

Information Platform for Chemical Monitoring

IPCHEM 2020

Update on the state of play of IPCHEM

Research Centre

IPCHEM

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Foreword

Chemicals are everywhere, in the food we eat, in the air we breathe, in the clothes we wear, in the products we use. In order to develop and implement European legislation on chemicals and related environmental and health policies, we need to better understand and track the types and amounts of chemicals we might be exposed to. To address this need, the European Commission developed the Information Platform for Chemical Monitoring – IPCHEM.

IPCHEM is a single access point where EU authorities, national and regional authorities, and researchers can find and share information about where chemicals are found and at which concentrations. IPCHEM allows the user to discover, access and retrieve information on chemical occurrence and concentrations throughout Europe across different media.

IPCHEM has matured in recent years and contains a wealth of data on chemicals present in our environment, food, indoor air, and even in our bodies. Now in 2020, IPCHEM gives access to more than 150 data collections containing results of more than 450 million concentration measurements. Populating IPCHEM with further data sets to increase the geographical coverage and range of chemicals in different media is continuing with many data collections already in the pipeline. Furthermore, we started the process of developing use cases that illustrate how IPCHEM can help addressing policy questions in the area of chemical, environmental and health policies.

IPCHEM has gained trust and recognition by Member States and researchers including at the international level, and has been very positively received among stakeholders. It has recently been inserted into the Regulation on Persistent Organic Pollutants as a reporting tool for Member States to report chemical monitoring data. The Chemicals Strategy for Sustainability (October 2020) aims to enhance knowledge and data on chemicals occurrence and IPCHEM will be one of the most important tools in that context.

This report provides an overview on recent achievements of IPCHEM until 2020. The focus is on how IPCHEM and its four modules have evolved and how IPCHEM can support data users to answer their policy and research questions.

Kestutis Sadauskas Director Directorate B Circular Economy & Green Growth





Guy Van Den Eede Acting Director

Directorate F Health, Consumers and Reference Materials (Joint Research Centre)

Acknowledgements

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10 facts about IPCHEM



IPCHEM allows the exploration of **chemical occurrence data** across different media (environment, human biomonitoring, food and feed, products and indoor air).



Data available in IPCHEM are quality checked and presented in a **harmonised** way.



Metadata describing all the data collections in IPCHEM are publicly available.



IPCHEM supports the evaluation of the **impact of policy measures** on exposure to chemicals.



IPCHEM integrates data collections that contain **time series** starting from the 1960s.



IPCHEM is a powerful tool for **collaboration** between research projects, national bodies, EU agencies and the European Commission.



68% of datasets in IPCHEM are **publicly** available.



Metadata in IPCHEM include a contact point for each data collection to allow **direct interaction** with the data providers.



IPCHEM provides data for regulatory exposure and risk assessments.



IPCHEM includes data collections covering all EU countries, other European countries and even beyond.

1. IPCHEM at a glance: objectives and benefits

The Information Platform for Chemical Monitoring (IPCHEM¹) is the reference access point for discovering chemical monitoring data collections which are managed by and are available to European Commission bodies, Member States, international and national organisations and research communities. IPCHEM was established to support a coordinated approach for collecting, storing, sharing and assessing data on the occurrence of chemicals and chemical mixtures in humans and the environment. The data is structured in four thematic modules: environmental monitoring, human biomonitoring, food and feed, products and indoor air.

The main policy objectives of the platform are to:

- Promote a more coherent approach to the generation, collection, storage and use of chemical monitoring data in relation to humans and the environment.
- Contribute to the development of a comprehensive chemical exposure and toxicity knowledge base for use in environment and chemical policy.
- Assess effectiveness of the EU regulatory framework implementation.

In practical terms, IPCHEM focuses on:



- Hosting data currently not readily accessible (e.g. outcomes of research projects, off-line stored monitoring data, etc.) that will be searchable and accessible through the platform;
- Providing chemical monitoring data and information of **defined quality** in terms of spatial, temporal, methodological and metrological traceability.

