

Strengthening chemicals management in Best Available Techniques Reference Documents

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Abstract

Strengthening chemicals management under the Industrial Emissions Directive

On the EU level the main instrument to control industrial releases is the Industrial Emissions Directive (IED), particularly through the publication of BAT Reference documents (BREFs) and the corresponding key chapter, the BAT conclusions.

The objective of the IED is to achieve a high level of environmental protection as a whole. This target can only be achieved when the BREFs include all chemicals and substances used in or potentially released from industrial processes, both the ones that have already been identified as hazardous and regulated, as well as the less known and non-regulated ones.

At the centre of this report is the analysis of the information exchange under the IED, which results in BREFs and corresponding BAT conclusions. This report proposes how relevant information on chemicals used in or released from industrial processes can be more systematically addressed during BREF reviews. Special emphasis is given to possibilities to better use the available data generated in the context of other pertinent EU legislation such as REACH and POPs Regulation and Water Framework Directive (WFD). The HAZBREF project recommends further systemic cooperation and exchange of information between the European IPPC Bureau coordinating the BREF work and chemical experts from REACH, WFD and the POP convention community.

To identify the hazardous chemicals relevant for a given industrial sector and to strengthen the measures to control them, BREF reviews require extended frontloading, systematic identification of chemicals and reinforcing the BREF Technical Working Group (TWG) with knowledge on chemicals.

The HAZBREF project further recommends including a specific chapter on chemicals in all BREFs and BAT conclusions and proposes the key topics to be addressed.

The proposals of this report seem to fall within a favourable political context with the recently published European Green Deal that defines a new policy framework requiring a deep transformation for the EU's economy for a sustainable future. One of the key commitments of the EGD is the EU's zero pollution ambition for a non-toxic environment, which is supported by the Chemicals Strategy for Sustainability published in October 2020. The proposals made by the HAZBREF project would further strengthen the future BAT conclusions and support the IED in achieving the above-mentioned EU policy objectives.

Keywords: Industrial Emissions Directive, BREF documents, chemicals, hazardous substances

Tiivistelmä

Kemikaalien hallinnan parantaminen teollisuudessa BAT-vertailuasiakirjojen avulla

Teollisuuden päästöjä säädellään Euroopan unionin alueella pääosin teollisuuspäästädirektiivillä (IED), parasta käyttökelpoista tekniikkaa kuvaavien BAT-vertailuasiakirjojen (BREF) ja erityisesti niihin sisältyvien BAT-johtopäätösten avulla.

Teollisuuspäästädirektiivin tavoitteena on saavuttaa kokonaisuudessaan korkea ympäristönsuojelun taso. Se voidaan saavuttaa, jos BREFit sisältäisivät teollisuusprosesseissa käytettyjä ja päästettyjä kemikaaleja koskevia vaatimuksia. Haitallisiksi tunnistettujen ja säänneltyjen aineiden lisäksi vaatimuksissa tulisi huomioida myös muut teollisuusprosesseissa käytetyt kemikaalit.

Tämän raportin keskeinen osa on analyysi BREF-prosessin tiedonvaihdosta, jonka perusteella BREF-vertailuasiakirjat ja BAT-johtopäätökset muotoutuvat. Raportin ehdotusten avulla tietoa teollisuudessa käytetyistä ja päästetyistä kemikaaleista ja vaarallisista aineista voidaan hyödyntää BREF-dokumenttien uusimisessa systemaattisesti ja aiempaa tehokkaammin. Työssä keskityttiin oleellisen EU-lainsäädännön, kuten REACH- ja POP-asetusten sekä vesipuitedirektiivin (VPD), yhteydessä tuotun ja kerätyn, jo olemassa olevan tiedon hyödyntämiseen.

HAZBREF-hanke suosittelee yhteistyön ja tiedonvälityksen kokonaisvaltaista vahvistamista ja lisäämistä BREF-kehitystyötä koordinoivan Euroopan IPPC-toimiston sekä REACH-, VPD- ja POP-työtä tekevien kemikaaliasiantuntijoiden ja muiden tahojen kanssa.

Eri teollisuusaloilla käytettyjen vaarallisten kemikaalien ja aineiden tunnistaminen ja niistä aiheutuvia riskejä vähentävien toimenpiteiden tehostaminen edellyttää BREF-prosessin valmisteluvaiheen (frontloading) laajentamista ja teknisen BREF-työryhmän (BREF Technical Working Group, TWG) kemikaalitietämyksen merkittävää vahvistamista.

Lisäksi HAZBREF-hanke suosittelee lisäämään erityisen kemikaaleja koskevan luvun kaikkiin BREF-dokumentteihin ja niiden BAT-johtopäätöksiin.

Euroopan komissio julkaisi vuonna 2019 EU:n vihreän kehityksen ohjelman (European Green Deal), joka määrittelee EU:n politiikkatoimien uutta suuntaa. Yhtenä merkittävänä osana vihreän kehityksen ohjelmaa on saasteettomuustoimintasuunnitelma, jota kemikaalien osalta täydentää lokakuussa 2020 julkaistu uusi kestävyyttä edistävä kemikaalistrategia. Teollisuuspäästädirektiivin uudistaminen on saasteettomuuteen tähtäävässä toimintasuunnitelmassa keskeisesti esillä.

Perinteisen BREF-prosessin täydentäminen HAZBREF-projektin ehdottamalla tavalla vahvistaa ja tehostaa teollisuuspäästädirektiivin toimeenpanoa ja tulevia BAT-johtopäätöksiä kemikaalien ja vaarallisten aineiden osalta. Näin ehdotukset edistävät osaltaan edellä mainittujen EU:n politiikkatavoitteiden saavuttamista.

Asiasanat: teollisuuspäästädirektiivi, BREF-asiakirjat, kemikaalit, vaaralliset aineet

Sammandrag

Förstärkning av kemikaliehantering under industriutsläppsdirektivet

Industriutsläpp kontrolleras på EU-nivå i huvudsak genom industriutsläppsdirektivet (IED), särskilt genom publicering av BAT-referensdokument (BREF) för olika industrisektorer. BAT-slutsatserna i BREF-dokumenterna är referensen för tillståndsvillkor för IED-anläggningar i hela EU.

Målet med IED är att uppnå en hög nivå av miljöskydd som helhet. Detta kan bara uppnås om BREF-dokumenterna inkluderar både välkända och reglerade kemikalier och farliga ämnen samt kemikalier som inte är så välkända och reglerade, men som används inom industrin och potentiellt släpps ut i miljön.

Utgångspunkten för denna rapport är en analys av informationsutbytet under IED vilket resulterar i framtagandet av BREF-dokument och BAT-slutsatser. Rapporten lägger fram förslag hur relevant information angående kemikalier som används i industriprocesser och som potentiellt släpps ut i miljön, bättre kan utnyttjas i BREF-revideringarna. Rapporten fokuserar speciellt på hur data som genereras under annan EU lagstiftning såsom REACH och POP förordningen samt ramdirektivet för vatten (WFD) kan användas. För att förstärka kommunikationen och utbytet av information mellan dessa regelverk rekommenderar HAZBREF projektet ett mera systematiskt och formaliserat samarbete mellan den europeiska IPPC-byrån, som koordinerar BREF-arbetet, och experter som arbetar med REACH, WFD och POP.

För att kunna identifiera farliga kemikalier och ämnen som är relevanta inom en given industrisektor och för att kunna utforma åtgärder för dessa under BREF-arbetet krävs det mera fokus på kemikalier i förberedelsefasen (frontloading) av en BREF revidering, en mera systematisk identifiering av kemikalier samt större expertis om kemikalier i den tekniska arbetsgruppen ansvarig för BREF-revideringen. HAZBREF-projektet rekommenderar att ett specifikt kapitel gällande kemikalier införs i varje BREF-dokument.

Förslagen i denna rapport verkar sammanfalla väl med den nyligen publicerade Europeiska Gröna Givens som definierar en ny politisk ram som kräver en djup omvandling av EU:s ekonomi för en hållbar framtid. Ett av de viktigaste åtagandena inom den Gröna Givens är handlingsplanen för nollutsläpp som stöds av kemikaliestrategin för hållbarhet som publicerades i oktober 2020.

Förslagen att komplementera den traditionella BREF-arbetsprocessen med en systematisk fokusering på kemikalier och farliga ämnen skulle ytterligare förstärka innehållet i framtida BAT-slutsatser och bidra till att nå dessa EU mål.

Nyckelord: industriutsläppsdirektivet, industriutsläpp, BREF, kemikalier, farliga ämnen

Preface

This report is the product of activity 3.2 of Work Package 3 ‘policy improvement’ of the HAZBREF project “*Hazardous industrial chemicals in the IED BREFs*” and presents proposals on how to include information on hazardous substances more systematically into IED BREFs (i.e. Best Available Techniques (BAT) Reference documents under the Industrial Emissions Directive). The report goes deeper into the proposals of the HAZBREF activity 3.1 report ‘Analysis of the interfaces, possible synergies or gaps between Industrial Emission Directive, REACH Regulation (Registration, Evaluation, Authorisation and Restriction of chemicals), Water Framework Directive (WFD), Marine Strategy Framework Directive (MSFD) and the POP (Persistent Organic Pollutants) Regulation concerning hazardous substances’ (Suhr et al. 2020). The proposals of the activity 3.1 report were used for developing more concrete proposals presented in this report. This report also makes references to the HAZBREF Work Package 2 report ‘Approaches for a better use of available data to prevent or reduce releases of substances of concern from industrial installations’ (Aust et al. 2021). HAZBREF is funded by the EU Interreg Baltic Sea Region Programme and the implementation period was carried out from October 2017 until the end of March 2021.

The overall aim of HAZBREF is to increase the knowledge base of the industrial sources and the reduction measures of hazardous chemicals. HAZBREF identified relevant chemicals used in industrial sectors, their use patterns, environmental characteristics and measures to prevent and reduce releases to environment.

On the EU level the main instrument to control industrial releases is the Industrial Emissions Directive (IED), particularly through the publication of BAT Reference documents (BREFs) and their key chapter: the BAT conclusions. However, these BAT conclusions, in most cases, do not address hazardous substances in a systematic and comprehensive way. HAZBREF developed a systematic approach to exchange and utilize the existing information about hazardous substances between different regulatory frameworks (IED, REACH, Water Framework Directive, Marine Strategy Framework Directive, EU provisions on Circular Economy and Stockholm POP Convention) in the preparation of BREFs.

When the use and risks of chemicals are better addressed in BAT Reference documents, the capacity to manage industrial chemicals will be enhanced among both authorities and operators. The information gathered in BREFs is also useful for the Baltic Marine Environment Protection Commission HELCOM in the development of actions to reduce the inputs of hazardous substances to the Baltic Sea. HAZBREF also identified ways to promote the circular economy by finding options to include circular economy aspects in BREFs (Dahlbo et. al 2021).

HAZBREF outputs target both the policy and the enforcement level. On the policy level the outputs strengthen the links between different regulatory frameworks and their key players. On the enforcement level at industrial installations the project considered and identified model solutions for hazardous chemicals’ management.

The activities were carried out in four Work Packages:

- WP1 – Project management and administration (Lead Partner SYKE) including communication and dissemination of results
- WP2 – Identification of target substances (Lead by UBA) that include:
 - 2.1 Identification and selection of target substances
 - 2.2 Fate of substances during emission treatment
- WP3 – Policy improvement (Lead by UBA) that include:
 - 3.1 Strengthening links between regulatory frameworks on different levels
 - 3.2 Developing method to include substance information into BREFs, improve communication and data flow

- WP4 – Best practices in chemicals management in industry (lead by IETU) that include:
 - 4.1 Sectoral guidance for three IED sectors (chemicals, textile, surface treatment of metals and plastics)
 - 4.2 Case studies in selected installations
 - 4.3 BAT descriptions and model permits
 - 4.4 Circular economy aspects.

The HAZBREF partnership included 5 organisations from the Baltic Sea region: Finnish Environment Institute (SYKE) (Lead partner), German Environment Agency (UBA), Swedish Environmental Protection Agency (SWEPA), Institute for Ecology of Industrial Areas (IETU) and Estonian Environmental Research Centre (KLAB).

In addition, 27 associated organisations and a wide range of other stakeholders were be involved in HAZBREF, such as ministries and governmental environmental and chemical agencies from several EU countries, permitting and supervision authorities as well as industries and environmental NGOs.

More information about HAZBREF can be found on our project website (www.syke.fi/projects/hazbref).

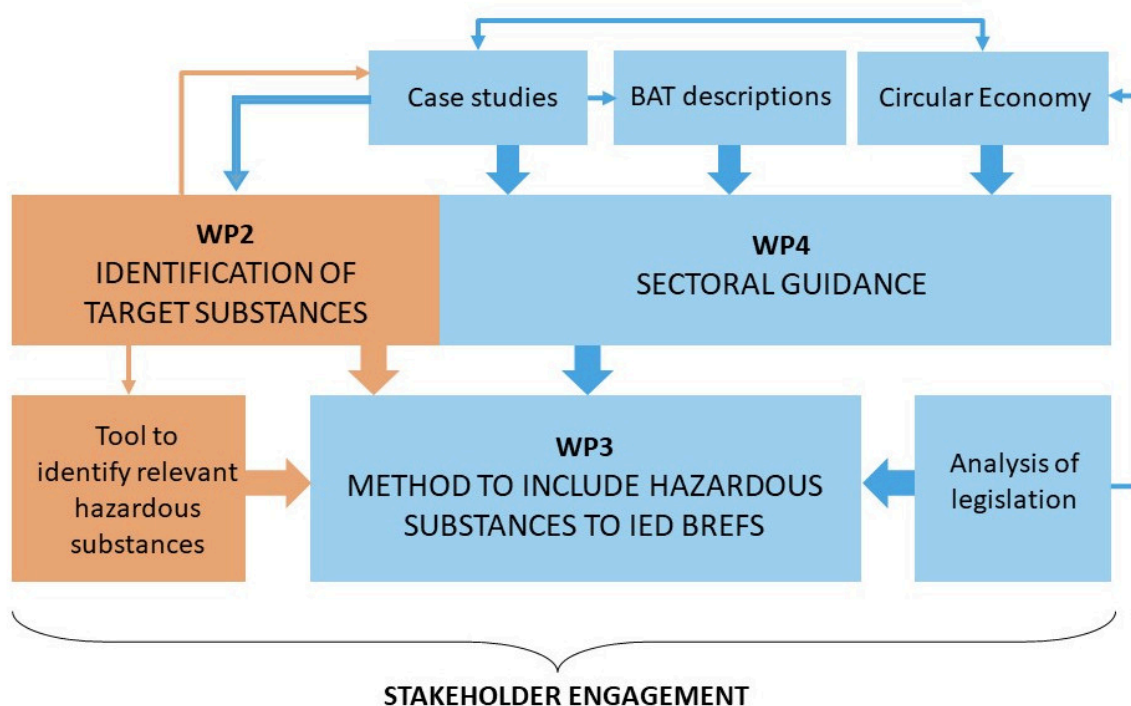


Figure 1. Overview of the design of the HAZBREF project with its four work packages.

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Constructive and valuable comments were received from the following stakeholders: The European IPPC Bureau, Unit C4 Industrial Emissions & Safety of Directorate-General for the Environment of the EU Commission, the Ministry of Ecology of France, the Ministry of Infrastructure and Water Management of Netherlands, Austrian Environmental Protection Agency, Swedish Environmental Protection Agency, The Chemical Agency of Finland, Chemical Agency of Sweden, European Environmental Bureau, European Chemical Industry Council, and Finnish Chemical Industry Association.

Contents

Abstract.....	3
Tiivistelmä.....	4
Sammandrag.....	5
Preface.....	7
1 Introduction.....	11
1.1 Background.....	11
1.2 Aim, scope and target groups of this report.....	13
2 Substances to be addressed in BREF reviews.....	15
2.1 The Scope of the IED is wide.....	15
2.2 Hazardous substances.....	15
2.3 From ‘hazardous substances’ to ‘substances of concern’ for consideration in BREFs..	17
2.4 Substances to be addressed in future BREF reviews.....	19
3 Recommendations to improve the procedure for considering chemicals in BREF reviews.....	25
3.1 The current pathway for identification of chemicals.....	25
3.2 Proposed amendments of procedure and workflow.....	29
3.3 A more detailed view on the identification of chemicals in BREF sectors.....	37
4 Cooperation between EIPCCB/TWG and other frameworks.....	41
4.1 EIPCCB/TWG and ECHA.....	41
4.2 EIPCCB/TWG and CIS WPD Working Group of Chemicals (WG CHEM).....	44
4.2.1 EU Commission level – improved communication and exchange of information between WGCHEM and EIPCBB/TWG.....	44
4.2.2 Member State level – enhanced co-operation between IED and WFD authorities.....	49
4.3 EIPCCB/TWG and Committee in accordance with article 20 of the POPs regulation.....	50
5 BAT conclusions regarding chemical management.....	53
5.1 Introduction.....	53
5.2 BAT for chemical management systems.....	54
5.3 BAT for chemical inventory.....	55
5.3.1 Inventory of chemicals used.....	55
5.3.2 Production process mapping, simplified mass balances and stream inventories...	56
5.4 BATs for process-integrated measures and end-of-pipe techniques.....	59
5.5 BATs for substitution.....	60
5.6 BATs for monitoring.....	62
5.6.1 Monitoring of hazardous substances.....	62
5.6.2 Monitoring via bioassays.....	63
5.7 BAT associated emission levels.....	63
5.8 Listing of regulated substances under REACH, POPs Regulation and WFD priority substances.....	65
6 Update or addendum to the BREF Guidance 2012/119/EU.....	66
7 Conclusions.....	71
Definitions and abbreviations.....	78
References.....	81

1 Introduction

This report analyses how the process of BREF reviews, as well as BAT conclusions, could be systematised and improved regarding the use and release of substances of concern and hazardous substances applied in industrial processes.

Special emphasis is given to possibilities to better use available and relevant data generated in the context of other pertinent EU legislation at the right time of the process. The report proposes general measures for improvement of the BAT information exchange and also describes in detail what in particular has to be improved, by which means and what kind of BATs for chemical management should be considered for BREFs.

The proposals of this report also provide input to the possible update of the 'BREF Guidance' 2012/119/EU within the ongoing IED revision (Chapter 6).

1.1 Background

The Industrial Emission Directive 2010/75/EU (IED) is the main instrument at the EU level regulating pollutant emissions from industrial installations. The IED aims to prevent, reduce and eliminate as much as possible industrial emissions into air, water and soil through application of best available techniques (BAT). The IED is based on several principles such as an integrated approach to pollution prevention and control, the use of BAT in permitting, inspections and monitoring and public participation.

BAT conclusions are developed through an exchange of information¹ with key stakeholders (Art. 13 IED). For the identification of BAT, the European Commission, EU Member States and representatives of European industry and environmental NGOs gather at the European Integrated Pollution Prevention and Control Bureau (EIPPCB) located in Seville, Spain. Together, they make up Technical Working Groups (TWG). The TWGs have the task to make sure that relevant information for BAT is submitted during the elaboration of BREFs. The submitted information is then assessed by the EIPPCB and the TWG and, if appropriate, included in the BAT conclusions.

This information exchange, often referred to as 'Seville Process', results in BAT Reference documents (BREFs) that include BAT conclusions. A BREF typically addresses a specific industrial sector or activity; a few BREFs are dedicated to cross-cutting issues such as emissions from storage (EFS) or industrial cooling (ICS). Once adopted by the Commission as Implementing Decisions, the BAT conclusions are the reference for setting permit conditions. Therefore, the Seville Process is at the very heart of the IED as it defines the concrete environmental requirements to be implemented in industrial installations throughout the Union.

The 'use of less hazardous substances' is one of the criteria for determining BAT (see No 2, Annex III IED). Therefore, the reduced emission of hazardous and other substances of concern is, or should be, part of the BAT conclusions and, consequently, a component of integrated IED permits for industrial installations. The BREFs are also referred to as instruments to tackle pollution from industry regulated under other EU legislative frameworks (e.g. Art. 10 WFD, REACH).

The HAZBREF project evolved from the gaps that regional and national competent authorities have identified in current BREFs. As the BAT conclusions are the main instrument for setting requirements in permits, it is clear that if measures related to the management, use and release of chemicals used in industrial processes are not clearly and explicitly reflected in BAT conclusions, it is also very difficult to implement them via integrated permits.

¹ In 2012, the Commission established guidance on the elaboration of BAT reference documents, the so-called BREF Guidance (European Commission 2012).

Hazardous substances that are well-known and expected to be emitted by a given sector are generally sufficiently addressed during BREF reviews. These substances include the legacy pollutants such as dioxins, polycyclic aromatic hydrocarbons (PAHs) and heavy metals. But so far, the information related to hazardous chemicals used in industrial processes, as well as other substances of concern emitted and addressed by other legislative frameworks, has been only partially considered and incorporated in BAT conclusions; the BAT conclusions have been incomplete in this sense.

It is positive that the EIPPCB and DG ENV have invested more time and effort in the challenge of including more available information on some hazardous substances in BREF reviews in recent years. The cooperation between ECHA and EIPPCB has developed and the substances in ECHA-databases have started to be checked for a few pilot sectors during the frontloading of the BREF reviews. For example, the databases related to REACH include information about the intrinsic properties of substances and the conditions required for their safe use. This information may be useful for BREF reviews. When the HAZBREF project started its work, this kind of data was not comprehensively assessed during BREF reviews.

DG ENV has also commissioned studies in order to identify and propose so-called 'Key Environmental Issues' (KEI) in four pilot sectors (textile industry, ceramic industry, slaughterhouses and animal by-products, and smitheries and foundries) which have been performed in the frontloading phase of the BREF reviews. This preparatory work has proven its worth for BREF reviews as KEIs have been assessed in more detail in these BREF reviews. However, in the context of this report it is worth noting that the pilot studies only use published literature for the identification of KEIs, they do not include a search in the ECHA database nor interviews with suppliers of chemicals in order to identify new developments related to chemicals. For the identification of substances of concern the current KEI approach is not sufficient.

Even if the consideration of hazardous and other substances of concern in BREF reviews has improved in recent years, there is still room to improve the BREF process ensuring that all relevant emissions of substances of concern are captured during the information exchange and that BATs for relevant chemical management measures are developed in a structured way.

General BATs for chemical management have not been included routinely in BREFs in the past. Meanwhile, there are industrial installations that have developed and implemented chemical management systems, but the situation varies around Europe. If the best chemical management practices were systematically included in BREFs, the knowledge of the substances and their emission abatement measures would be transferred throughout the Europe and the playing field would be levelled. Nevertheless, HAZBREF proposals on chemical management have been addressed in recent draft BREFs (TXT, FMP), with the inclusion of BATs for e.g. Chemical Management Systems (CMS) and more specific requirements for chemical inventories. This is a positive direction of the Seville process, which should be further strengthened in a systematic manner.

The publication of this report is timely and seems to fall within a favourable political context. With the presentation of the communication on the 'European Green Deal' (EGD; European Commission 2019) on December 11th 2019, the EU Commission has outlined a central project for the current term of office. As one of the measures for transforming the EU's economy for a sustainable future, the EGD presents in its Section 2.18 the 'zero pollution ambition for a toxic-free environment'. As part of the EGD, three actions related to the zero pollution ambition are proposed:

- a) the review of the Industrial Emission Directive to address pollution from large industrial installations (European Commission 2020a)²;
- b) a Zero Pollution action plan for air, water and soil that addresses, in particular, the interaction between various policies and regulations to prevent, reduce or clean-up pollution (European Commission 2021);
- c) and with the presentation of the EU Commission's communication of October 14, 2020 'Chemicals Strategy for Sustainability – Toward a Toxic-Free Environment' (CSS, European Commission 2020b), a sub-project of the EGD is now also being further specified.

These three actions are interlinked. The Staff Working Document on the evaluation of the IED (a) provides important elements for informing the work on the *Zero Pollution ambition for a toxic-free environment*. And the Zero Pollution action plan for air, water and soil (European Commission 2021) (b) reminds us that safe and sustainable design and low-emission technology offer strong opportunities for sustainable innovation, cleaner economic recovery and EU leadership in green growth. In accordance with the Council conclusions 'Towards a Sustainable Chemicals Policy Strategy of the Union' (Council of the European Union 2019) and the EP resolution on 'Chemicals Strategy for Sustainability' (European Parliament 2020), with the CSS (c) the EU Commission has presented an ambitious plan for chemicals policy in the coming years. With more than 60 announced activities on legislative and non-legislative measures, a comprehensive concept for the further development of the handling of chemicals in the EU now exists. CSS also includes a reference to the IED and its BAT conclusions as it:

- (1) announces to ensure that legislation on industrial emissions promotes the use of safer chemicals by industry in the EU by requiring on-site risk assessments and restricting the use of substances of very high concern (Section 2.1.1 of the CSS);
- (2) addresses to consider PFAS with a group approach under the IED (Section 2.2.3 of the CSS).

Bearing in mind these recent Commission Documents and the ongoing IED review work, it seems justified to assess options for improving the process of BREF reviews related to the use and release of chemicals and to utilise the HAZBREF findings of this report in this work.

1.2 Aim, scope and target groups of this report

The aim of this report is to present a method on how to systematically include information on hazardous and other substances of concern (SoC) into BREFs. The report also presents proposals for which kind of BATs for chemical management should be considered for BREFs.

For the purpose of this report, 'substances of concern'³ in the sense of IED' refer to chemicals or chemical groups, which might raise a concern when used or emitted by industry or which pose a hazard in the environment due to their intrinsic properties (e.g. fate and behaviour, toxicity of the substance). These substances might occur in industrial activities covered by Annex I of the IED. In Chapter 2 it will be explained why the term 'hazardous substances' is inappropriate to cover all relevant pollutants that future BREFs should address and why in this report we prefer to use the term 'substances of concern in the sense of IED' instead. The focus of this report is the analysis of the information exchange in the BREF reviews, that results in BREFs and corresponding BAT conclusions. This report presents

² Information on the impact assessment of the IED-Revision can be found under: <https://ec.europa.eu/environment/industry/stationary/ied/evaluation.htm> and <https://ee.ricardo.com/industrial-emissions-directive-revision-consultation>.

³ The term 'substances of concern' (SoC) is also used at the chemicals – products – waste interface. There, SoC refer to substances which might be of concern in the waste recycling phase. For this purpose, a database for information on Substances of Concern In articles as such or in complex objects (Products) has been set up under the Waste Framework Directive. Companies supplying articles containing substances of very high concern (SVHCs) on the Candidate List in a concentration above 0.1% weight by weight on the EU market have to submit information on these articles to ECHA. The criteria for 'substances of concern in the IED-context' is different from that and focus on the potential to be released from industrial installations. In the Biocidal Product Regulation (EU) 528/2012 'substance of concern' is defined in Art. 3 (1.f) and has another meaning that is consistent with the purpose and scope of the BPR.

proposals on how relevant information on chemicals used in industrial processes and that might potentially be released can be more systematically addressed at the right time during BREF reviews.

The BREF reviews are the main mechanism through which environmental requirements, such as those on hazardous and other substances of concern, are regularly reviewed and updated in permits for industrial installations. The exchange of information on the selection, use and management of chemicals used in industrial processes, and the prevention and reduction of releases of substances of concern during the BREF review ensures that BAT conclusions contain detailed, executable and concrete techniques for this important issue. Only in that case may the IED function as a key driver to put the knowledge on chemicals and options for reduction of emissions from industry into practice.

The findings of this report can also be seen as HAZBREF's input to the ongoing IED revision work related to the improvement of the BREF process concerning chemical management issues.

The target groups of this report are mainly the EIPPCB, the TWGs and related stakeholders involved in the BREF processes. The latter may include members of the IED Art. 13 Forum, experts from ECHA which deal with the use of chemicals in industrial installations, members of the Working Group of Chemicals working under the umbrella of the CIS process of the Water Framework Directive, or members of the Committee of the POP Regulation. The proposals of this report also provide input to the possible update of the 'BREF Guidance' (European Commission 2012) within the ongoing IED review. This is further discussed in Chapter 6.

It is not the intention of this report to propose new requirements for industry operators, but rather to include enhanced coherence with other EU legislation in the BREF process in order to facilitate, harmonize and strengthen the implementation and enforcement of existing measures. In principle, measures related to chemicals used in industrial processes are already required according to various legal provisions. For example, the IED obliges operators to know the nature and quantities of foreseeable emissions from the installation into each medium, to use less hazardous substances and to prevent or reduce their release to the environment. To comply with REACH, companies must identify and manage the risks linked to the substances applied in their industrial processes. Users of industrial chemicals have to demonstrate how substances can be safely used. However, concerning REACH provisions such as REACH authorisation process (see Table 1), it often remains unknown how the self-responsibility of operators (downstream-users) works in real life. And permit writers continue to face difficulties to judge unambiguously whether the BAT concept includes sufficient requirements for the safe use of industrial chemicals and the prevention and reduction of their release to environment. These challenges are taken up by this report.

Since the term 'hazardous' is a term that represents only a part of relevant chemicals potentially emitted from industry, HAZBREF recommends that substances under two categories should be specifically paid attention to in the BREF process: (1) Substances for which regulations of different legal contexts are already in place and that are - through their use in industrial processes - connected with IED and BREF reviews; and (2) non-regulated substances of concern (SoC) that are not retained after their use in industrial processes. Substances that have a high potential to be released are 'substances of concern (SoC) in the sense of the IED'. The substance properties that are important for the 'potential to be released' refer to physical-chemical properties and degradation properties. Parameters that may trigger concern from an IED perspective for a chemical used or produced are fate, behaviour and hazards. Substances are of particular relevance if, in addition to a high potential to be released, they have ecotoxicological or human toxicological properties or are emitted in large quantities. Widening the perspective when assessing substances used has the advantage that all relevant chemicals used and released from industrial installations are covered (within the scope of BREFs). The clarification and definition of terms used is further discussed in the following Chapter 2.

2 Substances to be addressed in BREF reviews

There are different conceptions regarding the core terms used in this report, such as ‘hazardous substances’, ‘polluting substances’ or ‘substances of concern’. These terms are discussed and explained in this chapter for the sake of clarity. The focus is always the IED context.

2.1 The scope of the IED is wide

As regards ‘pollution’, the scope of the IED (Industrial Emissions Directive 2010/75/EU) is wide:

- it covers all pollution arising from industrial activities according to Articles 1 ‘Subject matter’ and 2(1) ‘Scope’, and there is no explicit restriction here as to which types of pollution;
- the definition of ‘pollution’ in Article 3(2) is wide: “‘pollution’ means the direct or indirect introduction, as a result of human activity, of substances, vibrations, heat or noise into air, water or land which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment”;
- the definition of ‘emission’ in Article 3(4) is also wide:” ‘emission’ means the direct or indirect release of substances, vibrations, heat or noise from individual or diffuse sources in the installation into air, water or land”;
- according to Article 14(1)(a) ‘Permit conditions’ “permit conditions shall include emission limit values for polluting substances listed in Annex II, and for other polluting substances”;
- the criteria for determining BAT in Annex III are broad, especially point 10 which is not limited as to which substances it is applicable:” the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it”.

