be pursued to ensure coherence and mutual benefit.
- The potential use of passive sampling as an additional line of evidence in prioritisation studies will be explored.
- The list of sea-specific contaminants previously prioritised contaminants of concern in the North-East Atlantic and Baltic Sea will be uploaded to the NORMAN Database System – Suspect List Exchange (NDS-SLE).
- Chemical standards will be assessed and selected for purchase from the top 50 GC-amenable substances identified above. These compounds will be analysed by GC-HRMS using at least two different ionisation techniques (APCI and EI), followed by the upload of resulting mass spectra to MassBank.EU.

Task 3: Data gathering

Permanent task for systematic identification and collection of new datasets to improve the population of the NORMAN Database System with the data relevant to the marine environment.

Task 4: Screening

Explore potential for a “once per MSFD cycle screening study” (e.g. timeframe to be consistent with available resources and NORMAN commitments in other monitoring campaigns). Utilising the outputs of Task 1 prioritisation, WG-8 and policy resource support will work closely with WG-1, OSPAR and HELCOM to explore potential for a follow-up on OSPAR / HELCOM screening exercise.

Task 5: Microplastics

Explore possible collaboration with microplastics communities within NORMAN (WG-4). WG-8 will investigate (and report to the scoping paper) potential relevance of MP work in the marine environment. WG-8 will contribute to gathering data from past and ongoing projects to feed the Microplastics Database project (see **WG-4**).

Task 6: Survey on the availability of marine-specific bioassays within the NORMAN network and beyond (Activity coordinated by EHU belen.gonzalez@ehu.eus ; UvA Milo de Baat m.l.debaat@uva.nl in collaboration with Henner Hollert (Goethe University Frankfurt), Brendan McHugh (Marine Institute) and Fiona Regan (DCU))

This task aims to develop an overview of bioassays based on marine organisms available within the NORMAN network

and beyond, and to evaluate the potential interest and capacity for developing, curating, and comparing the ecotoxicological tests required for marine applications. A detailed description of the activity, including its scope, methodology, and expected outcomes, is provided in the dedicated section (see **WG-8 – Survey on the availability of marine-specific bioassays in the NORMAN network and beyond**).

Task 7: ILS on triazines and pesticides in seawater (AQ-8) and assessment of interlaboratory study needs within the marine community (Activity coordinated by WUR and WEPAL-QUASIMEME celia.martinsbento@wur.nl)

This activity will be carried out in collaboration with WEPAL-QUASIMEME (W-Q). W-Q currently operates an established ILS protocol (PT–AQ8–Triazines/Pesticides–Seawater), implemented as a proficiency test open to laboratories worldwide for the determination of triazines and pesticides in seawater and low-salinity seawater.

Although pesticides remain a topic of high interest and concern for environmental agencies and regulatory bodies, participation in this ILS has so far been limited. To better understand the reasons for this low level of engagement, a brief survey will be distributed to NORMAN members in May - June 2026.

The survey will invite laboratories to express their interest in the inclusion of new target compounds, alternative water matrices, or other unmet analytical needs for potential integration into the programme. If a sufficient number of relevant proposals is received, W-Q will incorporate selected additions into the ILS round planned for April 2027. A second dissemination document will be issued in late 2026 to communicate any updates to the ILS programme and to invite laboratories to register.

The inclusion of this activity in JPA 2026 is expected to stimulate increased participation from NORMAN laboratories and to improve understanding of laboratory needs related to marine-relevant interlaboratory studies. In addition, this initiative will strengthen and further promote collaboration between WEPAL-QUASIMEME (a NORMAN member) and the wider NORMAN network.

WG-8 Survey on the availability of marine-specific bioassays in the NORMAN network and beyond

Survey on the availability of marine-specific bioassays in the NORMAN network and beyond (Leader: EHU, belen.gonzalez@ehu.eus; UvA, Milo de Baat m.l.debaat@uva.nl in collaboration with Goethe University Frankfurt (Henner Hollert), Marine Institute (Brendan McHugh) and DCU (Fiona Regan)

The main objective of this task is to develop a comprehensive overview of bioassays based on marine organisms that are available within the NORMAN network and beyond, and to evaluate the potential interest and capacity for the development, curation, and comparison of ecotoxicological tests relevant for marine applications.

Effect-based methods are essential for understanding the toxic effects of chemical mixtures in the environment. While a wide range of bioassays is available for freshwater systems – often based on standardised toxicity tests using freshwater organisms (e.g. *Daphnia* spp.) – standardised bioassays for marine and saltwater organisms remain comparatively scarce. This represents a significant analytical gap for chemical risk assessment in the marine environment.

Beyond the mere availability of marine bioassays (whether standardised or non-standardised), laboratory analytical capacity is a critical factor for the successful implementation of robust effect-based testing strategies for marine environment. Currently, there is no comprehensive overview of existing marine bioassays nor of the analytical capacity and interest within the NORMAN network and broader European research structures. This gap has become increasingly relevant in light of ongoing efforts by HELCOM and OSPAR to derive lists of biological effects relevant for future regulations.

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To address these needs, a survey on the availability of marine-specific bioassays within the NORMAN network and beyond will be developed. The survey will be designed and implemented in full compliance with ethical standards for data handling and data protection, and will be distributed within the NORMAN network as well as to other relevant European organisations and initiatives (e.g. OSPAR, HELCOM, ICES) during the first half of 2026.

Based on the survey results, a technical report will be produced, identifying key gaps, priorities, and opportunities in the biological testing of emerging pollutants in the marine environment within the EU. The report will highlight both regulatory-relevant and research-oriented issues, and will be presented at the 2026 NORMAN General Assembly. It will also be disseminated to interested partners and European stakeholder organisations.

This activity will provide an up-to-date state of the art of available tools in marine ecotoxicology and will identify knowledge, methodological, and infrastructure gaps to help guide future research and development efforts.

