SCIENCE BASED TARGETS NETWORK
GLOBAL COMMONS ALLIANCE

FRESHWATER

TECHNICAL GUIDANCE

WATER QUALITY V2: TOXIC CHEMICALS WITH FOCUS ON PESTICIDES AND POINT SOURCE DISCHARGES

DRAFT FOR PUBLIC CONSULTATION (2025)

STEP
3
MEASURE, SET & DISCLOSE

Contents

1 Introduction Step 3: Freshwater quality targets for toxic chemicals

1.1 About this guidance

Relation to the main Freshwater target-setting guidance

Complementing the current Freshwater science-based targets guidance, which includes water quantity and water quality related to nutrients, V2 of the guidance expands the water quality guidance with an additional focus on toxic chemicals. The methods focus on pesticides due to their intentional toxicity, direct release in the environment, and relative data availability. In addition, the guidance supports SBTN's strategic focus on the agricultural and textile sectors, which both significantly contribute to freshwater pollution. Guidance is also provided for toxic chemicals beyond pesticides, specific to point source discharges. Because of the relative availability of data on point source discharges, these sources are included in the guidance to broaden applicability to other sectors and chemicals.

Types of companies that can set targets with this guidance

The guidance is directed toward companies with knowledge of the types of pesticides used in agricultural plant protection products (PPPs) and companies with farm- or basin-level information on pesticide usage and emissions in their direct operations or supply chain. This includes companies sourcing or producing agricultural commodities, including food and fiber crops. Companies can set targets for the parts of their business (relevant farms and basins) and locations that fall within "target boundary A" (for which they have traceability). Moreover, companies producing and trading PPPs or pesticides can set a cessation target for highly hazardous pesticides (HHPs). The guidance is also directed toward companies that directly discharge toxic chemicals into surface waters via wastewater effluent.

1.2 General approach for setting science-based Freshwater targets for toxic chemicals

Impacts of toxic chemicals/pesticides on freshwater ecosystems and human health, and global context

The increased production and release of toxic chemicals have led to considerable risks and harm to humans while also contributing to biodiversity loss (Groh et al., 2022; Persson et al., 2022). More specifically, the global chemicals industry is projected to double between 2017 and 2030 (UNEP, 2019). The speed of these developments surpasses the global capacity for evaluation and monitoring—the planetary boundary for novel entities that include toxic chemicals is already considered exceeded, demanding urgent action (Persson et al., 2022). Beyond global conventions like the Stockholm Convention on Persistent Organic Pollutants and the Rotterdam Convention on Hazardous Chemicals and Pesticides in International Trade, there are also voluntary global frameworks that tackle these issues. For example, "The Global Framework on Chemicals – For a Planet Free of Harm from Chemicals and Waste" was adopted in 2023 in Bonn.

The targets, amongst others, call out companies to identify, prevent, and minimize adverse effects from chemicals (Target A3) and urge them to phase out Highly Hazardous Pesticides

(HHPs) (Target A7). In addition, Target 7 of the Kunming-Montreal Global Biodiversity Framework aims to "Reduce Pollution to Levels That Are Not Harmful to Biodiversity."

Reducing environmental impact from the use of chemical pesticides plays an important role in achieving those targets, with around 3 billion kg of pesticides being applied every year (Sharma et al., 2020). They are designed to control organisms and pests that harm crops to safeguard yields, but also show significant adverse effects to non-target species, specifically when entering water bodies (Parra-Arroyo et al., 2022; Kumar et al., 2023). Pesticides have been found to bioaccumulate and harm aquatic organisms as well as humans through fish and drinking water consumption (Synfrudin et al., 2021; Kumar et al., 2023; Saha and Dutta, 2024). There is a broad international consensus that the reliance on chemical pesticides needs to be minimized (WHO/FAO 2018). Alternatives, like biopesticides, mechanical pest control, and increased crop rotation, are available to support the transition away from chemical pest management (Sharma et al., 2020; Finger et al., 2024). Farmers and agricultural producers wield major influence in pest control, and companies sourcing agricultural commodities can support them in their transition through direct engagement and procurement.

Toxic chemical impact pathway

Defining appropriate indicators for assessing a company's contribution to chemical pollution and related impacts on human health and the environment, as well as assessing the relevance of related impact reduction efforts, requires an understanding of the impact pathway of chemicals. This can be described using the Driver, Pressure, State, Impact, and Response (DPSIR) framework introduced in the SBTN Guidance for Step 1 (see Figure 1). For setting Freshwater targets, the focus in this guidance is on aquatic ecotoxicological impact; however, human toxicity impacts are, e.g., considered for the definition of HHPs. Furthermore, human health is accounted for through Maximum Pesticide Residue regulations for food (EPA, 2025; EU, 2025).

The DPSIR framework can be split into the technological domain and the environmental domain, where the technological domain covers drivers and pressures that can be influenced by companies (e.g., chemical producers and farmers). Understanding which chemicals to phase out or substitute with safer and more sustainable alternatives or pest management practices requires an impact-level approach, due to different toxicity potential across chemicals. This means that each chemical contributes differently to the overall impact, and reducing certain chemicals affects impact reduction differently than reducing other chemicals.

Companies can provide data on pressures (e.g., pesticide usage) and use secondary data sources such as databases and scientific tools to translate them into state (concentrations in the environment) and impact (effect on the environment depending on exposure and toxicity). Currently, impact is usually approximated by testing ecotoxicity on indicator species; more research is needed to understand how diverse local ecosystems are affected by single or mixtures of toxic chemicals in the environment (Siegmund et al., 2023; Oginah et al., 2025). Further research efforts are currently on their way to also enable science-based target setting for chemical impacts at regional scale (e.g., for a given catchment), such as absolute environmental sustainability assessment (AESA), building on quantifying impact from all contributing sources, defining ecological capacities for diluting chemical impacts, and attributing both (impacts and impact capacity) to contributing actors or sources (Kosnik et al., 2022).