The recitals 2, 12 and 21 of the IED confirm the wide understanding of pollution prevention and control of emissions by stressing the obligation to prevent, reduce and as far as possible eliminate pollution arising from industrial activities, to adopt all the measures necessary to achieve a high level of protection of the environment as a whole and to take account of developments in best available techniques.

In contrast to this, the definitions of hazardous substances in Article 3(18) and the list of polluting substances in Annex II is narrower. In the next section we will dive into this.

2.2 Hazardous substances

Hazardous substances – generic use

The term ‘hazardous substances’ generally refers to adverse ecotoxicological or human toxicological properties of a substance – something like ‘dangerous’ or ‘harmful’ but the meaning of the term is not self-evident and depends on the legal context (see Section 2.3). According to general understanding hazardous substances are those substances that can cause hazard or risk. These hazards can result in adverse physical, health and environmental impacts.

Hazardous substances – in the IED

The IED defines ‘hazardous substances’ in Article 3 (18) as: ‘hazardous substances’ means substances or mixtures as defined in Art. 3 of the CLP Regulation (EC No 1272/2008), the EU regulation on hazard classifications, labelling and packing of substances and mixtures.

That means that any reading of the term ‘hazardous [chemical]’ in the scope of the IED must include substances with a harmonised classification under CLP (Annex VI) and substances fulfilling the hazard criteria for those (self-classified).

Art. 3 of the CLP Regulation reads as follows: ‘[...] A substance [...] fulfilling the criteria relating to physical, health or environmental [...] hazards, laid down in Parts 2 to 5 of Annex I is hazardous [...]’. There, hazards are expressed by defined hazard classes (e.g. hazardous to the aquatic environment), hazard category codes (e.g. aquatic chronic category 1) and are labelled by using hazard statements codes (e.g. H410 ‘Very toxic to aquatic life with long lasting effects’). Thus, the CLP defines ‘hazardous’ by referring to a list of hazard classes, which means, at the first instance, that if a substance fulfils the hazard criteria it is considered to be hazardous. Conversely, this does not necessarily mean that a substance that does not fulfil the criteria is not hazardous. For example, hazards outside the Parts 2 to 5 of Annex I CLP exist such as PBT and vPvB substances or those having endocrine disrupting properties. Substances presenting hazard properties that are used by operators must either be self-classified by the manufacturer or are already classified according to the harmonized classification system. Substances classified according to the latter are listed in the Annex VI CLP ‘list of harmonised classification and labelling of hazardous substances’. Self-classifications (notifications) are also included in the CLP database (ECHA website).

In addition to the definition in Article 3(18), the term ‘hazardous substances’ appears in a number of places in the IED which are relevant for this report⁴: (a) article 22 on site closure, (b) article 58 on substitution of hazardous substances, and (c) Annex II point 2 naming the ‘use of less hazardous substances’ as one of twelve criteria for determining BATs, hence for consideration in the information exchange about BAT.

Art. 22 IED on site closures deals with definitive cessation of activities. It contains provisions related to ‘the use, production or release of relevant hazardous substances’ with reference to the definition explained in the above paragraph (a). It has to be noted that the objective of article 22 is the prevention of soil and groundwater contamination at the site (and not other emissions to air and surface water for example). The IED stipulates that where an industrial activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time (Art. 22 (2) IED). The purpose of the baseline report, a potentially valuable source of data for relevant hazardous substances, is to allow for a comparison of the current state of soil and groundwater contamination with the state upon definite cessation of activities. In contrast, the IED does not require explicitly to prevent and reduce the day-to-day emissions of ‘hazardous substances’ via exhaust air or wastewater discharge and there are less dedicated techniques related to them (or BAT AELs). For those emissions the IED uses the broader term ‘pollution’ (Art. 3 (2)) or ‘emission’ (Art. 3 (4)) respectively. Consequently, their meaning is further specified by the ‘list of polluting substances’ of Annex II IED.

Art. 58 IED on substitution of hazardous substances applies only to installations using organic solvents. It requires a substitution obligation for substances or mixtures that are classified as carcinogens, mutagens, or toxic to reproduction. Hence, one specific sector (use of organic solvents) under the scope of the IED has an explicit obligation to substitute certain types of hazardous substances, in particular those that carry hazard statements H340, H 350, H350i, H360D or H360F, whereas for other sectors the IED refers to the list of polluting substances of Annex II IED. This Annex II IED however also includes substances which have been proved to possess CMR properties. The obligation for substitution for those

⁴ The IED furthermore contains provisions related to hazardousness in various articles related to hazardous waste in Chapter IV IED, namely ‘Special Provisions for Waste Incineration and Waste-Co-Incineration Plants’.

is less explicitly expressed by Annex III point 2 of the IED which is further explained in the next paragraph.

Annex III point 2 of the IED stipulates as one criterion to be considered for the determination of BAT ‘the use of less hazardous substances’. This criterion can be read as an obligation to assess options for non-regrettable substitution in BREF reviews.

In summary: BREF reviews shall have a wide approach and include any significant pollution caused by industrial chemicals irrespectively whether it is referred to as ‘hazardous substance’ (according to CLP) or as ‘polluting substance’ with specific hazard properties (Annex II IED).

2.3 From ‘hazardous substances’ to ‘substances of concern’ for consideration in BREFs

As discussed in Section 2.1 and 2.2, the wording of the IED does not restrict the meaning of the terms ‘pollution’, ‘emissions’ and ‘hazardous’ to a narrow interpretation, nor to exempt certain types of hazards or any regulatory status of a substance from scrutiny during BREF reviews.

Bearing this in mind, it seems useful to be aware of meanings and use of the term ‘hazardous’ in other legal frameworks that are connected to the IED. Depending on the legal context, the term ‘hazardous’⁵ may address different (and additional) properties of substances. The term ‘hazardous’ is not always used in a consistent way in other EU regulations relevant for the context of this study. On the other hand, the meaning of ‘hazardous’ is aligned to a certain extent. For instance, there are those EU regulations that list a defined number of unwanted substances, such as the WFD list of priority substances and priority hazardous substances (selected based on risk assessment procedure on aquatic environment) published in the Daughter Directive 2013/39/EU; or the Directive 2011/65/EU (RoHS Directive).

Other EU regulations list hazard classes (e.g. CLP Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures); others do not specify at all the term ‘hazardous’ within the regulation (e.g. REACH; EC 1907/2006). Finally, the Biocidal Product Regulation (BPR) refers to a positive approved list of active substances (e.g. Regulation (EU) No 528/2012 concerning biocidal products). But, simultaneously, it excludes ‘substances of concern’ (Art. 3 (1.f) BPR) from the simplified authorisation procedure. The definition of ‘substances of concern’ within the BPR⁶ is aligned with and refers to the meaning of ‘hazardous’ in the CLP Regulation.

REACH, in particular, only refers to ‘hazardous chemical agents’, ‘hazard properties’ and ‘substances classified as hazardous’ (Annex VI CLP) in many of its provisions. REACH includes additional hazards, such as those recognized in REACH Art. 57 (d–f) and specified by REACH Annex XIII, i.e. PBT and vPvB⁷, but without using or explicitly defining the term ‘hazardous substances’ for them within the regulation (e.g. in the appropriate Art. 3 on definitions and general provisions).

As REACH stipulates risk management measures (RMM) for the safe use of chemicals during the entire life cycle of substances (or mixtures) this also includes measures relevant for the life cycle stage ‘industrial installations’. Authorised by REACH provisions, ECHA collects data from registration dossiers for so far approximately 26 000 substances. Most data are publicly available on the ECHA Chem

⁵ ‘Hazards’ are based on intrinsic properties of substances, whatever the use. In contrast, ‘risk’ is determined by combining hazard identification with exposure (use and potential release). Risk management may lead to different provisions in respective legal instruments.

⁶ ‘Substances of concern (SoC)’ is defined in the BPR Art. 3 (1.f). The definition of SoC within the BPR is different from the one used in the HAZBREF project (and consequently the IED) which focusses on the prevention and reduction of emission, as far as it is technically and economically viable, by use of BAT. Varying use and focus of the term ‘substances of concern’ is not surprising and not considered problematic since the respective concern is defined to certain extent by the scope, purpose and subject matter of a given regulation (e.g. IED, BPR and SCIP database where the concern refers to the recyclability of waste).

⁷ The CLP Regulation also recognises these as hazards, but does not classify them yet (Art. 53 (2) Adaptations to technical and scientific progress, CLP).

database. This is a valuable data source for BREF reviews also regarding substances of concern for industrial use. Future TWGs may consider more systematically substances of concern for the determination of BAT by taking advantage of the vast data pool of the ECHA database. This may include substances regulated under REACH (see table 1 in the following Section 2.4).

Both REACH and IED address substances that may raise concerns from their perspectives. One may recognize that there is considerable overlap with substances covered by REACH and polluting/hazardous substances according to IED but also several differences between the two regulations. These differences should be kept in mind when discussing the use of substance-oriented data from REACH under IED for the purpose of determining BAT.

REACH lays down provisions for *safe use of substances* (as such, in mixtures, in articles) and applies to the manufacture, formulation and use (industrial, professional, consumer) *along the entire life cycle* (until a substance becomes waste). The focus of the *substance-orientated approach* are substance properties, their fate and behaviour including trigger values and, derived from them, recommended measures for the safe use. Responsibilities are given to manufacturers and importers (registrants) to collect data, assess risks and derive provisions for safe use of a substance from manufacture to waste phase. The downstream users have to ensure that they follow the assessment made by registrants to use such substances in a way that will not adversely affect human health or the environment.

In contrast, the IED lays down rules on *integrated prevention and control of pollution arising from industrial activities*. The main focus is to set and control appropriate permit conditions in order to prevent, reduce and, as far as it is technically and economically viable, eliminate emissions arising from industrial activities.

Another important difference between IED and REACH is that the emission controls based on BAT have to be implemented independently from a proven risk or exceedance of a proven negative effect (comparable to the $PEC/PNEC > 1$ under REACH). BAT has to be seen as a kind of ‘safety net’ that is combined with the consideration of meeting environmental quality objectives as a second (and separated) step. That means where environmental quality objectives or quality standards require stricter conditions than those which would result from the application of BAT only, more stringent emission control measures shall be set. The IED follows an *installation-orientated approach*. The challenge, therefore, is to make substance-oriented data and knowledge useable for the determination of BAT and permit conditions and translate them into practicable obligations of operators at installation-level that can be monitored and controlled.

When addressing the release of substances from installations into air, water or soil (being it ‘hazardous’ or ‘polluting substance’ or simply ‘pollution’ or ‘emission’) HAZBREF considers in addition to already regulated substances (see Section 2.4a), in particular two aspects:

- (a) the ‘potential to be released’, or conversely, the ability to be eliminated (in the WWTP) – which qualifies a substance as ‘target substance’ for BREF reviews. This is considered to be the starting point and following considerations are essential only, if there is the potential to be released;
- (b) in addition, the intrinsic persistency or toxicity of the substance – which may qualify a substance as a ‘relevant target substance’ (see section 2.4b). Both aspects have several degrees of importance.

In order to capture both aspects - the release potential of chemicals and their intrinsic substance properties - and to assess concerns and solutions from an emission control-perspective, HAZBREF proposes to talk of ‘substances of concerns (SoC) under IED perspective’. For example, if a substance

probably leaves the installation and there is a particular high concern for the persistency⁸, mobility or toxicity of this substance it should be considered as ‘relevant target substance for BREFs’.

The large number of chemicals used in industrial processes and their varying intrinsic properties of concern suggest that filter criteria (biodegradability/persistency, mobility, potential for eco- and human toxicity) are required for identifying substances for consideration in BREFs. Because: not all substances can be given the same attention. The term ‘target substances’ used in the HAZBREF project means chemicals or chemical groups, which may raise a concern under IED perspective or might pose a hazard due to their intrinsic properties, and which might be emitted from industrial processes covered by Annex I of the IED.

2.4 Substances to be addressed in future BREF reviews

Based on the explanations given in Sections 2.1, 2.2 and 2.3, the following practical recommendations by HAZBREF can be drawn: In BREF reviews, the following chemicals or substances should be specifically paid attention to (but not limited to):

- a) Substances for which regulations of different legal contexts are already in place (or substances planned to be regulated in the future) and that are - through their use in industrial processes - connected with IED and BREF reviews.**

HAZBREF proposes that their relevance (use and release) for a given BREF sector should be assessed during BREF reviews, see table 1. The aim is, thereby, not to reassess the hazard classification and prioritization work carried out under other legal frameworks, but to use this work and available data and establish their relevance for IED installations. Out of a long list of substances or mixtures with classified hazards, the actual use and relevance of these substances in BREF sectors should be assessed, and, when relevant, measures for the prevention and reduction of emissions determined. Proposals on how the identification and assessment of these substances for BREF reviews can be carried out in practice are presented in Chapter 3 and 4.

Another helpful tool for knowing what’s going on with substances under REACH and CLP and that may be useful for the preparatory work of BREF reviews is the public activities coordination tool (PACT) table. The table provides filters when using the search option⁹ (in Dec. 2020, there are 4143 substances on this list). PACT provides an overview of the substance-specific activities by authorities under REACH and CLP in one user-friendly table that contains different levels of information. The information in the tool is updated every 48 hours. Inclusion in the PACT table means that a Member State or ECHA has examined or is examining the substance. It does not mean that the substance has the suspected properties or that further regulatory risk management actions will be imposed before the relevant regulatory list – such as the Candidate List, the restricted substances list, or Annex VI to CLP – is updated.

⁸ It is obvious that from an IED perspective, i.e. a Directive that lays down rules designed to prevent or, where this is not practicable, to reduce emissions, hazards related to persistent chemicals are of particular importance because of the high probability that those substances will be emitted to air, water or land. Avoiding emissions is the very subject of the IED. Substances that display persistent and bioaccumulable properties without meeting the PBT or vPvB criteria should therefore still qualify for target substances for BREF reviews.

⁹ The public activities coordination tool (PACT) provides an overview of the substance-specific activities that authorities are working on under REACH and the CLP Regulation. These activities are being carried out in line with ECHA’s Integrated Regulatory Strategy. PACT provides up-to-date information on the activities planned, ongoing or completed by ECHA and/or MSCAs for a given substance in the following areas: Data generation and assessment – dossier evaluation, substance evaluation, informal hazard assessment (PBT/vPvB/ED); Regulatory management option analysis (RMOA); Regulatory risk management – harmonised classification and labelling (CLH), SVHC identification, restriction. The list can be found here: <https://echa.europa.eu/pact>.

Table 1. Substances regulated (or planned to may take place in near future) under different EU regulations, connected to the IED and BREFs to be considered in BREF reviews.

Substance group	Rationale	Remarks	References
Classified as hazardous according to Art. 3 CLP, CLP Annex VI ¹⁰	IED Article 3(18) refers in its definitions of the term 'hazardous substances' to the CLP Regulation: substances or mixtures as defined in Article 3 of CLP Regulation (EC 1272/2008) on classification, labelling and packaging of substances and mixtures. For the classification of e.g. aquatic environmental hazards, refer to hazard statements H400, H410, H411, H412 or H413 ¹¹ in section 3.1 or 3.2 of the SDS.	Hazardous substances referred to in CLP Regulation (1272/2008) including harmonised entries in Annex VI, self-classified substances, and those presenting other hazards. The 'substance groups' listed below are some prioritized examples for substances posing environmental and/or health hazard.	CLP Regulation EC 1272/2008; IED article 3
CMR 1a and 1b substances ¹²	Chronically toxic and very serious impacts on health (known or presumed human carcinogen (H340), mutagen (H350) or reproductive toxicant).	Included in the list of pollutants under IED Annex II. Not all CMR substances are restricted by REACH and if so with exemptions. In addition, CMR cat. 2 substances ¹³ could be also considered.	CLP Regulation EC 1272/2008; CMR category 1A/1B substances listed in the table 3.1 of annex VI to CLP regulation are restricted by REACH.
WFD, Annex X – Priority substances	'Priority hazardous substances' to be phased out, 'priority substances' targeted for reduction and removal from wastewater discharge. May pose significant risks to the aquatic environment or human health.	Included to the List Pollutants under IED Annex II.	Water Framework Directive EC 60/2000 Annex X; EQS Daughter Directive 2013/39/EU.
EU WFD River Basin Specific pollutants, if monitored in water bodies of 3 Member States	Pollutants of regional or local importance that may pose a significant risk to the aquatic environment or human health. If monitored in water bodies of 3 Member States to be considered in BREF reviews.	Not necessarily relevant throughout Europe.	National legislation that implements Water Framework Directive EC 60/2000.
Watch list (WL) ¹⁴ for surface water	Identifies emerging potential water pollutants. WL will provide high-quality information on the concentrations of emerging or little-known pollutants across the EU.	If used in industry, concerned substances are relevant for BREF reviews; current stage of knowledge could be delivered by WG Chemicals for industrial point sources (see Section 4.2).	The substances of the most recent Watch list are listed in Commission Implementing Decision (European Commission 2020c). The WL is a dynamic structure which is regularly updated.

¹⁰ Including all substances of CLP Annex VI that pose a hazard does not mean that they should all be given equal attention. Under IED perspective, the hazard classes of particular relevance are health hazards [hazard categories (carcinogenic (Cat. 1A or 1B or 2), germ cell mutagenic (Cat. 1A or 1B or 2), toxic for reproduction (Cat. 1A, 1B or 2) and chronic toxicity (STOT RE Cat. 1 or 2)] and environmental hazards, namely aquatic hazard statements H400, H410, H411, H412 or H413. Data on bio-accumulation and biodegradability may be added.

¹¹ H400: Aquatic acute 1, H410: Aquatic chronic 1, H411: Aquatic chronic 2, H412: Aquatic chronic 3 or H413: Aquatic chronic 4.

¹² CMR cat. 1A: known to have CMR potential for humans, based largely on human evidence; CMR cat. 1B: presumed to have CMR potential for humans, based largely on experimental animal data.

¹³ CMR cat. 2: suspected to have CMR potential for humans.

¹⁴ Under the Water Framework Directive (WFD), the surface water Watch List (WL) is a list of potential water pollutants that should be carefully monitored by the EU Member States to determine the risk they pose to the aquatic environment and whether EU Environmental Quality Standards (EQS) should be set for them. This list should be updated every 2 years. The lists have been published so far in 2015, 2018 and 2020.

Substance group	Rationale	Remarks	References
Biocides such as disinfectants, preservatives and other products	Very eco-toxic substances based on their intrinsic properties; intended to destroy, deter, render harmless, or exert a controlling effect on any harmful organism. All biocidal active are approved by ECHA before placed on the market.	Included to the List Pollutants in IED Annex II.	BPR Regulation EC 528/2012 List of active substances available at: https://echa.europa.eu/information-on-chemicals/active-substance-suppliers .
SVHCs on the Candidate list ¹⁵	Substances with SVHC properties (CMR, PBT, vPvB or equivalent level of concern such as endocrine disruptor) are added on the Candidate list and put forward for prioritisation and inclusion in Annex XIV ('authorisation list'): Seriously and/or irreversibly damaging the environment or human health, as well as substances damaging the hormone system. Substances may become subject to authorization or restriction in the future. Non-binding substitution requirements; criteria Art. 57 (a–f) REACH. However, the aim of authorisation is substitution, so if a substance is on Annex XIV, use under authorisation may only be requested if no substitutes are available.	If substance included in the Candidate List is used in an installation, legal obligations are to be met. Substances used in the industrial sites can be searched from the ECHA database and REACH Annex XV dossiers, but because their 'use information' is insufficient for IED BREF purposes, an expert judgment is needed to verify the data. The Community rolling action plan (CoRAP) ¹⁶ should also be considered here: If a substance is on this CORAP list it means that a Member State has evaluated or will evaluate it over the coming years.	Up-to-date Candidate list can be downloaded under: https://echa.europa.eu/candidate-list-table . REACH Article 59
Registry of SVHC intentions until outcome (RoI)	Proposals to identify SVHC (meeting the criteria for Art. 57) by Member State Competent Authorities or ECHA, REACH Annex XV, preparing dossiers for consultation whether to include them on the Candidate List (Notification). May become subject to authorization or restriction in the future.		List of substances currently under consideration: https://echa.europa.eu/registry-of-svhc-intentions .
SVHCs subject to authorisation and listed in Annex XIV REACH	The major part of applications are related to industrial uses. It is not certain if downstream users (i.e. industrial companies) are aware of their authorized use and responsibilities to notify (inform) the authorized use to ECHA. Thus, if information doesn't flow in the supply chain it is possible that companies will use the authorized substance without being aware of it and without ECHA and national surveillance authorities knowing about this illegal use. The consideration of Annex XIV substances would be promoted if these substances are specially emphasize already in the environment permit application in order to ensure that the operator will pay attention specifically (but not only) on those substances and respective requirements on them.	Annex XIV substances use is only allowed if authorized by the Commission. The conditions for authorization are very strict and only minimised exposure to the environment, workers or general public is allowed from these uses. Substances used in the industrial sites can be searched from the ECHA database and REACH Annex XV dossiers, but because their use information is insufficient for IED BREF purposes, the expert judgment is needed to verify the data. It could be worth to check the uses in the specific decisions and in applications for authorisation to find uses in relevant industry sectors.	Annex XIV of REACH List of substances available at: https://echa.europa.eu/authorisation-list . Authorisation decisions by COM include the name of the authorisation holder and a succinct summary of representative risk management measures (RMMs) and operational conditions (OCs). Art 66 notifications are available to ECHA and MSCAs.

¹⁵ On the one hand, there is the candidate list (209 substances) with proven SVHCs. At the same time, there are proposals from the Member States and ECHA on substances that may fulfil the SVHC criteria and may belong on the list in the future, see also the registry of SVHC intentions until outcome (237 substances). And then there is the list of Annex XIV substances (currently 54 substances).

¹⁶ For the current substance evaluation CoRAP list, please refer to: https://echa.europa.eu/information-on-chemicals/evaluation/community-rolling-action-plan/corap-table/-/dislist/name/-/ecNumber/-/casNumber/-/iec_submitter/-/cse_public_lifecycle/Not+started/haz_de-tailed_concern/-/.

Substance group	Rationale	Remarks	References
Substances with restrictions on use listed in Annex XVII REACH	It is not certain if downstream users (i.e. industrial companies) are aware that they potentially use a substance which is restricted in this use in EU. The consideration of Annex XVII substances would be promoted if permit conditions would oblige companies to annually report on compliance with Annex XVII (and others).	Substances used in the industrial sites can be searched from the ECHA database and REACH Annex XV dossiers, but because their use information for IED BREF purposes is insufficient, expert judgment is needed to verify the data.	Annex XVII of REACH List of substances available at: https://echa.europa.eu/substances-restricted-under-reach .
Persistent, Bioaccumulative and Toxic substances (PBT) and very persistent and very bio-accumulative substances (vPvB) & PBT and vPvB candidates	They do not easily break down, have high bioaccumulation potential in the environment and high toxicity. Because of these factors, PBTs have been observed to have a high order of bio-accumulation and biomagnification, very long retention times in various media, and widespread distribution across the globe. vPvBs and PBT have the potential to cause great harm even at low toxicity, since they can build up and become concentrated over time.	Substances used in the industrial sites can be searched from the ECHA database but because their use information is insufficient, expert judgment is needed to verify the data. PBTs and vPvBs are in many cases covered by restrictions, POP Regulation or REACH authorisation requirements, but PBT and vPvB candidates are not.	List of substances available at: https://echa.europa.eu/pbt .
POPs Regulation	The objective is to eliminate the production, placing on the market and use of POPs and reduce releases of unintentionally produced POPs.	Most substances are not (or no longer) used by industry in EU, but some process borne (unintentionally produced) POPs are still released and relevant. BATc should systematically consider the complete set of unintentionally produced POPs and the few prohibited substances (e.g. PFOS, PFOA).	EU 1021/2019 http://www.pops.int/TheConvention/ThePOPs/All-POPs/tabid/2509/Default.aspx A comparison with reported emissions inventories per sector according to National Action Plans could be a first step.
Persistent, Mobile and Toxic substances (PMT) very Persistent and very Mobile substances (vPvM)	Substances with a specific combination of intrinsic substance properties in particular mobility and persistency pose a threat to the sources of drinking water.	The PMT / vPvM concept is not officially used in the REACH process, but it is considered important from a MS perspective and can be addressed by use of concept 'equivalent level of concern' (ELoC). According to Chemicals Strategy for Sustainability (European Commission 2020b), Commission will promote the legal status of PMTs and vPvMs within CLP (new hazard class) and REACH regulations (Art. 57).	It is possible to filter the SIN List with PMT properties.

HAZBREF recommends as a routine for each future BREF review, that it should be assessed whether SVHCs or other prioritized substances posing an environmental and / or health hazard listed in table 1 are used in the industrial sector for which the BREF is updated. The results of this assessment should be part of the BAT conclusions in the form of a list to ease orientation for inspection and enforcement. If authorised substances or substances from the Candidate List (SVHC) are identified to be still in use in a given industrial sector (BREF), specific considerations about the substitution and minimization of use should be part of the BAT conclusions, in case risk management measures and substitutions driven by REACH refers to the application of BAT.

b) Non-regulated substances of concern from the chemical universe¹⁷. Their use and release should be assessed during BREF reviews.

Besides the lists of priority chemicals or regulated chemicals, which are *per se* undesirable in industrial processes or require special safety measures to prevent exposure and release (see Table 1 above), certain non-regulated substances may also be of interest for consideration in BREF reviews. BAT conclusion by definition includes the most effective and advanced techniques for preventing and reducing emissions in order to achieve a high level of protection of the environment as a whole. So, in the IED-context, not only regulated chemicals (see Table 1) but also chemicals which are likely to be emitted are to be considered in BREFs for emission control measures.

Parameters for chemicals that may trigger concern from an IED-perspective – i.e. from an emission control point of view based on BAT as first step of a combined approach¹⁸ – are fate (e.g. biodegradability / persistence, adsorption capacity), behaviour (e.g. diffusion, mobility, volatility) and hazards (e.g. eco- and human toxicity). The consideration of these chemicals in BREF reviews builds upon existing and available data, criteria and trigger values. This means that HAZBREF does not propose to reassess classification or prioritization of chemicals already done elsewhere, but to use available data on substance properties in order to prevent or further reduce emissions from industrial installation. Following the BAT-concept, this is an objective irrespective of whether a defined no effect levels is exceeded. In short: HAZBREF proposes to use already applied and widely proven assessment criteria for chemicals in a new context. It proposes a two-step approach: 1st ranking step: consideration of the ‘potential to be released’ to the environment for chemicals used; 2nd ranking step: consideration of the ‘hazards for human health and environment’. Figure 1 shows the proposed procedure for identification of ‘substances of concern in the sense of IED’.

For the purpose of this report, substances that have a high potential to be released are referred to as ‘substances of concern (SoC) in the sense of the IED’. Substances are of particular relevance for BAT conclusions if, in addition to their high potential to be released, they have ecotoxicological or human toxicological properties of concern or are emitted in large quantities.¹⁹ The substance properties that are important for the potential to be released refer to physical-chemical properties and biodegradation properties. These data are (or at least should be) available and accessible via the ECHA database or Safety Data Sheets.

¹⁷ ECHA has created a mapping tool of all registered substances called the ‘chemical universe’ in which each substance is assigned to a pool indicative of the regulatory actions already initiated or under consideration for that substance (News 4.12.2019: <https://echa.europa.eu/fi/-/mapping-the-chemical-universe-list-of-substances-by-regulatory-action-published>). It also identifies those substances for which the need for suitable regulatory actions still needs to be determined <https://echa.europa.eu/fi/universe-of-registered-substances>.

¹⁸ See Art. 10 Combined approach of the Water Framework Directive stipulating that where a quality objective or quality standard requires stricter conditions than those which would result from the application of BAT (only), more stringent emission controls shall be set accordingly.

¹⁹ In a separate HAZBREF report Aust et al. 2021, an interactive scheme is provided that may guide those responsible for chemicals management to identify relevant target substances for which action is then required. This interactive scheme may be used by operators, competent authorities or may also consulted by TWGs and EIPPCB when assessing needs for action concerning chemicals used.

Concluding remarks from Chapter 2 are that HAZBREF recommends that ‘substances of concern under the IED’ are those that have a high ‘potential to be released’²⁰ and an ‘intrinsic potential for eco- or human toxicity’²¹ being it already regulated substances, substances planned to be regulated in near future (see Section 2.4a) or being it non-regulated substances (see Section 2.4b). These substances should be included in the assessment carried out by the EIPPCB and TWGs for the determination of BAT. If appropriate, targeted BAT conclusions should be prepared.

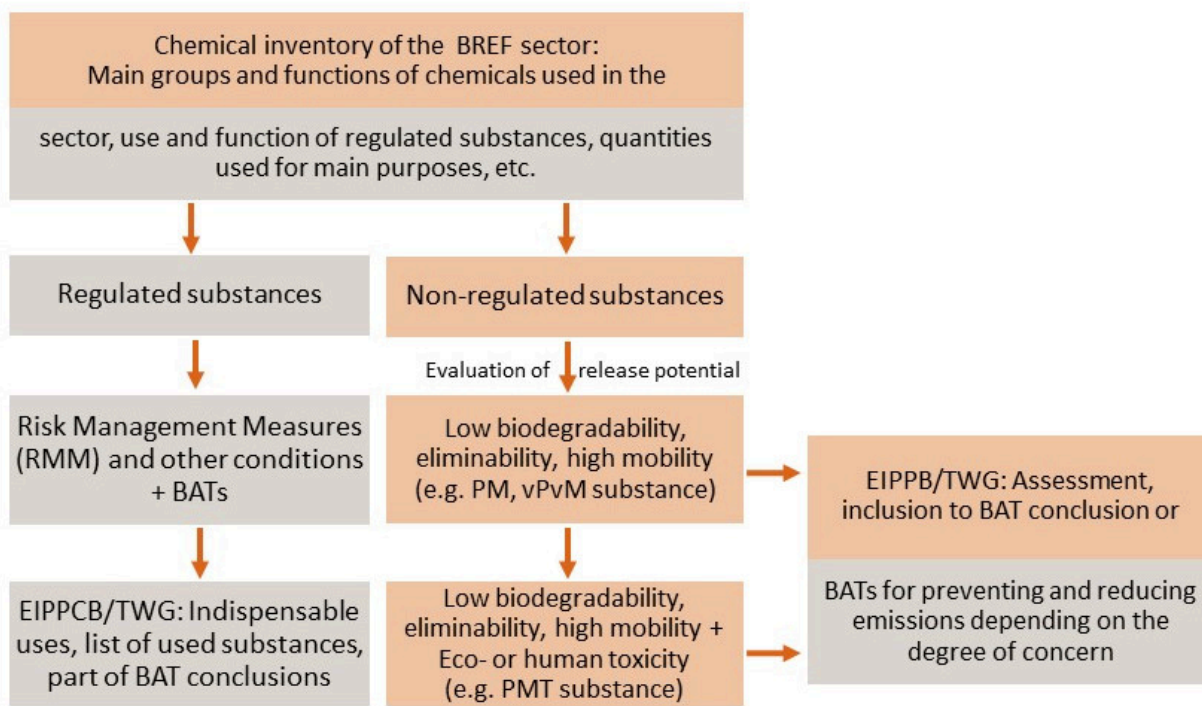


Figure 1. Two substance categories of ‘substances of concern in the sense of IED’ that should be specifically paid attention to in the BREF process: already regulated substances (grey colour) and non-regulated substances with low biodegradability and high mobility potentially leading to emissions to the environment (light orange colour).