The proposed activity will establish strong **links with other NORMAN WG** and with broader European scientific and **policy networks**, including:

- WG-1 and CWG-NTS: Provision of information supporting the prioritisation of substances using marine-specific bioassays
- WG-2 and WG-3: Integration of bioassay information (availability, performance, and results) with marine-specific data
- WG-4: Integration of bioassay information related to nano- and microscale particulate contaminants with marine-specific data
- OSPAR, HELCOM, and ICES: Contribution to ongoing and future prioritisation and assessment efforts at the regional sea level.

CWG-NTS Non-target Screening Cross-Working Group Activity

CWG-NTS: Cross-Working Group Activity on Non-target Screening (Activity coordinated by Eawag juliane.hollender@eawag.ch and LCSB - Luxembourg emma.schymanski@uni.lu)

The CWG-NTS plays a central role within the NORMAN community and is internationally recognised for its leadership in the development and testing of HRMS-based non-target screening (NTS) methods and strategies. The actions undertaken by the CWG-NTS over the years have been instrumental in enhancing the performance of HRMS-based NTS methods, as well as the quality and reliability of suspect and non-target screening data. Through these sustained efforts, NTS is now firmly recognised as an essential approach complementing target monitoring in the assessment and early identification of chemical risks to environmental ecosystems and human health.

In 2026, the programme will build on activities initiated under previous JPAs while also launching several new activities. These are described in detail below.

On-going activities related to the NORMAN Database System and MassBank Europe

- NORMAN Suspect Lists Exchange and FAIR-TPs (LCSB) (see “NORMAN-SLE” and “FAIR-TPs” above)
- NORMAN SusDat database: Database development and maintenance (EI, NKUA) (see “NDS”)
- Digital Sample Freezing Platform upgrading (EI) (see “NORMAN DSFP”)
- Finalisation and testing of EMPODAT – SUSPECT database - a new NDS module to host suspect screening results (EI) (see “NDS”)
- MassBank Europe - Continuous development and upgrade (LCSB, Eawag and IPB Halle) (see “MassBank”).

Identification Scoring System for GC-HRMS (NILU and EI)

The identification of emerging contaminants using HRMS through non-target screening (NTS) has seen significant advancements in terms of reproducibility, automation, and harmonisation, particularly for liquid chromatography (LC) systems. Meanwhile, gas chromatography (GC)-based workflows have not achieved the same level of progress. Existing identification point (IP) scoring systems are tailored to LC workflows, limiting their applicability to GC methods. This gap in methodology undermines the reproducibility, automation, and harmonisation of NTS approaches across analytical platforms. Drawing insights from recent methodological advancements such as those presented in Koelmel et al. (2022), this task seeks to adapt and refine the scoring framework for GC-specific workflows, ensuring compatibility while maintaining the rigor of LC-derived standards.

This activity, approved under JPA 2025 but not initiated due to time constraints, is re-proposed for 2026 with the following work plan.

- Generation of a GC-EI-HRMS dataset by selected laboratories covering different types of GC-EI-HRMS instrumentation (in addition, raw data from ongoing activities, e.g. from GC-HRMS JPA 2024, will be used in 2025)
- Adaptation of the IP scoring system currently available for LC-HRMS to integrate GC-EI-HRMS-specific parameters such as isotopic patterns, retention index, and fragment ion ratios
- Development of a framework that harmonises scoring criteria across LC- and GC-based NTS methods, emphasising automated and transparent confidence level assignments
- Validation of the updated framework through collaboration with participating laboratories and testing on real-world datasets
- Organisation of an online workshop
- Preparation of a manuscript for submission to a peer-reviewed journal detailing the harmonised scoring system and its application in multi-platform workflows. The manuscript will be published as gold open access.

Chemicals in Plastics (follow-up of (Micro)plastics – additives and leaching of non-intentionally added substances (NIAS)) (TNO and EI)

This activity builds on the study on (micro)plastic leachates initiated under JPA 2024/2025, which investigated the chemical substances potentially released from environmentally relevant (micro)plastics using HRMS-based non-target

and suspect screening techniques. The work planned for 2026 will involve retrospective screening of plastic associated chemicals in the environment using the samples available in the DSFP. The details are provided in the dedicated section (see **CWG-NTS – Chemicals in Plastics**).

NDS-CCS: An open database for sharing ion-mobility derived collision cross section (CCS) values (University of Antwerp, SLU, UJI, LCSB)

This activity aims to establish a Europe-based database for the collection, consolidation, and comparison of experimental reference CCS data. It responds to the identified need for improved accessibility and harmonisation of CCS datasets, which represent a crucial parameter for chemical identification in suspect and non-target screening workflows. The work planned for 2026 is described in detail in the dedicated section (see **CWG-NTS / NDS – An open database for sharing ion-mobility derived CCS values**).

Persistence Directed Testing of Chemicals in WWTP effluents (DTU, Technical University of Denmark)

The objective of this activity is to test a novel *Persistence-Directed Testing* approach, in which biodegradation tests are combined with HRMS analyses after various chromatographic separations to assess the persistence of a wide range of chemicals within complex mixtures.

This activity builds on the preparatory work carried out under JPA 2025. The work planned for 2026 is described in detail in the corresponding dedicated section (see **CWG-NTS Persistence Directed Testing of Chemicals in WWTP effluents**).