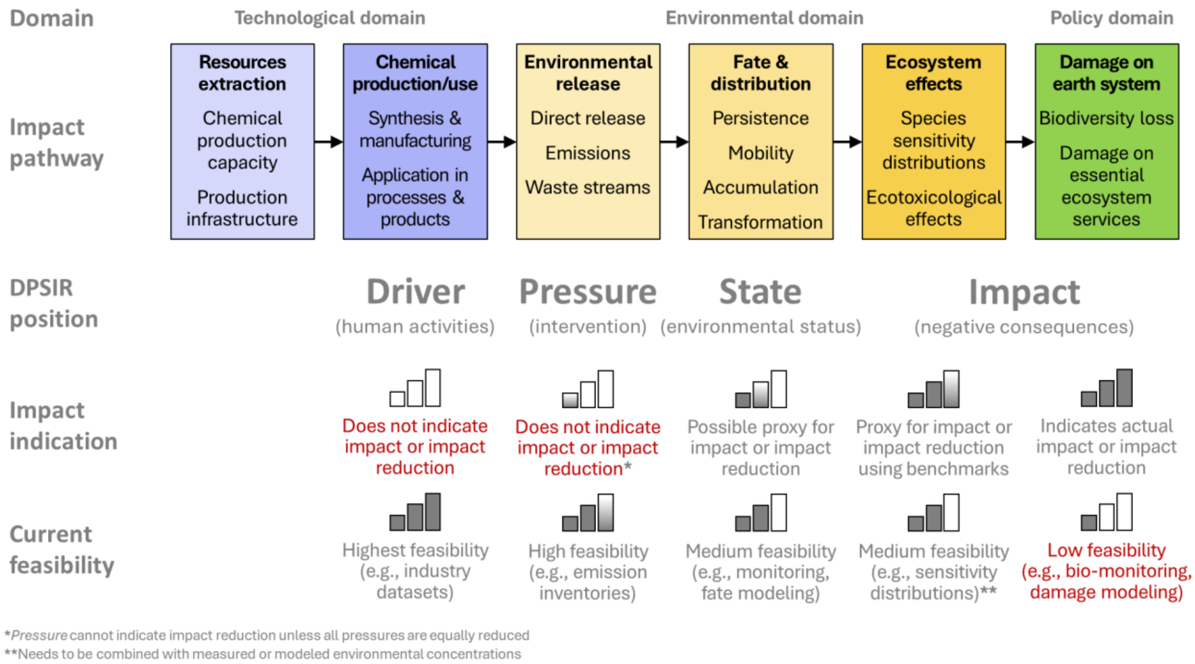


Figure 1. Impact pathway elements for chemical impacts, their positioning within the DPSIR framework, their potential to indicate impacts, and their current feasibility. Note that for simplicity, only impacts on ecosystems are shown, though chemical impacts also affect human health. A detailed description of the toxic chemical impact pathway along the DPSIR framework can be found in the Annex.

1.3 Minimum data requirements

Minimum data requirements vary depending upon whether targets are being set for pesticides and/or point source discharges. Requirements for each category are provided below.

1.3.1 MINIMUM DATA REQUIREMENTS FOR PESTICIDES

Companies producing or procuring agricultural commodities must collect data to define their baseline level of pressure for pesticide use for all priority farms or regions (basins) in their direct operations and upstream activities in target boundary A data level 2 (i.e., those activities with sufficient traceability for target setting). This data will be needed to calculate impacts. Companies producing or trading PPPs and pesticides data must collect pesticide or PPP names and CAS numbers to set a cessation target for HHPs.

When collecting baseline data for target-setting, where possible, companies should use data from the *last five full years* at a given farm or region (basin) unless this time frame is not representative of their operations or typical environmental conditions. If fewer than five years of data are available, companies should define their baseline using the entire period for which data are available, and in any case, explicitly indicate the timeframe of the collected data.

The minimum data requirements for pressure and impact baseline measurement are summarized in Table 1.

Table 1. Minimum data requirements for baseline pressure and impact quantification for agricultural pesticides.

	Data requirement	Data type

Agricultural producers that apply pesticides
and
Procurers of agricultural products
	Primary/direct measurements	Pesticide or Plant Protection Product name and CAS number (for HHPs Cessation Target only)
		On farm or basin-level (for Pesticide Impact Reduction Target):
		• Pesticide name and CAS number
		• Mass applied per treatment and unit area
		• Number of treatments per year
		• Treated area
		• Pesticide emission intensity or fractions, or primary data on:
		  ○ Crop type
		  ○ Crop growth stage
		  ○ Buffer zones: yes/no
		  ○ Pesticide application method

	Secondary	If no primary data on pesticide emission intensity or fractions are available, generic factors from Nemecek et al., 2022 can be used.
PPP or pesticide producers or traders	Primary	Pesticide or Plant Protection Product name and CAS number (for HHPs Cessation Target only)

1.3.2 MINIMUM DATA REQUIREMENTS FOR POINT SOURCES

Companies must collect data to define their baseline level of pressure for all direct point discharges in their direct operations and upstream scope for which targets will be set.

Table 2. Minimum data requirements for baseline pressure quantification for direct point source discharges.

	Data requirement	**Data type**
All companies with point source discharges	Primary/direct measurements	Facility-specific discharge monitoring for: • Volume of water discharged per time period (e.g., ML/month) • Effluent concentrations for all chemicals identified in Step 1

1.4 Target pathways

Depending on the type of pesticide and level of supply chain traceability, companies must set a Pesticide Impact Reduction target and/or a Highly Hazardous Pesticides (HHP) Cessation target (see Figure 3). Producers and traders of PPPs and pesticides only need to set a Highly Hazardous Pesticides Cessation target, as current data availability does not allow for downstream impact quantification.