²⁰ Details on the parameters regarding the ‘potential to be released’ are given in Section 2.3.1 of the HAZBREF report Aust et al. 2021.

²¹ Details on the parameters regarding the ‘potential for eco- and human toxicity’ are given in Section 2.3.1, table 1 and 2.3.2 of the report mentioned in footnote 36. This also includes trigger values or end points that should be considered to determine whether the substances released e.g. via the water pathway represent a substance of concern.

3 Recommendations to improve the procedure for considering chemicals in BREFs reviews

This chapter recalls the current process of information exchange on BAT, identifies weaknesses and areas for improvement in the Sevilla-Process and recommends an improved workflow through an extended, more organised and structured preparation phase for BREF reviews. This includes an earlier involvement of the TWG (pre-TWG), a reinforcement of the TWG with knowledge on chemicals and EU chemicals legislation (subgroup) and a more systematic identification of substances for BREF reviews by using the available data sources. The setting up of an accompanying advisory body of chemical and sector experts (subgroup) to support best possible outcomes seems advisable, at least for those industrial sectors that use a wide variety of chemicals (e.g. TXT, PP, STM, TAN, CWW).

3.1 The current pathway for identification of chemicals

In principle, the review of Best Available Techniques Reference Documents (BREFs) including the elaboration of BAT conclusions as part thereof follows the procedures and workflows described in the BREF Guidance that has been published in 2012 as a Commission Implementing Decision (European Commission 2012). This document lays down rules concerning guidance on the collection of data and on the drawing up of BAT reference documents and on their quality assurance. It also describes the organization of the information exchange about BAT and the data collection and submission.

The BREF Guidance has steered the work of the EIPPCB and the TWGs during the nine years of its existence. However, when the document was elaborated, not all evolving issues and challenges could be foreseen and, therefore, the guidance does not provide precise and comprehensive guidelines for all important topics today. During the years, the Sevilla-Process has evolved as a kind of ‘learning institution’ and has improved gradually. There are only few instructions on how to address the chemicals during BREF reviews (for a deeper analysis see Chapter 6). Also, the planned time schedule is not very realistic under current conditions and some work steps are missing or undervalued.

Acknowledging that in practice some deviations from the BREF Guidance were necessary and that details and focus may vary depending on which BREF is concerned, figure 2 shows the major work steps and the chronological sequence from the start until the elaboration of the first draft BREF as established over the years.

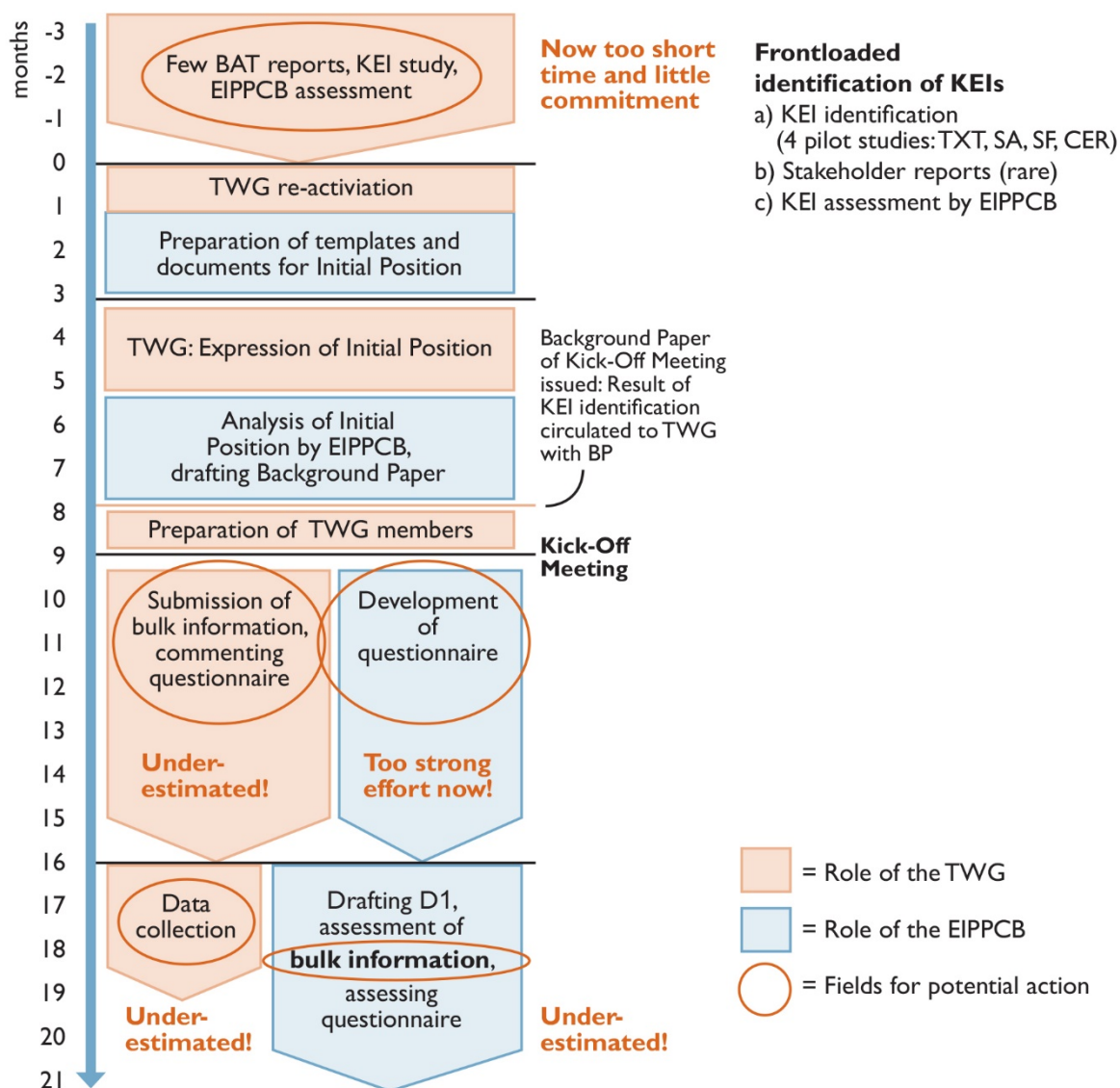


Figure 2: Course of the first half of the development of BREFs and BAT conclusions now.

From figure 2, the following messages can be taken for the major phases for drafting BREFs:

Frontloading (about 3 months)

- the preparatory phase of BREF reviews currently is relatively short and lasts normally around 3 months;
- only a few, if any, BAT background reports on how to address and develop BAT regarding substances of concern are still submitted. Most TWG members that drafted and provided BAT background reports in the first IPPC BREF review cycle have stopped developing those reports for IED BREF reviews. Active involvement of and initiatives from the TWG in that pre-phase is relatively low compared to the work steps that follow. The frontloading phase is not always regarded by TWG members as part of the core business of the Sevilla-process;
- TWG members and EIPPCB have relatively little commitment to a more comprehensive assessment of relevant hazardous substances and other substances of concern. Possibilities, tasks and needs in the BREF process seem unclear and less specified at this stage;

- studies commissioned by DG ENV for the four pilot sectors (textile industry (TXT), Slaughterhouses (SA), Smitheries and Foundries (SF) and Ceramic Industries (CER)) were useful for the identification of so-called Key Environmental Issues (KEI) determined according to the four criteria relevance, EU-significance, availability of BAT to control them, and the possibility to derive BAT-AELs or BAT-AEPLs²². HAZBREF believes that these criteria are not useful for identifying less known, not commonly measured and reported substances, such as released industrial chemicals which are the subject in this report. The current 4 studies for KEIs focus purposely on published literature data only. A complementary approach for the systematic analysis of relevant substances needs to be established which should include actually available data.
- the frontloading phase of BREF reviews usually does not deliver a comprehensive overview about the production (only relevant for chemical industry), use and release of ‘substances of concern in the sense of IED’ due to limited time, the general focus on mass pollutants with a broad data availability and the use of mainly E-PRTR data to establish the significance of pollutants (PRTR is unsuitable for the subject of this report).

From the re-activation of the TWG to the Kick of Meeting (about 9–10 months)

- although the templates for expression of Initial Positions (IP) sent by the EIPPCB to TWG members allow the provision of information on substances of concern in the sense of IED, this has rarely been done systematically and comprehensively in practice so far. This would require sufficient preparation time and instructions on what kind of information is needed to be considered for the BREF revision;
- the Background Paper (BP) that is drafted by the EIPPCB and issued 6 weeks before the Kick-Off Meeting, at the latest, currently contains preliminary results of the assessment of KEIs, as well as a comprised assessment of information of the initial positions. The use of industrial chemicals and the release of substances of concern are mostly not assessed comprehensively²³. In some cases, even if information on hazardous substances was provided, it might be regarded as not relevant, if it was provided by a single Member State only, or if no standardised monitoring method is available. A rather defensive mode of the Seville process is observed when treating less-measured (newer) pollutants. In contrast, classical pollutants and some well-known regulated substances are thoroughly considered;
- after the Kick-Off-Meeting (KoM), most decisions related to KEIs and issues to be further examined by the TWG are fixed and kept unchanged during the rest of the BREF elaboration process. The elaboration of BATs for relevant chemicals suffer from this constraint;
- the EIPPCB itself has little resources and staff to carry out research of their own and therefore mainly assesses data submitted by the TWG and easily accessible literature.

²² The KEI approach has been initially proposed by DG ENV to IED Art. 13 Forum members in 2015, was controversially discussed and from 2016 onwards used by the EIPPCB to identify KEIs. The 4 proposed criteria for identifying KEIs are: (1) Are the environmental issues and associated parameters relevant for the activity or process concerned? (2) Is the industrial process and its pollution and consumption a significant part of industrial pollution and consumption in the EU? (3) The potential for identifying new or additional techniques that would further significantly reduce pollution and (4) The potential for defining BAT AELs and BAT AEPLs that would significantly improve the level of protection for the environment. HAZBREF considers the criteria mostly unsuitable for the intended purpose and even more for identifying relevant substances of (potential) concern for BREF reviews. Only criterion 1 seems to us to be suitable in principle for determining KEIs (note: in the IE Directive there is no clear definition of "environmental relevance"). Significance criterion 2 partly contradicts the precautionary principle and underestimates the relevance of environmental impacts of the neighborhood in permits. The reference to the entire EU is a too rough grid for the purpose of plant permits. Criterion 3 and 4 cannot be reliably determined before the start of the BREF review. In particular with regard to newer challenges or where data collection may help filling data gaps criteria 3 and 4 are not suitable. The four KEI criteria were only established as an orientation for the TWG to facilitate the identification of KEIs for each BREF but should not be misunderstood as conclusive or exhaustive.

²³ For example, before and during the Kick-Off Meeting of the TXT BREF review, emerging and less-known emitted hazardous substances, like certain CMR-substances or PFAS, were assessed and regarded by EIPPCB as not relevant although some MS proposed those substances as KEI in their Initial Position. On the request of Germany, a list of CMR was compiled during the KoM to be included as KEI. As EIPPCB requested this list to be developed before the end of the KoM, it did not allow for a systematic approach. Compiling the (very likely incomplete) list at all was only possible because TWG members were able to contact additional external experts on short notice out of the current Kick-off Meeting.

Development of questionnaires and data collection (roughly 10.5 months)

- the focus on the questionnaires for data gathering absorbs a lot of time and efforts. The development of the questionnaire alone takes roughly 6.5 months, several drafts, a meeting and commenting phases before being sent out to the operators of selected reference plants that volunteer to fill in the questionnaires;
- at the same time, TWG members are requested to submit so-called ‘bulk information’, which means all other BAT background material, BAT relevant studies and publications. The inappropriate term ‘bulk information’ for this most valuable information coincides with an underestimation of the importance of this information by the TWG and the EIPPCB. It is, in fact, very valuable information on BATs which is particularly relevant for chemicals;
- when the data collection starts roughly 16 months after the re-activation of the TWG, the EIPPCB starts drafting the BREF and its BAT conclusions mainly by assessing ‘bulk information’ and transferring it to a meaningful text. Steps that follow are not further discussed in this report because we consider them to be less relevant for the subject.

The current traditional pathway for identification of Key Environmental Issues is shown schematically in figure 3 which summarises the complex BREF review process in a nutshell. The focus for the four levels of BAT conclusions shown on the right side of the picture is what it delivers referring to hazardous substances or other substances of concern.

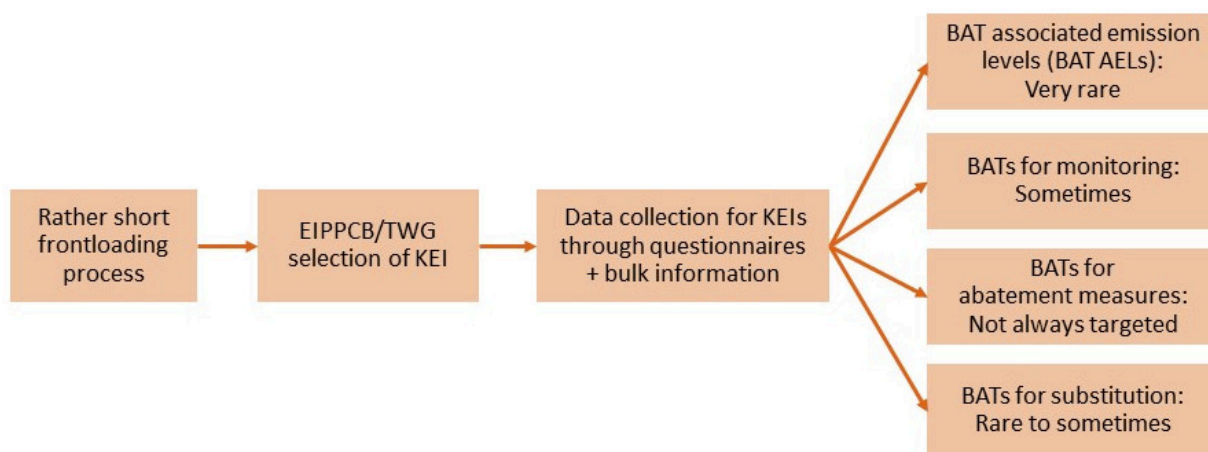


Figure 3: Traditional pathway of BREF reviews focusing on KEIs and questionnaires.

When looking at the current procedures for BREF reviews with a focus on the identification of chemicals and measures to control them, it can be said that the traditional pathway, based mainly on the KEI approach and complex questionnaires, does not always deliver satisfying results²⁴.

²⁴ Some of the doubts, criticism and reservations concerning the proposed criteria for the KEI concept can be found in the minutes of the 8th Meeting of the IED Art. 13 Forums held in Brussels 19 October 2015: <https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetailDoc&id=28996&no=2>. Nevertheless, at the 9th IED Art. 13 Forum Meeting 20 October 2016, the Commission decided to stick to its proposal for identifying KEIs in advance of the information exchange by use of 4 criteria and to apply the approach to sectors for which BREF reviews will soon start (see: <https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetailDoc&id=33192&no=3>). In order to test its adequacy, flexibility and effectiveness, identify weaknesses and make recommendations for improvement, the consultant Ricardo was commissioned that delivered its 5 reports in 2018. The report on the methodology used and the four reports on the “preliminary determination of Key Environmental Issues” can be downloaded in CIRCABC: <https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp?FormPrincipal: idcl=FormPrincipal: id1&FormPrincipal: SUBMIT=1&id=33336634-65ed-4dcb-9a18-430825e073ee&javax.faces.ViewState=zGo5XnUHE9QmS-McxfYu53SEFdn6OQlIbxGrodUeoRsZwo8roFhMvIZgbYdXeAGiyPg1bwmhAD%2FqUXNkWk%2FjG4iWjixuz%2FoaGjJKX-Aiu7TMQVz8QQRQuLI%2FdOWkngGZFu%2B9NQCAyXsmrEO2pK1w4yPo61HZW8%3D>.

Shortcomings, weaknesses and challenges of the present approach for the elaboration of BREFs and BAT conclusions can be summarized as follows:

- the current KEI approach and criteria do not reliably catch hazardous substances or chemicals and cannot bring light into the grey areas of not knowing as they mainly rely on monitoring data (which exist only for parameters with ELVs) or publicly available information;
- operators may not have an interest in informing the TWG comprehensively about chemicals used, produced or released which are not yet regulated under IED (and very often they might also not know the complete picture themselves) while it is very likely that neither the MS nor the relevant CA have the full picture on chemical compositions and, hence, emission pathways;
- the exclusive focus on routinely measured emissions that are significant at the EU level, risks missing other key environmental issues that are released at lower mass flow or loads but are e.g. SVHC or CMR substances or those whose degradation products are substances of concern or that are particularly relevant locally (nevertheless, the neighbourhood is concerned by permit decisions);
- emerging pollutants relevant for the sector are very likely to be excluded from the information collection of plant-specific information as they are often not (yet) regulated and, in some cases, only monitored on a voluntary basis by plant operators;
- the traditional KEI/questionnaire-approach gathers very little knowledge about pathways of hazardous substances released from installations and emission reduction measures and lead to rather conservative and backward-looking BAT proposals. At least monitoring requirements should be set up for emerging pollutants for which no BAT AEL or reduction measures can be derived at the moment.

Considering these shortages, HAZBREF suggests developing and applying additional systemised work steps during the frontloading phase of BREF reviews. The recommendations build on existing proven practice with more emphasis on identification of hazardous substances and other substances of concern. The proposed reinforced frontloading is not intended to appear as something completely new but rather complementary to the traditional pathway. Thus, the recommendations have the potential to improve the current procedure and workflow of the information exchange resulting in more comprehensive information and measures for releases of substances of concern in BREFs and BAT conclusions.

3.2 Proposed amendments of procedure and workflow

HAZBREF recommends systematizing and streamlining the identification of hazardous substances and other substances of concern and strengthening the determination of measures to better control them during BREF reviews. This requires:

- some restructuring of the timeline,
- putting more emphasis on the preparatory phase of BREF reviews and reconsideration of priorities (some classical pollutants possibly need less attention, less- or unknown pollutants more),
- complementing the so-called Key Environmental Issue approach, and
- slight amendment of the stakeholder involvement.

To implement a more systematic approach, the preparatory phase of BREF reviews (frontloading) needs a little more time (about 3 months²⁵), clearer procedures, more planning by the EIPPCB, more commitment and efforts from all involved parties (EIPPCB, TWG, associated parties such as ECHA, WG CHEM, national authorities). Efforts undertaken at the beginning of BREF reviews are well

²⁵ Some time for extension of the preparatory phase of BREF reviews may partially be taken from the questionnaire development, which can thus be made somewhat less elaborate and complex.

invested, the identifications of gaps and priorities and the determination of required actions are crucial for more complete BAT conclusions concerning substances of concern.

It cannot be emphasised enough that a pre-requisite for an organized frontloading of BREF reviews is a reliable work programme for BREF reviews (planning must be at least 3 to 4 years ahead). Unfortunately, this has not been the case for many years, although this issue has been addressed several times in IED Article 13 Forum meetings. Currently, only the coming year is covered by the work planning of the EIPPCB. If this remains unchanged, the feasibility of proposed improvements is limited.

Figure 4 summarises the main aspects and actions that HAZBREF recommends for BREF reviews in order to strengthen the pre-phase of BREF reviews. The proposal in Figure 4 suggests that an amendment or update of the so-called BREF Guidance (European Commission 2012) is advisable (see Chapter 6).

The following points, that are only schematically shown in the figure, are worth being explored a little further. Together they form a more systematic approach for the identification of chemicals and measures to control them in BREF reviews:

Building on existing practice

- The HAZBREF recommendations build on existing practice on how the Sevilla-process is designed and carried out. They aim at strengthening the weaker parts while leaving those which already deliver good results untouched. The character of the Sevilla process as ‘learning institution’ is acknowledged.
- While it is important to build on proven practice, it is nonetheless necessary to think beyond existing rules and traditions to be able to kick-start improvements related to the ‘zero pollution ambition’.

Extended and more organized frontloading

- The recommended extended frontloading is best carried out in an organised manner that includes active participation of the TWG right from the beginning. The steps foreseen for future BREF reviews during the frontloading phase should be shared with TWG members right from the start. The TWG should be actively involved as an integral part of BREF reviews also in this work step. Awareness of the relevance of active participation, also in the preparatory phase, should be raised.
- Major steps of the frontloading phase as recommended by HAZBREF should be described, discussed with TWG and in the Art. 13 Forum, and institutionalised by an update of the BREF Guidance 2012/119/EU (see Chapter 6).
- The extension of the frontloading phase must not necessarily take significantly more time than now (around 3 months more). The time required depends above all on the approach chosen and the availability of experts that are willing to contribute in the expert groups.
- the EIPPCB should encourage TWG members to carry out applied research projects or case studies on specific aspects of the use of chemicals in due time before the start of BREF reviews. In contrast, currently very few or almost no BAT research projects are carried out to support the work of the TWG.

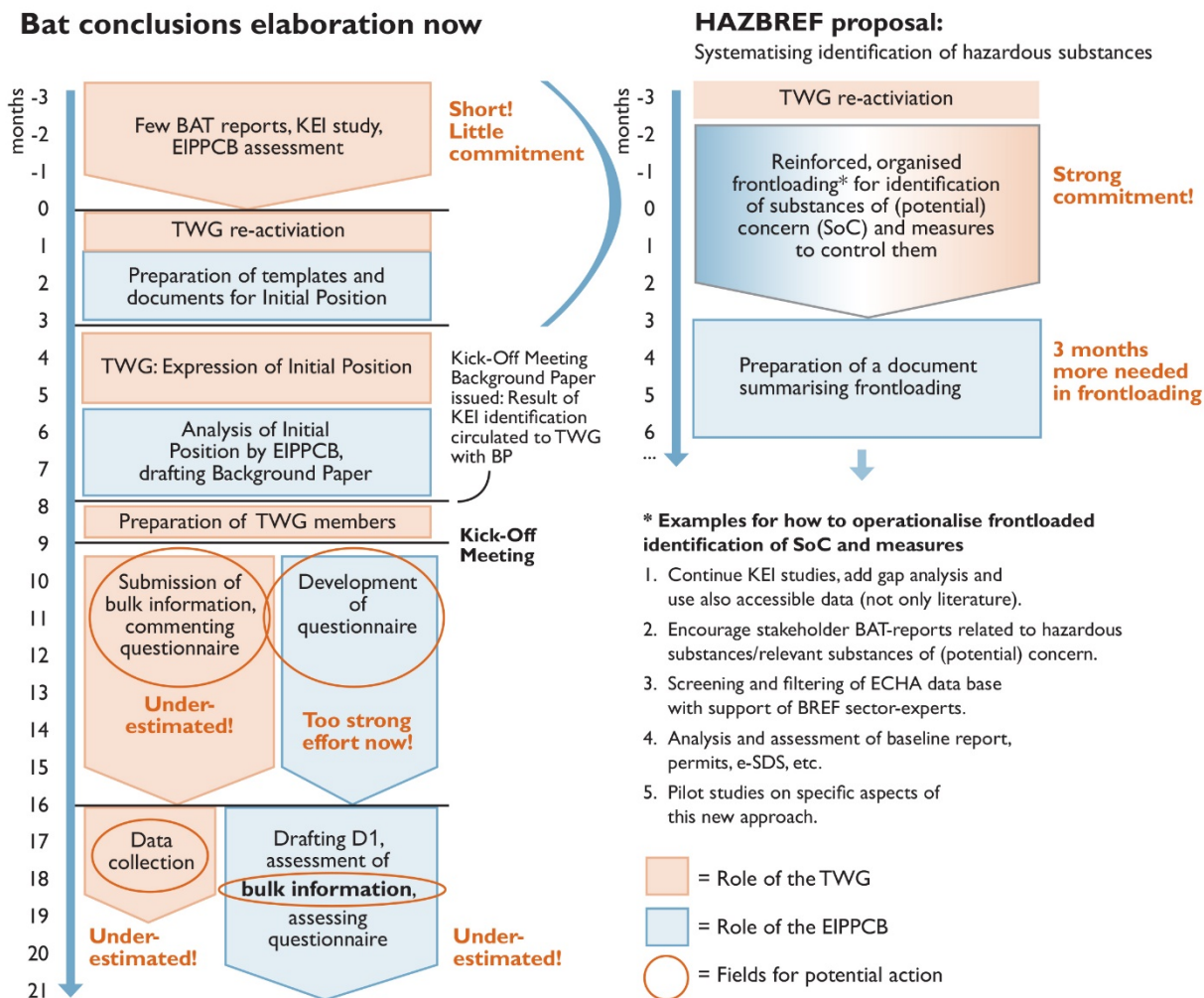


Figure 4. Proposal for systematising the identification of hazardous and other substances of concern.

Commissioning of a consultant

- For all BREF reviews of the 2nd review cycle, HAZBREF recommends that EIPPCB or DG ENV carries out a similar – but extended – preparatory study like the four Ricardo studies titled “Preliminary determination of Key Environmental Issues” (“Ricardo Study”) right after the re-activation of the TWG. However, these studies should include a gap analysis of the weaker points of the BREFs in question, the use of other relevant data sources than those published in literature (e.g. data base search, monitoring results), and a systematized screening of used chemicals utilizing the expert knowledge and findings of the pre-TWG (for more details see further below).
- The recommended preparatory work conducted by specialized consultants may begin with a desktop-study. The consultants should also analyse a selected set of available chemical inventories of companies of the given sector²⁶ and some baseline reports²⁷ to be drawn up according to

²⁶ For this type of analysis, the consultant needs the support from Member State representatives. By use of signed agreements on the handling of confidential data, the legitimate interests of companies in the protection of intellectual properties should be taken into account.

²⁷ These baseline reports are prepared by the operator and submitted to the competent authority before a permit for an installation is updated for the first time. Baseline reports contain information about the use, production or release of relevant hazardous substances as defined in Article 3 of Regulation (EC) No 1272/2008 (CLP Regulation).

Article 22 IED. Other data sources, such as exemplary permits or extended Safety Data Sheets (SDS) including exposure scenarios, should also be used as a data source for the evaluation of relevant substances of concern.

- The consultancy may also address the (sector-specific) state of the art resulting from the ongoing implementation of all other legal obligations under different EU regulations related to chemicals used in industrial processes. Experiences gained by MSs Competent Authorities throughout their permitting and supervising activities are of interest also to e.g. directly identify key chemicals/substances deserving investigations and/or needs for actions.
- Work may include recommendations to conduct specific real measurements concerning the ‘SoC’ in the vicinity of plants in order to determine whether there is an actual concern in case the substances can actually be found outside of a given site (e.g. Non-target or suspect analysis in effluents of chemical plants, some P&P, TXT or STM plants).
- Once the draft preparatory study, a document that summarises the organized frontloading, is drawn up by consultants (or volunteering Member States if consulted soon enough and committed) and will be assessed by the EIPPCB. It will then be circulated for comments among TWG members. This work step should be considered as an integral and important part of the information exchange on BAT.
- Based on the preparatory study and the feedback of the TWG, a list of chemicals relevant for the BREF review could be proposed by EIPPCB. The list would then be assessed at the Kick-Off Meeting of the TWG and during the data collection phase. In parallel, BAT-measures to guarantee and control the safe use of chemicals needs to be elaborated (see also proposals below on the advisory group/subgroup composed with chemical/equipment supplier and sector-experts).
- The consultant accompanies and supports the pre-TWG regarding organizational matters, participates at pre-TWG meetings and drafts the report on findings of the pre-TWG. The report of the consultant’s own data search (see below) is attached to the report of the pre-TWG.

Systematic identification of chemicals (for more details see Chapter 3.3)

- HAZBREF recommends as preparatory work (before any search in databases is carried out) the drawing up of a sectoral inventory of the chemicals used in a BREF sector. This sectoral inventory of chemicals would give an overview on the main production processes in a BREF sector and the associated chemical groups used within these processes. The technical and chemical functions of the main chemicals used would also be addressed. It should be preferably commissioned and coordinated by industrial associations affected by the given BREF review and drafted with contributions from their industrial members (operators of IED plants).
- The systematic approach includes a search of ECHA’s database by using key words (use descriptors, etc.), the screening and filtering of the SPIN register²⁸, available national chemical registers (e.g. KemiDigi²⁹, taking into account the confidentiality issues). Additionally, other non-regulatory lists like the SIN list³⁰ or sector-specific lists of restricted substances (like the Zero Discharge of Hazardous Chemicals (ZDHC) – Manufacturing Restricted Substance List

²⁸ SPIN is a database on the use of Substances in Products in the Nordic Countries. It is a publicly accessible database, which can be used free of charge. It contains information on the chemicals that are used in the Nordic countries. The information includes quantities, industries in which it is used (NACE and national) and the function it is used for (USE Category).

²⁹ The KemiDigi project brings chemical data together in one service. Kemi Digi is a national Finnish chemical information resource and service which pulls together national chemical data. It aims to create a streamlined electronic service for companies managing their reporting obligations related to chemicals. The possible confidentiality issues must be considered by authorities when using the data in the BREF process.

³⁰ The SIN List is a list of hazardous chemicals that are used in a wide variety of articles, products and manufacturing processes around the globe. The SIN abbreviation – Substitute It Now – implies that these chemicals should be removed as soon as possible as they pose a threat to human health and the environment. For more information: <https://sinlist.chemsec.org/what-is-the-sin-list/>.

(MRSL)³¹ for the textile industry) could be used as complementary information sources for substance uses. The use patterns or the description on why and how substances are used should be included in the data search, if they are available. The use descriptors for data search could be chosen with the support of the sector experts (pre-TWG).