Activities from previous JPAs

- **CT on Passive air sampling and wide-scope suspect/non-target screening for organic substances in air** (University of Stockholm) (**in collaboration with PS-CWG**): The results from participating laboratories were received in September 2025, and data processing began in autumn 2025. The work will continue in 2026 until completion of the final report. The results will subsequently be presented and discussed at a final workshop, including consideration of next steps toward a potential joint publication. Relevant outcomes will also be contributed to the NORMAN-SLE database to support the identification of indoor air chemicals.
- **CT for the intercomparison of Ion mobility separation data** (SLU): The study involved 19 participating laboratories. Data processing was completed in December 2025, with manuscript submission expected in 2026 (see “Collaborative Trial for the intercomparison of Ion mobility separation data. Development of open-access CCS databases for IMS”)
- **Intercomparison study on PS and suspect and NTS for PFASs** (QAEHS / RECETOX / VU). Following Phase I of this study—during which a single type of passive sampler was deployed at a highly contaminated site in Australia alongside grab sample collection – Phase II expanded the scope by deploying two different PS devices. This phase aimed to additionally investigate: (i) the performance of different passive samplers across a range of PFAS; (ii) laboratory-specific extraction techniques, as Phase I focused solely on differences in analysis and reporting; and (iii) analytical methods, specifically chromatography–mass spectrometry approaches. Sampler deployment and homogenisation were organised by RECETOX in November and December 2024. To minimise shipping costs, samplers were distributed from RECETOX to 17 participating laboratories at the end of April 2025. A homogeneity test for a selected set of target PFAS was conducted by the University of South Bohemia. Following extension requests from several laboratories, data submission was postponed to December 2025. Result processing and evaluation are anticipated to take place during Q1–Q3 2026 (this task is carried out in collaboration with WG-6 and CWG-PS).
- **Machine learning-supported algorithms for assessment of the spectral quality and diagnostic information of MS² data acquired with LC-ESI-HRMS** (VU, UBA): This activity was initiated in 2024. As an initial step, the spectral quality prediction model was further developed and improved. Subsequently, MS² data from **MassBank**, **MoNA**, and various custom/in-house MS² libraries were integrated into the model, together with **SIRIUS CSI:FingerID** outputs for molecular fingerprint prediction. In addition, new predictors—specifically fragment ions and neutral losses derived directly from MS² data—were incorporated. Based on insights gained from the modelling activities, including the identification of suitable chemical space regions, a list of target compounds was selected. The next planned step was to continue the work in 2025 with the preparation and distribution of spiked samples containing the selected compounds. However, due to the lack of available student support, this phase could not be implemented, and the activity is currently in stand-by (see “**CWG-NTS - Assessing the spectral quality and diagnostic information of MS² data acquired with LC-ESI-HRMS**”).
- **Development of the NORMAN GC-HRMS workflows** (NKUA, NILU and EI): Reference standards (~100 GC-amenable compounds) were purchased in a previous related activity and distributed to NILU, BOKU, and NKUA. In 2025, the standards were analysed by GC-HRMS. The corresponding mzML files were collected and prepared for import into DSFP. A GC-HRMS workflow has been established and will be tested on the newly generated dataset. The next step is to create a labelled dataset with true and false identifications for modelling. If the dataset size proves too small, open-science datasets will be reused (see “**CWG-NTS - NORMAN GC-HRMS workflows**” JPA 2021).

- **Integration of computational toxicity driver prioritisation tools to support NTS workflows in HT-EDA** (EAWAG, EI) (see “Bringing together NTS and toxicity – Cooperation between DSFP and MLin vitroTox, MS2Tox and other tools” JPA 2024): the activities started in 2024, and some preliminary results were presented at the Artificial Intelligence workshop (Leipzig, October 2024). In 2025, a dataset of substances detected and quantified in effluent wastewater samples from JDS4 was compiled. These samples were analysed using a battery of bioassays to assess the activation of key receptors and pathways. To evaluate the contribution of detected contaminants to these biological effects, 45 models from four toxicity prediction tools (MLin vitroTox, MS2Tox, deepFPlearn, and ToxAI) were applied. The predictions were compared across overlapping endpoints, identifying compounds associated with specific biological responses. Additionally, MLin vitroTox and MS2Tox were used for feature prioritization, identifying key chemical properties linked to specific effects. Non-target screening component lists from the DSFP were processed using fingerprint-based prioritization, significantly reducing peak lists. The outputs of this exercise are expected to be used to write a manuscript.

CWG-NTS Chemicals in Plastics

Chemicals in Plastics (Activity coordinated by TNO andrea_mizzi.brunner@tno.nl and EI alygizakis@ei.sk as follow-up of “(Micro)plastics – leaching of additives and non-intentionally added substances” (JPA 2024)

Plastic pollution is a growing environmental concern, with (micro)plastics and their associated chemicals presenting complex challenges for monitoring and risk assessment. Conventional methods often fail to detect emerging contaminants, especially plastic additives and non-intentionally added substances (NIAS). To address these gaps, advanced analytical techniques such as high-resolution mass spectrometry (HRMS) are essential for comprehensive screening.

In the previous JPA, HRMS-based non-target screening of (micro)plastic leachates were performed. To continue with these efforts, the **work plan in 2026** will be organised around the following tasks:

Retrospective Screening with EMPODAT Suspect:

Utilizing the NORMAN EMPODAT Suspect functionality, we will perform retrospective screening of 500 environmental samples for the ~1000 plastic associated chemicals identified in the JPA 2024. This approach will help establish the prevalence of plastic associated chemicals in the environment, historical trends and direct links between plastic leachates and environmental contamination.

Scientific publication on Non-Target Screening Analyses of (Micro)Plastic Leachates:

In the JPA 2024 study, a broad spectrum of compounds released from (micro)plastics was identified and characterised, going beyond the predefined suspect lists. In addition, high-performance thin-layer chromatography (HPTLC)-based bioassay screening was performed as a step toward hazard identification. These results together with the retrospective screening data (from JPA 2026) will be submitted for publication.

Stakeholder Workshop on Plastic-Associated Chemicals:

A multi-stakeholder workshop will be organised to bring together experts from regulatory authorities, industry, NGOs, academia, and international initiatives. The workshop will facilitate knowledge exchange and dialogue on analytical strategies, regulatory frameworks, and emerging challenges related to plastic-associated chemicals, while actively fostering cross-sector collaboration. By combining strong scientific content with targeted stakeholder engagement, this activity will not only advance academic understanding but also support evidence-based policy development and practical implementation.