The IPCHEM platform envisages providing the following benefits for its end-users:

- Facilitating a **fast retrieval and accessibility** to chemical monitoring data stemming from different sources **through one unique reference gateway**;
- Improving quality and comparability of chemical monitoring data used in chemical exposure and risk assessment processes;
- Enabling the evaluation of the effectiveness of chemical policies and legislation to reduce chemical exposure and adverse effects to human health and the environment on the basis of best available quality data;
- Supporting a better planning of future chemical monitoring campaigns at EU and Member States levels and a resource efficient sharing of data and analytical methodologies.



"IPCHEM is more than just a gold mine of data. It has become a meeting point for a multidisciplinary community advancing exposure science and risk assessment."

> Maurice Whelan Head of Unit Unit F3 Chemical Safety and Alternative Methods (Joint Research Centre)



"Chemicals pollution is one of the key drivers putting the Earth at risk. Human biomonitoring and environmental monitoring data that are accessible on IPCHEM are extremely useful for making regulatory decisions on chemicals and implementing the Chemicals Strategy for Sustainability."

> Cristina De Avila Head of Unit Unit B2 Sustainable Chemicals (DG Environment)

2. IPCHEM in numbers

IPCHEM experienced a steep increase in the number of data collections and concentration measurements it includes in the last two years. At the end of 2020 IPCHEM hosts more than 450 million concentration measurements (Figure 1, Figure 2A), with the most populated modules being on environmental monitoring data and food and feed related monitoring data (Figure 1). More than 100 metadata for Human Biomonitoring (HBM) data collections have been gathered under the HBM4EU project (Figure 2B). HBM metadata and related aggregated data for a part of them have been incorporated in the platform in aggregated format and will become available to the public soon.

For each data collection, metadata providing general information on the data set are made publicly available. They include general information describing the underlying monitoring study, information on the monitoring purpose, on the data providing organisation, conditions of data access, on sampling and analytical methods, and links to additional resources describing the data collection.

Monitoring data are provided at single measurement level or as aggregated data. The aim is to make data publicly available at the highest level of data granularity possible to facilitate the combined analysis for different purposes. Some of the data collections have however restricted access levels to specific user groups such as the European Commission and EU agencies, EU Member State national authorities or specific research consortia (Figure 2C).

IPCHEM includes data collections covering different geographical areas (Figure 2D). Some are focusing on a specific city or region, some are looking into a single country, while many are covering the whole EU. There is also an increasing number of data collections with coverage beyond Europe already included and there are more to come.



Figure 1: Overview of data integration status in IPCHEM in December 2020.



B - Number of data collections by module.



C - Data collection accessibility by module. D - Spatial coverage of data collections. 12 Public Restricted 10 TOTAL 8 Environment 6 Human Biomonitoring 4 Food & Feed 2 Products & Indoor Air 0 Multicountry Localleity Global National Fundesh Regional 0% 20% 40% 60% 80% 100%





Module coordinators









DG ENV & JRC Policy & scientific/technical lead

> European Commission

Partners and collaborators



HBM4EU

i:m

ersa European Food Safety Authority

nce and policy

a healthy futu













🦟 vito

Data providers and data users









Citizens



3. Who is who: players and layers in IPCHEM

IPCHEM is not only a unique information platform but a very active collaboration too, involving many actors with multiple roles that interact at various levels.

Policy Lead

DG Environment takes the policy lead, and is responsible for identifying relevant policy needs and establishing links with different policy areas. Further, the Policy Lead oversees strategy formulation, priority setting, engaging with other policy Directorate Generals of the Commission, and promotes IPCHEM for policy support.

Scientific and Technical Lead

JRC takes the scientific and technical lead, being responsible for developing and maintaining the IPCHEM platform infrastructure and functionality, facilitating harmonisation of metadata and data reporting, data integration and liaison with data providers, and providing support to module coordinators. Furthermore, JRC contributes to the exploitation of IPCHEM for policy priorities and to the strategy formulation and priority setting.

Module Coordinators

The four modules are coordinated by different organisations, based on the best match of the thematic area with ongoing activities. Current coordinators are the European Food Safety Authority (EFSA) for the module on food and feed, the European Environment Agency (EEA) for the modules on environment and human biomonitoring, and JRC for the module on indoor air and products. The responsibilities of the module coordinators focus on identifying important data sets and data providers, supporting the evolution of metadata and data templates in the thematic area, and liaison with data providers. Furthermore, module coordinators contribute to the utilisation of IPCHEM for addressing policy questions, and to promoting IPCHEM as a policy and regulatory support tool.