- The active search for chemicals includes knowledge, data and findings from experts from ECHA, WG CHEM and POP (Stockholm) Convention (see proposals of Section 4.1.– 4.3).
- The result of the search is a long list of chemicals and a draft proposal for elements of a short list. The chemicals from the long list will not all be relevant for the selected sectors as the use descriptors of the databases are too broad, unspecific, not sector- or process-specific. This list needs to be cross-checked with regulatory lists (see table 1 in Section 2.3). A useful tool to check the regulatory status of hazardous substances is the ECHA legislation finder EUCLEF (<https://echa.europa.eu/legislation-finder>).

Reinforcing the TWG with knowledge on used chemicals (pre-TWG, subgroup)

The reinforcement of the TWG with knowledge on chemicals used in a sector should be considered as one of the crucial pre-requisites for producing valuable results. Depending on the amount and variety of chemicals used in a given BREF sector, this reinforcement can be achieved by (a) setting up a pre-TWG, (b) the commissioning of a consultant as described above and (c) the establishment of an expert subgroup specialized in chemicals used in the sector concerned supporting the EIPPCB and TWG during the process. The subgroup can also start early and by taking over the tasks of the pre-TWG (see (a)).

- (a) The pre-TWG in the reinforced frontloading process would consist of, in addition to interested TWG members, sector and chemical experts (especially chemical suppliers and suppliers of equipment for the relevant sector) and include in special cases also measuring institutes (e.g. if conducting real measurements concerning the ‘SoC’ in the vicinity of plants is considered). This implies that the re-activation of TWGs is moved forward a few months (e.g. 3 months). Experts from ECHA, WG CHEM and POP Convention should be considered to participate in selected meetings (see proposals made in Sections 4.1., 4.2 and 4.3). Members of the pre-TWG could either become a part of the TWG and accompany the review process or could participate in a TWG subgroup dedicated to the issue of the use of chemicals in a given sector. The TWG finally decides upon the substances of concern to be considered in the BREF review during the Kick-off meeting.
- (b) The work of the pre-TWG could be supported by a consultant as far as organizational aspects are concerned (protocol, meeting organization etc.). The consultant could also be in charge of drafting a report based on the input provided by the pre-TWG (see further above). The report on the results of the pre-TWG is shared with the entire TWG/EIPPCB.
- (c) It is advisable to establish an advisory subgroup of chemical and sector experts that may gather in a dedicated group to support best possible outcomes.

This proposed strengthening of the TWG is necessary in order to make progress concerning chemicals used and substances released in industrial installations. The challenge is to combine *a substance-specific perspective* with a *sector-specific perspective*³². Traditional TWG experts see their strengths more on the sectoral perspective. So, it makes sense to seek complementary know-how by expanding the number and expertise of participants in the TWGs with chemicals and equipment suppliers or other experts in related fields.

³¹ For more information on the Zero Discharge of Hazardous Chemicals (ZDHC) – Manufacturing Restricted Substance List (MRSL) the reader is referred to: https://www.chem-map.com/chemical_news/manufacturing-restricted-substances-list-mrsl-faqs/.

³² The statement “REACH information brings a substances-focused dimension to the safe use of chemicals that complements the site-specific approach taken under the IED” on page 12 of a REACH Guidance Document can be found at: <https://echa.europa.eu/guidance-documents/guidance-on-information-requirements-and-chemical-safety-assessment>.

Figure 5 summarises and visualises the recommendations made by HAZBREF and connects them, on the right side of the picture, with the expected outcome at BAT conclusion level (they are explained in detail in Chapter 5 of this report).

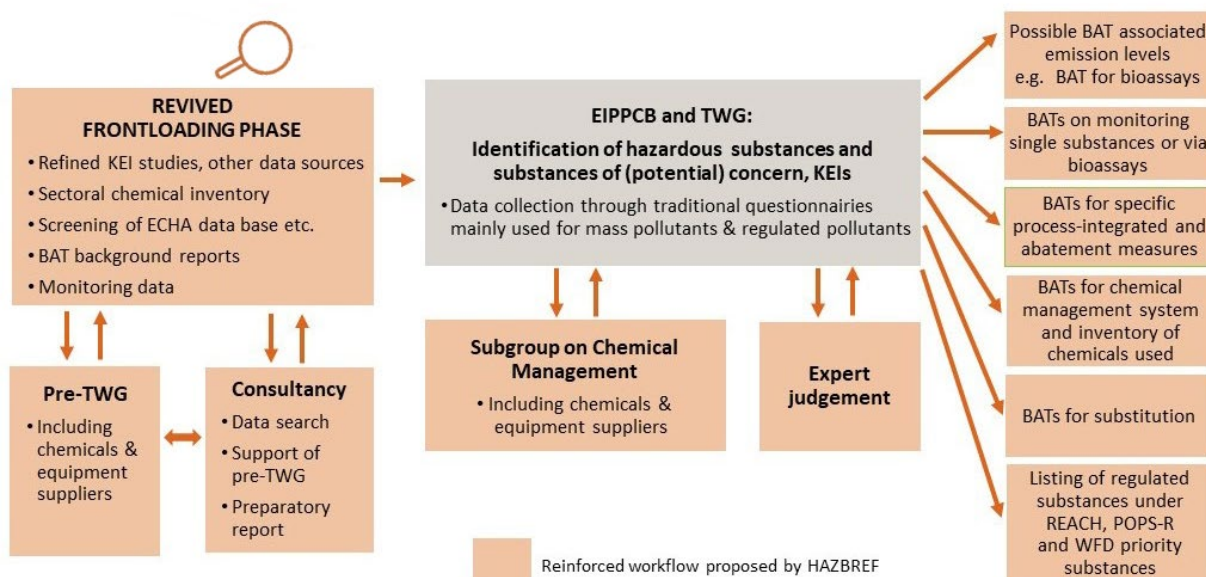


Figure 5. Revived frontloading, reinforced TWGs and workflow for systematised identification of SoC and more specific BAT conclusions to control them.

We call the specialized expert group pre-TWG. The work of this group starts before the traditional TWG and its purpose is to prepare and complement the traditional TWGs during the preparatory phase of BREF reviews. This may apply particularly for BREF sectors in which a large amount and a variety of chemicals is used.

The task of this pre-TWG is to further analyse the preparatory study proposed above in this section regarding the following aspects:

- the completeness of the chemical list drafted by the consultants (reassessment and shortlisting the long list of substances compiled through an ECHA's database search with regard to those which are not in use in the sector; or add novel substances that have been missed);
- if appropriate, proposing additional process-borne substances that may be formed in the production process (e.g. during the application of melanin resins, formaldehyde is formed and emitted);
- the most relevant processes for a given BREF sector (e.g. etching, chromium plating, etc. for the STM BREF), emission pathways (wastewater, air, product, solid waste) and the estimation of the quantities of chemicals used and approximated emission.³³

The result of the work of the pre-TWG could be, among other things:

- Profound proposals to the TWG (including relevant processes, emission pathways and hazards) for substances that should be further examined during the data collection and assessment phases (in the traditional wording these substances would be called 'KEI').
- Recommendations on fields for further analysis and candidate BATs which are worth assessing further by the TWGs. Also, measurement campaigns could be advisable in some cases. The Kick-Off TWG meeting could then decide whether measurement campaigns, e.g. based on Suspect or Non-Target Analysis in wastewater should be carried out in some volunteering plants.

³³ If the industry association in charge of a given BREF review together with their industrial members (plant operators) would carry out a sectoral inventory of the chemicals used in a BREF sector, as proposed above, this would make the work of the pre-TWG extremely easier.

Pilot studies on specified issues on chemicals complementing the questionnaires covering general aspects³⁴

- The work of the pre-TWG may lead to a more focused data collection phase and may reduce somewhat the time demand for the development of the questionnaire.
- The questionnaire may focus on gathering information about regulated hazardous substances, SVHCs and substances alike that are still used. However, the measures to prevent and reduce emissions of specific chemicals including options for substitution cannot be derived from questionnaires since the format is limited to just answering pre-defined questions³⁵.
- For the elaboration of options for substitution and other measures of the defined substances of concern, experts with in-depth sector and chemical knowledge are necessary (chemical sub-group).
- The pre-TWG should recommend BAT candidates for which specific pilot studies on chemicals could be conducted optionally (e.g. on specific process-integrated measures, closed-loop systems, substitution)³⁶ preferably ahead of the Kick-off meeting. The TWG and the EIPPCB could choose to extend the elaboration phase for drawing up these pilot studies until the end of the data collection phase.
- In these pilot studies on chemicals, alternatives for substitution or also applied advanced abatement techniques for minimisation of emissions could be examined and described in more detail including negative side effects and technical constraints. Part of these case studies could be gathering up-to-date knowledge on new developments on the market and their applicability. However, HAZBREF sees challenges and practical obstacles for commissioning these kind of pilot studies (timing, responsibilities, active involvement of chemical and sector experts).

Better connection between different update cycles on regulated substances and BREF reviews

Different legal frameworks have separate update cycles. It is important to be aware of this discrepancy between the legal frameworks in order to better synchronise time-shifted updates of requirements.

The relevant review cycles of the main regulations discussed within this report are:

- a) **IED**: According to recital 13 IED, the Commission should aim to update BAT reference documents not later than 8 years after the publication of the previous version due to the dynamic character of best available techniques that develop over time. In practice, there is a certain delay that leads us to update cycles of 10 years. In parallel, single BREFs are reviewed and updated continuously.
- b) **WFD**: In the area of the WFD and its priority substances, the following update cycles are relevant: According to Article 16 (4) WFD ‘Strategies against Pollution of Water’ the Commission shall review the list of priority substances at least every four years. In practice, the list of priority substances has so far been updated in 2008 and then in 2013 by the Directive 2013/39 EU. A new third proposal is currently being prepared. As part of the strategy, surface water watch-list substances could be monitored across the EU for up to four years. These watch list substances

³⁴ In the Seville-Process, there seems to prevail the view that a questionnaire is a kind of one-fits-all tool. This overestimation of the usefulness of questionnaires (which undoubtedly yields good results for other areas) for issues such as the use, fate and release of industrial chemicals makes them more complex with often disappointing results. For negative experience from the TXT BREF review, see footnote 40.

³⁵ Using questionnaires to find out options for substitution is out of place, if only because it is a complex issue in which a whole range of factors have to be considered and assessed. For instance, also precursors also have to be considered when assessing substitutes (e.g. 6:2 FTS is a precursor of PFHxA which will be restricted under REACH based on the group restriction approach). Another factor are undesirable negative side-effects of certain substitutes.

³⁶ In contrast, according to HAZBREF findings it is not recommended to conduct case studies for the verification of chemical lists as a complete verification of chemicals used in the sectors via case studies is not realistic due to the limited number of case studies, the huge diversity of the sectors and the multiple processes applied. Furthermore, conducting the case studies is very time-consuming. However, it is advisable to conduct case studies for the purpose indicated in this report.

are to be updated every two years according to Article 8b of the Daughter Directive 2013/39 EU. They are published as Commission Implementing Decisions; so far in 2015 (European Commission 2015), 2018 (European Commission 2018a) and 2020 (European Commission 2020c).

- c) **REACH:** The public activities coordination tool (PACT³⁷) informs about up-to-date information on activities planned, ongoing or completed by ECHA and/or Member States for a given substance. Therefore, for substances for which the use in a given BREF sector is known it makes sense to check the entries in the PACT during the frontloading phase of BREF review process. Also, the Community Rolling Action Plan (CoRAP³⁸) or list³⁹ gives orientation about possible updates of information.
- d) **CLH:** There is no regular update cycle for introducing new or updating existing harmonized classifications for human health concerns or classifications for environmental concerns. The substances which are under revision are listed in the PACT.
- e) **SVHC Identification:** Substances identified as SVHC are listed on the candidate list of SVHC for authorization. The candidate list is updated every six months. The inclusion of the substances from the candidate list in the Annex XIV of REACH (a list of substances which need an authorisation) follows after a prioritization step. The prioritization for inclusion in annex XIV and the resulting requirement to apply for authorization follow, in practice, a cycle of around 24 months. Information on the status in the authorization process (including SVHC identification) and the expiry date after which a substance can no longer be used without an authorization for that use can also be found on the PACT website. <https://echa.europa.eu/fi/pact>
- f) **Restrictions:** There is also no regular update cycle for the list of restrictions for uses according to REACH (annex XVII of REACH). New restrictions will be added to the annex when MS have agreed on a restriction. The agreement is based on a dossier from a MS or the ECHA on request from the Commission. The creation of the dossiers (as well as the SVHC dossier does) follows a fixed schedule. The substances which are in the restriction process and the status of this process has can also be found in the PACT and the Registry of Intentions (RoI)⁴⁰.
- g) **Extended safety data sheets (eSDS):** eSDS for >10 t per year registrations include exposure scenarios⁴¹ that can also be of interest for the assessment of certain substances during BREF reviews. eSDS under REACH are created by the registrants or other stakeholder responsible for the chemical safety assessment under REACH. eSDS is distributed down the supply chain. The eSDS should be updated if new information becomes available on the hazards or the need for more stringent risk management measures.

³⁷ The PACT table with various filter options and a search function can be found under: <https://echa.europa.eu/pact>. From this screening, SVHCs or possible restrictions or authorisation decisions can be identified. The most important entries in the PACT table in the context of this report is the overview of regulatory risk management measure harmonized classification and labelling (CLH), identification as SVHC, restrictions on use. The information on data generation and assessment activities and the activities on regulatory management options analysis might be of interest to have an idea what substances might be of relevance in the next years also.

³⁸ <https://echa.europa.eu/information-on-chemicals/evaluation/community-rolling-action-plan/corap-table>.

³⁹ The CoRAP for substance evaluation is presented and updated under: https://echa.europa.eu/information-on-chemicals/evaluation/community-rolling-action-plan/corap-table/-/dislist/name/-/ecNumber/-/casNumber/-/lec_submitter/-/cse_public_lifecycle/Not+started/haz_detailed_concern/-/.

If a substance is on this list, it means that a Member State has evaluated or will evaluate it over the coming years. The CoRAP prioritises substances for evaluation over a period of three years. The evaluation aims to clarify a concern that the manufacture and/or use of these substances could pose. After nomination for the CoRAP, it will take several years until a regulatory risk assessment of a substance of concern takes effect (harmonised classification (CLH), SVHC identification, authorisation, restriction). The CoRAP is part of the PACT table in the ECHA Website.

⁴⁰ <https://echa.europa.eu/de/registry-of-restriction-intentions>

⁴¹ More information can be found under: <https://echa.europa.eu/safety-data-sheets>. The key information that an exposure scenario for communication should contain is: (a) the uses and types of activities that the exposure scenario covers; (b) the operational conditions (OC) and Risk Management Measures (RMM) that were assumed by the registrant when assessing the risk; (c) advice for safe use of the substance, addressing the different activities during a use.

- h) **POPs Regulation:** There are no regular update cycles of substances in the Stockholm convention nor in the POPs regulation. Any Party to the Convention may submit proposal for listing a new chemical⁴² in the Annexes. The review process for listing new chemicals, in accordance with Article 8 of the Stockholm Convention, involves 5 steps in approximately 4 years: Submission of proposal for listing a chemical, Screening phase, Risk profile, Risk management evaluation and Decision on listing of the chemical in Annex A, B, and/or C. If BREF experts are involved already in the development of the risk management evaluation (see Section 4.3), this would give an early warning for upcoming substance phase-out periods.

Web-based platform at existing EIPPCB website with links to the relevant development in pertinent EU Regulations

A possible way forward could be to set up and maintain a web-based platform at existing EIPPCB website with links to the relevant development in pertinent EU Regulations. There could also be links to expert groups that work at the interface with IED provisions related to certain pollutants or the use of less hazardous substances. From a substance-specific perspective, the public activities coordination tool (PACT) is a good example for providing an overview of activities that authorities are working on under REACH and the CLP Regulation, However, for the scope of the IED and its BREF/BAT conclusions, the focus per definition remains in permitting installations. Thus, the proposed dynamic website should always start from the sector-perspective. With one foot firmly in the IED and the installation, the proposed website might then comprise all relevant substance-specific provisions an operator has to comply with.

3.3 A more detailed view on the identification of chemicals in BREF sectors

This section holds the magnifying glass over the paragraph ‘Systematic identification of chemicals’ presented in Section 3.2. Important points have already been briefly touched upon there, but they will be dealt with in more detail here.

In terms of a basic approach, a distinction must be made between two cases: (1) the main substances (bulk chemicals) used in a BREF sector are known. This tends to be approximately the case if a sectoral inventory of chemicals used has been compiled in advance of a BREF review; or (2) the main substances used in a sector are largely unknown. In this case, an initial search of the ECHA database should be started knowing that it identifies many substances that are actually not used in the given BREF sector.

Searching in the ECHA database by ‘use categories’ delivers unsatisfying results

Data from the REACH registrations stored in ECHA’s public database⁴³ could facilitate the identification of relevant substances for BREF reviews. The benefit of ECHA’s database is that it addresses individual chemicals (according to their CAS numbers) and opens access to their individual uses and properties (substances selected can be characterised according to hazard and environmental criteria).

Nevertheless, one of the findings of HAZBREF turned out to be that it is not currently possible to produce by a simple search a list of all chemicals used in a BREF sector. One reason for this is that the use information provided by registrants in the ECHA database also includes ‘potential uses’ (not actual uses or not yet put into practice). Another is that in ECHA’s database information on ‘use categories’ is only available on a very generic level, which is much broader (e.g. ‘manufacture of textile, leather or fur’ and ‘textile treatment product’, or: ‘manufacture of chemicals’) than the scope of industrial sectors addressed by BREFs (e.g. pre-treatment, dyeing of textiles and associated process such as printing,

⁴² <https://echa.europa.eu/list-of-substances-proposed-as-pops>.

⁴³ The data needed for this purpose is partly available on the ECHA website: <https://echa.europa.eu/information-on-chemicals/registered-substances>.

finishing, or: LVOC, LVIC, OFC BREFs). However, more specific information on uses seems to be available at the level of Chemical Safety Reports. The possibilities to use parts of such CSR data for the BREF reviews needs be assessed by ECHA.

If the main chemicals used in a sector are not known, searching in the ECHA database is not advisable. It currently does not directly deliver lists of substances that are actually used in a given industrial sector covered by a BREF. Further preparatory work is required for this purpose. Only after a sectoral chemical inventory (see below) and further assessment on chemicals used in a BREF sector have been performed, may the relevant substances (with CAS number) for BREF review purposes be identified. They could then be further characterized by physical-chemical data and data on toxicity with support of the ECHA database.

Sectoral chemical inventory for BREF scope is needed before screening on ECHA database

HAZBREF recommends that the preparatory work, which is necessary before the screening in the ECHA database can take place, is performed during the frontloading phase of BREF reviews (see Section 3.2). As part of this work, a sectoral inventory of the chemicals used and released in a BREF sector should be elaborated. A challenge here is that sectoral chemical inventory should not only address the ‘main chemicals’ (bulk chemicals) but also include process aids, impurities, etc. that sometimes may raise concerns but are used in quite low volumes compared to the bulk chemicals. The sectoral inventory should specifically check if the substances which are regulated under different EU regulations are used or emitted from the BREF sector of concern (see Table 1). This chemical inventory should preferably be commissioned as part of the (extended) KEI studies in coordination with industrial associations and concerned operators in a given BREF sector and then passed on to the TWG for their consideration.

This sectoral chemical inventory gives an overview on the main production processes applied in a BREF sector and the associated main chemical groups used within these processes but also on some substances used in low volumes compared to the main chemicals. The technical and chemical functions of the main chemicals used would be covered, as well as known retention factors, or vice versa, the expected release.

For elaborating and providing this sectoral chemical inventory, it seems advisable that this work is coordinated with ECHA to ensure that the chemical inventory would allow effective data exchange with the ECHA database. HAZBREF recommends that the structure of this chemical inventory is agreed at general level for all sectors.

The aim and purpose of the sectoral chemical inventory is to gather necessary data and share knowledge on which chemicals or chemical groups are actually used in a BREF sector and for which purpose they are used.

Further, this sectoral inventory of chemicals would enable a better grouping of chemicals used and/or produced in accordance with their intended technical functions in relevant BREF sectors.

Once this information is available, a screening of the ECHA database can start⁴⁴ and provide complementary information for instance on the substance properties (physical-chemical data, ecotoxicity), fate and behaviour in the environment (e.g. degradation) as well as on the uses in order to substantiate potential hazards.

Furthermore, screening on use and use volumes from the SPIN register⁴⁵ is recommended to be performed. The data in the SPIN register is not perfect and covers only the Nordic countries, but it is valuable as it may provide supplementary sector specific data on actual uses of the chemicals. More information on utilization of the SPIN register data is described in the HAZBREF report on chemicals management in the surface treatment industry (Krupanek et al. 2021).

⁴⁴ Another HAZBREF report (Aust et al. 2021) describes in more detail the various approaches to collect information on substances potentially used and produced in BREF sectors proposes ways how to identify and quantify substance properties of concern, discusses substance data sources and provides guidance for substance evaluation.

⁴⁵ Substances in preparations in Nordic countries <http://spin2000.net/>.

According to HAZBREF experience gained in the 18 case studies, experts in industrial processes and process and product chemicals can describe technical and chemical functions of chemicals in detail. This makes it feasible to evaluate relevant substances (or main groups of substances) used in a particular industry according to their technical function or structural similarity. In order to conduct this kind of evaluation, experts with in-depth sector and chemical knowledge are necessary. Thereafter, the developed main chemical groups can be characterized with regard to hazard, environmental release and fate criteria. The results of this assessment contribute to identifying substances as relevant for BREF reviews or BAT conclusions respectively.

Identification of regulated substances

Another step for future BREF reviews that should be carried out during the proposed reinforced front-loading phase is the identification of the uses of those substances that are already regulated at some level (some of them are still allowed to use) in other Directives and Regulations (see Table 1). The result of this assessment should be understood as complementary (not as additional) to existing provisions in order to improve the consideration of chemicals in BREF revision process. These regulated substances should be a more significant part of BREFs and BAT conclusions in order to draw the attention of permit writers to these substances.

If, for instance, restricted substances or substances from the candidate list (SVHC) or priority substances under the WFD are identified to be used in a given industrial sector (BREF), specific considerations about substitution and safe handling should be part of the BAT conclusions. SVHC substances are regulated under REACH with the intention to phase-out their use and to reduce exposure. Therefore, in principal they need to be considered for emission minimisation or substitution also under BREFs.

In a similar way, also other substances regulated under different EU regulations and connected to the BREFs (see Table 1) are to be considered.

A useful tool to check the regulatory status of hazardous substances is the ECHA legislation finder EUCLEF⁴⁶. This might align chemical management measures in the facilities with other regulations besides the IED (e.g. REACH, CLP, WFD). These activities should also consider non-regulatory chemical reference lists (e.g. SIN list and voluntary quality standards like ZDHC, MRSL for the textile industry), if available and applicable.

Identification of other substances of concern released from installations

It is not satisfactory in the context of the ‘zero pollution ambition’ to limit the focus of BREFs and BAT conclusions only to SVHCs or other priority substances. Otherwise, many substances released into the environment from industry via wastewater (and other waste streams) would not be covered. It is necessary to treat those substances which are *per se* hazardous or priority substances (regulated in other regulations and directives) differently from those which require action due to their potential to be released from installations.

The substance properties that are important for the potential to be released refer to physical-chemical properties and degradation behaviour. These data can be extracted from the ECHA database. A separate HAZBREF report (Aust et al. 2021) substantiates this approach and makes detailed recommendations on how to proceed. Different approaches are described there to identify substances of concern for BREF reviews.

These approaches are based on an assessment of substance properties regarding fate and behaviour of substances in the environment, as well as ecotoxicological and human toxicological effects. The HAZBREF recommendations includes a set of criteria (trigger values for parameters of concern) and an interactive scheme for decision making, in order to support IED stakeholders to access and interpret

⁴⁶ <https://echa.europa.eu/legislation-finder>

substance data from the ECHA database for registered substances⁴⁷ or other databases⁴⁸, e.g. Safety Data Sheets.

The ‘interactive scheme (decision tree)’ for the identification of substances of concern links the release potential to the (eco)toxicological relevance of chemicals⁴⁹. The data on (eco-) toxicity for the substance in question can be taken from the chemical inventory of the facility, which is based on the information of the SDS and/or the database entries of ECHA. Thus, the interactive tool assists the identification of substances or chemical groups with specific concerns that are relevant to be managed with care in installations. These chemicals or groups of chemicals of concerns are also candidates for consideration in BREF reviews.

This interactive scheme is designed in the first place for operators to identify substances in a BREF sector for which action is required. It may also be consulted by TWGs and EIPPCB when assessing needs for action concerning chemicals used that are currently not regulated but still relevant for the preparation of BAT conclusions.

Further analysis of substances identified in sectoral chemical inventory and database searches

Once an annotated list of substances of concern for a given industrial sector is developed by the means described so far, as a next step the TWG and the EIPPCB supported by the proposed subgroup (see Section 3.2) could select certain substances for further analysis and the development of targeted BAT conclusions.

⁴⁷ <https://echa.europa.eu/information-on-chemicals/registered-substances>

⁴⁸ <https://echa.europa.eu/information-on-chemicals>

⁴⁹ Available at <https://hazbref.rescol.de/doku.php>.

4 Cooperation between EIPPCB/TWG and other frameworks

This chapter digs up in a detailed way the possibilities for more enhanced cooperation between EIPPCB/TWG (i.e. concerning IED BREFs) and actors of some key legislative frameworks (i.e. chemicals legislation such as REACH in Chapter 4.1; WFD in Chapter 4.2; POPs regulation in chapter 4.3). Data sources, information flows, possible field of cooperation and related recommendations between experts and other actors of EIPPCB/TWG and chemicals legislation, WFD and POPs regulation are presented in each sub-chapter. Other studies analyzing interlinks and synergies of different pieces of EU Environmental and chemical legislation have also been utilized in this chapter (IMPEL 2010, 2011, 2013, 2015, Toropovs et al. 2013).

4.1 EIPPCB/TWG and ECHA

The goal for cooperation between the EIPPCB/TWG and the European Chemicals Agency (ECHA) is to make the information exchange on substances of concern easier for a given BREF sector in order to facilitate their better consideration in BREF reviews.

Since the ECHA database is lacking reliable and sufficiently precise use information⁵⁰ and it is not designed for overviews of substances used in certain industrial or BREF sectors, the information on ‘uses’ contained in the database is usually quite general. A query for properties of concern can only be done substance by substance. Furthermore, the composition of the chemical products, preparations or mixtures used in BREF sectors or installations is not documented in a number of cases or does not always follow a unique substance identifier (CAS no). However, the producer or importer of chemical products should know this substance information, but there is not enough incentive or obligation to reveal / give information about it and the industry often refers to confidentiality reasons.

HAZBREF recommends strengthening the communication between ECHA and EIPPCB and to routinely exchange relevant information. HAZBREF acknowledges the increased ECHA/EIPPCB cooperation in recent BREF reviews (starting in 2017 with the TXT BREF review) as a positive step in the right direction, which could still be further systemised and formalised. The main aim of this cooperation is to utilize the ECHA database information to identify substances for BREF reviews based on information on uses, properties and regulatory status of substances. In order to better identify substances used in a given BREF sector the aim of the cooperation is to improve ‘use descriptors’ in the ECHA database based on knowledge in IED sectors. As a result, substances of concern that are potentially used or released from a given BREF sector can be more easily identified and addressed in BREF reviews.

In practical terms, for the cooperation between ECHA and the EIPPCB and the TWGs it seems reasonable to distinguish whether the substances used in a BREF sector of concern are known, in what degree of detail they are known, or whether their use is widely unknown. The starting point of knowledge determines the actions needed. The actions in these different situations are explained below.

⁵⁰ The main reason may be that the chemical suppliers and producer companies have simply not sent the real, reliable and accurate use information to ECHA and, consequently, data on uses is often incomplete in the database. Or suppliers/ producers of chemicals do not know all uses. However, more specific information on uses seems to be available at the level of Chemical Safety Reports. The possibilities to make accessible and use parts of such CSR-data for the BREF reviews needs be assessed by ECHA.

a) When the chemicals used in a sector are widely unknown

Step 1.) A list of chemicals used in the BREF sector (as comprehensive as possible) needs to be compiled in the frontloading phase. Various interactions between ECHA and the EIPPCB and the TWGs in both directions are needed. Necessary steps may include:

- the EIPPCB with the support of the TWG describes the BREF sector under review as detailed as possible (e.g. scope of industrial sectors, technical processes included) and exchanges experience with ECHA to meet the current ‘use description system’ used in ECHA’s database. E.g. use maps for BREF sectors including use names agreed at sector level could be elaborated and agreed on and, if possible, use names for data search refined and fine-tuned. ECHA could then query the database for substances and mixtures used in the sector. However, currently the descriptors in the two frameworks are not compatible and consistent making it impossible to attain the needed use data for IED sectors. Use description in ECHA’s database is often less precise than the scope descriptions in BREFs. It remains a challenge to establish unambiguous links between both sets of descriptors. Experience shows that descriptions in ECHA’s data are often not useful to make an informed decision whether a certain substance is used in a certain industrial sector⁵¹.
- It is the responsibility of ECHA to update the ‘use descriptor system’ and to improve its logic. This is a crucial question for the IED to enhance usability of data provided in database. The current procedure for querying the database and the problems that could arise are described in more detail in a separate HAZBREF report (Aust et al. 2021).
- Members of the TWG from the industry concerned (sector associations, operators) supported by other chemical experts of the TWG gather a list of substances and mixtures used in a BREF sector making sure that the unique identifier for a substance is the CAS number. An appropriate instrument to compile this kind of information is a sectoral chemical inventory (see proposal in Chapter 3.3 for further information) that collects data from the operational chemical inventories which are carried out at installation level. To simplify this work and to deal with confidential business information, grouping of substances according to the technical or chemical function may be carried out. The necessary information regarding fate and hazard properties can be assigned to the representative substances of the substance group via the ECHA database. Other information sources on compilations of substances used in a BREF sector as well search in other existing databases (e.g. REACH Annex XV dossiers, ECHA’s SCIP database) may supplement this work.
- If the current limitations of the use of the ECHA database remains unchanged the use descriptors are not useful to extract meaningful data on chemicals used in industrial sectors addressed by BREFs. Then, a sensible tool to gather information on chemicals used and released in BREF sectors remains the elaboration of sectoral chemical inventories as proposed by HAZBREF in Chapter 3.3.