CWG-NTS / NDS-CCS: An open database for sharing ion-mobility derived collision cross section (CCS) values

NDS-CCS: An open database for sharing ion-mobility derived collision cross section (CCS) values (Activity coordinated by lidia.belova@uantwerpen.be University of Antwerp, alberto.celma.tirado@slu.se SLU, Lubertus Bijlsma bijlsma@uji.es UJI, emma.schymanski@uni.lu LCSB)

Hyphenating ion mobility separation (IMS) with high-resolution mass spectrometry (HRMS) has demonstrated clear advantages for the annotation of emerging environmental contaminants in complex matrices. IMS allows the separation of ions based on their shape, size and charge, and gaseous mobility resulting thereof. From the measured mobility, a collision cross section (CCS) value can be calculated for every analyte. The CCS value can serve as an additional annotation parameter for the identification of chemicals in suspect and non-target screening. The implementation of IMS in exposomics studies has shown a vast increase in recent years. However, the use of CCS

values for compound annotation is dependent on the availability of open access databases providing reference CCS values, derived from reference standards or, if latter are not available, from prediction models. Numerous extensive datasets, both predicted and experimental, have been published and made available to the scientific community covering a wide range of environmental contaminant classes, their metabolites, endogenous compounds etc. To improve data accessibility, these CCS datasets can be gathered in open access repositories (e.g., NORMAN-SLE) or implemented in existing chemical databases such as PubChem. However, given the current political developments leading to substantial cuts in research funding and putting the accessibility of US based large scale data repositories at risk, there is a growing need to establish European datahubs to secure available CCS repositories and their availability to the scientific community.

The aim of this activity is therefore to establish a Europe-based database for the collection, consolidation and comparison of experimental reference CCS data. First, the datahub will be populated with experimental CCS data already consolidated within the NORMAN-SLE, PubChem, the dataset collected within the NORMAN JPA conducted in 2023 (involving 19 laboratories) and new relevant literature data. All data will be gathered in a newly created easily accessible webpage facilitating FAIR data sharing within the scientific community. The webpage will also ensure easy integration of new CCS datasets submitted by other NORMAN laboratories or external partners. To facilitate future data submissions, a data reporting template, with harmonised required experimental parameters to be included, will be developed. These actions will set the basis for further developments and improvement of CCS prediction data and establishment and wider implementation of experimental CCS-m/z trendlines for the annotation of homologue series of environmental contaminants.

The **workplan in 2026** will be organised around the following activities:

- Collection of existing experimental CCS datasets from the NORMAN-SLE, NORMAN JPA 2023 on CCS inter-comparison, PubChem, and recent IMS studies in the exposomics field.
- Consolidation of CCS data reporting to harmonise available experimental parameters including instrumental set-up, calibration approach, measurement parameters, etc.
- Creation of an open source webpage for CCS data sharing, interlinking compound data with PubChem and SusDat databases.
- Development of a standardised procedure for submission of experimental reference CCS datasets by NORMAN and external partners including minimum requirements of needed information.

CWG-NTS Persistence Directed Testing of Chemicals in WWTP effluents

Persistence Directed Testing of Chemicals in WWTP effluents (Activity coordinated by Philipp Mayer philm@dtu.dk DTU, Technical University of Denmark)

Persistence is becoming increasingly important for environmental risk assessment and management of chemicals. Persistent chemicals (1) can remain in the environment for extended periods of times, (2) can be prone to long range transport, (3) have time to distribute and contaminate other media including groundwater, if mobile and (4) are notoriously difficult to clean-up. Persistence is thus one of the most important criteria to prioritise organic pollutants as well as identify hazardous chemicals of emerging concern.

Biodegradation and persistence are traditionally assessed in standardised single substance tests. However, several NORMAN partners are conducting biodegradation and persistence research where multiple chemicals are tested simultaneously in mixtures. This emerging area highlights significant new research opportunities at the interface between mixture-based persistence assessment and high-resolution mass spectrometry (HRMS) analysis.

In this context, a novel Persistence-Directed Testing approach was recently introduced using produced water from oil platforms as a case study (Møller, 2025; DOI:10.1021/acs.est.5c08802). In this approach, biodegradation tests were integrated with SPME-GC-MS and SPE-LC-HRMS analyses to elucidate the persistence of numerous chemicals in complex discharges. The approach has the potential to (1) identify discharges of "Unidentified Persistent Chemicals", (2) prioritise identification efforts towards the most persistent compounds, and (3) support improved water treatment strategies, chemical substitution, and regulatory decision-making.

The plan for 2026 is to apply Persistence-Directed Testing to a WWTP discharge using a comprehensive range of HRMS-based analytical techniques. Analytical efforts will focus on the polar chemical space by combining reversed-phase liquid chromatography with 1-2 dedicated methods targeting ionic and highly mobile compounds (e.g. ion chromatography (IC), supercritical fluid chromatography (SFC), or hydrophilic interaction liquid chromatography (HILIC)).

The analytical strategy will comprise: (1) target analysis to assess the persistence of known chemicals; (2) suspect screening to evaluate persistence within predefined suspect lists; and (3) non-target screening to determine the number and fraction of persistent chemicals, enable tentative annotations, identify new groups of persistent

substances, and highlight unidentified persistent chemicals. Where feasible, the activity will also include dedicated efforts on semi-quantification and the identification of persistent metabolites.

The time plan is to: organise the test at DTU in June/July 2026; Analytics and Data treatment at NORMAN partners in August/December 2026 and Data integration and Manuscript Drafting 2027.

CWG-PS Passive Sampling Cross-Working Group Activity

CWG-PS - Passive Sampling Cross-Working Group Activity (Activity coordinated by NIVA Ian.Allan@niva.no and INRAE cecile.miege@inrae.fr)

Over the years, the CWG activity on Passive Sampling has played a key role in (i) advancing the application of passive sampling in both research and regulatory contexts, (ii) strengthening interaction and knowledge exchange between passive sampling experts and monitoring authorities, and (iii) evaluating laboratory performance in the analysis of emerging pollutants from passive sampler extracts. In 2025, the CWG-PS was actively involved in, and provided key contributions to, several major initiatives, including the Joint Danube Survey (JDS5) and intercomparison studies aimed at advancing the application of passive sampling in combination with non-target screening techniques. These activities focused on the use of passive samplers for the analysis of PFAS in water and organic contaminants in air.