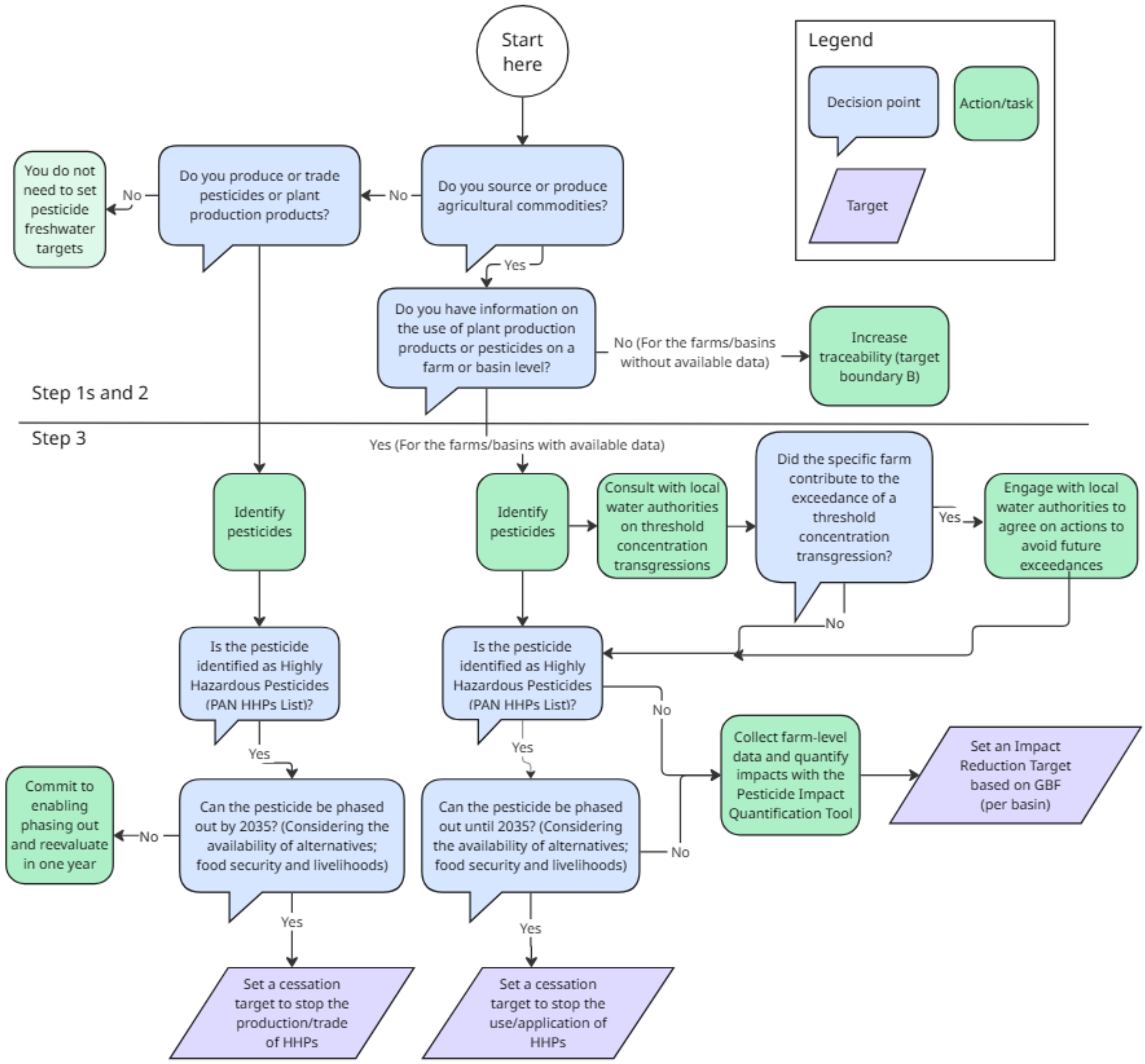


Figure 3: Decision tree outlining which targets to set for pesticides. For companies that source or produce agricultural commodities and therefore use pesticides in their value chain, and have data available on a farm/basin level (as determined in Steps 1 and 2), science-based targets for those farms/basins are applicable. Depending on whether pesticides are classified as highly hazardous or not, companies must set a cessation target for any Highly Hazardous Pesticides and/or collect further data to quantify the pesticide impact on a farm level (possible aggregation per basin) and set a Pesticide Impact Reduction Target for non-highly hazardous pesticides. In case a cessation is not possible, those pesticides need to be included in the Pesticide Impact Reduction Target. Additionally, local consultation complements this process.

2 Setting pesticide Freshwater targets

2.1 Data selection and baseline impact values

2.1.1 Pesticide identification

Companies *must* identify used and applied pesticides (i.e., which pesticides have been used in Plant Protection Product [PPP] formulations, stating their latest CAS registry number and common substance name).

As a reference, the **Pesticide Compendium** can be used to check or find CAS numbers and/or substance names.

When setting HHPs cessation targets, only identifying pesticides is sufficient. However, for pesticides not categorized as HHPs (see Section 2.2.1), companies also need to quantify their use to set Pesticide Impact Reduction Targets (see next section).

However, we recommend that companies quantify the impact of their HHP usage in order to schedule milestones toward meeting the full cessation target, prioritizing most impactful HHPs first. This further prioritization step could make use of nutrient pollution data and crop production density to approximate where hotspots of pesticide pollution might be relevant, based on likely co-pollution of nutrients and toxic chemicals where both chemical fertilizers and pesticides are used.

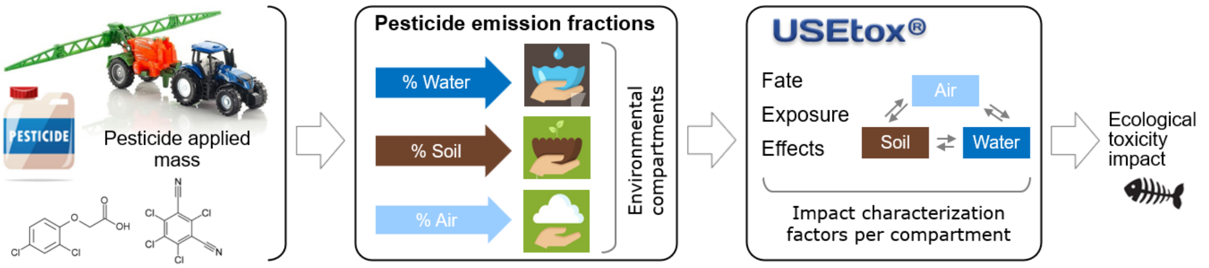
2.1.2 Local consultation on threshold exceedance

Companies that use pesticides in their direct operations and companies that source agricultural commodities directly from producers must contact local stakeholders (e.g., local basin authorities, water management agencies) and check for surface or groundwater threshold concentration exceedances of those pesticides during the time those pesticides were used (up to a maximum of three years). If the location and time can reasonably be expected to be influenced by the company's farm, companies must flag this exceedance.

Companies must provide a statement saying that they have informed themselves about the exceedance of local thresholds for pesticides, reporting whether there was an exceedance, and stating whether their farms likely contributed to the exceedance.

2.1.3 Pesticide impact quantification

For pesticides that are not classified as HHPs or cannot be phased out yet, companies *must* calculate pesticide-related environmental impacts. Two types of data are needed: (a) primary data provided by the farmer or pesticide user that describe the pesticide-use scenario and (b) for each pesticide-use scenario, secondary data on the respective emission and impact estimates that are derived from available models (e.g., USEtox). See Figure 4 for an overview of the data sources and calculations for quantifying ecological toxicity impact.



$$\frac{\text{mass applied}}{\text{area treated}} \times \sum_{\text{compartments}} \left(\frac{\text{emitted mass to compartment}}{\text{mass applied}} \times \frac{\text{impact}}{\text{emitted mass to compartment}} \right) = \frac{\text{impact}}{\text{area treated}}$$

Figure 4. Overview of required inputs and secondary data sources for quantifying impact and impact reduction performance associated with pesticide use in agriculture. Applied pesticide mass refers to pesticides input per area treated. USEtox translates pesticide application to loss pathways via emissions to air, water, and soil and applies impact factors to estimate respective ecotoxicity-related impacts on freshwater ecosystems.

SBTN has developed a Pesticide Impact Quantification Tool to help companies quantify the baseline impact of their pesticide use (see screenshot in Figure 5; the tool is not yet ready for full review). The UNEP/SETAC USEtox model (https://usetox.org/) described in Rosenbaum et al. (2008) underlies the Pesticide Impact Quantification Tool. It was chosen to inform the target for this version as it allows the quantification of toxic chemical impact and comparison between pesticides when combined with use and emission data, taking fate, exposure, and effects into account. The USEtox model was chosen as it is fully science-based, was developed in a global consensus-building process based on an extensive model comparison under the auspices of the UNEP/SETAC Life Cycle Initiative, and is widely used by industry and authorities for life cycle assessment, chemical footprinting, chemical substitution, and risk screening. It is freely available and already covers impact factors for several thousand chemicals, including many pesticides (Rosenbaum et al., 2008; Hauschild et al., 2008).