Partners

Partners are available for consultation on the strategic development of IPCHEM and prioritisation of related tasks. They also act as ambassadors for IPCHEM. Partners can have multiple roles, such as module coordinator and data provider at the same time.

Currently, IPCHEM partners are various policy DGs such as DG RTD, DG SANTE, DG EMPL, several units within JRC, as well as the European agencies EFSA, EEA, the European Chemicals Agency (ECHA), the European Agency for Safety and Health at Work (OSHA). Furthermore, IPCHEM interacts closely with the Human Biomonitoring Initiative (HBM4EU), the Organisation for Economic Co-operation and Development (OECD), e.g. by linking to the eChemPortal, and exchanges with the UN Environment Programme UNEP on the Global Environmental Monitoring Survey (GEMS).

Collaborators

Many additional organisations collaborate on IPCHEM activities, some with specific tasks such as supporting harmonisation within a group of data providers or providing data sets of large consortia. Current partners include, the NORMAN network, the Lombardy Energy Cleantech Cluster (LE2C) Working Group on emerging and priority micropollutants, and Life Apex project on biomonitoring in top predators.

Other roles

The IPCHEM platform of course depends on the willingness to share data by many **data providers**, working with many national authorities and research projects. The IPCHEM team is supporting also **data users** and working on illustrating how monitoring data in IPCHEM can help to address policy questions in the area of chemical, environmental and health policies (see Section 6).

4. Spotlight: the four IPCHEM modules

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- One of the major benefits of IPCHEM is that it covers harmonised monitoring data in different media in one platform allowing one to search across different areas, to look for example into aggregate exposure from different sources, or combined exposure from multiple chemicals.
- IPCHEM is organised in four modules according to thematic areas to best handle occurrence data in different media. This allows each module to develop at its own speed and in its own context. This also facilitates the involvement of relevant experts in the respective fields to develop templates for metadata and data and to identify important partners and data providers.
- Each module is coordinated by a module coordinator supporting the strategic development of the module in terms of data collections, partners, and formats for data and metadata.



Figure 3: Overview of data collections in the four IPCHEM modules.

4.1 The human biomonitoring module

The human biomonitoring (HBM) module has gained momentum in recent years with the start of the HBM4EU² project. In a first step the IPCHEM team met with experts from HBM4U to gather information on the functionality needed for the IPCHEM platform to make HBM data and metadata available. HBM4EU is an EU H2020 research project with a joint effort of 30 countries, the European Environment Agency and the European Commission, and with inputs from a broad group of stakeholders from the EC and civil society. The initiative provides the basis for future coordinated HBM in Europe. Currently the project has collected and generated new evidence of the actual exposure of citizens to chemicals and its correlations with possible health effects in order to support policy making. The EEA is the module coordinator for the HBM module and involved as a partner in the HBM4EU project.

VITO³ leads the HBM4EU Work Package on data management and analysis and plays an important role in facilitating the harmonisation of metadata and data for HBM4EU and IPCHEM'S HBM module at the same time. HBM4EU collects existing data from previous HBM studies and performs new studies according to harmonised protocols, generating new HBM data, which will be shared via IPCHEM. Metadata has been gathered for more than 120 HBM data collections throughout Europe and integrated into IPCHEM to make the data collections findable. Aggregated data for 60 of those data collections were integrated in IPCHEM and are now becoming available to the HBM4EU project partners. In the future datasets will become publicly available where the data providers agree. Some research questions require the use of individual level data which are protected as personal data under data protection regulations. IPCHEM is preparing hosting facilities and data protection approaches to be able to host also individual level data in the future.

4.2 The environmental module

The environmental module is the most populated module of IPCHEM comprising 18 data collections and 255 million concentration measurements. The environmental module provides information on concentrations of chemicals in water, air, soil and biota. Key data streams for this module come from EU Member States reporting under environmental legislation, provided via the European Environment Agency (EEA), who is the module coordinator. This includes mainly data on water and air guality.