The **activities in 2026** will pursue the work started in the previous JPA. In parallel, new initiatives will be launched in collaboration with the plastics and polymers community as described below.

Task 1: Harmonising and extending knowledge of polymer-chemical interactions to benefit both the passive sampling and plastic communities (Activity coordinated by NGI and UFZ)

This activity aims to strengthen links between the passive sampling and plastics research communities to improve understanding of polymer–chemical interactions. Because the same parameters govern chemical uptake in passive samplers and interactions between chemicals, additives, and environmental plastics, integrating these perspectives will support more realistic contaminant modelling in plastic-rich environments and improve interpretation of microplastic and passive sampling data. A workshop will be organised during the IPSW conference (May 2026) to further explore this topic and define opportunities for collaboration and – building on its outcomes – organise a half-day online meeting after summer 2026 to bring together both the passive sampling (PS) and plastics communities. A detailed description of the activity is provided in the dedicated section (see **CWG-PS – Harmonising and extending knowledge of polymer-chemical interactions**).

Task 2: Workshop: Meeting the Challenges of Reliable Analysis of Passive Samplers for Hydrophilic & Hydrophobic Compounds – Needs and Insights from Interlaboratory comparisons Studies (Activity coordinated by WUR/WEPAL-QUASIMEME celia.martinsbento@wur.nl; RECETOX branislav.vrana@recetox.muni.cz; University of South Bohemia rgrabic@frov.jcu.cz; with the support from Kees Booij (PaSOC)

The quality and reliability of chemical analysis in environmental monitoring programs are crucial for accurate risk assessment. Low uncertainties in reported concentrations enhance confidence in measurements and reduce the risk of incorrect environmental management decisions. Analytical laboratories apply various internal QA/QC measures, but regular participation in Proficiency Testing programmes is equally important and often required to assess performance and comparability between laboratories.

WEPAL-QUASIMEME, in collaboration with RECETOX, University of South Bohemia and PaSOC, has organised several ILSs for hydrophilic (using POCIS-HLB PS; 2 times) and hydrophobic (using silicone PS, 6 times) compounds in surface water, between 2014 and 2024. Results from these ILSs have shown great variability between participants, particularly for the hydrophilic compounds – median coefficients of variation (CV) over all rounds of 31% for the hydrophobic compounds in silicone PS, and of 41% for the hydrophilic compounds in POCIS-HLB PS. Such variability is high compared to the EU Water Framework Directive’s target of a maximum CV of 25%.

Limited information from laboratories regarding analytical methods and instrumentation makes it difficult to identify the causes of variability or propose effective improvements. While individual analysis by laboratories of deviations may help, a collaborative workshop to discuss and share experiences, may result in jointly identifying potential solutions that could significantly enhance both within- and between-laboratory performance and the comparability of reported data.

Activities 2026

An on-line workshop will be organised in 2026 to:

- present and discuss the results of the ILSs conducted by WEPAL-QUASIMEME between 2014 and 2024 on the analysis of PS for both hydrophobic and hydrophilic compounds.

- present and discuss how RECETOX prepared and organized the deployment and retrieval of the PS, including the procedures implemented to ensure samples homogeneity.
- invite participating or interested laboratories to present their analytical methods and instrumentation, and to share challenges encountered as well as potential solutions identified for improvement.
- hold a “roundtable” discussion to propose potential solutions or improvements for the next ILS.

Based on participants' feedback, roundtable session, discussions, and outcomes, the potential strategies or solutions identified will be incorporated into the new ILS on Silicone and POCIS-HLB PS for the analysis of hydrophobic and hydrophilic compounds in surface waters, planned for 2027.

Activities from previous JPAs

- **Intercomparison study on passive sampling and NTS for PFASs (Phase II – continuation)** (Leader: QAEHS k.sarit@uq.edu.au in collaboration with RECETOX branislav.vrana@recetox.muni.cz, University of South Bohemia rgrabic@frov.jcu.cz, NIVA Ian.Allan@niva.no and University of Amsterdam s.samanipour@uva.nl). This project was launched in 2023 with the aim to address and identify some of the limitations and opportunities with the passive sampling and broad scale non-target analysis of PFASs.

- **Intercomparison study on passive sampling and NTS for PFASs (Phase II – continuation)** (Leader: QAEHS k.sarit@uq.edu.au in collaboration with RECETOX branislav.vrana@recetox.muni.cz, University of South Bohemia rgrabic@frov.jcu.cz, NIVA Ian.Allan@niva.no and University of Amsterdam s.samanipour@uva.nl)

This project was launched in 2023 with the aim to address and identify some of the limitations and opportunities with the passive sampling and broad scale non-target analysis of PFASs.

- **Phase I** (organised as full in-kind contribution by QAEHS, UQ) involved the deployment of one type of passive sampler at a highly contaminated site in Australia along with grab sample collection. Homogenised passive sampler and grab sample extracts, along with reference standards and blanks were sent to participating laboratories for analysis in Sep/Oct 2023 and results from the labs were submitted in the first half of 2024. **Result processing and evaluation are expected to take place during Q1–Q3 2026.**
- **Phase II** of the project (Intercomparison of Passive Sampling Technologies) started under JPA 2024. The goal is to additionally investigate: (i) the performance of different passive samplers across a range of PFAS; (ii) laboratory-specific extraction techniques, as Phase I focused solely on differences in analysis and reporting; and (iii) analytical methods, specifically chromatography–mass spectrometry approaches. Sampler deployment and homogenisation were organised by RECETOX in November and December 2024. To minimise shipping costs, samplers were distributed from RECETOX to 17 participating laboratories at the end of April 2025. A homogeneity test for a selected set of target PFAS was conducted by the University of South Bohemia. Following extension requests from several laboratories, data submission was postponed to December 2025. Result processing and evaluation are anticipated to take place during Q1–Q3 2026.
- **Analytical assessments of organic micropollutants in the Danube River using a combination of passive sampling, targeted analysis, non-target screening (NORMAN collaboration in Joint Danube Survey JDS5)** (Leader: RECETOX, branislav.vrana@recetox.muni.cz)