Step 2.) Once the above-mentioned list of substances has been drawn up, the identification of target substances from ECHA database for given BREF sector follows. At this stage too, a cooperation between EIPPCB/TWG and ECHA is advisable at least until a well-functioning procedure for consideration of hazardous substances in BREF reviews is set up. Necessary steps may include:

- EIPPCB/TWG with the support of ECHA collects data on substance properties for substances used in sector from ECHA database, relevant data are e.g. data on degradability, mobility, volatility, water solubility, eco- and human toxicity⁵²;

⁵¹ ECHA’s Guidance on Information Requirements and Chemical Safety Assessment, Chapter R.12: use description (ECHA 2015), however is not supportive to move towards this target when it states with regard to the sector of use category (SU): ‘(...) in the case of uses taking place across many sectors, [the sector or use category] may not be needed as registrants are not expected to provide an exhaustive list of all sectors.’ (page 23, Section R.12.4.2.3)

⁵² Parameters and trigger values can be found in a separate HAZBREF report (Aust et al. 2021).

- TWG compares data on substance properties from ECHA database (or SDS) with trigger values a) to identify substances with a potential to be released into environment and b) to identify substances with hazard properties. The result is a group of substances of concern to be addressed in the BREF. The procedure presented in section 2.4b can be utilized for identifying SoCs in this step.
- This step includes specifically non-regulated substances of concern (SoC) from the chemical universe (section 2.4b) used and emitted from given BREF sector. This step also includes regulated substances (section 2.4a), but only concerning the searching of use information (searched from ECHA database and maybe from SPIN).

Step 3.) After this, the regulatory status of these BREF target substances may be checked. Steps may include a check by EIPPCB/TWG with the support of ECHA of the information on REACH measures planned or in place for the substances on ECHA website. This may be complemented by a check of the regulatory status in other legislations for substances used in a BREF sector in the legislation finder EU-CLEF. Based on this knowledge, the TWG may decide if additional action is required for identified substances under IED to handle substances according to the regulations.

b) When the chemicals used in a sector are known, i.e. chemical inventory exists, unique substance identifier as CAS No. exists

Step 1 on cooperation can be skipped if the list of the used chemicals is already available. This makes the work and the assessment carried out by the EIPPCB/TWG much faster.

Figure 6 summarises REACH related substance-specific information that could provide important input to the BREF review process. Almost all the relevant information on hazardous and other substances of concern which are listed in the second box from the left in the picture, as well as data on substance properties and regulations on substances are available at ECHA's Website including the ECHA database.

Further recommendations from HAZBREF to improve the cooperation between ECHA and EIPPCB/TWG are:

- ECHA should nominate a representative for the communication with EIPPCB to allow improved communication and data flow between ECHA and EIPPCB.
- ECHA / ECHA representative should be informed on the information needs in the BREF process in order to facilitate information collection.
- The co-operation and information exchange between EIPPCB/TWG and ECHA should start as early as possible during a BREF review (frontloading phase of BREF reviews, see Section 3.2).
- An expert from ECHA may consider a participation in a kick-off meeting of a given BREF review; co-operation may continue after the kick-off meeting, if required. However, to date there is no mandate to do so and, consequently, no clear description of tasks. Knowledge about data requirements from EIPPCB/ TWG is still weak and subsequent processing and use of delivered information within BREF reviews not always clear neither.
- The use description in ECHA's CHEM database should urgently be aligned between REACH and IED and in general improve and develop the database in order to e.g. include more reliable and sufficiently precise use information. In particular, this improves the usability of the extensive REACH data for the BREF process. But REACH also benefits from the BREF process, as improved information on uses might become available. A standardized data exchange processes must be set up for a continuous and more reliable cooperation between ECHA and EIPPCB.

More information about REACH and their connection to BREFs and BAT conclusions and key interlinks between REACH and IED BREFs is presented in HAZBREF Activity 3.1 report (Suhr et al. 2020).

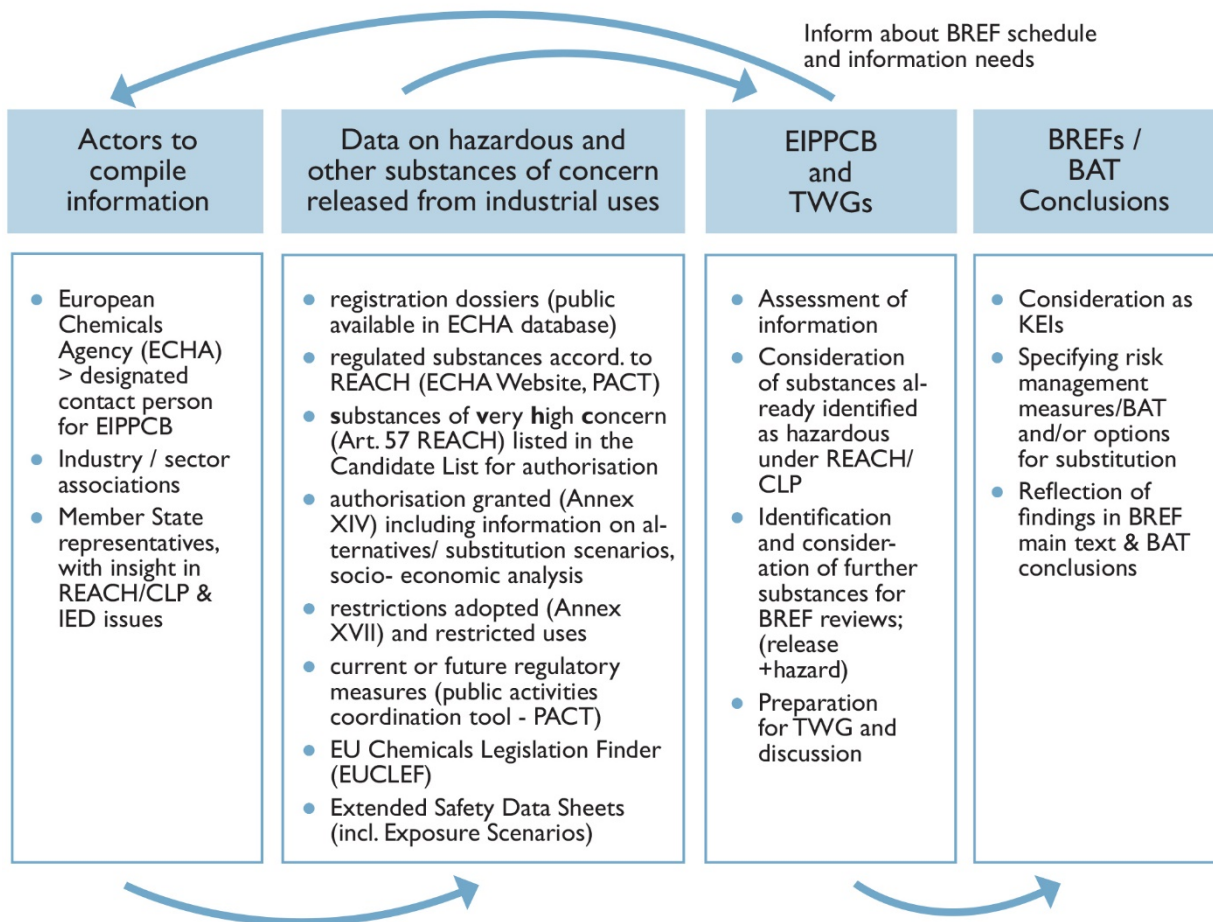


Figure 6. REACH related data sources that could provide important input to BREF reviews and BAT conclusions.

4.2 EIPPCB/TWG and CIS WFD Working Group of Chemicals (WG CHEM)

4.2.1 EU Commission level – improved communication and exchange of information between WGCHEM and EIPPCB/TWG

In order to address the challenges of implementing WFD provisions in a cooperative and coordinated way, the Member States, Norway and the Commission have agreed on a Common Implementation Strategy (CIS) for the WFD⁵³. The main objectives of the CIS are to ensure a better implementation of the water legislation and to promote the integration of water-related issues in other environmental policies, as well as in other sectoral policies such as agriculture, transport or energy. The results of this work, for instance, are guidance documents on different technical aspects related to WFD implementation⁵⁴. The CIS Work Programme states e.g. the activities and the mandates of the Working Groups and is agreed by the EU Water Directors. The CIS Work Programme have been prepared for time periods of three years the most recent one being for years 2019–2021⁵⁵.

⁵³ https://ec.europa.eu/environment/water/water-framework/objectives/implementation_en.htm

⁵⁴ The list of guidance documents which have been published to date can be found under: https://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm.

⁵⁵ <https://circabc.europa.eu/ui/group/9ab5926d-bed4-4322-9aa7-9964bbe8312d/library/06379897-0056-4e0d-83cc-68583085b27b/details>

The relevant working group dealing with WFD priority substances under the WFD (and the Flood Directive) Common Implementation Strategy (CIS) is the Working Group Chemicals (WG CHEM). The above-mentioned current work programme defines as one of the tasks of the Working Group of Chemicals to ‘exchange information on other issues relevant to chemicals in surface waters, (...) and (...) on links with other legislation on chemicals, such as the Industrial Emissions Directive and Reach’⁵⁶. Until recently, there has been little direct communications between the unit of DG ENV responsible for WG CHEM and EIPPCB and TWG members.

Information on discharges of priority substances from industry have to some extent been taken into account in the BREF processes (e.g. INERIS 2016⁵⁷), but until today, BAT conclusions do not express explicitly whether and to which extent the presence or absence of these substances have been investigated and available measures proposed as BAT, if emissions are expected in a given sector. Also, the list of pollutants considered by the EIPPCB since 2016 remains limited to the substances regulated in EQS Daughter Directive 2013/39/EU. Other substances such as those that may become prospectively EU priority substances, e.g. from the Watch list of substances for Union-wide monitoring in the field of water policy, or River Basin Specific Pollutants (RBSPs) identified in at least three Member States and released from industrial installations, are normally not proposed as Key Environmental Issue for BREF reviews.

HAZBREF recommends strengthening the communication and exchange of data and information related to industrial sources between WG CHEM and EIPPCB and to routinely exchange relevant information. The main aim of this cooperation is to utilize WG CHEM expertise to gather data on whether WFD priority substances and other substances of concern that are potentially used or released from a given BREF sector and to make them available at the right time for EIPPCB and TWGs in charge of BREF reviews.

The feasibility of the following proposals could be further assessed and developed by EIPPCB and WG CHEM:

- Commission staff in WG CHEM and EIPPCB should work together for better BREFs. In practice, this can be done via improved communication and data/information flow between WG CHEM and EIPPCB but also via more active cross-participation to WG CHEM and EIPPCB meetings. This would mean that a dedicated representative from the WG CHEM should be formally involved in the BREF review process, and vice versa.
- The work should be coordinated in order to minimize additional burden to both WG CHEM and EIPPCB/TWG members. It is important that the resources of both WG CHEM and EIPPCB/TWG members are ensured for this work.
- Systematic co-operation and information exchange between EIPPCB/TWG and WG CHEM should start in the frontloading phase of BREF reviews, i.e. prior to the Kick-Off Meeting where experts for a given industrial sector convene the first time. This would facilitate gathering and presentation of relevant information concerning releases of WFD substances for

⁵⁶ See Section 3.5 of the work programme 2019–2021, p. 9.

⁵⁷ On behalf of the French Ministry of Environment INERIS has carried out a comprehensive monitoring study the result of which are compiled in a study report that connects priority substances with releases from industrial sectors. The title of the English translation of the report is: “*Hazardous substances for the aquatic environment in industrial wastewater releases. National Action for Research and the Reduction of Releases of Hazardous Substances into Water Bodies (RSDE) by Classified Facilities – Second Phase*” (June 2016). The original French version of the documents is available on www.ineris.fr. The summary report of the monitoring results and its annexes /results by substance and by sector) can be downloaded in English under: https://rsde.ineris.fr/doc/docs%20rsde/Rapport_RSDE_ICPE_INERIS-DRC-15-149870-12457C_VF_EN_FINAL_relu_modifacceptees_compilation.pdf; https://rsde.ineris.fr/doc/docs%20rsde/Rapport_Substances_UK_Compilation.pdf; https://rsde.ineris.fr/doc/docs%20rsde/Rapport_Secteurs_UK_compilation.pdf. Only when the INERIS study was published in 2016, monitoring results on PS and PHS reported in this study have been used in all BREF reviews that have started after this date (TXT, SA, SF and CER BREF). Since then, the situation clearly improved. The INERIS reports are now regularly looked at by the EIPPCB to prepare the call for initial positions when a BREF review is launched. The INERIS study is explicitly mentioned in the Background Papers and/or Call for Initial Positions of all of these BREFs.

identification of Key Environmental Issues⁵⁸ in the Background Paper (BP) that is presented to the TWG for the Kick-Off Meeting.

- The nominated representative from WG CHEM should attend the Kick-Off-Meeting of BREF reviews in order to comment and present the current stage of knowledge on relevant WFD substances (see fig. 7 below and table 1) concerning industrial release of priority substances in a given BREF sector. Data may include knowledge regarding relevant industrial emissions both directly and indirectly discharged to water.
- In practice, also national WFD competent authorities and experts may feed information to the BREF revision process directly via IED Member State representatives (TWG Members) and/or via WG CHEM. However, to date there is no mandate to do so and consequently no awareness, responsibility about tasks and knowledge about data requirements and subsequent processing and use of delivered information within BREF reviews. Submission of data on River Basin Specific Pollutants are possibly best provided by WFD experts to TWG experts. It is recommended to utilize both ways (European and national level) in order to ensure that information will end up to BREF revision process.
- The interactive co-operation should continue also after the frontloading phase and Kick-off Meeting in order to ensure that input concerning WFD substances can be communicated through the whole BREF review process. However, the later the relevant data is submitted for consideration in BREF TWGs, the more difficult it is to agree on appropriate measures for prevention, reduction or monitoring.
- The WG CHEM group should be informed on the information needs in the BREF process in order to facilitate information collection. WG CHEM has usually two or three meetings per year lasting only 1.5 working days filled with items. A meeting document on BREF reviews is needed to be carefully prepared before BREF revision work starts and should be presented for a relevant WG CHEM meeting by the EIPPCB (or another person with insight of the IED and the BREF work). The document should consider which BREFs are to be revised and the schedule for it and especially what kind of input / information is asked from WG CHEM for the forthcoming relevant BREF reviews. The presentation of the BREF work could include the current procedure regarding the consideration of Annex X WFD priority substances during BREFs.
- The WFD and its CIS WFD Guidance Documents should be more coherent with the IED work than currently. There are usually only limited references to the IED in these documents and little examination of what is meant in practice by integrating the obligations of WFD and IED. Nevertheless, it should be noted that not all WFD guidance documents concern the IED. It is recommended that new WFD guidance (or an update of existing guidance) such as CIS WFD Guidance Documents address the issue of interactions between WFD and IED in more detail, building on the experiences in the Member States. This should be ensured in future by both Commission (DG ENV) and Member States representatives contributing to the preparation of Guidance Documents.

Figure 7 shows WFD related substance specific information that could provide important input in the earlier stages of the BREF process for the decision on Key Environmental Issues (KEIs). Later in the BREF process, measures based on BAT are developed for the chosen KEIs by the TWGs (see also Chapter 2.3, table 1 of this report).

⁵⁸ The identification of Key Environmental Issues (KEI) at the beginning of BREF reviews is crucial because only for them, available data are systematically collected via questionnaires and only for them BAT emission levels associated with BAT are derived. If a pollutant is not defined as KEI normally the efforts to gather emission data and develop measures for their reduction is minor. Preliminary findings with regard to KEIs are normally proposed by a written document called Background Paper (BP) that is drafted by the EIPPCB and sent 6 weeks before the Kick-off Meeting of the TWG to all participants for preparation to the meeting.

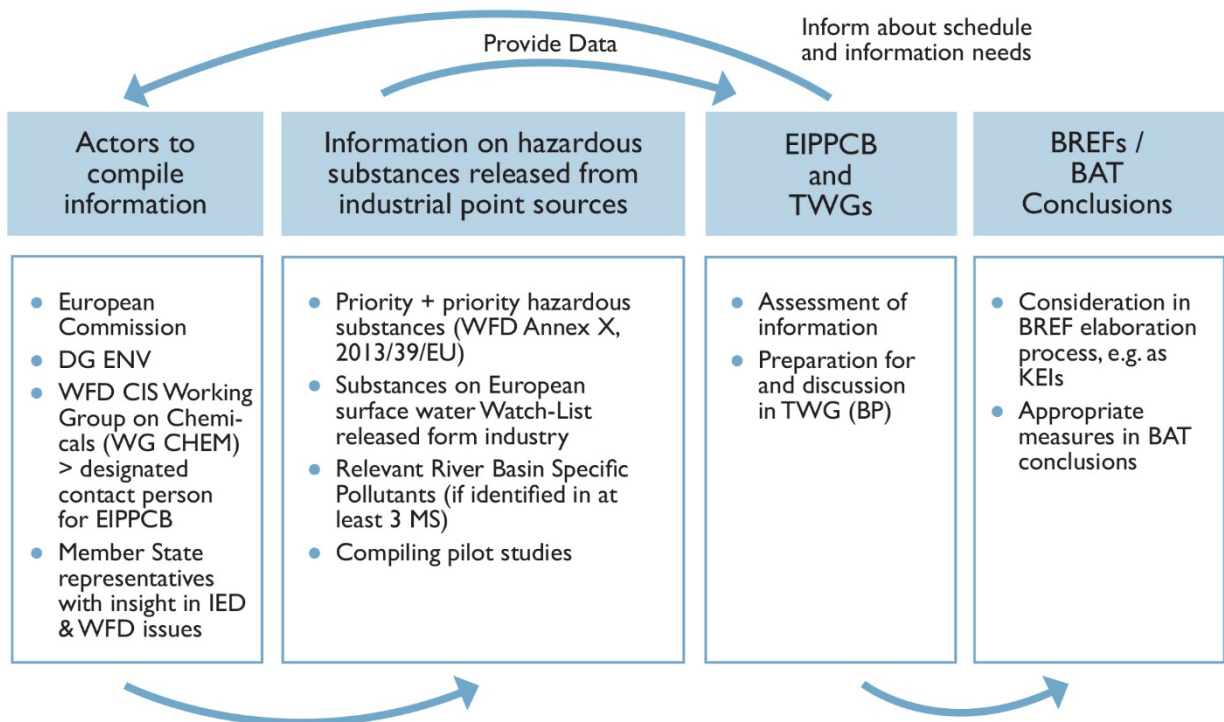


Figure 7. WFD related data sources that could provide important input to BREF reviews and BAT conclusions.

The above-mentioned substance specific input and information needed might be spread over different data sources that are widely unknown to the IED expert community and, therefore, are not yet used for BREF reviews. Relevant data may be part of river basin management plans (RBMPs) or contained in national studies carried out for preparation of RBMPs (that are often more detailed than the RBMPs themselves) such as emission inventories⁵⁹ or guidance for WFD substances. The latter case reflects the situation in Finland, for example. Nevertheless, in Finland, RBMPs themselves are not detailed enough to include this information but situation may be different in other member states.

The information, or part of it, that might be useful for the identification of Key Environmental Issues in BREF reviews may be directly available to WG CHEM, e.g. in format of substance-specific dossiers compiled during prioritization (or nomination) of EU PS/PHS substances or may be scattered among different institutes in Member States. Table 2 summarises the type and expected place of publication of data related to WFD substances in order to shed light to the four main questions to be answered for the BAT assessment during BREF reviews:

- Which WFD substances are used and/or released from a given BREF sector?
- How the substance identified is used in the given BREF sector (use patterns, functionality)?
- What are EQS values (or PNEC values)⁶⁰ for the substance in question?
- What are the emissions to environment from a given BREF sector?

Table 2 presents rough indications where information can possibly be found. Member State representatives could be asked by the call for the Initial Position (first step for BREF reviews), whether and what monitoring data from industrial releases on WFD priority substances of the industrial sector concerned are available.

⁵⁹ Member States are obliged to perform emission inventories of WFD substances (PS/PHS + RBSPs) every sixth years.

⁶⁰ The EQS values or the PNEC values are not intended to be used to directly derive emission levels associated with BAT (BAT AELs) for BREF sectors according to Article 3(13) IED. However, these values may give a first indication on how eco-toxic a given substance is and may orientate the TWG when evaluating how crucial setting BAT for a substance is. PNEC = Predicted No Effect Concentration.

Table 2. Type and availability of information related to WFD substances that are potentially useful for BREF reviews. The characters used: X = Information available; (X) = information may be available; – = no information available.

Type of WFD substance / type of information needed for BREF reviews	WG CHEM	RBMPs (in national language only)	Studies prepared/ information compiled in national work (in national language only)
EU PS/PHS			
Identification of substances – CAS number(s) for substances which are used and/or released from given BREF sector	X or (X) in case of wide substance group	–	X
How identified substances are used in given BREF sector?	X	–	X
How eco-toxic are identified substances (EQS values set for them)?	Information available from most recent Daughter directive of WFD		
Emissions to environment from given BREF sector (load/year, e.g. kg/a)	–	X	(X)
River Basin Specific Pollutants (RBSP)			
Identification of substances – CAS number(s) for substances which are used and/or released from given BREF sector	–	–	X
How identified substances are used in given BREF sector?	–	–	X
Specification of the risks posed to humans and the aquatic environment. (EQS values set for them) *	(X)	–	X
Emissions to environment from given BREF sector (load/year, e.g. kg/a)	–	–	(X)
Surface water Watch List (WL) substances **			
Identification of substances – CAS number(s) for substances which are used and/or released from given BREF sector	X or (X) in case of wide substance group	–	X or (X) in case of wide substance group
How identified substances are used in a given BREF sector?	(X) or – depending on substance	–	(X) or – depending on substance
How eco-toxic are identified substances (reliable PNEC values set for them)?	Information available from Commission Implementing Decisions on surface water WL (European Commission 2015, 2018 & 2020c)		
Emissions to environment from given BREF sector (load/year, e.g. kg/a)	(X) or – depending on substance	–	(X) or – depending on substance
Notes: * EQS values for RBSPs may vary a lot between different Member States ** Substances of the most recent surface water Watch list are listed in Commission Implementing Decision (European Commission 2020c)			

Since it is mainly unknown which type of information is available in Member States and presented in summary form at EU level, it seems worthwhile commissioning a pilot study (Box 1). The pilot study would aim to find answers to these questions: how useful the WFD data really is for BREF reviews, how data can be made easily accessible for the EIPPCB and the TWGs and how the data could possibly be best prepared to enhance their usefulness at BREF sector-level.

More general information about WFD and priority substances, WG CHEM, EQS values and their connection to BREFs and BAT conclusions and key interlinks between WFD and IED BREFs is presented in HAZBREF Activity 3.1 report (Suhr et al. 2020).

Box 1. Recommendation to carry out a pilot study

In order to avoid an overload of BREF reviews, it must be ensured that during the early frontloading phase of BREF reviews (preparatory phase), studies using available information on industrial use and release of priority substances and alike are carried out for a given BREF sector.

HAZBREF recommends that a pilot study is conducted in order to investigate in concrete terms the best ways how the information is gathered on WFD priority substances and other substances of concern (see fig. 8 above) that are potentially used or released from a given BREF sector. This kind of pilot study should be carried out for the next appropriate BREF reviews that will start according to the work programme of the EIPPCB (e.g. STM or LVIC).

These studies could build, for instance, upon the monitoring results and findings on emissions of priority substances from IED installations published in two INERIS reports in 2016 (INERIS 2016). The pilot study should, however, include additional substances that were not considered in the INERIS report, such as those that may prospectively become EU priority substances, e.g. from the surface water Watch list of substances, or River Basin Specific Pollutants (RBSPs) identified in at least three Member States and released from installations of a given BREF sector. As a result of such a pilot study, a routine how to prepare early investigations on WFD substances potentially used or released, that may lead to their inclusion as Key Environmental Issues in BREF review process, could be established.

This kind of pilot study could be performed in the form of an extended KEI study by a consultant, as has been done previously in 4 pilot sectors commissioned by DG Environment.

4.2.2 Member State level – enhanced co-operation between IED and WFD authorities

The institutional relationships between IED and WFD authorities may vary between Member States. Regardless of how the responsibilities are organised, there is a need for more efficient collaboration between IED and WFD authorities at a national level. It is important to facilitate working methods (formal and/or informal) to ensure that the right information is shared between both frameworks and that this information exchange is timely. Two reports published a decade ago in the context of the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) worked out that coordination and cooperation at both Member State level and Commission level are key factors for success⁶¹.

⁶¹ Evidence is given in two reports elaborated in the IMPEL context: “Linking the Water Framework Directive and IPPC Directive, Phase 1 (IMPEL 2010) and phase 2 (IMPEL 2011).

4.3 EIPPCB/TWG and Committee in accordance with article 20 of the POPs regulation

Within the EU the main control measures concerning the release of unintentionally produced POPs from stationary sources (industry) and substances subject to prohibitions are supposed to be developed in the context of the IED.

In upcoming BREF reviews, the complete set of emissions of unintentionally produced POPs and the few substances that are subject to prohibitions (e.g. PFOA, PFOS), should be systematically considered and BAT conclusions derived where considered suitable. Each BAT conclusion should clearly state that the occurrence of POPs has been assessed and that presented BATs cover all relevant aspects concerning this matter.

A first step in the elaboration process of BREFs could be to compare with the reported emission inventories per sector according to National Action Plans (NAP POP). These NAPs need to include an inventory of all unintentional released POPs as listed in Annex III of the POPs regulation. These are the ones listed both in the UNECE protocol and in the Stockholm Convention. Some NAPs may also contain proposed measures with regard to minimising POP releases from industrial plants that could be of interest when reviewing BREFs.

The POP regulation requires adequate monitoring data of POPs for facilities using processes that release unintentionally produced POPs. Better highlighting of POPs and setting of monitoring requirements for relevant POPs in BAT conclusions would therefore improve the implementation of the POPs Regulation as well.

The permitting authorities would have a clear orientation and better justification to set ELVs or monitoring requirements in the BAT based permit conditions if there would be complete requirements for monitoring BATs or BAT AELs for unintentionally emitted POPs in the BAT conclusions. In turn, this data could be an information source for Member States when reporting unintentionally produced POPs to the Stockholm Convention. This would also lead to more up-to-date emissions factors in the air emission inventories.

Existing BAT BEP guidelines⁶² elaborated under the Stockholm Convention should be considered in the BREF process and vice-versa: the BAT BEP expert group under the Stockholm Convention would profit from input by the BREF experts. This can be organised through the National Focal Points or through the national experts in the BAT BEP expert group.

The BAT process could benefit to have, from time to time, joint meetings/workshops between the IED and POPs experts to discuss experiences and brief each other on consecutive related work. Any Party to the Convention⁶³ may submit a proposal to the Secretariat for listing a chemical in the Annexes and it would be valuable for IED experts to be informed about these proposals. IED experts should also be informed about the updates on specific exemptions of Annex I and II POPs. As briefly mentioned at the end of Section 3.2 the review process consists of five steps and the expertise of BREF and IED experts could be valuable when developing the risk profile and the risk management evaluation⁶⁴ that is carried out by the POP Review Committee (POP RC), which is the evaluating committee under the Stockholm Convention. The secretariat of the Stockholm Convention issues information requests to collect that information. These should be distributed by the National Focal Points to all relevant stakeholders, and information submitted by the NFPs to the secretariat.

⁶² To facilitate implementation of Article 5, Parties recognized the need for a harmonized framework for detailed state-of-the-art guidelines on best available techniques and guidance on best environmental practices. The Guidelines on the best available techniques and guidance on best environmental practices provide the necessary guidance called for in paragraph c) of the Article 5 of the Stockholm Convention.

⁶³ For the Stockholm Convention, every Party has nominated a National Focal Point and a National Contact Point that should distribute and collect all relevant information. For the POPs regulation, every Member State has nominated a competent authority (CA). Ideally, these entities are the same or collaborate closely.

⁶⁴ <http://chm.pops.int/TheConvention/POPsReviewCommittee/Recommendations/tabid/243/Default.aspx>

Figure 8 summarises the main data sources related to POPs that should be considered by BREF experts, reasonable information flows between POPs and IED experts and possible fields for cooperation between POPs experts and BREF experts. The closer cooperation could result in mutual benefits.

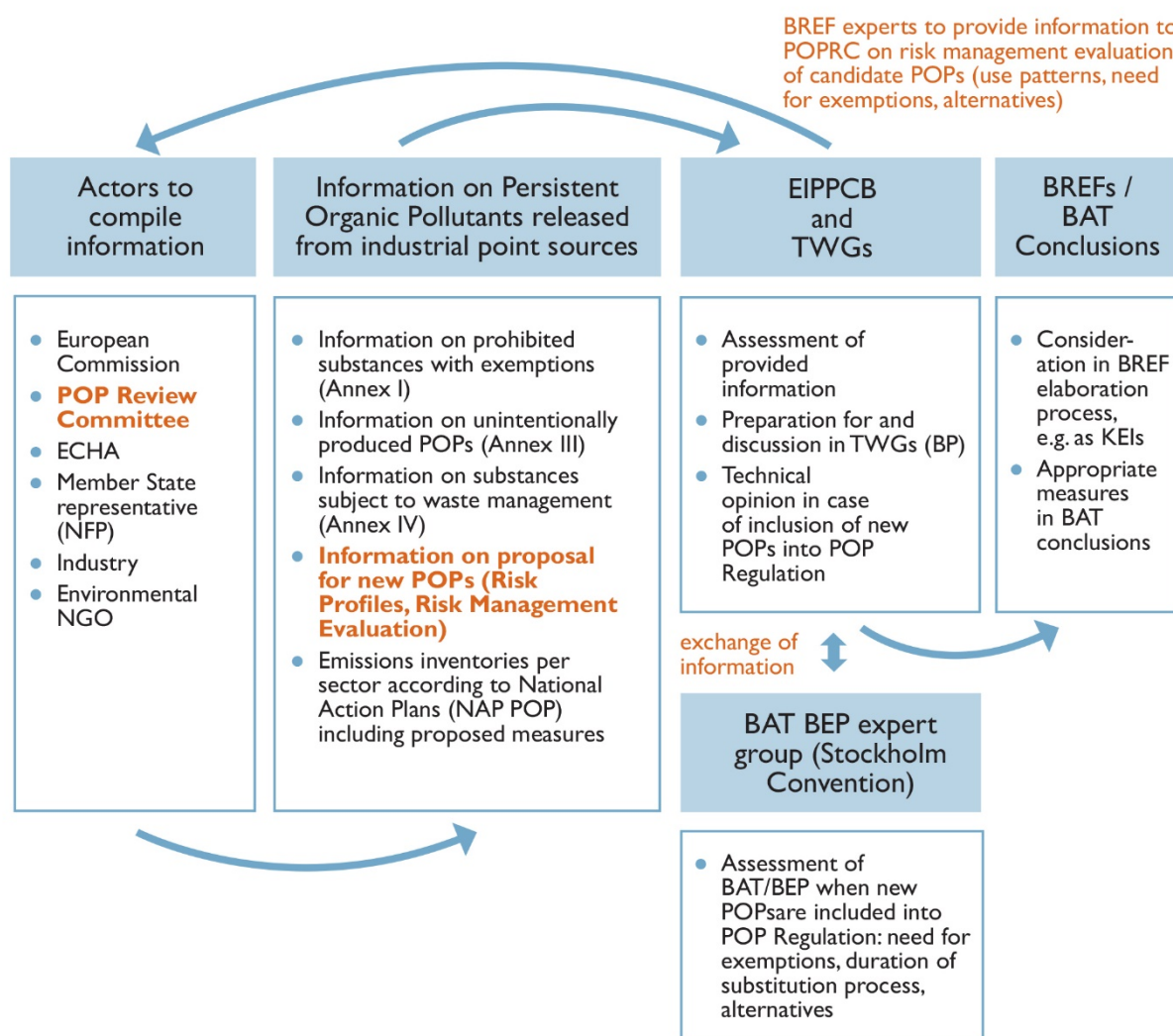


Figure 8. Data sources, information flows and possible field of cooperation between POPs experts and BREF experts.