General information					
Example marketed plant protection product (PPP)		Solofol	Activus SC	Mimic	**Total**
└ Active ingredient name contained in the PPP		folpet (800g/kg)	pendimethalin (400g/L)	tebufenozide (240g/L)	
└ CAS registry number of active ingredient		133-07-3	40487-42-1	112410-23-8	
Treated crop or crop type (e.g. cereals)		vine/grape	maize	tomato	
Crop stage of treated crop (based on BBCH classification)		50 (flower buds)	13 (3 leaves unfolded)	70 (fruit development)	
Buffer zones around treated field(s)		no	no	no	
Pesticide application method		air blast sprayer	boom sprayer	knapsack sprayer	
Calculation steps					
--PESTICIDE FIELD MASS APPLIED--					
mass applied	(kg applied/ha)	0.32	1.6	0.18	-
number of treatments	(treatments/yr)	3	1	3	-
mass intensity	(kg applied/ha-yr)	0.96	1.6	0.54	-
treated area	(ha)	10	50	6	-
annual mass	(kg applied/yr)	9.6	80	3.24	-
--PESTICIDE IMPACT--					
freshwater ecotoxicity impact intensity	(CTU/ha-yr)	**5.3E+03**	**2.9E+03**	**8.8E+01**	**2.8E+03**
annual freshwater ecotoxicity impact	(CTU/yr)	**5.3E+04**	**1.5E+05**	**5.3E+02**	**2.0E+05**
--pesticide impact: contribution--					
freshwater ecotoxicity impact intensity	[%]	**64%**	**35%**	**1%**	100%
annual freshwater ecotoxicity impact	[%]	**27%**	**73%**	**0%**	100%

Figure 5. Pesticide Impact Quantification Tool based on USEtox. Example farm-level quantification using primary data (black) and results (blue and purple) using generic emission fractions from Nemecek et al. (2022) and USEtox impact characterization factors. The extended version can be found in the Annex.

Basic data requirements that companies must input include information on pesticide field application at the farm level:

- identification of applied pesticides from Section 2.1.1 (i.e., which pesticides have been used in plant protection product [PPP] formulations, stating their CAS registry number and common name);
- the cumulative amount used of each pesticide per hectare-year (across individual treatments); and
- the respective total annual area treated with each pesticide expressed in hectares.

The amount of a pesticide used, expressed in kg/ha-year, is either derived by directly reporting pesticide-level amount used per hectare and treatment multiplied by the number of treatments per year, or if not known, it is derived from the amount of PPP formulation applied per hectare and treatment multiplied by the weight fraction of each pesticide in the PPP multiplied by the number of treatments per year. Details on the pesticides used in a PPP can be derived from the product information.

For setting Pesticide Impact Reduction Targets, companies *must* quantify their pesticide impact baseline either on a farm-level or on a basin level by aggregating farm information. In case a company would like to set Pesticide Impact Reduction Targets on basin level, Hydrobasin Level 6 can be used as a default, or an appropriate local basin delineation can be used if it is at a smaller scale than Hydrobasin Level 6 and hydrologically relevant. This level is chosen as considerations concerning which pest control option to use usually happen on a farm level, and the emission of pesticides influences the water quality and therefore the freshwater ecotoxicity impacts on a local basin level. Moreover, local pesticide management regulations, programs, and assessments would be provided at this level.

To translate pressure into impact, we recommend that companies use site-specific emission fractions if available. To measure emissions, farmers can do drift experiments as described, e.g., in van de Zande et al. (2015). This means measuring at certain points outside the treated field the fraction of the applied pesticide that is reaching the surface areas via wind drift and deposition. Specific drift curve models are available in this and other studies (e.g., Holternan et al., 2018; Casanova et al., 2022) for different crops and application techniques (e.g., boom sprayer). Note that drift fractions should always be integrated over the deposition area to get the total mass fraction emitted to surfaces outside the treated field, as described in Zhang et al. (2024).

If site-specific emissions fractions or impact estimates are not available, companies must use the Pesticide Impact Quantification Tool, which uses generic emission and impact assessment models, including the PestLCI Consensus model provided by Nemecek et al., 2022 and impact characterization factors from USEtox (integrated into the Pesticide Impact Quantification Tool). See Box 1 for more details on the impact characterization factors.

For the tool to determine generic emission fractions, additional information is needed on

- crop type (e.g., cereals; field emission distribution depends on crop phenology),
- crop growth stage according to the BBCH classification provided by Meier (2001) (field emission distribution depends on soil coverage by crop as a function of crop growth),
- whether buffer zones are used around treated fields (yes/no), and
- application method (e.g., boom sprayer; emission distribution beyond the treated field depends on how pesticides are applied).

Information derived from both emission (PestLCI) and impact assessment (USEtox) models is fully science based. Both models build on a consistent mass balance, use mechanistic process descriptions, such as for modelling volatilization or run-off processes in USEtox, and adopt fully quantitative and measurable metrics. Individual processes and model components in these models build on a wide range of scientific approaches that have been evaluated against experimental data and other models.

Alternatively, companies may use local data and models. If more local data or spatial models are used, companies must ensure they are able to evaluate the company's direct influence on aquatic ecosystems, integrating fate, exposure, and ecotoxicological effects across varying pesticides. This information equips companies with information to prioritize the most important pesticides for reduction. Companies must provide their pesticide use and emission data and use the local data and models to derive impact-level metrics for aquatic ecotoxicity. Moreover, companies need to justify why the selected model or approach is more relevant or applicable for a given context.

Ecotoxicity impact characterization factors

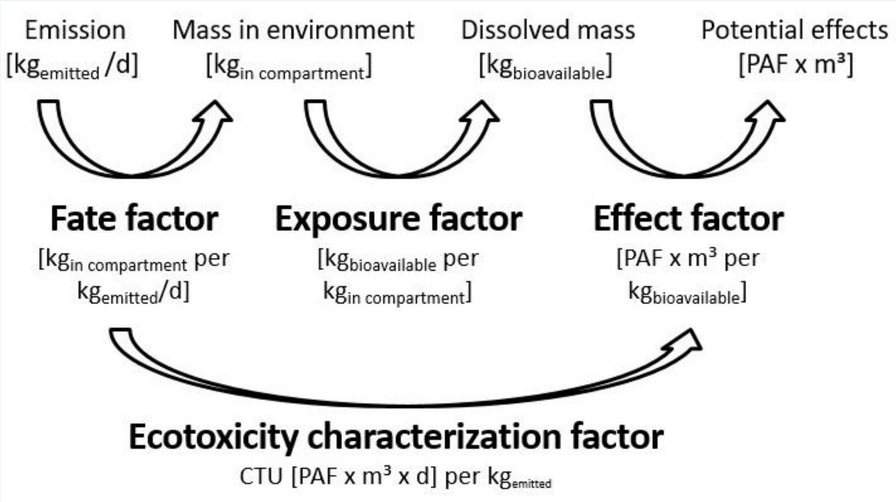


Figure 6: Factors applied to translate emitted mass into potentially disappeared fractions (PDF) of freshwater species, integrated over space and time.