This task continues the work initiated in 2025 in line with the agreed work plan. The JDS5 was conducted during the summer of 2025, one main objective being the identification of river-basin-specific pollutants and characterisation of their fate in the aquatic environment, including associated environmental risks. JDS5 provides NORMAN experts with an excellent large-scale testbed for evaluating and comparing analytical and monitoring approaches across a major transboundary river basin.

Passive sampling was applied in JDS5 as a monitoring tool for trace organic pollutants in the Danube River. NORMAN has previously demonstrated the applicability of passive sampling for chemical and effect-based monitoring, as well as for the prioritisation of a broad range of organic contaminants, during JDS3 and JDS4 (Novák et al., 2018; Vrana et al., 2018; Šauer et al., 2023; Beggs et al., 2023). As a result, the passive sampling methodology developed by NORMAN has become an integral component of the Danube Survey monitoring framework.

In 2025, passive samplers were deployed as planned at 10 representative sites selected from the 48 JDS5 locations where full-scale investigations were carried out. These sites were chosen from designated “supersites”, where additional in-depth investigations were conducted in parallel with the passive sampling activities. In line with the work plan, repeated sampling of trace organic pollutants was performed using the methodology successfully applied during JDS4, enabling continuity and comparability over time.

Three types of passive samplers were deployed, targeting hydrophobic compounds, polar compounds, and PFAS, respectively. Samplers for hydrophobic substances were based on silicone materials, while samplers for polar compounds utilised commercially available SPE sorbents (Affinisep HLB disks). For PFAS, validated microporous

polyethylene tube (MPT) samplers developed by the University of Queensland were applied.

Samplers were deployed for approximately 100 days between June and September 2025. Consistent with JDS4, samplers were installed at stationary locations such as dams, jetties, bridge pillars, and stationary buoys. The extended deployment period allowed integrative accumulation of contaminants in the passive samplers to levels suitable for reliable detection. With the exception of one site, where samples were collected but compromised during sampling, the passive sampling campaign was successfully completed. As the stationary passive sampling methodology remained consistent with that applied during JDS4, results can be evaluated using established calibration parameters and directly compared with JDS4 outcomes.

In addition, hydrophobic passive samplers were deployed for one month in July 2025 at 10 effluents from large municipal wastewater treatment plants (WWTPs) within the Danube River Basin to investigate emission source patterns.

Samples collected from polar, non-polar, and PFAS passive samplers will be subjected to:

- Analysis of selected target priority substances, river-basin-specific pollutants, and a wide-scope target list;
- Suspect screening and non-target screening (NTS) of passive sampler extracts.

The work in 2025 progressed according to the pre-agreed schedule:

- A steering group meeting was held in March 2025 to finalise the monitoring programme (RECETOX);
- A battery of passive samplers was deployed between June and September 2025;
- Analysis of passive samplers by partner laboratories (2025–2026).

Milestones 1 and 2 were completed as planned in 2025. Milestone 3 will be extended into 2026, without requesting additional funding.

- **CT on Passive air sampling and wide-scope suspect/non-target screening for organic substances in air (in collaboration with PS-CWG)** (Action leader: adria.sunyer@aces.su.se ; jon.martin@aces.su.se Stockholm University) (see also WG-6)

The laboratories were invited to participate in the study in June 2024 and the deployment of the passive PDMS foam sampler adsorbents was organised during summer. A preparatory workshop took place on 10 October 2024 before distribution of the exposed samplers to the participants in November 2024 together with the SOP and reporting templates for LC and GC. The results were received in September 2025, with contributions from 13 participants, comprising 11 LC-HRMS datasets and 5 GC-HRMS datasets, including three participants who submitted both. Data curation and result processing were completed in February 2026. All participants will be invited to attend a follow-up workshop planned for April 2026, during which the results and outcomes of the collaborative trial (CT) will be presented and discussed. A final report compiling the individual laboratory results will be provided to all participants. Following curation, the datasets will be uploaded to the NORMAN Suspect List Exchange (NORMAN-SLE) to contribute harmonized data on airborne organic substances. The workshop will also include discussion of next steps toward a potential joint publication summarising the principal findings and methodological insights from the trial.

CWG-PS Harmonising and extending knowledge of polymer-chemical interactions to benefit both the passive sampling and plastic communities

Harmonising and extending knowledge of polymer-chemical interactions to benefit both the passive sampling and plastic communities (Activity coordinated by Elisa Rojo Nieto elisa.rojo-nieto@ufz.de UFZ; Nicolas Estoppey nicolas.estoppey@ngi.no NGI)

Over the past two decades, passive sampling (PS) has become a robust technique for monitoring legacy, regulated and emerging hydrophobic organic contaminants in aquatic environments. Its ability to provide time-integrated measurements and yield freely dissolved concentrations makes it compatible with regulatory monitoring and risk assessment objectives. The robustness of passive sampling for these compounds is the result of a focus of the PS community to understand the interaction and exchange of chemicals between environmental matrices and well-defined polymers used for PS.

In parallel, a rapidly growing body of research has demonstrated that plastic/polymeric materials in the environment (micro and nanoplastics) can act as sorbents for organic chemicals. Plastics also routinely contain (from production) a range of additives to obtain desired mechanical, thermal or optical properties.

The same fundamental parameters that govern chemical uptake into passive samplers (partition coefficients, diffusion coefficients, polymer-chemical interactions) also govern the interaction of chemicals and plastic additives with

environmental plastics. Yet, these two research communities have developed largely in parallel, using overlapping but not harmonised methodologies. This creates a unique opportunity to contribute to both fields.