In order to illustrate how a closer cooperation concerning POPs could work, a fictive example of a newly proposed POP candidate is used: If a POP candidate is proposed by a Party to the Stockholm Convention, it is proposed because of its persistent properties. This is a task for chemical assessment. The POP RC assesses the substance to examine whether it actually meets the POP criteria (Risk Profile). It then assesses how the risk of the proposed new POP could be managed (Risk Management Evaluation).

The input of the BREF experts would be helpful at this stage because the POP RC can assess the properties of the substance but does not know exactly where and how the substance is used or released. Normally, members of the POP RC only have a rough knowledge of the technical processes. Also, the REACH registration only gives general information on use quantities and use areas for a substance. It is therefore difficult for the POP RC to determine how a POP candidate can be replaced or where granting exemptions would still be necessary. Currently, industry representatives are the main source of

information, thus results may be biased, e.g. concerning the need for exemptions, areas of use or release routes that might be overlooked.

This is where the POP experts could add an additional information step: The EU POP RC representatives together with their National Focal Points could contact the respective BREF experts in order to obtain information on areas of application of a new POP candidate, its function or substitution possibilities by circulating prepared documents for comments. The Risk Profiles and the Risk Management Evaluations are usually drawn up between the meetings of the POP RC, each with an information request at the beginning and several commenting rounds in between. It would be possible to send the information request to the BREF experts as well (TWG, EIPPCB) requesting them for comments and additional data even before a new POP is listed in the Convention.

This would inform the POP RC, as well as the Conference of the Parties (COP), and improve the specifications of the listing (which, if any, exemptions are necessary, transition periods, alternatives or alternative processes). After listing a new POP in the Stockholm Convention, it is included in the POP regulation to adopt it into European law.

5 BAT conclusions regarding chemical management

This chapter presents HAZBREF recommendations on how chemicals are to be considered in a specific chapter on chemicals in BREFs and, specifically, in BAT conclusions (Chapters 5.1–5.7). Chapter 5.8 points out the importance of having updated most recent information on lists of regulated substances under REACH, POPs Regulation and WFD priority substances.

5.1 Introduction

Since the publication of the first IED BAT conclusions in the EU Official Journal in March 2012, in total 17 BAT conclusions were produced. These BAT conclusions are of varying quality and completeness regarding chemical management and measures to prevent or reduce emissions of substances of (potential) concern. Some BAT conclusions address the use of less hazardous substances to larger, others to a minor extent.

Nevertheless, the consideration of hazardous substances and other substances of concern has developed over the years. During the most recent and ongoing BREF reviews the use and release of hazardous substances is more intensely assessed by the TWGs, which is acknowledged by HAZBREF as a positive step in the right direction. This can be seen in the reviewed first draft BREF for textile industry (D1 TXT) which was released on 19 December 2019 (JRC 2019). These draft BAT conclusions incorporate already many of the general ideas and recommendations of the HAZBREF project, even if not all relevant substances, such as CMRs, were properly covered in the process⁶⁵. HAZBREF project partners were part of the TWG for the TXT BREF review and submitted material and text proposals for candidate BATs for the section on chemical management of this draft (e.g. for chemical inventories and storage and handling of chemicals)⁶⁶. From HAZBREF perspective, Section 5.1.5 ‘Chemicals’ of draft 1 TXT BREF (JRC 2019) for the first time follows a clear structure with regard to chemical management (BAT 13), chemical inventories and tracking system (BAT 14), reduced consumption of chemicals (BAT 15) and options for substitution in order to prevent or reduce emissions to water of poorly biodegradable substances (BAT 16). These BATs of D1 TXT BREF come very close to what HAZBREF recommends in this chapter.

The completion of the traditional pathway of the BREF process (see Section 3.1) by a systematic, additional focus on chemicals and hazardous substances (see Section 3.2–3.3) would further streamline, strengthen and institutionalise the content of future BAT conclusions with regard to its contribution to a non-toxic environment.

The number, comprehensiveness and detail of BATs for chemical management in the BREFs depend naturally on to which degree relevant hazardous substances/chemicals are used and/or emitted in a BREF sector. However, the BREF process should always consider the need to address the following issues in the BAT conclusions:

- general BAT for a chemical management system;
- a BAT for setting up, maintaining and updating an electronic chemical inventory;
- simplified mass balances and stream inventories of wastewater and waste gas flows;
- recommendations for substitution of certain (groups of) substances, if applicable and feasible, taking into consideration a check of regrettable substitution;

⁶⁵ This has been achieved through the strong commitment of individual TWG Members in the Kick-off Meeting for the TXT BREF review, their ability to obtain data on proposals for a list of relevant missing pollutants (e.g. CMR) while still at the meeting, and in the end through a lot of coincidence (see also footnote 40).

⁶⁶ Proposal of BAT candidates for prevention and reduction of emissions from hazardous chemicals (July 2019): <https://www.syke.fi/download/noname/%7B8A8A48F4-E20E-4607-A474-CB4DAE8A0EB0%7D/148172>.

- BATs for specific abatement measures for poorly biodegradable (groups of) substances, and
- references on how to identify relevant target substances for BREFs that may negatively affect the environmental protection objective of the IED.

HAZBREF recommends including a specific chapter on chemicals in all BREFs and BAT conclusions that, depending on the amount, quantity and diversity of chemicals used in a given sector, may include the BATs for the topics described below and which may need some specification depending on the BREF sector.

5.2 BAT for chemical management systems

HAZBREF recommends that a BAT for a Chemical Management System (CMS) should be included to each BAT conclusion adapted to the specifics of each sector. CMS is a systematic approach regarding chemicals and substances and should cover several integrated administrative, document-related and practical management measures, including the setting up and use of chemical inventories (see 5.3 below), the guarantee of a safe use of chemicals and the investigation of alternative processes, if appropriate.

The purpose of the CMS is to control relevant chemicals that are produced (only for chemical industry), used or released at the site, to increase and make easily accessible knowledge of the characteristics and substance properties, risks and impacts and to prevent and reduce emissions of poorly biodegradable or hazardous substances. The scope and level of detail of the CMS should generally be related with the quantities, types and amounts of chemicals typically used in the sector. Positive recent examples for such BAT conclusions can be found in the draft BREFs for both the Textiles Industry and Ferrous Metals Processing (see BAT 13 D 1 TXT BAT conclusions (December 2019; JRC 2019); BAT 2bis Revised D 1 FMP BAT conclusions (October 2020)). Both draft BAT conclusions list key features of chemical management systems and propose CMS as one of the sector-specific BATs.

Based on findings of another HAZBREF Report (HAZBREF 2020)⁶⁷ Germany proposed amendments to BAT 13 of the Draft 1 of the BREF Textiles Industry as shown in Box 2. The final text of the BAT on CMS will be changed according to the comments of other TWG members, the assessment of the EIPPCB and the outcome of the Final TWG Meeting to be held on-line between May to June 2021.

⁶⁷ Within this HAZBREF report, see Section 3.2 Essential Elements of good chemicals management in Sectoral Guidance for Chemicals Management in the Textile Industry (September 2020), p.25.

Box 2. CMS proposal for the revised draft 1 TXT BREF by EIPPCB (Dec. 2019) including proposed amendments of Germany

In order to improve the overall environmental performance, BAT is to elaborate and implement a chemicals management system (CMS) that incorporates all of the following features:

- I. process chemicals procurement policy to select process chemicals and their suppliers with the aim to minimise the use of hazardous chemicals such as substances of very high concern, substances with CMR properties (Category 1A and 1B), PBT or vPvB substances, or substances with an equivalent level of concern, such as endocrine disrupting chemicals;
- II. goals and action plans to avoid or reduce the use of hazardous chemicals and substances that may pass existing treatment systems in concentrations that may raise concern;
- III. selection of recipes for textile finishing based on the application of the emission factor concept (see Section 5.9.1) as a tool that allows for assessing and predicting air emission released from chemical auxiliaries, e.g. during thermal treatment;
- IV. selection of process chemicals considering their eliminability to minimize the release into water as well as their effect to the aquatic compartment (eco-toxicity);
- V. anticipatory monitoring of regulatory changes related to hazardous chemicals and safeguarding compliance with applicable legal requirements;
- VI. regular survey whether new and safer alternatives to the use of hazardous chemicals are available;
- VII. identification of the process chemicals pathways through the plant (from procured process chemicals to products, waste and emissions);
- VIII. assessment of the risks associated to the chemicals based on the chemicals' hazards, concentrations and amounts. This should include an estimation of their emissions to the environment;
- IX. development and implementation of procedures for the handling, storage, use and return of process chemicals.

Source: D1 TXT BREF (Dec 2019) with proposed amendments according to comments from Germany (attachment to comment DE 416 "Proposal from Germany for amendments of Section 5.1.5 Chemicals", March 2020).

5.3 BAT for chemical inventory

5.3.1 Inventory of chemicals used

To allow for an effective chemical management, it is necessary to clearly identify which chemicals are used and how they should be stored and handled in order to minimize the risk for human health and the environment. Furthermore, information on how the chemicals can be substituted, if risks for the safe use are identified and alternatives are listed in the SDS, can be derived from a chemical inventory. This requires that chemical inventories are set up and continuously updated. Chemical inventories allow among other things for a targeted compilation and assessment of chemical-related information, which can serve the specific information requirements of different organizational units within an industrial installation. They can also serve as an important reference and information tool for stakeholders such as IED permitting authorities (e.g. to assess compliance with lists of restricted substances or other chemical related regulations), thus going beyond the mere purpose of fulfilling storage or stock-keeping requirements.

Companies use different commercially available systems, e.g. sophisticated cloud-based tables connected to different data bases (including SDS information⁶⁸) or also simpler hand-made Excel-tools. The suitable tools depend very much on the company.

In order to ensure the availability and completeness of all information necessary for a responsible chemical management that can be used for both internal and external requirements, the inventory should include all relevant chemical substances and products (including by-products, intermediates, residual raw materials and solvents) present throughout the production cycle. A chemical inventory is the basis for further chemical management activities, such as the proper selection of chemicals, unloading, storage and handling, application of chemicals and the selection and design of appropriate end-of-pipe techniques.

Different BATs for chemical inventories and to a varying degree have been included into BAT conclusions already published and, in particular, in ongoing BREF reviews. In earlier BAT conclusions, e.g. the BAT conclusions for the Production of Pulp, Paper and Board published in September 2014, BATs for chemical inventories are still not specific enough (e.g. just mentions 'including quantities and toxicological properties') and are undervalued (e.g. hidden as part of a general BAT on general good housekeeping). BAT conclusions for other industrial sectors that are published some years later sometimes include more specified BATs related to chemical inventories. But still for many BAT conclusions chemical inventories have not been addressed at all (e.g. BAT C for the Refining of Mineral Oil and Gas (10/2014), BAT C for the Production of Wood-based Panes (11/2015), BAT C for the Non-ferrous Metals Industries (06/2016), BAT C for the Production of Large Volume Organic Chemicals (12/2017) and others).

HAZBREF recommends that such BATs on chemical inventories are considered, strengthened, specified and tailormade for each industrial sector during BREF reviews.

5.3.2 Production process mapping, simplified mass balances and stream inventories

To be able to take actions for reducing emissions of substances of concern, good knowledge of the production processes, of input- and output-streams and of wastewater flows, waste gas flows and of solid waste from different processes is needed (see text box no. 2, item VII and text box no. 3). The mapping of production processes connected to substances of concern includes different steps: the identification of points and quantities of inputs, estimation or measurement of outputs, calculation of mass balances (input/output flows)⁶⁹, implementation of actions and verification.

The first step of the production process mapping is to review all the relevant chemicals that are part of the production process at the site, as described above for the proposed BAT for chemical inventory, and compile basic data on the composition and quantity of chemicals released via waste water and waste gas in streams originating from different processes. This is a key element to assess the possibilities of reduction of pollution at the source.

Chemical inventories and production process mapping are closely linked with another valuable tool for controlling emissions: an inventory of inputs and outputs, including wastewater and waste gas

⁶⁸ Safety Data Sheets (SDSs) are an important source of information for installation operators because they compile and provide substance information in a use-related way. However, it has been revealed in the HAZBREF project (e.g. in 18 selected case studies) that the available SDS are in many cases insufficient, incomplete or outdated. The SDSs should be made more readily usable - with improvements, updates and more real emission scenarios. SDSs contain too little information on the substances actually used in a sector: these are hidden as components or additives or impurities in chemical products and mixtures. There is an urgent need to improve substance data accessibility for users of SDSs, as their information and information from the ECHA CHEM data base is essential for establishing a chemical inventory. Operational data on the amount of substances used (possibly differentiated by technical processes), data on substance properties, on fate (e.g. degradation) and behavior in waste water treatment plants and specific risk reduction measures (abatement technique could complete the chemicals inventory).

⁶⁹ As far as available tools for material flow analysis are concerned Sankey diagrams might be a valuable option. A Sankey diagram is a special type of flow chart in which the flow quantities are indicated by arrows proportional to the quantity: The width of the arrow represents the quantity to scale. Sankey diagrams can be used to visualize material and energy flows. Thus, Sankey diagrams direct the viewer's attention to the largest flows or the largest consumers.

streams. The major difference is that stream inventories summarize the concentrations, flows and loads of main pollutants in the various wastewater and waste gas streams of a plant as well as raw materials and products. The stream inventory is based on simplified input/output process flow sheets of major processes that show the origin and distribution of the emissions over the plant. In contrast, chemical inventories compile data on specific chemicals and their relevant environmental and toxic properties.

Wastewater and waste gas stream inventories mostly do not focus on hazardous substances or chemicals, but primarily on sum parameters and pollutants that are regulated in EU member states (e.g. COD, BOD, N, P, metals, salts, AOX, etc.). The first BAT conclusion that explicitly addresses the stream inventory as BAT and specifies its key features is the BAT conclusions published in 2016 for common wastewater and waste gas treatment/ management systems in the chemical sector (CWW)⁷⁰. Since then, almost all BAT conclusions contain wastewater and waste gas stream inventories as one of the various BATs. BAT conclusions that have been elaborated and published afterwards continue adopting a similar BAT on inventories of wastewater and waste gas streams (e.g. also the most recently published BAT conclusions for the Food, Drink and Milk Industries (12/2019) and BAT conclusions on Waste Incineration (12/2019).

A recent example of a stream inventory is the BAT conclusion #3 of the Waste Treatment Industries that was published in August 2018 (European Commission 2018b; Box 3).

Box 3. BAT 3: in order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:

- I. information about the characteristics of the waste to be treated and the waste treatment processes, including:
 - (a) simplified process flow sheets that show the origin of the emissions;
 - (b) descriptions of process-integrated techniques and wastewater/waste gas treatment at source including their performances;
- II. information about the characteristics of the wastewater streams, such as:
 - (a) average values and variability of flow, pH, temperature, and conductivity;
 - (b) average concentration and load values of relevant substances and their variability (e.g. COD/TOC, nitrogen species, phosphorus, metals, priority substances/ micropollutants);
 - (c) data on bioeliminability (e.g. BOD, BOD to COD ratio, Zahn-Wellens test, biological inhibition potential (e.g. inhibition of activated sludge)) (see BAT 52);
- III. information about the characteristics of the waste gas streams, such as:
 - (a) average values and variability of flow and temperature;
 - (b) average concentration and load values of relevant substances and their variability (e.g. organic compounds, POPs such as PCBs);
 - (c) flammability, lower and higher explosive limits, reactivity; presence of other substances that may affect the waste gas treatment system or plant safety (e.g. oxygen, nitrogen, water vapor, dust).

Applicability:

The scope (e.g. level of detail) and nature of the inventory will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have (determined also by the type and amount of wastes processed).

⁷⁰ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016D0902&from=EN>. Therein, BAT # 2 describes key features of stream inventories, in this case specified for the needs of the chemical industry.

These inventories of wastewater and waste gas streams may also be extended by addressing or adding the distribution and pathways of substances of (potential) concern in the course of the production process.

HAZBREF confirms that a stream inventory is BAT for almost all industrial sectors and recommends that such BATs should be considered and developed further accordingly in forthcoming BREF reviews. The BREFs should include descriptions and references of best practices, available well-proven effective tools that are helpful in making such inventories.

An example of an interesting approach⁷¹ applied for the papermaking sector is shown in figure 9. It estimates the distribution of chemicals used (here: biocides used in papermaking) to the exhaust air, products (in this case: paper), wastewater and solid waste (in this case: rejects, sludge).

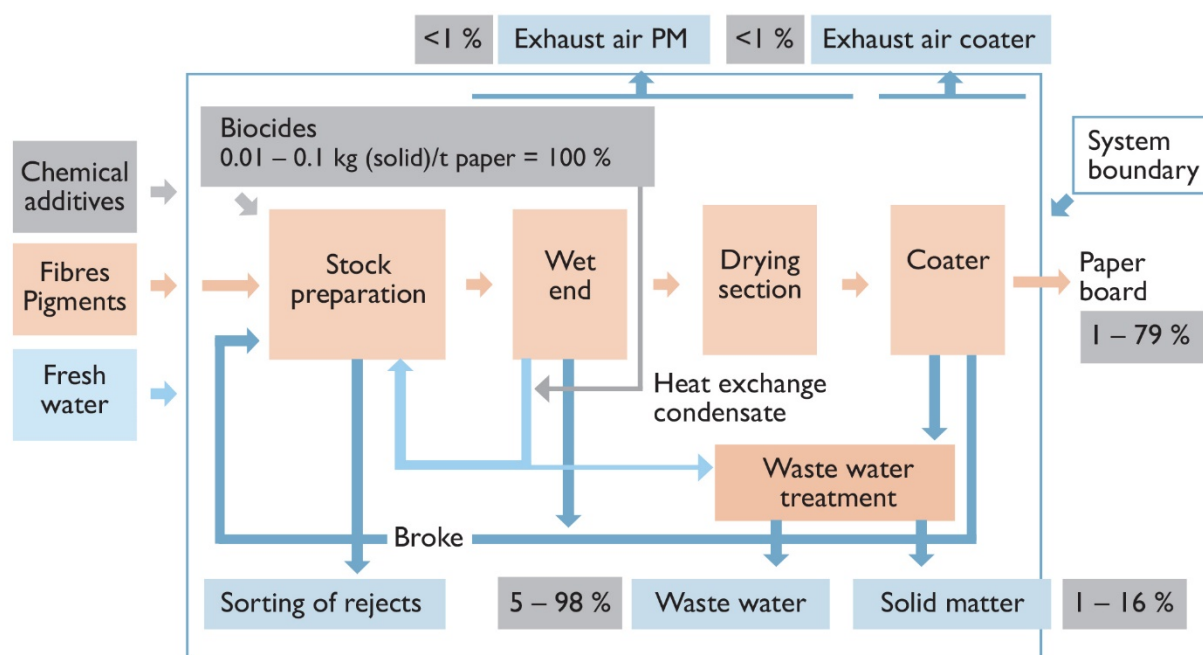


Figure 9. Example of process mapping/mass balance for biocides (modified from Suhr et al. 2015 p. 68, fig. 2.8).

The rough mass balance shows the basic principle of this analysis. For the example biocides, investigations found relatively wide ranges because of the variety of biocides used (oxidising and non-oxidising biocides, bio-dispersants, etc.) and the fact that a lot of assumptions were made to assess the possible partition of biocides to the various compartments of the environment. In the example, the dosage of biocides varies according to the chemicals used for this purpose (application of biocides between 10 and 100 g/t of paper). Most of the dosed biocides stay in the water circuits and react there. A maximum of 79 % of the biocides used could be expected in the produced paper (in other cases only 1 %). A maximum of 98 % of the dosed material could, in theory, be found in the effluent (5 % only in other cases).

⁷¹ In 2007 – 2008, the 'Chemical Additives' Technical Committee, part of the German papermaker's association ZELLCHEMING, has investigated the potential environmental impacts of the major groups of chemical additives. For major groups of chemical additives results are presented in ZELLCHEMING (2008).

5.4 BATs for process-integrated measures and end-of-pipe techniques

Different measures for prevention and reduction of emissions are required depending on the properties of the substances of concern used in a given sector. Appropriate BAT based measures should be developed in the following order:

- Prevention of emissions by taking measures at the source of pollution: Selection of chemicals and appropriate dosage, consideration and search for options for non-regrettable substitution, if necessary (including process changes to allow the use of less hazardous substances, see Section 5.5 below), application techniques such as reduced liquor ratios.
- Reduction of emissions. This may include measures such as:
 - minimizing consumption and losses of chemicals e.g. through low volume application techniques or spray techniques,
 - separation of wastewater or waste gas streams that may contain substances that are difficult to treat with common abatement techniques,
 - choice and operation of suitable and tailor-made abatement techniques that act as a barrier to the environment, i.e. prevent substances that should not be released from the installation from entering the environment. For instance, for persistent or toxic substances specific treatments will often be required at least for those streams where relevant quantities are expected or measured (determined by process mapping and stream inventories, see section 5.3 above),
 - application and maintaining persistent and toxic substances in closed loops.

BATs for process integrated measures are already considered in existing BREF reviews, if mass pollutants or those identified as KEI are concerned. They seek for improvements of existing production processes and include measures close to the source of pollution as well as abatement techniques. However, some BAT conclusions are incomplete or not specific or targeted in this respect often because data is lacking for novel or emerging pollutants and process alternatives. New techniques are often not sufficiently considered in BREF reviews as in the current short frontloading phase resources (limited time, staff, involvement of specialized expert knowledge) are too limited for a more targeted approach needed to determine and describe more specific BAT candidates.

For instance, for the drawing up of D1 of the reviewed TXT BREF the EIPPCB and the TWG did not succeed in sufficiently describing the state of knowledge of a more advanced water management approaches like zero liquid discharge (ZLD). Although there is an increasing number of applications of the ZLD technique and sufficient information available in various European countries, as well as countries outside Europe (e.g. India), a meaningful BAT candidate could not be drafted. Data on advantages and constraints of ZLD is, in principle, available including information on context conditions, driving forces for the use of ZLD techniques, technical descriptions of process sequences including appropriate pre-treatment, critical cross media aspects in particular the missing solutions for waste disposal. However, elaborating ZLD as candidate BAT would have taken time, staff capacity of EIPPCB and/or TWG members necessary to gather and assess available information and to establish direct contacts to operators and plant managers running these techniques. But this time was not invested in this case.

Since many of these techniques are very sector- and process specific, it is difficult to propose general BATs here. However, the HAZBREF project has developed some examples based on case studies in three industrial sectors (e.g. optimisation of intermediate gas flows in polymer production, see HAZBREF CHEM sector guidance; Bomark et al. 2021).

In Section 3.2, HAZBREF recommends that an advisory subgroup of chemical and sector experts should be set up that supplements and strengthens the TWG in charge of BREF reviews. The involvement of specialised experts on chemical solutions may support the identification of measures for prevention and reduction of emissions and propose best technical and organisational options. And perhaps such

a reinforced TWG might have more success in developing candidate BATs that are most effective related to the retention of substance of concern identified for the sector.

5.5 BATs for substitution

The ‘use of less hazardous substances’ is one criterion for BAT and is listed in Annex III of the IED. Some BREFs consequently address substitution issues. However, addressing the need and options for substitution seems to be rather a coincidence in some BREF reviews. An identifiable systematic approach that seeks to catch all relevant substances of concern used and potentially released in a given sector does not seem to be applied at the moment in the BREF reviews.

It should be noted that two opposing positions continue to exist regarding whether or not a more comprehensive description of substitution possibilities should be assessed in BREFs. One position is that REACH is the right instrument for determining substitution options and to indicate that there are positive developments within REACH for substitution of substances (such as the group approach as for PFAS). According to the position, the option that the so-called non-regrettable substitution is also best considered under REACH. These positions argue that closer cooperation between the REACH and the IED expert community is needed and not that the IED or BREFs takes over the task of assessing substitution. The opposite argues differently and states that substitution is definitively part of the IED and is also the right instrument because the substitution of chemicals is mainly a technical question if and how unwanted substances can be replaced in industrial processes. Here the argument is also that the consideration of substitution under IED is complementing and not overlapping the REACH work on substitution. However, REACH only addresses substitution for SVHCs, which is very limited. The technical working groups of the information exchange about BAT are therefore the right place to determine substitution options⁷².

Draft 1 of the TXT BREF (JRC 2019) is a positive example that mirrors already to a large extent what HAZBREF recommends regarding addressing substitution issues in the BREF reviews. In figure 10 below, BAT #16 from the draft TXT BREF⁷³ is presented as an example of how BATs for specific identified relevant substances should be included in BAT conclusions.

Although from a systematic perspective this is a useful approach, the BAT conclusions on substitution are still not complete and specific enough. Vague wording for restrictions in applicability (e.g. BAT 16 b and c in D1 TXT BREF ‘restricted by product specifications’) or unspecific information on alternatives could lead to poor implementation or use of regrettable substitutes. For example, in case of BAT 16 c mineral-oil based antifoaming agents might be substituted with silicone-based antifoaming agents containing silicone cyclic substances (D4, D5 and D6), which are SVHCs. A more detailed description should at least include information on regrettable substitutes and specific product standards and product groups where substitution would not be possible. The questionnaires in the TXT BREF process asked for this information on regrettable substances but did not succeed in receiving sensible answers. Questionnaires are, however, not the appropriate tool to gather information on regrettable substitution. Instead, chemical expertise, in combination with process-knowledge, may be used to get this information (see Chapter 3). BAT conclusions cannot always be specific, due to the dynamic nature of the sector, but at least there should be clear guidance on how to find up-to-date information on e.g. regrettable substitution.

⁷² There is also an obligation to substitute (where possible) all hazardous substances in the worker protection legislation (Chemical agents at work 98/24/EC, art. 6 (2)). This is also much wider than the scope of the substitution obligation within REACH (SVHCs only).

⁷³ See Section 5.1.5 Chemicals, page 733 of the Draft 1 of the BREF Textiles Industry (JRC 2019), review is ongoing.

BAT 16. In order to prevent or reduce emissions to water of poorly biodegradable substances, BAT is to use all of the techniques given below.

Technique	Description	Applicability
a. Substitution of alkylphenols and alkylphenol ethoxylates	Alkylphenols and alkylphenol ethoxylates (AP/APEO) are substituted by biodegradable surfactants, e.g. alcohol ethoxylates (AE).	Generally applicable
b. Substitution of phosphorus- or nitrogen-containing complexing agents	Complexing agents containing phosphorus (e.g. triphosphates) or nitrogen (e.g. polycarboxylic acids such as EDTA, DTPA or NTA) are substituted by biodegradable substances, e.g.: <ul style="list-style-type: none"> • polycarboxylates (e.g. polyacrylates and copolymers of acrylic and maleic acids); • hydroxy carboxylic acids (e.g. gluconates, citrates); • sugar-based acrylic acid copolymers. 	The applicability may be restricted by product specifications
c. Substitution of mineral-oil-based antifoaming agents	Mineral-oil-based antifoaming agents are substituted by biodegradable substances, e.g. silicone-based antifoaming agents.	The applicability may be restricted by product specifications

Fig. 10. Excerpt of Draft 1 of the reviewed BAT conclusions Textiles Industry (JRC 2019).

Another example of how substitution should be approached in future BREF reviews concerns the BREF for Surface Treatment of Metals and Plastics (STM). E.g. for chromium plating and plastic etching in the STM sector, very specific alternatives are available to substitute the use of chromium trioxide in decorative, functional chromium plating, as well as plastic etching. This could be either Cr(III)-containing process-solutions but also completely different processes like High-Velocity Oxygen Fuel or closed reactors. This means that the substitution options need to be described as much detailed as possible and need to be related to certain products, substrates or surface properties. Furthermore, the use of chromium trioxide requires the use of PFAS as surfactants. Hence, if chromium trioxide can be substituted the use of PFAS can be completely avoided⁷⁴.

Such interrelations between traditional uses of chemicals and possible alternatives to be addressed in BATs should be discussed in the pre-TWG and addressed in case studies on specific chemicals and the preliminary study (for further details on this proposal, see Section 3.2). The specific case studies should also address cases where a substitution of hazardous chemicals is not applicable in order to provide more specific information on technical restrictions in applicability and on reduction and abatement measures.

HAZBREF is aware of the challenge to include up-to-date information on substitutes for specific substances into BREFs, as new technical solutions emerge frequently. However, BREFs should include the current status on the substances which are to be phased out or better replaced by environmentally safer solutions. It is the duty of the operator to find updated information on available substitutes. Regrettable substitution should be avoided (e.g. longer chained PFAS were substituted with shorter chained PFAS, which proved to be problematic (ECHA 2019)). So, if substitution is proposed as BAT – based on current knowledge – side effects, substance properties and the eliminability of the substitutes should be part of the approach followed and part of a routine procedure.

⁷⁴ It was not the task of the HAZBREF project to discuss whether the Seville-Process should also consider the concept of ‘essential use’ that has been developed in the context of the Montreal Protocol, which phased out the use of ozone-depleting chlorofluorocarbons except for certain ‘essential’ uses. There, the concept of ‘essential use’ is defined by referring to the two elements of an essential use: (1) a use is ‘necessary for health, safety or is critical for the functioning of society’ and (2) ‘there are no available technically and economically feasible alternatives’. Whether the second element related to ‘available alternatives’ is a criterion to be considered in future BREF reviews may be discussed and decided elsewhere.

5.6 BAT for monitoring

5.6.1 Monitoring of hazardous substances

BATs to monitor relevant emissions to water and air are included in all BAT conclusions. The parameters to be monitored include in the first instance all parameters for which BAT AELs have been derived. Sometimes, they do also include some hazardous substances, depending on the sector and its incidence. Monitoring requirements for hazardous substances have so far addressed especially heavy metals and some more ‘traditional’ pollutants, such as dioxins and – less frequently – PCBs, etc.