Impact characterization factors derived with the USEtox model translate for each pesticide a unit mass emitted into a specific environmental compartment (e.g., agricultural soil) into a potential impact on freshwater ecosystems, based on combining three main elements (see Figure 6):

(a) Fate factor: represents the time-integrated mass of a pesticide in an environmental compartment (e.g., freshwater) per mass emitted of that pesticide over a year into a source compartment (e.g., agricultural soil). Once the pesticide reaches the freshwater as an emission, the fate factor in freshwater hence represents the residence time of the pesticide in that compartment. The fate factors used in the Pesticide Impact Quantification Tool are specified for a subcontinental level.

(b) Exposure factor: represents the bioavailable (i.e., dissolved) mass fraction of a pesticide in an environmental compartment, i.e., the ratio of bioavailable mass and the total pesticide mass in that compartment.

(c) Effect factor: is derived from a species sensitivity distribution (SSD) curve with the potentially affected fraction (PAF) of freshwater species on the y-axis reflecting the response to an exposure concentration in freshwater on the x-axis.

In simpler words, USEtox combines factors for environmental persistence (fate), exposure (contact between chemicals and organisms), and toxicity (effect potency) for freshwater ecosystems into characterization factors by multiplication. The final unit allows for quantitative comparison across pesticides, compartments, and scenarios; hence, USEtox proposes to define “PAF m³ d” as Comparative Toxic Unit (CTU), which indicates the comparative character of this unit.

Box 1. Explanation of impact characterization factors derived with the USEtox model.

The pesticide-use scenario information is used by the Pesticide Impact Quantification Tool to select the correct emission fractions (where local measurements are not available) and impact characterization factors, which depend on the various aspects (e.g., emission distributions depend on the crop, and impact characterization factors depend on the pesticide). Applied dose per pesticide is then multiplied by the emission fractions per emission compartment and further multiplied by compartment-specific impact characterization factors, and summed over resulting factors across compartments to derive a pesticide-specific impact per hectare. While per-hectare impacts cannot be summed across pesticides, an arithmetic mean can be derived to indicate average impact per hectare. Multiplying pesticide-specific results by the respective hectares treated annually per pesticide yields overall annual impact per pesticide, and summed over pesticides used in a given farm or region yields annual impact per farm or region.

Results can be used to compare different pesticides, different farms (when aggregating impacts across pesticides used per farm), and different basins (when aggregating impacts across pesticides used per basin) in terms of their potential ecotoxicity impacts due to pesticide use.

As a result of this exercise, companies should have an overview of annual pesticide freshwater ecotoxicity impacts (in CTU over a given year) either per farm or aggregated per basin.

If pesticides are not available in the Pesticide Impact Quantification Tool, please report the pesticide name and CAS number back to SBTN.

2.2 Highly Hazardous Pesticides cessation targets

2.2.1 TARGET RATIONALE AND APPROACH

The HHPs cessation target supports the execution of Target A7 of the Global Chemical Framework:

> *"By 2035, stakeholders have taken effective measures to phase out highly hazardous pesticides in agriculture where the risks have not been managed and where safer and affordable alternatives are available, and to promote transition to and make available those alternatives."*

Companies *must* check their pesticides against national or regional lists of highly hazardous substances (or "substances of very high concern") and pesticides not authorized for use in certain regions, and pesticides currently listed as candidates to be labelled as highly hazardous.

Example sources are:

- The EU Pesticide Database (providing information on the approval status for the authorized use of pesticides in the European Union). Note that the registration of each pesticide for application to one or more agricultural crops relies on the competent authority of each EU Member State. Hence, pesticides that are authorized in the EU might not be registered and effectively used in some or most EU countries.
- The Candidate List of substances of very high concern (SVHC) for authorization in the European Union
- The Japanese list of Priority Assessment Chemical Substances
- The Candidate Chemicals proposed for listing under the *Stockholm Convention on Persistent Organic Pollutants*, including e.g., chlorpyrifos, or the *Rotterdam Convention on hazardous chemicals and pesticides in international trade*

Which pesticides are classified as highly hazardous might vary depending on the region and jurisdiction.

If any additional pesticides used by farmers or suppliers are listed on the *PAN HHPs list*, we *recommend* that companies also set a HHPs cessation target for these pesticides.

In case of contradicting sources, SBTN advises using the more conservative list. Further information on HHPs can be found in Box 2.

Highly Hazardous Pesticides (HHPs)

In 2014, the FAO and WHO published the fourth version of the International Code of Conduct on Pesticide Management. Therein, HHPs are defined as

> *Pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or environment according to internationally accepted classification systems such as WHO or GHS or their listing in relevant binding international agreements or conventions. In addition, pesticides that appear to cause severe or irreversible harm to health or the environment under conditions of use in a country may be considered to be and treated as highly hazardous.*

The FAO/WHO Guidelines on Highly Hazardous Pesticides (2016) define eight criteria, which cover pesticides that meet specific criteria by the WHO Recommended Classification, the Globally Harmonized System (GHS) of Classification and Labelling of Chemicals, or are listed in international conventions (Stockholm Convention, Rotterdam Convention, and Montreal Protocol). However, Criterion 8, pesticides with a high incidence of adverse effects, is dependent on the interpretation and assessment of local authorities.

The PAN HHPs List contains Highly Hazardous Pesticides as defined by international bodies (WHO), the European Union (EU Commission), national agencies (USA EPA, NITE Japan), and the Pesticide Property Database, building upon the FAO/WHO criteria.

Box 2. Information on Highly Hazardous Pesticides.

2.2.2 HIGHLY HAZARDOUS PESTICIDES CESSATION TARGET

For the pesticides identified as highly hazardous, companies *must* set a target to stop their usage and application.

When phasing out HHPs, companies should pay attention to avoid burden shifting and assess the impacts of alternatives (e.g., biological or mechanical pest control options or substitution through less hazardous chemical substances), including beyond freshwater ecotoxicity impacts (e.g., possibly increased land footprint).

If, after assessing alternatives, companies conclude that no safer alternatives are available, and food security and the livelihoods of farmers would be endangered, they need to provide a justification for continued use to SBTN and indicate commitment to enabling a phase out. Moreover, companies need to reevaluate the cessation after one year. When implementing the cessation target, it is *recommended* that companies partner with and support farmers in their transition toward more sustainable agricultural practices to avoid trade-offs with food security and local livelihoods (see Section B, GBF, 2025).