Passive sampling polymers (e.g., silicone, PE, POM) have been extensively characterised and used to predict chemical partitioning in the environment. However, micro and nanoplastics are far more diverse (e.g., PET, PP, PU, PVC, tyres/elastomers) and display a wider range of sorption behaviours due to differences in crystallinity, additives, weathering, and ageing. Because of this, there is now strong scientific and regulatory interest in harmonising the understanding of polymer–chemical interactions across both fields.

Integrating these perspectives would allow: (i) more realistic modelling of contaminant distribution and transport in environments with high plastic loads, (ii) improved interpretation of data from microplastic surveys and passive sampler campaigns, and (iii) better predictions for fulfilling the Environmental Quality Standards (EQS).

Activities 2026

1. Organisation of a two-hour satellite session on “Plastic-associated chemicals and equilibrium partitioning science” during the International Passive Sampling Workshop (IPSW), to be held on 13–15 May 2026 in Prague. Building on the outcomes of this session, a half-day online meeting will be organised after summer 2026 to bring together the passive sampling (PS) and plastics communities.

2. Preparation of a critical review including recommendations on how key parameters (e.g. diffusion coefficients, partition coefficients) should be generated, compiled, and evaluated in order to best serve both communities.

3. Extending partition coefficients from well-studied polymers (silicone, PE, POM) to less-studied polymers is a key aspect of this approach. Car tire rubber is also a particularly relevant matrix. Experimental designs to determine polymer–polymer partition coefficients will be discussed jointly by the communities during the JPA.

Exploring NORMAN’s global expansion with focus on Global South membership

Exploring NORMAN’s global expansion with focus on Global South membership (Activity coordinated by UFZ werner.brack@ufz.de , WUR celia.martinsbento@wur.nl and VU Amsterdam sicco.brandtsma@vu.nl)

The World Café discussion at the NORMAN GA 2025 showed strong support for expanding NORMAN beyond Europe and therefore, including members, data, and projects from the Global South. Members highlighted several reasons:

- Many countries already use European legislation as a blueprint for their own regulations.
- Exporters to Europe must comply with European rules.
- NORMAN offers valuable resources for partners in the Global South, including networking experience, databases, expertise, etc.
- NORMAN can learn from Global South experiences and strengthen its role as a global player in the field of environmental pollution by organic micropollutants.
- New, jointly developed cost-effective technologies, citizen science approaches, and other innovations can also benefit Europe, where environmental monitoring budgets are declining.
- Expanding globally enhances data sharing and harmonizes monitoring methods, improving scientific knowledge and environmental policy both in Europe and the Global South.

However, this expansion also presents challenges for NORMAN that need careful consideration. These include:

- NORMAN needs a clear vision and strategy for this expansion, developed carefully and involving as many NORMAN members as possible, as well as potential Global South partners. Lessons learned from UNEP projects should also be integrated.
- Expanding to the Global South may require new organizational structures in NORMAN to ensure adequate representation and voice for these new partners.
- New membership models may be needed, as many potential Global South partners may not be able to afford the membership fees.
- GA formats must balance the value of face-to-face meetings with accessible participation options for non-European members who cannot travel.
- Developing appropriate methodologies for the Global South, including sampling, storage, sample preparation and analysis, QA/QC, and data sharing and evaluation, will require substantial communication and capacity building.
- Chemical lists will need to be updated to include substances of relevance in the Global South.

The **activities in 2026** will focus on the following tasks:

- 1) A questionnaire will be developed and distributed to all NORMAN members in March 2026 to gather ideas, identify existing collaborations with partners in the Global South, and collect suggestions for potential new partners. Information on existing datasets from Global South countries currently held by NORMAN members will also be compiled to support possible invitations to contribute to the NORMAN Database System.
- 2) A second questionnaire will be prepared for potential partners in the Global South to assess their interests and expectations regarding engagement with NORMAN. This questionnaire will be disseminated through established communication channels, including the NORMAN website and LinkedIn.
- 3) A short report will be prepared that summarises the lessons learned from UNEP projects and outlines potential ways forward, developed in close cooperation with NORMAN members previously involved in UNEP activities. The outcome of this report will support the organization of the workshop proposed in point 3 below.
- 4) A workshop will be organised in autumn 2026 to develop a strategy for engaging partners from the Global South in NORMAN. The workshop will address the issues identified above, as well as any emerging topics. Scientists from the Global South who already collaborate with NORMAN members will be invited, along with one or two interested candidates from Africa, Asia, or South America who can provide insights into what would make NORMAN attractive for broader Global South participation.
- 5) A presentation will be prepared for the NORMAN GA 2026 to present the outcomes of the questionnaires, the report on lessons learned from UNEP, and the workshop. The presentation will also outline proposed plans and next steps for 2027.

NORMAN – ICPDR Joint Danube Survey 5 (JDS5)

NORMAN – ICPDR Joint Danube Survey (JDS5) (Activity coordinated by Environmental Institute slobodnik@ei.sk)

The collaborative activities organised within NORMAN in support of JDS5 (described in detail in JPA 2025) have progressed as planned and will continue in 2026 until the final report is completed.

Joint Danube Survey 5 (JDS5): The WWTP project - An integrated assessment

Joint Danube Survey (JDS) 5: The WWTP project - An integrated assessment (Activity coordinated by UFZ charlotte.henkel@ufz.de)

The collaborative activities organised within NORMAN in support of JDS5 (described in detail in JPA 2025) have progressed as planned and will continue in 2026 until the final report is completed.