In a few rare cases, BAT conclusions also include requirements to monitor other hazardous substances, for example those that are part of the BREF Waste Treatment (WT BREF). There, for example BAT # 7 requires operators to monitor PFOA/PFOS in wastewater. However, the difficulty is that no EN standard is available to monitor PFOA/PFOS and BAT #7 does not even specify a modern analysis standard for PFAS. For the mechanical treatment of metal waste in shredders, BAT #8 includes the measurement of brominated flame retardants in channelled emissions to air; and for the treatment of WEEE containing VFCs⁷⁵ and/or VHCs the measurement of Chlorofluorocarbons (CFCs) is part of the monitoring BAT. The requirement to monitor these substances is limited insofar as it only applies if these substances appear in the inventory of wastewater and waste gas streams (see BAT #3). A well-prepared stream inventory with the help of some modelling tools may also facilitate the development of a cost-effective monitoring plan for ‘non-traditional’ pollutants.

The monitoring of hazardous substances is often expensive and laborious. Therefore, the inclusion of numerous parameters to be monitored has often been resisted by industry. Many hazardous substances are widespread in the environment; however, the knowledge of emission sources of many hazardous substances is often poor and without further information, it is difficult to target risk reduction measures. The monitoring requirement and frequency should be in relation to the emission situation described in the stream inventory made by a given installation (see Section 5.3.2). An important advantage of additional monitoring data is that they may also provide evidence on the presence of certain substances of concern that may be relevant to be addressed in future BREF reviews. It should also be remembered that many substances of the same family group can be monitored simultaneously with a single analysis which reduces costs (e.g. various heavy metals or PFASs).

HAZBREF recommends including BATs for the monitoring of single substances or groups of substances (e.g. PFAS) in specific cases only, e.g. if it needs a control of whether these substances are effectively retained by applied techniques. A drawback of the single-substance monitoring to consider is also that in many cases it is relatively easy to escape the monitoring requirement, e.g. by switching from one substance to another with a similar function (e.g. observed when setting requirements for PFAS). The need of more targeted BATs on the monitoring of substances of concern depends on the sector and usually is connected to the relevance of those substance identified in the stream inventory performed at the installation.

In addition of monitoring the emissions, HAZBREF proposes that the monitoring of substances outside the installation in the surrounding environment could be considered. This is already common practice in e.g. Finland. It could lead to a better understanding of the dispersion of substances, and a better understanding of the exposure of the environment and the long-term impacts as well as information for the determination of KEIs.

⁷⁵ VFCs = Volatile (hydro)fluorocarbons; VHCs = Volatile hydrocarbons.

5.6.2 Monitoring via bioassays

One way to get information on the ecotoxicological effects of the waste waters is to require measurements of bioassays (e.g. by use of standardized biological test systems such as luminescent bacteria, algae, daphnia, dugweed, fish egg, etc.) for treated effluents. The monitoring via bioassays could also be used to identify potential emerging dangerous substances (e.g. endocrine disruptors released in water). Bioassays can be regarded as an indicator of the presence of hazardous substances facilitating the evaluation of the environmental risk from the installation.

An example for such a BAT for bioassays is the CWW BAT conclusions according to which the requirement for toxicity testing is to be decided based on a risk assessment, after an initial characterization (see monitoring BAT #4 on toxicity; CWW BAT conclusions). Toxicity testing can also be the first step in assessing whether further process-integrated or abatement measures are needed to reduce the remaining ecotoxicological effect of treated effluents. It is advisable to consider conducting bioassays in treated effluents also for other industrial sectors than the chemical industry⁷⁶.

Possible negative effects of treated effluents can be best detected by biological test systems, which are suitable to give an integrative response regarding the ecotoxicological effects of wastewater. The first standardized biological method developed and applied was the test on acute toxicity to fish (golden orfe). A series of biological methods (bioassays) for the integrative detection of eco-toxicological effects have been developed since then and are used in a few EU Member States for wastewater monitoring (e.g. in Austria, Germany). Among the selection criteria for bioassays, there are mainly ecotoxicological effects, levels of organisation (molecular level to biocenosis), trophic levels (decomposers to consumer) and the available standardized methods. They are summarized in Figure 11.

As described further above in this section, so far only one BAT conclusion – the BAT #4 on monitoring of the CWW BAT conclusions for wastewater from the chemical industry – includes a requirement for measuring the ecotoxicological effects of waste water.

HAZBREF recommends that it should also be considered if ecotoxicological tests can be systematized and possibly BATs for monitoring or even BAT AELs derived in future BREFs, if sufficient data and evidence is available⁷⁷.

5.7 BAT associated emission levels

BAT AELs for hazardous substances have been included in BREFs to a varying degree depending on the sector. According to the current approach, in the course of the information exchange BAT AELs are only proposed by the EIPPCB when there is a sound basis for doing so. In practical terms, this means that whether the basis is strong enough depends exclusively on the information exchanged by the TWG considering the quantity and quality of the plant-specific data submitted to the EIPPCB. Lack of data on hazardous substances is often hindering the inclusion of BAT AELs for hazardous substances. Another limitation is certainly the sheer number of individual substances emitted. The amount of single substances in wastewater might be in the range of some thousands (e.g. in effluents from chemical industry). It is not possible to detect all those substances by chemical analysis, neither qualitatively nor quantitatively. It is, therefore, not advisable to measure high numbers of single substances in treated effluents. However, in specific cases, measurements of single chemical substances might be advisable,

⁷⁶ For instance, in Germany, the Waste Water Ordinance (in German: Abwasserordnung – AbwV) requires the measurement of bioassays for the following sectors (equivalent to so-called Annexes of the AbwV): Manufacturing of coating materials and varnish resins (Annex 9), Manufacturing of chemical pulp (Annex 19), Chemical Industry (Annex 22), Installations for mechanical-biological treatment of municipal waste (Annex 23), iron, steel, and malleable iron foundries (Annex 24), Tanneries (Annex 25), Physical-chemical treatment of liquid wastes (Annex 27), Iron and Steel production (Annex 29), Water purification, cooling systems and steam generation (Annex 31) and others.

⁷⁷ In the German Waste Water Ordinance and Austrian Ordinance of Waste Water Emissions, the use of bioassays for establishing the remaining ecotoxicological effects of treated wastewater is proven practice for decades. For emission limit values, a dilution factor is determined and to be complied with by dischargers.

e.g. where characteristic contamination of wastewater is given by production and processing and the effluents are dominated by a few substances or families of substances. This applies e.g. to contamination of wastewater with heavy metals.

In order to keep the analytical burden for operators low and to avoid time-consuming supervision of measured results by authorities, many regulators prefer sum-parameters to detect and monitor the efficiency of biodegradation and elimination of pollution in wastewater treatment plants, e.g. by parameters such as BOD, COD, AOX, TOC, TN_b. However, measured concentrations of both sum-parameters, as well as of selected parameters in treated wastewater, are not suitable to predict the hazard potential of the whole effluent.

The inclusion of BAT AELs, as mentioned above, only considers data collected from plants during the TWG work and not e.g. the harmfulness of the substance in question (e.g. toxicity or persistence). The introduction of appropriate BAT AELs for very toxic or persistent substances is one issue that should be discussed further as the Union wants to move towards the ‘zero pollution ambition’ as part of the European Green Deal. The search for complementary ways should be developed to set BAT AELs for certain substances where plant-specific data does not exist or is scarce. Possibly an expert judgement could play a stronger role here. However, in this case the independence of the experts would have to be considered even more. Another option could be to assess whether measurement campaigns, e.g. based on Suspect or Non-Target Analysis in wastewater should be carried out in some volunteering plants. HAZBREF recommends testing the usability of measurement campaigns in the forthcoming BREF review round.

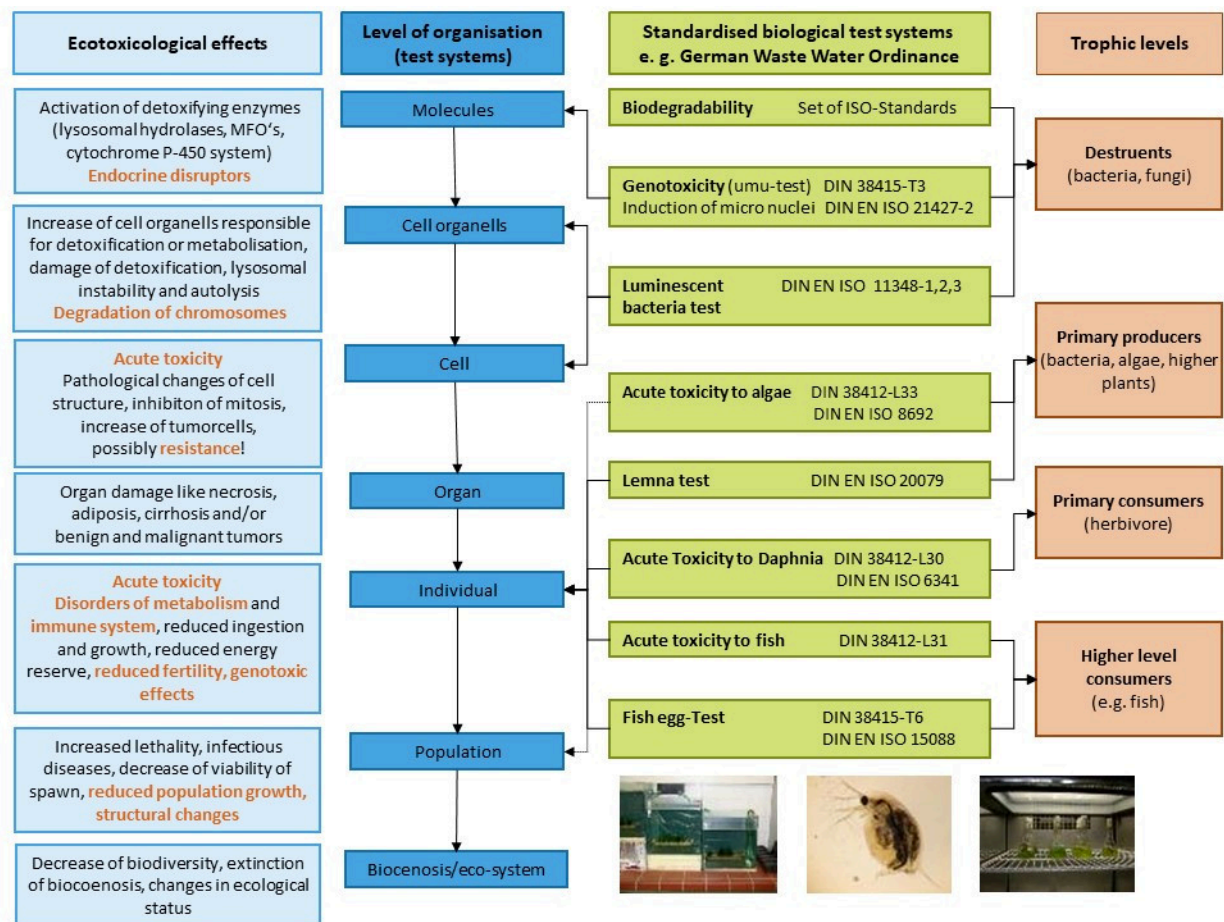


Figure 11. Selection criteria for EN/ISO standardized bioassays in a nutshell (modified from Hans-Jürgen Pluta: UBA internal presentation).

5.8 Listing of regulated substances under REACH, POPs Regulation and WFD priority substances

The environmental permitting authorities do not always have enough knowledge on substances regulated under different frameworks, e.g. REACH or CLP, or the relevance of WFD priority substances for different sectors. The need for such information and tools in the BREFs to find updated information was a clear message from authorities. Therefore, HAZBREF recommends that future BREFs list those substances that are still used in the industrial sector but are currently authorized or restricted under REACH or listed as priority substances under the WFD or the POPs Regulation. However, the attention of readers should be drawn to the fact that such lists only address a small section of all chemicals (i.e. the concept of ‘substances of concern in the sense of IED’ proposed by this report). The long timelines in REACH, WFD or the POP Regulation implies that substances will only appear on the BREF radar a decade after the hazardousness of the substance and its environmental evidence has become a subject of discussions in those legislations. That’s why substances also planned to be regulated in near future (e.g. Registry of SVHC intentions until outcome, PBT & vPvB candidate substances, PMTs / vPvMs) are indicated in Table 1. Also, relevant substances from other frameworks could be listed when needed.

The lists are regularly updated and since the review cycle of BREFs is long, such lists get outdated. Therefore, HAZBREF also recommends that the BREFs would also include references and tools how to find updated information on substances that are restricted under different frameworks.

One of the HAZBREF findings is that even if the lists are constantly updated, it would be beneficial for permitting authorities to have the latest information included into BREFs.

A complementary proposal from HAZBREF is to explore facilitation of access by installation operators and technical working groups to the EU Chemicals Legislation finder EUCLEF, possibly with support of the EIPPCB website: “EUCLEF gives you an overview of the European Union’s legislation on chemicals. You can search for information on your substances, find applicable laws and check what obligations you may have. For each piece of legislation (...), you can find a summary of all the relevant information, including the scope, obligations, exemptions, regulatory activities and lists of impacted substances, together with links to the full legal texts in all EU languages.”

6 Update or addendum to the BREF Guidance 2012/119/EU

In 2012, the Commission has established guidance on the elaboration of BREFs, the so-called BREF Guidance (2012/119/EU). It has been published as a Commission Implementing Decision (European Commission 2012) and lays down rules concerning guidance on the collection of data and on the drawing up of BAT reference documents and on their quality assurance. It also describes the organization of the information exchange about BAT and the data collection and submission.

Since the document is more than 8 years old and considering that the information exchange is a kind of ‘learning institution’ that has evolved over time and bearing in mind that practices that proved to be suitable were established also going beyond the mere provisions of the BREF Guidance, it is not surprising that the BREF Guidance is not up-to-date with regard to the subject of this report. There are only few instructions on how to address chemical management and measures to reduce releases of the substances of concern during BREF reviews. In particular, some work steps are missing or undervalued, and the planned time schedule is not always realistic under current conditions and priorities. The ongoing IED review work and new EU policies, such as the announced Zero Pollution Ambition action plan, makes the update of the BREF guidance timely and necessary in order to have more focus on measures to curb emissions of hazardous substances to the environment from industry.

In this report we focus on recommendations on how to improve the information exchange with regard to including information on hazardous and other substances of concern more systematically into BREFs. We think that there is a merit to institutionalize the most important procedural proposals of HAZBREF and adopt them formally by an update or a targeted amendment of the BREF Guidance in order to get them implemented in a reliable way. The recommendations do not comprehensively include changes needed to cover all findings of the HAZBREF project, such as promotion of toxic-free material cycles studied in the HAZBREF Circular Economy report (Dahlbo et al. 2021). The promotion of CE aspects in BREF would also require updates in the BREF guidance regarding e.g. strengthening the TWGs with expertise on waste recovery and cross sectoral information, but this is not addressed here in detail. When reviewing the BREF Guidance concerning waste and circular economy issues, the conclusions of the EU Action Plan for CE and the interface between chemical, product and waste legislation should also be thoroughly assessed (European Commission 2018c)⁷⁸.

In the following table 3, the left columns contain the section numbers of the BREF Guidance 2012/119/EU and its title or main content that need some amendment; the central column titled “proposed amendments” then make proposals in a nutshell on what aspects needs to be changed more precisely (or deserves a separate section) and the right column gives a short rationale why we believe an amendment should be considered. The purpose of this compilation is to facilitate the consideration of updating the BREF Guidance and orientate the work concerning a more systematic and comprehensive reflection of information on hazardous and other substances of (potential) concern in future BREFs. We hope it is perceived to be helpful.

⁷⁸ Apart from circular economy issues, also other issues need an update and a clearer description in an updated version of the BREF Guidance (European Commission 2012), such as the decarbonisation efforts of the industry, the presentation and data collection of energy efficiency aspects or water savings, consumption and reuse options. They are consciously not addressed in this report.

Table 3. Summary of proposed amendments for a BREF Guidance 2012/119/EU update. Bolded brown text mean proposed amendments; if proposals for amendments are not bolded, the proposal is of a more general nature. Further work is needed to develop the concrete change of text in the future BREF Guidance.

Section number and title in the BREF Guidance 2012/119	Proposed amendments	Rationale and additional comments
Section 1.1.1: (...) exchange of information shall (...) address (a) (...) the consumption and nature of raw materials, water consumption, (...)	Section 1.1.1: (...) exchange of information shall (...) address (a) (...) the consumption and nature of raw materials, including the chemicals used , (...)	The highlighting of chemicals makes it clearer that attention must be paid to
Section 1.2.4: The typical workflow for the drawing up and reviewing of BREFs, in particular table 1 and also Appendix 2	The pre-phase of BREF review (frontloading) needs to be explicitly mentioned, major tasks and expected activities specified and the timescales adapted. This includes the proposed pre-TWG (see Section 3.2 of this report)	A reinforced and organized frontloading is crucial for the assessment of chemicals during BREF reviews. A short frontloading is current practice
Section 1.2.4: In addition to these plenary TWG meetings, subgroup meetings can be organised to facilitate the work (see Section 4.4.3)	Setting up a subgroup composed of chemical experts is advisable, as well as clarification of the function and tasks of this advisory group	The expertise needed includes e.g. representatives from ECHA, chemical sector experts, suppliers of chemicals and equipment
Section 1.2.4: In addition to this (these) formal draft(s), working drafts may be distributed to facilitate the work (see Section 4.6.5)	(...) This applies in particular to newly introduced or extensively changed sections such as those on chemicals, (...) and others	Distributing, commenting and updating separate sections on chemicals in reviewed BREFs in the form of working drafts allows for continuous and transparent progress and filling in gaps indicated in working drafts
Section 1.2.4: In order to increase efficiency in the preparation of work, the EIPPCB will inform the Forum (...) as much in advance as is reasonably possible of the dates/periods a TWG is expected to be reactivated or set up	In order to increase efficiency in the preparation of work, the EIPPCB will inform the Forum (...) at least 3–4 years ahead of the dates/periods a TWG is expected to be reactivated or set up and the overall work programme of the EIPPCB	Enough time to gather information for the frontloading face is absolutely needed for MS and other stakeholders
Section 2.3.5 Applied processes and techniques (...) raw materials and consumables used (...) auxiliary substances/materials used	2.3.5 Applied processes and techniques (...) raw materials and consumables used (...) auxiliaries used (process and product chemicals/ chemical additives). Further details are presented in Annexes, if appropriate	Clarification that TWGs and EIPPCB are expected to include relevant information on process and product chemicals used and the current knowledge about their fate.
Section 2.3.6 Current emissions and consumption levels	Information will include inputs to and outputs from sub-processes of major groups of chemicals, thus highlighting the more environmentally significant sub-processes and those groups of substances that deserves special attention.	Simplified in-/output flow sheets and process mapping related to the use of chemicals and their fate allow determining priorities and special aspects of concern
Section 2.3.7.1 General information on Techniques to consider in the determination of BAT The techniques described will cover those which reduce the use of raw materials, water and energy, as well as measures used to prevent or to limit (...)	The techniques described will cover those which reduce the use of raw materials, chemicals , water and energy, as well as measures used to prevent or to limit the environmental consequences of the use of chemicals and (...)	The addition strengthened the attention paid to the use of chemicals and their fate in BREF reviews

Section number and title in the BREF Guidance 2012/119	Proposed amendments	Rationale and additional comments
Entire Section 2.3.7 Techniques to consider in the determination of BAT	Make clear that at appropriate locations/sentences that reviewed BREFs are expected to contain candidate BATs for chemical management, chemical and stream inventories, targeted and specific process-integrated and abatement techniques for major groups of poorly biodegradable or toxic chemicals, also including options for substitution	This clarification would give a clear orientation to the TWG that candidate BAT on specific measures to prevent and reduce emissions of substances of (potential) concern is within the scope of BREF reviews and submission of descriptions of techniques to consider in the determination of BAT valued
Section 2.3.13. Annexes. Dependent upon the relevance to the sector and the availability of information, the main part of the BREF may be supplemented by annexes containing supporting information taken from literature and/or case studies.	2.3.13. Annexes. Dependent on the relevance to the sector and the availability of information, (...) may be supplemented by annexes (...). In particular, systematised information about major groups of chemical auxiliaries or additives used in the sector are of interest	Annex I, II, IV and V of the BREF Textiles Industry from July 2003 give good examples
Section 3.4. Individual BAT conclusions without BAT associated environmental performance levels. Individual BAT conclusions without BAT AEPLs, e.g. concerning monitoring, site remediation or environmental management systems, will be structured similarly as shown in Figure 3.1 (...)	With regard to chemicals used, individual BAT conclusions should always consider and address the following *issues: general BAT for a chemical management system; a BAT for setting up and updating an electronic chemical inventory; simplified mass balances and stream inventories of waste water and waste gas flows; substitution of certain (groups of) substances, if applicable, taking into consideration a thorough check of regrettable substitution; BATs for specific abatement measures for poorly biodegradable (groups of) substances.	HAZBREF recommends the inclusion of a specific chapter on chemicals in all BAT conclusions that, depending on the amount, quantity and diversity of chemicals used in a sector, may include all or a selected number of the BATs described adjacently that may need some specification from BREF to BREF
Section 4.4.1 Establishment of TWGs	To address specific issues for which detailed expertise and special knowledge is needed, such as for the use, fate and management of chemicals, the setting up of a pre-TWG that works in the preparatory phase of BREF reviews may be considered. The EIPPCB and TWGs members should actively promote the participation in this advisory group that should include suppliers of chemicals and machinery and sector experts, if possible.	For a revived and organized frontloading phase, the TWGs need to be reinforced with knowledge on used chemicals by suppliers of chemicals and equipment. The setting up of a pre-TWG may imply that the re-activation of TWGs is brought forward a few months. Experts from ECHA, WG CHEM and POP convention should participate. More details are mentioned in Section 3.3 of this report ⁷⁹
Section 4.4.3. TWG subgroups. The functioning of such subgroups is managed in a transparent way by the EIPPCB enabling all TWG members to have access to the groups and allowing them to follow and understand the subgroup's activities (...)	The EIPPCB proposes already in the preparatory phase of BREF reviews appropriate subgroups including mandate, tasks, expected outcome and working procedures. Newer subjects such as the use, fate and management of chemicals as well as (...) are suitable candidates for such subgroups. Participation of EIPPCB staff in these groups is mandatory.	The establishment and well-functioning of a subgroups with special knowledge on chemicals so far is undervalued. The involvement of these experts is crucial for gathering and assessing practicable and up-to-date information on chemicals, preventive measures including options for substitution

⁷⁹ Unless otherwise specified, the term 'Section' refers to the sections of this report.

Section number and title in the BREF Guidance 2012/119	Proposed amendments	Rationale and additional comments
<p>Section 4.4.5. Involvement of equipment suppliers in the exchange of information. (...) The term 'equipment suppliers' should be understood in a rather broad sense in order to extend the knowledge boundaries of the information exchange.</p>	<p>Chemical suppliers with in-depth knowledge of chemicals or auxiliaries used in a sector and of needs and constraints of the BREF sector of concern should be actively motivated by the EIPPCB for cooperation. TWG Members should be approached in order to support the EIPPCB in its motivating and persuasive efforts</p>	<p>Clarification is needed that chemical suppliers are part of suppliers besides suppliers of machinery and abatement techniques. The composition of the TWG is active work that requires time and efforts to convince experts that its worth participating</p>
<p>Section 4.5. The role of the EIPPCB. (...) 3. leads technical discussions in (...) subgroup TWG meetings and chairs those meetings (see also Sections 4.6.2 and 4.4.3);</p>	<p>(...) This means that EIPPCB staff participates at subgroup meetings</p>	<p>In the past, EIPPCB staff refused participation arguing that they are not obliged to participate subgroup meetings. However, they should in order to benefit from external special knowledge, to learn and to co-chair discussions</p>
<p>Section 4.6. Milestones in the information exchange</p>	<p>The preparatory phase for BREF reviews is missing, but important and should be added (frontloading). As far as the use and fate of chemicals applied in a sector is concerned, this includes organizational issues, technical aspects, a listing of major issues to be dealt with during this phase and expected products (preparatory study).</p>	<p>Substances of (potential) concern to be considered in BREF reviews, proposals for procedures and tasks to be carried during frontloading are mentioned in other parts of this report, in particular in Sections 2.3, 2.4, 3.2 and 5 of this report</p>
<p>Section 4.6.2 TWG Meetings, 4.6.2.1 General. The EIPPCB may organise additional ad hoc meetings with an individual or a group of TWG members to discuss or explain individual issues (...) (see also Section 4.4.3 on TWG subgroups).</p>	<p>The EIPPCB may also promote to set up, organize and lead subgroups meetings of experts with special knowledge on chemicals in particular for BREFs for sectors that use many and varying chemicals in their processes. The work on chemicals shall consider substances under REACH, Water Framework Directive, POPs Convention and other relevant frameworks.</p>	<p>Additional focus on chemicals and hazardous substances is needed and better interlinkage between regulatory frameworks. These sub-groups should include experts from ECHA, WG CHEM, POPs Convention, in addition to other chemical expertise</p>
<p>Section 4.6.3. First round of data collection following the kick-off meeting</p>	<p>Here, a paragraph on the deliveries of the pre-TWG should be added including the preparatory report on chemicals</p>	<p>The products produced by the pre-TWG are explained in detail in Section 3.2 of this report</p>
<p>Section 4.6.5.2. Working drafts. (...) the EIPPCB may decide to send out a draft version of the BREF or parts of the BREF as a working document for information and consultation of the TWG where members may choose to volunteer comments (...)</p>	<p>We recommend using more than before the possibilities of informal consultations enabled by Working Drafts, in particular as far as the use and fate of chemicals are concerned. It allows for sharing the progress of work and indicating gaps or controversial issues to be discussed with the whole TWG.</p>	<p>This informal consultation could, for instance, be used to highlight possible data gaps, prepare proposals, seek feedback or support and trigger the further collection of information</p>
<p>Section 4.7.2 EIPPCB website</p>	<p>10. a continuously updated list of those substances that have been or are potentially still used in the sector but are currently authorized or restricted under REACH, listed as priority substances or watch list under the WFD or POPs Convention or otherwise regulated. This list can also be established by referencing to other pertinent websites considering their updating cycles.</p>	<p>It should be investigated if a web-based solution could be established and maintained on the EIPPCB website to find updated information on substances of (potential) concern that are regulated under different frameworks.</p>

Section number and title in the BREF Guidance 2012/119	Proposed amendments	Rationale and additional comments
Chapter 5.and Section 5.4 Environmental performance and operational data needed for the key BREF chapters	The section 5.4 that deals with environmental performance and operational data undervalues the specific challenges of gathering and assessing meaningful information on chemicals used and measures to better control them. A dedicated section as for other main types of environmental performance should be added	The Section 5.4.2.2 Consumption of raw and auxiliary materials/feedstocks is too general and seems to refer to major input materials. Addressing chemicals needs specialized knowledge and data
Section 5.4.3 Emissions to water and 5.4.4 Emissions to air	Pollutants that are emitted in lower concentrations and mass flows, but are still of concern deserve a special reference and text (SVHC, CMR (category 1A and 1B), PBT, PMT, WFD substances and other substances of (potential) concern). This may include briefly listing the main substance properties of interest and the processes by which relevant data could be gathered and assessed	The use of chemicals, the information needs in terms of substances groups of interest, substances properties, use patterns and available data sources and means to address them in a suitable manner is generally undervalued and text kept short or missing.
Section 5.5. Specific issues under the remit of each technical working group	In the case of a BREF review, TWG members should suggest their views on how to proceed with the proposals made in the preparatory study on chemicals drawn up by the pre-TWG (see Section 3.2 of this report). This includes proposals on which aspects should be further developed and consolidated, practical tips about data sources and expertise, practical cases to be looked at and wishes about the type and format of sector-specific data on chemicals that should be collected for the review of the BREF in question. Based on the findings of the preparatory study provided by the pre-TWG, the background paper prepared by the EIPPCB for the kick-off meeting should present the TWG suggestions and make concrete proposals for the outline of a sector- specific data collection for chemicals	The section 5.5 of the BREF Guidance is focused on the data collection via questionnaires for traditional mass pollutants and regulated and well-known substances. The text does not refer to and capture newer substances of (potential) concern or emerging pollutants.

7 Conclusions

This chapter summarises the main proposals of the report, how relevant information on chemicals used in industrial processes, and that might potentially be released, can be more systematically addressed at the right time during BREF reviews. Special emphasis is given to possibilities to better use available data generated in the context of other pertinent EU legislation. The proposals include general measures for improvement of the BAT information exchange but also describes in detail what specifically has to be improved, by which means and how it could be done.

Substances to be addressed in future BREF reviews (Chapter 2)

For the purpose of this report, ‘substances of concern in the sense of the IED’ directs the gaze towards substances that are emitted from industrial installations. It comprises both ‘regulated substances’ and ‘non-regulated substances’ (see Section 2.4 and fig. 2). In this context, substances which might raise a concern are chemicals or chemical groups used in IED installations and that due to their low biodegradability/eliminability and high mobility may lead to emissions into the environment. They include substances, which pose a hazard to human health and/or to the environment due to their intrinsic properties (e.g. fate and behaviour, toxicity of the substance). Substances of concern in the sense of IED should be more systematically addressed in future BREF reviews.

The objective of the IED is to achieve a high level of environmental protection as a whole. This target may only be achieved when the BREF review process includes not only hazardous substances that are well-known, often covered by established emission control regulations and that are expected to be emitted by a given sector, but also until today less-known, monitored but still emitted chemicals used in industrial processes.

In order to address this issue, HAZBREF recommends that the following substances distinguished into two categories should be specifically paid attention to in the BREF process:

- (1) Substances for which regulations of different legal contexts are already in place (or substances planned to be regulated in the future) and that are – through their use in industrial processes – connected with IED and BREF reviews.
- (2) Non-regulated substances of concern (SoC) with low biodegradability/eliminability and high mobility potentially leading to emissions to the environment.

Looking at the category 1 above, the regulated substances used or emitted from IED BREF sectors that should be assessed in terms of use, release and emission control measures during BREF reviews are:

- Classified as hazardous following CLP Regulation (for ‘Classification, Labelling and Packaging’) Annex VI.
- Carcinogenic, mutagenic and reprotoxic (CMR) substances category 1a and 1b⁸⁰.
- Water Framework Directive (WFD),
 - Annex X Priority substances.
 - EU WFD River Basin Specific pollutants, if monitored in water bodies of at least 3 Member States.
 - Watch list substances for surface waters.
- Biocides such as disinfectants, preservatives and other products.
- Substances of Very High Concern (SVHCs) on the Candidate list.
- Registry of restriction intentions (SVHC) until outcome (RoI).