> *"**Taking into account food security and livelihoods** – Nutrients and pesticides are important inputs in many agricultural systems. Any actions to reduce the impacts of pollution from these sources should consider possible impacts on food security and livelihoods. Actions towards this target should be a part of wider sustainable agriculture and food systems transitions; include safeguards to achieve food security; and should not compete with priorities of farmers and those*

> *who rely on agri-food systems for their livelihoods, including small-holders, and indigenous peoples and local communities."*

If cessation is not possible or a longer timeframe than 2035 is expected to be needed to phase out HHPs, companies directly producing or procuring agricultural commodities should commit to ensuring the following as minimum first steps for ACT (Step 4):

- Only use the recommended dose as a maximum (minimum dose to be effective against the pest[s])
- Only spray/treat the area needed (e.g., infected area for curative control)

Moreover, HHPs that cannot be phased out or substituted must be included in the Pesticide Impact Reduction Target.

Further resources on best practices can be found in the Annex.

Target language

"By 2030, [Company X] will stop the usage and application of half of its Highly Hazardous Pesticides and stop the usage and application of all by 2035."
OR
"By 2030, [Company X] will stop the production/trade of half of its Highly Hazardous Pesticides and stop the production/trade of all by 2035."

2.3 Pesticide Impact Reduction targets

2.3.1 TARGET RATIONALE AND APPROACH

The Pesticide Impact Reduction target enables companies to prioritize the phase-out, reduction, or substitution of pesticides based on their freshwater ecotoxicity impact and aims to reduce impact levels to 50% of the impact baseline following Target 7b (Reduce Pollution to Levels That Are Not Harmful to Biodiversity) of the Global Biodiversity Framework (GBF):

> *"Reduce pollution risks and the negative impact of pollution from all sources by 2030, to levels that are not harmful to biodiversity and ecosystem functions and services, considering cumulative effects, including: (a) by reducing excess nutrients lost to the environment by at least half, including through more efficient nutrient cycling and use;* ***(b) by reducing the overall risk from pesticides and highly hazardous chemicals by at least half, including through integrated pest management, based on science, taking into account food security and livelihoods****; and (c) by preventing, reducing, and working towards eliminating plastic pollution."*

Currently, this guidance asks companies to set a 50% impact reduction target based on the Global Biodiversity target. While ideally local impact reduction targets would be used as benchmarks for percentage impact reduction, the current maturity of approaches and data availability prohibit the feasibility of this approach for companies (for further details, see Annex).

If the exceedance of local thresholds with likely contribution of a company's farms was identified through the local consultation in Section 2.1.2, companies must engage with local authorities to agree on actions to avoid future exceedances, accounting for the estimated farm-specific contributions. Companies *must* proceed with setting impact reduction targets in addition to the local commitments.

As minimum first steps for ACT (Step 4), companies should commit to ensuring the following:

- Only use the recommended dose as the maximum (minimum dose to be effective against the pest[s])
- Only spray/treat the area needed (e.g., infected area for curative control)

2.3.2 IMPACT REDUCTION TARGETS BASED ON THE PESTICIDE IMPACT QUANTIFICATION TOOL

The Pesticide Impact Reduction Tool based on USEtox can be used to evaluate the baseline scenario against one or more alternative scenarios and calculate the relative overall impact change for each alternative scenario as compared to the baseline (see Figure 7). Moreover, the Tool can be used to identify top contributing pesticides in terms of overall farm- or basin-level impact that should be prioritized for phase out, reduction, or substitution.

General information		BASELINE SCENARIO				ALTERNATIVE SCENARIO					Reduction
Example marketed plant protection product (PPP)		Solofol	Activus SC	Mimic	**Total**	Activus SC	Mimic	Product xxx	Product yyy	**Total**	
└ Active ingredient name contained in the PPP		folpet (80%)	pendimethalin (40%	tebufenozide (240%)		pendimethalin (400g/	ebufenozide (240g/L	pesticide xxx	pesticide yyy		
└ CAS registry number of active ingredient		133-07-3	40487-42-1	112410-23-8		40487-42-1	112410-23-8				
Treated crop or crop type (e.g. cereals)		vine/grape	maize	tomato		maize	tomato				
Crop stage of treated crop (based on BBCH classification)		50 (flower buds)	13 (3 leaves unfold)	70 (fruit developing)		13 (3 leaves unfold)	70 (fruit developing)				
Buffer zones around treated field(s)		no	no	no		no	no				
Pesticide application method		air blast sprayer	boom sprayer	knapsack sprayer		boom sprayer	knapsack sprayer				
Calculation steps											
--PESTICIDE FIELD MASS APPLIED--											
mass applied	(kg applied/ha)	0.32	1.6	0.18	-	1.6	0.18	1	1	-	
number of treatments	(treatments/yr)	3	1	3	-	1	3	1	4	-	
mass intensity	(kg applied/ha-yr)	0.96	1.6	0.54	-	1.6	0.54	1	4	-	
treated area	(ha)	10	50	6	-	50	25	20	10	-	
annual mass	(kg applied/yr)	9.6	80	3.24	-	80	13.5	20	40	-	
--PESTICIDE IMPACT--											
freshwater ecotoxicity impact intensity	(CTU/ha-yr)	**5.3E+03**	**2.9E+03**	**8.8E+01**	**2.8E+03**	**2.9E+03**	**2.8E+02**	**5.7E+01**	**5.6E+02**	**9.5E+02**	**66%**
annual freshwater ecotoxicity impact	(CTU/yr)	**5.3E+04**	**1.5E+05**	**5.3E+02**	**2.0E+05**	**1.5E+05**	**7.0E+03**	**1.1E+03**	**5.6E+03**	**1.6E+05**	**20%**
--pesticide impact: contribution--											
freshwater ecotoxicity impact intensity	[%]	**64%**	**35%**	**1%**	100%	**77%**	**7%**	**1%**	**15%**	100%	
annual freshwater ecotoxicity impact	[%]	**27%**	**73%**	**0%**	100%	**91%**	**4%**	**1%**	**3%**	100%	

Figure 7: Pesticide Impact Reduction Tool based on USEtox, comparing the baseline with an alternative scenario of farm-level pesticide use. The calculated relative impact reduction in relation to the baseline scenario can be found on the far right of the figure. Note that even though this example shows the pesticide substitution with lower-impact pesticides, SBTN encourages finding biological or mechanical pest management options (see Annex).

The impact reduction target can be met by removing (e.g., phasing out), reducing (e.g., lowering doses or applying fewer treatments per crop cycle), or replacing (e.g., substituting with an alternative, less toxic pesticide or pest control option) certain pesticides at the farm or basin level. The impact reduction is calculated as the difference in overall annual impact at the farm or basin level, respectively, before (i.e., baseline scenario) and after removing, reducing, and/or replacing one or more pesticides (i.e., alternative scenario):

$$\%\ \text{impact reduction} = \left(1 - \frac{\text{impact}_{\text{alternative scenario}}}{\text{impact}_{\text{baseline scenario}}}\right) \times 100.$$

Note that due to different emissions, persistence, and effect potencies across pesticides, reducing an equal x% applied mass of two distinct pesticides will usually not lead to an equal y% reduced impact.