One of the most recently added datasets is NAIADES which provided 7.6 million measurements for France from 1960-2018. The recent EU funded project Life Apex⁴ will support this module providing further data on chemical concentrations in biota, in particular contaminant data from apex predators and their prey. Other data sets are on their way. Furthermore, under the Regulation on Persistent Organic Pollutants⁵, Member States have now also the possibility to provide environmental monitoring data on POPs via IPCHEM to fulfil their reporting obligations. This is a new approach to facilitate reporting, sharing of monitoring data and (re)use of the data. In addition to populating the module with new data, a process to further discuss (meta)data formats and functionality needs with experts will be started. This will ensure the harmonisation of data originating from data collections created for different purposes and using different methodology.

- 3. https://vito.be/en
- 4. https://lifeapex.eu/
- 5. https://eur-lex.europa.eu/legal-content/EN/TXT/
- PDF/?uri=CELEX:32019R1021&from=EN



"Within HBM4EU, IPCHEM allowed us to make the HBM data collections findable via one central access point"

> Eva Govarts VITO Work Package leader HBM4FU



"As a society we have on the one hand an obligation to get most out of expensive monitoring data paid for by citizens, which we do by creating an overview and access to data on chemical pollution – and on the other hand to ensure that the evidence allows for scientifically correct, and trustworthy interpretations. Meanwhile we have an opportunity to further ensure that the evidence and the functions of IPCHEM, can inform policies to reduce harmful impacts of chemicals on people and the planet – as called for in the European Green Deal and in the Chemicals strategy for sustainability."

Xenia Trier



^{2.} https://www.hbm4eu.eu/

"Adopting an open data approach has been a key objective of EFSA's 2020 strategy. Thanks to IPCHEM, we have greatly improved the discoverability of European chemical monitoring data for re-use."

Mary Gilsenan & Alessandro Delfino EFSA

and feed module



4.3 The food and feed module

The food and feed module had a breakthrough in 2020. The European Food Safety Authority (EFSA) collects monitoring data for chemicals in food and feed from EU Member States.

Following agreement with Member State data providers, EFSA as the module coordinator and data provider, collaborated closely with the JRC IPCHEM team to integrate all the occurrence of pesticide residues in food collected by EFSA since 2011. These data concern the use of plant protection products on crops for food or feed production, as well as monitoring data on veterinary medicinal product residues and other substances in live animals and animal products. The data will be updated annually in IPCHEM following the publication of annual European summary reports on these chemicals. This achievement has resulted in more than 200 million chemical monitoring analytical records in food in the public domain.

A next step forward will be the integration of data on chemical contaminants in food and feed, which EFSA is progressively publishing in the public domain. For example, data on the occurrence of perfluoroalkyl substances (PFASs) in food are already in the pipeline.

4.4 The product and indoor air module

The current focus of this module is on indoor air data, while product related information is still to come. Three indoor air quality related monitoring data collections have been integrated so far into IPCHEM, focusing on indoor air pollution and its relation to human exposure in public buildings, schools and offices. A list of ten candidate data collections for potential integration were identified and prioritised for 2021.

In 2020, the IPCHEM metadata and data collection templates for indoor air monitoring data were revised and extended⁶. This was based on harmonisation and standardisation efforts on the development of indoor air monitoring protocols and guidelines for monitoring indoor pollution attributed to chemical and biological stressors, which were undertaken by European Commission services, EU Members States, EU funded projects and research networks.

Metadata and data elements were identified as being mandatory, recommended, or optional to be provided, allowing a flexible application by end users. The suggested elements should be provided for reaching the required quality in the data documentation as well as for ensuring a correct data traceability and interpretation.

The updated metadata and data templates can be implemented by data providers when planning and setting up their future indoor air monitoring campaigns, or for mapping and harmonising data elements of their existing data collections for integration into IPCHEM.