⁸⁰ CMR cat. 1A: known to have CMR potential for humans, based largely on human evidence; CMR cat. 1B: presumed to have CMR potential for humans, based largely on experimental animal data.

- SVHCs subject to authorisation and listed in Annex XIV REACH.
- Substances with restrictions on use listed in Annex XVII REACH.
- Persistent, Bioaccumulative and Toxic substances (PBT) and very Persistent and very Bioaccumulative substances (vPvB).
- POPs Regulation substances.
- Persistent, Mobile and Toxic substances (PMT) and very Persistent and very Mobile substances (vPvM).

Looking at the category 2 above, certain non-regulated substances may also be of interest for consideration in BREF reviews. Parameters that may trigger concern from an IED perspective for a chemical used or produced are fate, behaviour and hazards. The substance properties that are important for the potential to be released refer to physical-chemical properties and degradation properties. Substances are of particular relevance if, in addition to a high potential to be released, they have ecotoxicological or human toxicological properties of concern or are emitted in large quantities.

In short, HAZBREF recommends that ‘substances of concern under IED perspective’ are those that have a high ‘potential to be released’ and an ‘intrinsic potential for eco- or human toxicity’ and those which are already regulated substances (or substances planned to be regulated in near future). These substances should be included in the determination of BAT and, if appropriate, targeted BAT conclusions prepared.

HAZBREF recommendations to improve the procedure for considering chemicals in BREF reviews (Chapter 3)

HAZBREF recommends systematizing and streamlining the identification of hazardous substances and other substances of concern and strengthening the measures to better control them during BREF reviews. This requires:

- **Extended and more organized frontloading**
 - The recommended extended frontloading is best carried out in an organised manner that includes active participation of the TWG right from the beginning.
 - The extension of the frontloading phase must not necessarily take significantly more time than now (around 3 months more) but depends above all on the approach chosen and the availability of experts.
 - The EIPPCB should encourage TWG members to carry out targeted research projects or case studies on specific aspects of the use of chemicals in due time before start of BREF reviews (a reliable work programme is a currently unavailable pre-requisite).
- **Systematic identification of chemicals**
 - HAZBREF recommends, as preparatory work, the drawing up of a sectoral inventory of the chemicals used in a BREF sector concerned depending on the amount, quantity and diversity of chemicals used. This sectoral inventory of chemicals would give an overview on the main chemicals actually used in production processes in a BREF sector. This sectoral chemical inventory would describe the technical and chemical function of the main chemical groups and the knowledge in terms of emissions and pathways. It should be preferably drafted in cooperation with industrial associations and IED operators and submitted for evaluation to EIPPCB and TWG members.
 - The systematic approach includes a search at ECHA’s database, the screening and filtering of the SPIN register and available national chemical registers. Additionally, other non-regulatory lists like the SIN list or sector-specific lists of restricted substances could be used as complementary information sources for substance uses. Concerning the search in ECHA’s database HAZBREF learned that ‘use descriptors’ in the database are very

generic and much broader than the scope of given BREFs and extracted substances often do not match with the scope of BREF activities.

- The active search for substances of concern includes knowledge, data and findings from experts from ECHA, WG CHEM (Working Group Chemicals under WFD) and Stockholm POP Convention.
- The result of the search is a long list of chemicals and a draft proposal for elements of a short list, and from which the relevant substances are proposed by the TWG supported by a subgroup constituted by chemical experts (proposed by HAZBREF).
- **Reinforcing the TWG with knowledge on used chemicals**
 - As one of the crucial pre-requisites for producing valuable results the reinforcement of the TWG with knowledge on chemicals used in a sector should be considered. The reinforced frontloading process would consist of, in addition to interested TWG members, sector and chemical experts (especially chemical suppliers and suppliers of equipment for the relevant sector) and include in special cases also instances performing chemical measurements. We call this group ‘pre-TWG’ in order to express and emphasise the preparatory character of this work (frontloading phase). The same experts may just continue working in subsequent work steps of the traditional TWG.
 - The TWG work for BREF sectors where significant amounts and diversity of hazardous substances/chemicals are used and/or emitted (e.g. sectors TXT, PP, STM, TAN, CWW) should be supported by a sub-group for Chemical Management to facilitate preparation of BATs for chemicals and hazardous substances.
- **Commissioning of a consultant**
 - HAZBREF recommends continuing to carry out preparatory KEI studies. The existing ‘Ricardo-studies’⁸¹ should be continued, extended and refined. Future studies for ‘preliminary determination of Key Environmental Issues’ should include a gap analysis of the weaker points of the BREFs in question and a systematized screening of used chemicals that utilizes the expert knowledge. These studies should seek cooperation with industry and chemical experts/suppliers and also consider findings of the proposed ‘pre-TWG’ as described above.
 - Based on the preparatory study and the feedback of the TWG, a list of chemicals relevant for the BREF review could be proposed by EIPPCB. The list would then be assessed at the Kick-Off Meeting of the TWG and more detailed information gathered during the data collection phase.

Figure 12 summarises and visualises the recommendations made by HAZBREF and connects them, on the right side of the picture, with the expected outcome at BAT conclusion level (they are explained in detail in Chapter 5 of this report).

⁸¹ The report on the methodology used and the four reports on the “preliminary determination of Key Environmental Issues” can be downloaded in CIRCABC: <https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp?FormPrincipal: idcl=FormPrincipal: id1&FormPrincipal SUBMIT=1&id=33336634-65ed-4dcb-9a18-430825e073ee&javax.faces.ViewState=zGo5XnUHE9QmS-McxfYu53SEFdn6OQIbxGrodUeoRsZwo8roFhMvIzgbYdXeAGiyPg1bwmhAD%2FqUXNkWk%2FjG4iWjixuz%2FoaGjJKX-Aiu7TMQVz8QQRQuLI%2FdOWkngGZFu%2B9NQCAyXsmrEO2pK1w4yPo61HZW8%3D>.

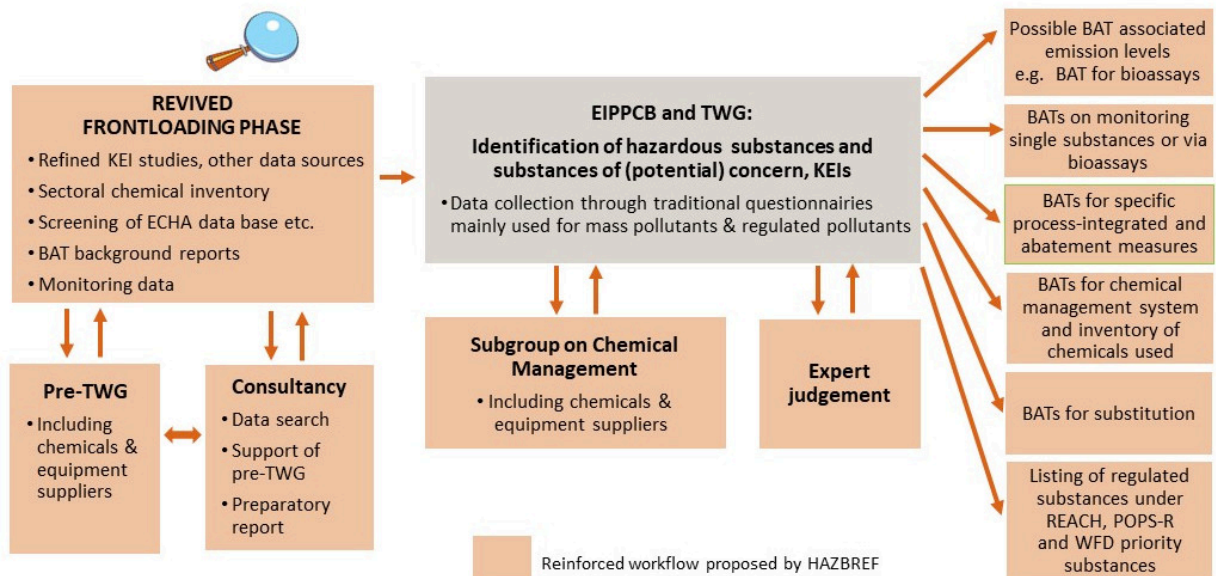


Figure 12. Revived frontloading, reinforced TWGs and workflow for systematised identification of SoC and more specific BAT conclusions to control them.

Cooperation between EIPPCB/TWG and other frameworks (Chapter 4)

The BREFs are also supposed to include specified requirements to tackle industrial emissions of substances regulated under other EU legislative frameworks than IED (e.g. Art. 10 WFD, Art. 62, no. 5(b) REACH, Directive 2006/122/EC).

So far, the information related to hazardous chemicals used in industrial processes, as well as other substances of concern emitted and addressed by other legislative frameworks, has been only partially considered and incorporated in BAT conclusions. HAZBREF finds it positive that the EIPPCB and DG ENV have invested more time and effort in the challenge of including more available information on some hazardous substances in BREF reviews in recent years by checking substances in ECHA databases for a few pilot sectors during the frontloading of the BREF reviews.

To further systemise and formalise the cooperation between EIPPCB and REACH, WFD and the POP convention community HAZBREF recommends:

- **Strengthening the communication and information exchange between ECHA and EIPPCB**

The main aim of this cooperation is to utilize the ECHA database information to identify substances for BREF reviews based on information on uses, properties and regulatory status of substances. In order to better identify substances used in a given BREF sector, the aim of the cooperation is to improve ‘use descriptors’ in the ECHA database based on knowledge in IED sectors. As a result, ‘substances of concern in the IED context’ including already regulated substances that are potentially used or released from a given BREF sector can be more easily identified and addressed in BREF reviews.

- **Strengthening the communication and exchange of data and information between WG CHEM and EIPPCB**

The main aim of this cooperation is to utilize WG CHEM expertise to gather data on whether WFD priority substances are potentially used or released from a given BREF sector and to make them available at the right time of BREF reviews.

- **Pilot study to investigate the best ways how information is gathered on WFD priority substances used or released from a given BREF sector**
This kind of pilot study should be carried out for the next appropriate BREF reviews that will start according to the work programme of the EIPPCB (e.g. STM or LVIC).
- **In upcoming BREF reviews, the emissions of unintentionally produced POPs should be systematically considered and BAT conclusions derived where considered suitable**
Each BAT conclusion should clearly state that the occurrence of POPs has been assessed and that presented BATs cover all relevant aspects concerning this matter.

BAT conclusions regarding chemical management (Chapter 5)

The completion of the traditional pathway of the BREF process by a systematic focus on chemicals and hazardous substances would further streamline, strengthen and institutionalise the content of future BAT conclusions with regard to its contribution to an EU strategy on non-toxic environment.

The number, comprehensiveness and detail of BATs for chemical management in the BREFs depend naturally on to which degree relevant hazardous substances/chemicals are used and/or emitted in a BREF sector. HAZBREF recommends including a specific chapter on chemicals in all BREFs and BAT conclusions that, depending on the amount, quantity and diversity of chemicals used in a given sector, may include the BATs for the topics described below and which may need some specification depending on the BREF sector:

- **BAT for a chemical management system (CMS)**
 - CMS is a systematic approach regarding chemicals and substances and should cover several integrated administrative, document-related and practical management measures, including the setting up and use of chemical inventories, the guarantee of a safe use of chemicals and the investigation of alternative processes, if appropriate.
 - HAZBREF recommends that a BAT for a Chemical Management System (CMS) should be included to each BAT conclusion adapted to the specifics of each sector.
- **BAT for setting up, maintaining and updating an electronic ‘chemical inventory’**
 - It is necessary to clearly identify which chemicals are used at the installations and how they should be stored and handled in order to minimize the risk for human health and the environment.
 - Information on how the chemicals can be substituted, if risks for the safe use are identified and alternatives are listed in the SDS, can be derived from a chemical inventory.
 - HAZBREF recommends that BATs on chemical inventories are considered, strengthened, specified and tailor-made for each industrial sector during BREF reviews. This includes descriptions and references of best practices and available well-proven and effective tools that are helpful in making chemical inventories.
 - HAZBREF also recommends that BATs for ‘inventories of wastewater and waste gas streams’ are kept and continued as in several BAT conclusions (e.g. CWW, WT). However, it seems advisable to add a definition, its main scope and content and references of best practices of these inventories of wastewater and waste gas streams.
- **BATs for substitution of certain (groups of) substances**
 - HAZBREF is aware of the challenge to include up-to-date information on substitutes for specific substances into BREFs, as new technical solutions emerge frequently.
 - However, BREFs should include the current status on the substances which are to be phased out or better replaced by environmentally safer solutions. It is the duty of the operator to find updated information on available substitutes and find the best available substitute fitting to the specific industrial process. Regrettable substitution should be avoided.

- **BATs for process integrated measure**
 - Process-integrated BATs related to chemicals are already considered in existing BREF reviews concerning improvements of existing production processes and measures close to the source of pollution as well as abatement techniques. However, some BAT conclusions are incomplete or not specific or targeted. These techniques are very sector- and process-specific, but the HAZBREF project has developed some examples based on case studies in three industrial sectors (HAZBREF 2020, Krupanek et al. 2021, Bomark et al. 2021).
 - The involvement of specialised experts on chemical solutions may support the identification of measures for prevention and reduction of emissions and propose best technical and organisational options. And perhaps the proposed reinforced TWG might have success in developing candidate BATs that are most effective related to the retention of substance of concern identified for the sector.
- **BAT Associated Emission Levels (BAT AELs)**
 - Lack of data is often hindering the inclusion of BAT AELs for hazardous substances. Another limitation is the sheer number of individual substances emitted. The amount of single substances in wastewater might be in the range of some thousands (e.g. in effluents from chemical industry). It is, therefore, not advisable to measure high numbers of single substances in treated effluents in order to derive BAT AELs.
 - The introduction of appropriate BAT AELs for some very toxic or persistent substances is one issue that should be discussed further as the Union wants to move towards the ‘zero pollution ambition’ of the European Green Deal. However, practical constraints suggest that BAT AELs for a higher number of single pollutants is not advisable but only in exceptional cases. The search for complementary ways should be developed (new sum parameters, ecotoxicological tests by use of standardised biological test systems) Another option could be to assess whether chemical measurement campaigns, e.g. based on Suspect or Non-Target Analysis in wastewater should be carried out in some volunteering plants. HAZBREF recommends testing the usability of chemical measurement campaigns in the forthcoming BREF review round.
- **BATs for monitoring**
 - HAZBREF recommends including BATs for the monitoring of single substances or groups of substances (e.g. PFAS) in specific cases only, e.g. if it needs a control of whether substances of concern are effectively retained by applied techniques.
HAZBREF recommends that it should also be considered if ecotoxicological tests for treated effluents (e.g. by use of standardized biological test systems such as luminescent bacteria, algae, daphnia, dugweed, fish egg, etc.) can be promoted by BAT conclusions and possibly BATs for monitoring or even BAT AELs derived in future BREFs, if sufficient data and evidence is available.
- **Listing of regulated substances under REACH, POPs Regulation and WFD**
 - The environmental permitting authorities do not always have enough knowledge on substances regulated under different frameworks, e.g. REACH or the relevance of WFD priority substances for different sectors. The need for such information and tools in the BREFs to find updated information was a clear message from the authorities.
 - Therefore, HAZBREF recommends that future BREFs list those substances that are still used in the sector but are currently authorized or restricted under REACH or listed as priority substances under the WFD or the POPs Regulation. Also, relevant substances from other frameworks could be listed when needed.

The proposals of this report seem to fall within a favourable political context with the recently published European Green Deal that defines a new policy framework requiring a deep transformation for the EU's economy for a sustainable future. One of the key commitments of the EGD is the EU's zero pollution ambition for a non-toxic environment, which is supported by the Chemicals Strategy for Sustainability. The proposals made by HAZBREF project would further strengthen the future BAT conclusions concerning chemical management measures also supporting the IED in achieving these recent EU policy objectives.

Definitions and abbreviations

AOX	Adsorbable Organic Halides. A measure of the organic halogen load of a sampling. The procedure measures chlorine, bromine, and iodine as equivalent halogens.
BAT	Best Available Technique
BAT-C	BAT conclusion
BAT-AEL	BAT associated emission level
BAT-AEPL	BAT associated environmental performance level
BP	Background Paper (elaborated as a basis for meetings of the Technical Working Groups)
BPR	Biocidal Products Regulation that refers to Regulation (EU) 528/2012 concerning the placing on the market and use of biocidal products
BREF	<u>Best Available Techniques (BAT) reference documents</u>
CBI	Confidential Business Information
CSS	Chemical Strategy for Sustainability
CIS	Common Implementation Strategy under WFD
CLH	Harmonised classification and labelling. Harmonised classifications are listed in Annex VI to the CLP Regulation.
CLP Regulation	Classification, Labelling and Packaging Regulation
CMR Substances	Carcinogenic, Mutagenic and Reprotoxic substances
CMR 1a and 1b substances	Under GHS, CMR substances can be classified into 3 categories depending on the severity of hazards. Category 1A: Known human carcinogen (H340), mutagen (H350) or reproductive toxicant (H360) based on human evidence; Category 1B: Presumed human carcinogen (H340), mutagen (H350) or reproductive toxicant (H360) based on animal studies.
CMS	Chemical Management Systems
CO	Carbon monoxide
COD	Chemical oxygen demand
CSR	Chemical Safety Report under REACH
DG ENV	Directorate-General for Environment
EC	European Commission
ECHA	European Chemicals Agency
EEA	<u>European Environment Agency</u>
EGD	European Green Deal
EIPPCB	European Integrated Pollution Prevention and Control Bureau
ELV	Emission Limit Value
E-PRTR	European Pollutant Release and Transfer Register
EQS	Environmental Quality Standards under WFD
EQSD	Environmental Quality Standards Directive
ES	Exposure Scenario

eSDS	Extended → <u>SDS</u> . Document of chemical safety that consists of a standard SDS, has more subsections than the general one and includes one or more <u>exposure scenario(s)</u> in an annex.
EU	European Union
GHS	Global Harmonised System
HAZBREF	EU Interreg project “Hazardous industrial chemicals in the IED BREFs”
HELCOM	Baltic Marine Environment Protection Commission – Helsinki Commission
IED	<u>Industrial Emissions Directive</u> , Directive 2010/75/EU of the European Parliament and the Council on industrial emissions
IMPEL	<u>The European Union Network for the Implementation and Enforcement of Environmental Law</u>
Industrial chemicals	Chemicals used in industrial processes such as process and product auxiliaries; chemical products utilised in different industrial applications incl. biocides, cleaning/disinfection agents
JRC	Joint Research Centre
KEI	Key Environmental Issue
LVIC	Abbreviation used to refer to the Best Available Techniques Reference Document for Manufacture of Large Volume Inorganic Chemicals
LVOC	Abbreviation used to refer to the Best Available Techniques Reference Document for Manufacture of Large Volume Organic Chemicals
MSFD	Marine Strategy Framework Directive
NAP	National Action Plan pursuant to Art. 6 of the POPs Regulation
NGO	Non-Governmental Organisation
NO _x	Nitrogen oxides
OFC	Abbreviation used to refer to the Best Available Techniques Reference Document for Manufacture Organic Fine Chemicals
PACT	Public activities coordination tool
PBT	Persistent, bio-accumulative and toxic (cf. vPvB)
PFAS	Perfluoroalkylated substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulphonate
PHS	Priority hazardous substances under WFD
PMT	Persistent in the environment, mobile in the water cycle and toxic
POPs Regulation	Persistent Organic Pollutants Regulation
POPRC	POP Review Committee under the Stockholm Convention
PS	Priority substances under WFD
vPvM	Very persistent in the environment and very mobile in the water cycle
RBMP	River Basin Management Plans under WFD
RBSP	River Basin Specific Pollutants under WFD
REACH	<u>Registration, Evaluation, Authorisation and Restriction of chemicals</u> , EC 1907/2006
RMM	Risk management measure

RoHS	Restriction of (the use of certain) Hazardous Substances in electrical and electronic equipment acc. to Directive 2011/65/EU
SDS	Safety Data Sheet
SG-R	Sub group on Review of Priority Substance List under WFD
SoC	'Substances of concern' are synonymous to 'target substances for consideration in BREFs' (→ target substances)
SO ₂	Sulphur dioxide
SPERCs	Special Environment Release Categories
STM	Abbreviation used to refer to the Best Available Techniques Reference Document for Surface Treatment of Metals and Plastics
STP	Sewage Treatment Plant
SVHCs	<u>Substances of Very High Concern</u> according to the Candidate list of substances of very high concern for authorisation under REACH
Target substances	The term 'target substances' used in the HAZBREF project means chemicals or chemical groups, which may raise a concern or might pose a danger due to their properties, and which might occur in industrial activities covered by Annex I of the IED
TWG	Technical Working Group
UNECE	United Nations Economic Commission for Europe
VOC	Volatile organic compounds
vPvB	Very persistent and very bio-accumulative (cf. PBT)
WFD	<u>Water Framework Directive</u> , Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy
WG CHEM	Working Group Chemicals
WP	Work Package
WWTP	Waste Water Treatment Plant
ZPA	Zero Pollution Ambition

References

- Aust N., Fischer J., Moltmann J. F., Kacan S., Werschkun B., Riedel F., Forsius K., Vähä E., Jouttijärvi T., Mehtonen J., Högmander P., Månsson A., Appelgren H., Bomark S., Debourg C., Suhr M., Leuthold S., Zietlow B., Krupanek J. & Kupits K. 2021. Approaches for a better use of available data to prevent or reduce releases of substances of concern from industrial installations. HAZBREF WP2 Report. https://www.syke.fi/en-US/Research_Development/Research_and_development_projects/Projects/Hazardous_industrial_chemicals_in_the_IED_BREFs_HAZBREF/Publications [Accessed 12.11.2021].
- Bomark S., Vähä E., Forsius K., Jouttijärvi T., Kalisz M., Krupanek J., Kupits K., Mehtonen J., Månsson A., Högmander P. & Johansson A. 2021. Sectoral Guidance for Chemicals Management in the Chemical Industry with focus on the production of fertilisers and polymers. HAZBREF project Activity 4.1 report. <https://www.naturvardsverket.se/om-oss/publikationer/6900/sectoral-guidance-for-chemicals-management-in-the-chemical-industry-with-focus-on-the-production-of-fertilisers-and-polymers> [Accessed 12.11.2021].
- Council of the European Union 2019. Council conclusions Towards a Sustainable Chemicals Policy Strategy of the Union. <https://data.consilium.europa.eu/doc/document/ST-10713-2019-INIT/en/pdf> [Accessed 12.11.2021].
- Dahlbo, H., Vähä, E., Turunen, T., Forsius, K., Jouttijärvi, T., Järvinen, E., Månsson, A., Kalisz, M., Leuthold, S., Kupits, K. 2021. Promoting non-toxic material cycles in the preparation of Best Available Technique Reference Documents (BREFs). HAZBREF Activity 4.4 report. Reports of the Finnish Environment Institute 24/2021. <http://hdl.handle.net/10138/329318>
- European Chemicals Agency (ECHA): Authorisation List. <https://echa.europa.eu/authorisation-list> [Accessed 28.1.2020].
- European Chemicals Agency (ECHA): Community Rolling Action Plan. <https://echa.europa.eu/regulations/reach/evaluation/substance-evaluation/community-rolling-action-plan> [Accessed 28.1.2020].
- European Chemicals Agency (ECHA): Candidate List of substances of very high concern for Authorisation. <https://echa.europa.eu/candidate-list-table> [Accessed 28.1.2020].
- European Chemicals Agency (ECHA): Substance list evaluation - CoRAP. <https://echa.europa.eu/information-on-chemicals/evaluation/community-rolling-action-plan/corap-table> [Accessed 28.1.2020].
- European Chemicals Agency (ECHA): Registered substances. <https://echa.europa.eu/information-on-chemicals/registered-substances> [Accessed 28.1.2020].
- European Chemicals Agency (ECHA): substances restricted under REACH. <https://echa.europa.eu/fi/substances-restricted-under-reach> [Accessed 28.1.2020].
- European Chemicals Agency (ECHA) 2015. Guidance on Information Requirements and Chemical Safety Assessment, Chapter R.12: use description. https://echa.europa.eu/documents/10162/13632/information_requirements_r12_en.pdf/ea8fa5a6-6ba1-47f4-9e47-c7216e180197 [Accessed 12.11.2021].
- European Chemicals Agency 2019. ECHA's committees recommend restricting a subgroup of PFAS. Press release 17.6.2019. <https://echa.europa.eu/fi/-/echa-s-committees-recommend-restricting-a-subgroup-of-pfas> [Accessed 28.1.2021].
- European Commission 2012. Commission Implementing Decision (EU) 2012/119 of 10 February 2012 laying down rules concerning guidance on the collection of data and on the drawing up of BAT reference documents and on their quality assurance referred to in Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012D0119&from=EN>
- European Commission 2015. Commission Implementing Decision (EU) 2015/495 of 20 March 2015 establishing a watch list of substances for Union-wide monitoring in the field of water policy pursuant to Directive 2008/105/EC of the European Parliament and of the Council.
- European Commission 2018a. Commission Implementing Decision (EU) 2018/840 of 5 June 2018 establishing a watch list of substances for Union-wide monitoring in the field of water policy pursuant to Directive 2008/105/EC of the European Parliament and of the Council and repealing Commission Implementing Decision (EU) 2015/495.
- European Commission 2018b. Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment.
- European Commission 2018c. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of the circular economy package: Options to address the interface between chemical, product and waste legislation. COM(2018) 32 final.

- European Commission 2019. The European Green Deal. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels, 11.12.2019, COM(2019) 640 final.
- European Commission 2020a. SWD(2020) 181 final. Commission Staff Working Document. Evaluation of the Industrial Emissions Directive (IED).
- European Commission 2020b. Chemicals Strategy for Sustainability Towards a Toxic-Free Environment. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels, 14.10.2020, COM (2020) 667 final.
- European Commission 2020c. Commission Implementing Decision (EU) 2020/1161 of 4 August 2020 establishing a watch list of substances for Union-wide monitoring in the field of water policy pursuant to Directive 2008/105/EC of the European Parliament and of the Council.
- European Commission 2021. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Pathway to a Healthy Planet for All - EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil'. Brussels, 12.5.2021 COM(2021) 400 final.
- European Parliament 2020. European Parliament resolution of 10 July 2020 on the Chemicals Strategy for Sustainability (2020/2531(RSP)). https://www.europarl.europa.eu/doceo/document/TA-9-2020-0201_EN.html [Accessed 12.11.2021].
- HAZBREF 2020. Sectoral Guidance for Chemicals Management in the Textile Industry, September 2020. HAZBREF Activity 4.1 report. https://www.syke.fi/en-US/Research_Development/Research_and_development_projects/Projects/Hazardous_industrial_chemicals_in_the_IED_BREFs_HAZBREF/Publications [Accessed 12.11.2021].
- IMPEL 2010. Linking the Water Framework Directive and IPPC Directive, Phase 1. European Union Network for the Implementation and the Enforcement of Environmental Law. www.impel.eu/wp-content/uploads/2016/09/Report-Linking-the-Water-Framework-and-the-IPPC-Directives.pdf [Accessed 12.11.2021].
- IMPEL 2011. Linking the Water Framework Directive and IPPC Directive, Phase 2. European Union Network for the Implementation and the Enforcement of Environmental Law. www.impel.eu/wp-content/uploads/2016/09/impel-report-WFD-IPPC-final-report-07-December-2011.pdf [Accessed 12.11.2021].
- IMPEL 2013. European Union Network for the Implementation and the Enforcement of Environmental Law. Linking the Directive on Industrial Emissions (IED) and the REACH Regulation – Phase I. <https://www.impel.eu/wp-content/uploads/2016/08/FR-2013-09-Linking-the-IED-and-REACH.pdf> [Accessed 12.11.2021].
- IMPEL 2015. European Union Network for the Implementation and the Enforcement of Environmental Law (IMPEL) – Linking the Directive on Industrial Emissions (IED) and the REACH Regulation – Phase II. <https://www.impel.eu/wp-content/uploads/2016/08/FR-2014-10-Linking-IED-and-REACH-II.pdf> [Accessed 12.11.2021].
- INERIS 2016. Hazardous substances for the aquatic environment in industrial waste water releases. National Action for Research and the Reduction of Releases of Hazardous Substances into Water Bodies (RSDE) by Classified Facilities – Second Phase” (June 2016). https://rsde.ineris.fr/doc/docs%20rsde/Rapport_RSDE_ICPE_INERIS-DRC-15-149870-12457C_VF_EN_FINAL_relu_modifacceptees_compilation.pdf; https://rsde.ineris.fr/doc/docs%20rsde/Rapport_Secteurs_UK_compilation.pdf [Accessed 12.11.2021].
- JRC 2019. Best Available Techniques Reference Document for the Textiles Industry - Draft 1 (December 2019). https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/TXT_bref_D1_1.pdf [Accessed 12.11.2021].
- Krupanek J., Vähä E., Forsius K., Högmänder P., Johansson A., Jouttijärvi T., Mehtonen J., Kalisz M., Kupits K., Leuthold S., Bomark S. & Månsson A. 2021. Sectoral Guidance for Chemicals Management in the Surface Treatment of Metals and Plastics Industry. HAZBREF project Activity 4.1 report. <https://www.naturvardsverket.se/om-oss/publikationer/6900/sectoral-guidance-for-chemicals-management-in-the-surface-treatment-of-metals-and-plastics-industry> [Accessed 12.11.2021].
- Suhr M., Klein G., Kourti I., Gonzalo M. R., Santonja G. G., Roudier S. & Sancho L. D. 2015: Best Available Techniques (BAT) Reference Document for the Production of Pulp, Paper and Board, JRC Science and Policy Reports. https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/PP_revised_BREF_2015.pdf [Accessed 12.11.2021].
- Suhr M., Forsius K., Ginzky H., Löffler L., Mehtonen J., Häkkinen E., Tietjen L., Moltmann J. F., Månsson A., Pirntke U., Turunen T., Ujfalusi M., Vähä E. & Weiß A. 2020. Analysis of the interfaces, possible synergies or gaps between Industrial Emission Directive, REACH Regulation, Water Framework Directive, Marine Strategy Framework Directive and the POP Regulation concerning hazardous substances. HAZBREF Activity 3.1 Report. https://www.syke.fi/en-US/Research_Development/Research_and_development_projects/Projects/Hazardous_industrial_chemicals_in_the_IED_BREFs_HAZBREF/Publications [Accessed 12.11.2021].

Toropovs V., Reihlen A., Nõmmsalu H. & Dudutyte Z. 2013. EU Environmental and Chemical legislation: Water Framework Directive, Marine Strategy Framework Directive, IPPC/Industrial Emissions Directive, REACH and Waste Framework Directive – Interlinks and Synergies.

ZELLCHEMING 2008. Chemical additives for the production of pulp and paper. Functional essential - ecological beneficial. Deutscher Fachverlag.



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