The 50% reduction ambition from Target 7 of the Global Biodiversity Framework should be used as a default reduction target. However, companies are encouraged to set more ambitious reduction targets. Progress on the Impact Reduction target will be counted toward future targets in the case of guidance revisions (e.g., to provide a target-setting pathway with local data and models).

Target language

"[Company X] will reduce its impact from the usage of pesticides by 50% compared to a [date] baseline in [Basin Y] and ensure that its pesticide usage does not contribute to local threshold transgressions, within five years of the target-setting date."

3 Setting point source discharge targets

3.1 Rationale/Pathways

The rationale for setting science-based targets for point source discharges of toxics can be summarized as follows:

In the absence of site-specific information showing that greater levels of pollutant discharge will not be harmful to nature and human health, companies will restrict the toxic pollutant concentrations in their effluents to threshold levels consistent with acceptable ecosystem impacts.

This approach, which requires that water quality thresholds be met in the discharge itself (i.e., before consideration of dilution by the receiving water), represents a simplification of the DPSIR framework shown above, as seen in Figure PS1.

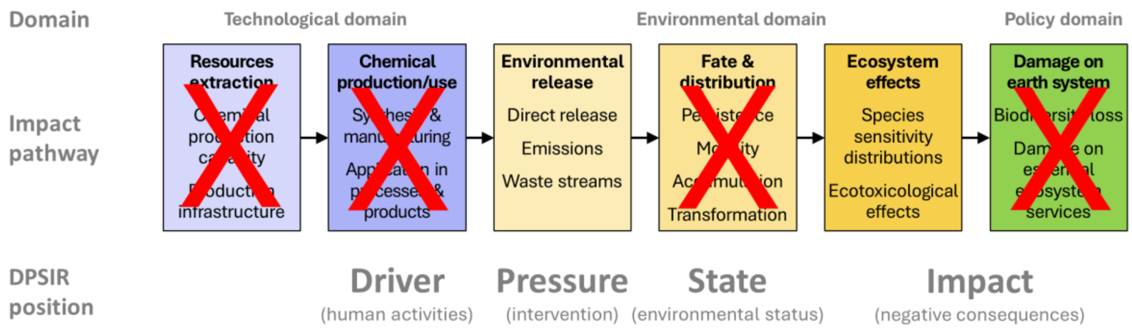


Figure PS1. Simplified impact pathway elements for setting targets for point sources of toxics.

Like water quality targets for nutrients, targets for point source discharges of toxics focus on the pressure of environmental release by specifying the maximum amount of pollutant that can be discharged. The requirement that water quality thresholds be met within the discharge itself allows the Fate & distribution step to be ignored.

The resulting target load can therefore be calculated by multiplying the discharge flow by the threshold chemical concentration that causes acceptable ecosystem impacts.

3.2 Decision tree

The decision tree for target setting for point source discharges is provided in Figure PS2. The first step in the decision process is the determination of whether limits on point source toxic chemical discharges have been set by the local basin management authority. If so, these limits must be directly incorporated into Section 3.3, using the local data for the concentration threshold, as long as it can be demonstrated that the limits explicitly consider the protection of nature in their development.

The second step of the decision tree considers the feasibility of target attainment. The approach provided here is designed to allow companies to begin setting targets for their point source discharges in the absence of detailed site-specific data on pollutant fate and transport. This simplified approach requires the use of the protective assumption that dilution of the discharge by the receiving water is not considered in the target-setting process and may, in some cases, result in inappropriate or infeasible targets. If companies determine that it is not feasible to meet water quality thresholds within their discharge, they may set targets using an external framework or defer target setting.

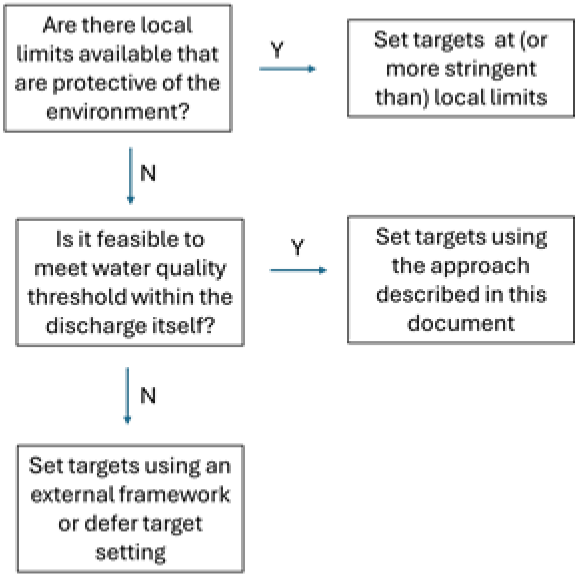


Figure PS2. Decision tree for target setting for point source discharges.

3.3 Target setting

The Rationale section provided the general target-setting equation for point source discharges. The exact equation with units is:

> Target (maximum allowable kg/month) =
> Discharge flow (ML/month) x threshold chemical concentration (ug/l) x 1000
> where 1000 is a unit conversion factor.

This equation requires two inputs: 1) the company's discharge flow, and 2) the threshold chemical concentration that causes acceptable ecosystem impacts. Companies must provide primary data on their discharge flow, leaving specification of the threshold concentration as the only remaining input.

3.3.1 CONCENTRATION THRESHOLDS

When there are local limits on chemical concentrations, companies must use those in the equation above.

Otherwise, alternative resources may be consulted. The specification of concentration thresholds for ecosystem health is a challenging topic discussed in detail in the UN Environment (2017) series of reports, "A Framework for Freshwater Ecosystem Management." As they note, rigorous specification of concentration thresholds considers:

- Classifying freshwater ecosystems using ecoregion delineation to identify the differences in characteristics and services they provide to society
- Defining ecological status classes

Concentration standards established and enforced by sovereign state authorities or by intergovernmental bodies or through international conventions to be observed within their respective jurisdictions must be used whenever they are available. Several resources are available that provide country-specific water quality standards that consider ecosystem health for Asia, Australia/New Zealand, Brazil, Canada, the European Union, South Africa, and the United States.

3.3.2 TIMESTEP FOR POINT SOURCE TARGETS

Companies should use monthly time periods for their point source toxics targets. Companies may use annual targets for reporting convenience only if the annual target is set at the lowest of the individual target levels. Table PS1 below provides an example for benzene, where the concentration threshold was set at the provisional level of 10 ug/l. Monthly targets are calculated by multiplying each month's flow times the concentration threshold (and the unit conversion factor of 1000). The company could set its targets using the monthly values or set an annual target using the lowest monthly target value of 60,000 kg/month.

Table PS1. Example monthly targets calculated using baseline monthly flows and a provisional concentration target of 10 ug/l.

Month	Discharge flow (ML/month)	Concentration threshold (ug/l)	Monthly target (kg/month)
January	9	10	90,000
February	8	10	80,000
March	6	10	60,000
April	7	10	70,000
May	10	10	100,000
June	8	10	80,000
July	7	10	70,000
August	8	10	80,000
September	7	10	70,000
October	11	10	110,000
November	8	10	80,000
December	7	10	70,000

3.3.3 TARGET LANGUAGE

"Company X will reduce its discharge of _____ in the ______ basin to ______ kg/month for each of the following months, within five years of the target-setting date."