Increasing chemical pollution threatens sustainable water resources worldwide. The growing complexity of pollutants entering WWTPs challenges conventional treatment, leading to effluents containing diverse, poorly understood contaminants that may affect aquatic life and human health. Understanding the chemical complexity of WWTP influents and effluents is crucial to assessing their role in aquatic pollution. While previous surveys such as JDS3 and JDS4 examined individual stressors, a comprehensive assessment of chemical mixtures from WWTP effluents across the Danube basin is needed. This JPA aims to fill this gap by integrating analyses of organic and inorganic contaminants using chemical analysis, bioassays, and tests for antibiotic resistance genes.

In the framework of the JDS5, wastewater influent, effluent, sludge and combined sewer overflow samples have been taken in ten WWTPs in the Danube catchment. In addition, passive samplers have been employed in the effluent of nine WWTPs by a team from UFZ and IBISS. The sampling campaign has been completed in summer 2025. The samples have been processed including filtering and solid phase extraction. The resulting extracts have been distributed to the collaborating laboratories for subsequent analyses (chemical analysis and bioassays). For those analyses, which require specific sample treatment, the (native) water samples have been distributed. The measurements and data analysis are scheduled for 2026 and are ongoing.

Activities 2026 (follow-up from JPA 2025):

Activity 1: Scientific coordination of the project (ongoing)

An important part of this JPA is to bring together experts from different disciplines, aligning the analyses and ensuring a complementary and holistic assessment of the wastewater samples. This includes the compilation of data and evaluation of results from different analyses in a comprehensive and integrated way. Results will be presented to the scientific community and public, and published in internationally recognised journals. Further, this project is committed to giving advice to policy makers. → UFZ

Activity 2: Sample preparation and distribution for chemical analyses and bioassays (completed)

The wastewater samples have been processed and distributed to the collaborating laboratories for the chemical analyses and bioassays.

Activity 3: Target, suspect and non-target screening of organic substances (ongoing)

Analysis of a broad range of target compounds using high-performance liquid chromatography (HPLC) coupled to high-resolution mass spectrometry (HRMS). Results will be supported by findings from suspect and non-target screening. → UFZ

Activity 4: Target analysis with a focus on selected WWTP contaminants of particular concern (ongoing)

Analysis of persistent, mobile (PM) and toxic (Ts) compounds and PFAS (including ultra-short chain PFAS), *tire-derived compounds*, drugs of abuse. → UFZ, University of Vienna, IDAEA-CSIC Barcelona

Activity 5: Analysis of micro-and nanoplastics (ongoing)

Analysis of nanoplastics and microplastics → UFZ, ESHU, WRIBN

Activity 6: Analysis of inorganic contaminants (ongoing)

Analysis of Rare Earth Elements and metals → University of Lorraine, University of Vienna

Activity 7: Battery of bioassays (ongoing)

A broad batterie of bioassays will be conducted targeting a range of specific endpoints, including endocrine, dioxin-like and neurotoxic effects. Findings from the chemical analysis will complement findings from the bioassays and help to explain mixture effects and identify potential drivers of the effects observed in the bioassays. For details of the endpoints see the JPA from 2025. → UFZ, Goethe-University Frankfurt, INERIS

Activity 8: Metaproteomics to explore the microbial community in sewage sludge (ongoing)

Proteins extracted from sewage sludge are enzymatically digested into peptides and then analyzed with nano-liquid chromatography coupled to a mass spectrometer (MS). Results will be used to better understand biological processes in wastewater treatment plants including the degradation of pollutants. → UFZ

Activity 9: Target analysis of more hydrophobic compounds using passive samplers (ongoing)

WWTP effluents will be analysed using passive samplers. → RECETOX, UFZ

Added value / Link with other NORMAN activities and / or other projects

An integrated assessment of wastewater influents and effluents is essential to evaluate the impact of WWTPs on the Danube River pollution. Results from this JPA will guide monitoring, prioritization, and removal strategies, serving as a best-practice example for implementing the EU Urban Wastewater Directive (UWWTD). Overall, this JPA is closely linked to other JDS-5 projects and contributes to a comprehensive assessment of the Danube River.

Interlaboratory studies (ILS) on pharmaceuticals, x-ray contrast media and hormones as well as on acrylamide and epichlorhydrine

Interlaboratory studies on on pharmaceuticals, x-ray contrast media and hormones as well as on acrylamide and epichlorhydrine (Leader: IWW, Gerhard Schertzinger g.schertzinger@iww-online.de)

There are increasing reports about the occurrence of these substances in the aqueous environment: in surface water, groundwater and for some of them even in drinking water.

Reliable analytical methods are needed to better assess the current situation and to investigate the effectiveness of several measures (such as advanced wastewater treatment) to reduce emission of these substances into surface waters

However, for these substance groups there are no European or internationally harmonised or standardised analytical methods available so far, and a thorough assessment of the suitability of different analytical methods used is still lacking.

Together with AQS BW, IWW Water Centre will organise interlaboratory studies on these compounds in drinking water.

- The ILS on pharmaceuticals, x-ray contrast media and hormones will be carried out during the 2nd quarter 2026. Parameters will be: candesartan, sulfamethoxazole, sulfadimidine, trimethoprim, gabapentin, valsartan, carbamazepine, metoprolol, and sotalol, amidotrizoic acid, iodipamide, iohexol, iomeprol, iopamidol, iopromide, iothalamic acid, ioxaglic acid and ioxithalamic acid, as well as selected hormones

- The ILS on acrylamide and epichlorhydrine will be carried out in august 2026.
More technical details and the dispatch dates can be found at www.iswa.uni-stuttgart.de/ch/aqs/index.en.html
The studies will combine proficiency testing of laboratories and evaluation of the suitability of methods used (V3 level).
As a result of this activity a comprehensive report on the outcome of the interlaboratory studies will be delivered with conclusions on:
 - the proficiency levels of European analytical laboratories;
 - the suitability of analytical methods for analysis of these two compound classes in water samples.Dissemination of information about the ILS (announcement/invitation, registration form etc.) will be done through the NORMAN website.

The proposed budget for this JPA may be revised by the Steering Committee in May 2026. All approved scientific activities will be implemented, independently of the revision of the budget.