 Kephalopoulos S, Bopp SK, Dalla Costa S, Cusinato A, Lipsa D, Geiss O (2020) Indoor air monitoring: Sharing and accessing data via the Information Platform for chemical monitoring (IPCHEM). Int J Hyg Environ Health, 227. https://doi.org/10.1016/j. ijheh.2020.113515

"Making available monitoring data through IPCHEM about the quality of the indoor environment will greatly help that the buildings in which we live, study and work can reach the kind of goodness required: be resilient and sustainable without compromising the comfort and health of their inhabitants. Buildings serving people not the other way around"

Stylianos Kephalopoulos JRC Module Coordination of Products and Indoor Air Module



5. IPCHEM and data quality

IPCHEM integrates chemical monitoring data from various heterogeneous sources, of different level of spatial and temporal detail. However, in order to be used for different purposes including in a regulatory context, these data need to be of known and defined quality. Quality in this context goes far beyond the mere analytical data quality and requires a novel definition and standardised assessment of data quality criteria in terms of spatial, temporal, methodological and metrological traceability.

Data collections are integrated in close collaboration between the data provider and the IPCHEM team. The Quality Check rules defined in IPCHEM are embedded in the ETL (Extract, Transform and Load) data-harmonisation processing. This current way of quality checks has proven capable of detecting several hidden quality issues that subsequently have been formally reported to the data provider, in order to take corrective action to fix the data quality issues or to flag the data records containing these issues. Previews of metadata and data as well as a harmonisation report are shared with the data provider for verification and validation before making the data available to other users.

A more advanced data guality conceptual framework was developed in order to extend the data quality concept to the whole life cycle of datasets integrated into IPCHEM. To achieve this, a proposal for a "Data quality self-assessment" questionnaire was elaborated in a formal document to be compiled by data providers. It includes elements that cover the data lifecycle and all steps involved in a chemical monitoring project, i.e. chemical monitoring planning, chemical sampling and transportation, the chemical sample preparation and pre-treatment phases, and the sample analysis and data management. More details are provided in the proposed quality framework⁷. Figure 4 illustrates the application of the framework to three datasets already included in IPCHEM



Figure 4: Application of the conceptual quality framework to three data sets in IPCHEM (see Comero et al, 2020⁷).

6. IPCHEM supporting chemical and health policies

The use case workshop

The initial focus in developing IPCHEM was on harmonising formats for metadata and data and populating the four modules. While efforts for data integration continue, the aim now is to illustrate how data providers and users can benefit from IPCHEM by developing specific use cases. A few applications of IPCHEM have been already presented. They include the checking of compliance of monitoring data with regulatory thresholds (IPCHEM webpage⁸), and spatial exposure assessment combining monitoring and modelling data (Pistocchi et al, 2019⁹). It is expected that IPCHEM will facilitate research efforts to link exposure and biological effects, including (eco)epidemiology studies.

Main policy areas that could be supported by the use of monitoring data

- 1. Spatio-temporal model evaluation
- 2. Regulatory risk assessments
- 3. Monitoring compliance and targeting intervention
- 4. Risk/impact indicators
- 5. Impact of regulatory intervention

The JRC IPCHEM team held a virtual workshop "EU chemicals, environment and health policies: How can IPCHEM contribute? - Workshop on developing IPCHEM use cases" on 15-16 September 2020. By bringing together experts from various fields including data providers and data users, the aim of the workshop was to define relevant policy questions and use cases to address them taking advantage of data provided via IPCHEM.

> Participants were experts from the areas of human biomonitoring, epidemiology, human and environmental health, environmental impact assessment, chemical mixtures, statistical analysis and modelling and staff from various European Commission Directorate Generals (JRC, ENV, SANTE, GROW, EMPL, RTD) and European Agencies (ECHA, EEA, EFSA, OSHA).

intervention In a first step participants identified policy questions and regulatory domains that may benefit from the use of monitoring data in IPCHEM. The focus of subsequent discussions was on formulating conceptual use cases, where monitoring data from IPCHEM can help address policy questions. In a second step experts shared ideas for possible case studies based on specific monitoring data possibly in combination with additional data sets from related scientific areas. Conceptual use cases and ideas for case studies were then linked to the extent possible to current regulatory processes and needs.

The workshop was just the start of a longer process in order to identify and brainstorm on possible use cases from different perspectives. The next steps will be to deepen the discussion on those use cases that are more relevant or more advanced with the aim to develop illustrative case studies in support of policy questions.

9. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6391594/pdf/main.pdf

7. How to practically use IPCHEM

The IPCHEM platform can be used to search, retrieve and compare chemical monitoring data that are provided in different data collections across various media. IPCHEM offers two ways to explore occurrence data: (1) search by chemical, medium and country or (2) a multi-chemical search by location. Both are briefly explained below. More details can be found in the user guide and tutorials available on the IPCHEM webpage¹⁰.

7.1 Searching for chemical occurrence in specific media and/or countries

Most users currently start their search in IPCHEM using a chemical name or CAS-number. The search can be done considering all data collections in all modules of IPCHEM, or can be focused directly on a specific medium or country (Figure 5). IPCHEM will show the list of data collections that contain data on the chemical, media and countries of interest. More details on each data collection can be found in the metadata pages (Figure 6). The user can then enter one data collection at a time to look in more detail at the data (Figure 7). IPCHEM allows exploring the data online (Figure 8, Figure 9 & Figure 10), while data can be filtered, collected and downloaded via the basket feature for further analysis offline.



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Figure 7: Exploring a data collection.

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Figure 9: Map view of selected data.



Figure 10: Trend overview for time series.

7.2 Searching for chemical occurrence in a specific location

IPCHEM provides a second option for exploring the data via the "IPCHEM Advanced Viewer", which allows the user to start the search by selecting a geographical area or location (Figure 11). The user can enter the name of a city and define an area by setting a specific radius around that location. IPCHEM will show available measurements in that area, allowing then to filter for chemicals, media, and data collection. This helps getting an overview of available data in IPCHEM for a specific area, e.g. useful to assess coexposure to multiple chemicals in one place.

This option is a pilot version which allows displaying and accessing those data collections for which the sampling locations are represented by geographical coordinates. The aim of the release of this Advanced Viewer is to collect feedback to further improve its design and implementation.



Figure 11: Overview of the advanced viewer page and functionalities.

8. What stakeholders say about IPCHEM

"IPCHEM is the open data platform that we as scientists need for our research and it is an instrumental source for EU and national authorities to build informed and science-based decision on. Accordingly, I am happy to share my data with IPCHEM and I sincerely hope for others to do so. So much monitoring is being done in Europe that we need one site from which we can retrieve as much data as possible."

Åke Bergman



"Data covering different sources of exposure from IPCHEM and models developed in the EU funded EuroMix project are supporting the implementation of European policy on the risk of combined exposure to multiple chemicals via multiple exposure routes (mixtures)."



Jacob van Klaveren National Institute for Public Health

and the Environment Ministry of Health, Welfare and Sport "Me and my colleagues work for water management authorities on a daily basis and find that the availability of data often limits their ability to fulfil their (legal!) obligations. IPCHEM has been designed to alleviate this. I see the success of IPCHEM as an important factor for our work."

Jos van Gils



"Open Science is a key objective of DG Research and Innovation. Open access to research results and their underlying data funded with public money is an important aspect of Open Science. But first of all, data needs to be findable and this is one important role of IPCHEM – a reference point to find data related to monitoring of chemicals. All projects funded by the EU research programmes in the Environment & Health area are actively invited to consider IPCHEM as data sharing portal."

> Sofie Norager DG Research and Innovation

> > European Commission

"Improving the scientific knowledge on human exposure to chemicals would allow to implement better risk management measures for protecting human health, and therefore in developing healthier public policies."



Piedad Martín Olmedo

"I am used to publish all my raw data as supplementary materials of my published papers, often in excel files to be downloadable, but IPCHEM allows to integrate my data in a searchable international database, without loosing the acknowledgment of the paternity of the data".



"IPCHEM is already a powerful tool with great potential to fulfil the ambition of exhaustive coverage of chemical monitoring data all over Europe. Regular input of our data in IPCHEM will certainly increase their visibility and will make them better shared at the European level. Extraction of data from IPCHEM for further processing with our tools will be highly beneficial to support risk assessment of contaminants of emerging concern in the environment and chemicals management in Europe."

> Valeria Dulio & Jaroslav Slobodnik



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