4 Glossary

Toxic chemicals: Substances or mixtures of substances that present acute or chronic hazards to human health, animals, or the environment.

DPSIR: The DPSIR framework describes the relationships between the origins and consequences of environmental problems, where social and economic developments as **D**riving forces exert **P**ressure on the environment and, as a consequence, the **S**tate of the environment changes, such as the provision of adequate conditions for health, resources availability, and biodiversity. Finally, this leads to **I**mpacts on human health, ecosystems and materials that may elicit a societal **R**esponse (Source: adapted from EEA, 1999).

Impact: Impact indicators describe negative consequences on the social and economic functions of the environment, such as the provision of adequate conditions for health, resources availability, and biodiversity (Source: adapted from EEA, 1999).

Pressure: Pressure indicators describe developments in release of substances (emissions), physical and biological agents, the use of resources and the use of land (Source: adapted from EEA, 1999).

State: State indicators describe the quantity and quality of physical phenomena (such as temperature), biological phenomena (such as fish stocks) and chemical phenomena (such as atmospheric CO_2 concentrations) in a certain area (Source: adapted from EEA, 1999).

Highly Hazardous Pesticides: "Pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or environment according to internationally accepted classification systems such as WHO or GHS or their listing in relevant binding international agreements or conventions. In addition, pesticides that appear to cause severe or irreversible harm to health or the environment under conditions of use in a country may be considered to be and treated as highly hazardous" (Source: FAO, 2014).

Active ingredient: Chemical or biological pesticide referred to as "the part of the product that provides the pesticidal action," with the product referring to a commercial plant protection product formulation. (Source: adapted from FAO, 2014)

Pesticide: "Chemical or biological ingredient intended for repelling, destroying or controlling any pest, or regulating plant growth" that is contained in a commercial plant protection product formulation (Source: adapted from FAO, 2014).

Plant protection product (or pesticide product): Commercial "formulated product (pesticide active ingredient(s) and co-formulants), in the form in which it is packaged and sold" (Source: adapted from FAO, 2014).

Direct Point Source Discharge: A single identifiable source (such as a pipe) from which pollutants are discharged to surface water.

Recommended dose: The recommended dose for pesticide application refers to the minimum effective dose. Further criteria can be found in EPPO, 2012.

Food security: Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Source: World Food Summit, 1996 in WBG, 2025).

5 Abbreviations

PPP: Plant Protection Product
DPSIR: Driver, Pressure, State, Impact, Response
PAF: Potentially Affected Fraction of Species
GBF: Global Biodiversity Framework
HHPs: Highly Hazardous Pesticides

6 Annex

6.1 Toxic chemical impact pathway

The impact pathway for chemical pollution starts in the technological domain, where natural resources are extracted and used to synthesize and manufacture chemicals. Specifically with respect to pesticides, crude oil is the main feedstock for organic pesticides and metal ore is an additional feedstock for metal-containing pesticides (e.g., certain metal-based fungicides). Pesticides are then included into plant protection product (PPP) formulations, usually along with other adjuvants and co-formulants to, e.g., enhance the uptake into target crops. Within the DPSIR framework, these elements are denoted as **Driver**, i.e., human activities associated with chemical pollution.

As emissions along industrial production processes, direct environmental releases, or applications of formulations, materials, or products, chemicals may eventually find their way out of the technological domain into the environmental domain. This element indicates an environmental intervention and is denoted as **Pressure** within the DPSIR framework. Pesticides (as part of applying PPPs in the context of agricultural or other types of pest control) are usually directly applied by farmers or other actors onto field crops, constituting a direct release into the environment, as compared to most other chemicals used in industrial applications or embedded in consumer products that mostly find their way into the environment through emissions.

Once chemicals find their way into the environment, this leads to changes in environmental concentrations in different media (e.g., air, water, soil). Within the DPSIR framework, this is denoted as environmental **State**. For pesticides and other chemicals, the fraction of environmental concentrations that may reach humans (e.g., via ingesting pesticide residues in food crops treated with pesticides) or ecosystems (e.g., via the dissolved fraction of chemicals reaching water bodies that can be taken up by aquatic organisms) is relevant and may lead to potential negative effects on humans or organisms, due to the designed toxic mode of action of chemical pesticides.

Upon contact with chemicals, humans on the one hand and organisms as part of ecosystems on the other hand may face negative consequences in the form of toxicological and ecotoxicological effects, respectively, that can range from cancer via reproductive and developmental effects to mortality. Within the DPSIR framework, this element can be seen as a proxy of **Impact**, since it focuses on the level of specific health effects for humans or on individual organisms for ecosystems, and not yet on the level of overall population lifetime loss or entire ecosystem damage.

Translating human toxicological and ecotoxicological effects at the level of individual organisms to damage on different indications of human population lifetime loss and biodiversity loss, respectively, allows for linking chemical pollution to negative consequences on viable elements that need to be protected to continuously sustain humans across generations. Human toxicological effects can be translated into direct effects on the human population over a lifetime, while ecotoxicological effects on ecosystems can be linked to human wellbeing indirectly via affecting the benefits that ecosystems provide for human society. These ecosystem-level effects range from genetic and species diversity loss to the loss of functional diversity and ecosystem services, such as pollination and food production. Such effects are hence denoted as actual **Impact** within the DPSIR framework.

6.2 Pesticide Impact Quantification Tool based on USEtox

General information						Total	Data source (*example for folpet)
Example marketed plant protection product (PPP)			Solofol	Activus SC	Mimic		For illustration; not relevant for impact calculations
└ Active ingredient name contained in the PPP			folpet (800g/kg)	pendimethalin (400g/L)	tebufenozide (240g/L)		Provided by farmer; PPP content only needed when starting from PPP amount used
└ CAS registry number of active ingredient			133-07-3	40487-42-1	112410-23-8		
Treated crop or crop type (e.g. cereals)			vine/grape	maize	tomato		Provided by farmer
Crop stage of treated crop (based on BBCH classification)			50 (flower buds)	13 (3 leaves unfolded)	70 (fruit development)		
Buffer zones around treated field(s)			no	no	no		
Pesticide application method			air blast sprayer	boom sprayer	knapsack sprayer		Provided by farmer; only relevant for own drift functions
Calculation steps							
--PESTICIDE FIELD MASS APPLIED--							
mass applied		(kg applied/ha-treatment)	0.32	1.6	0.18	-	Provided by farmer (based on national regulations & product label instructions)
number of treatments		(treatments/yr)	3	1	3	-	
mass intensity		(kg applied/ha-yr)	0.96	1.6	0.54	-	-
treated area		(ha)	10	50	6	-	Provided by farmer
annual mass		(kg applied/yr)	9.6	80	3.24	-	-
--PESTICIDE IMPACT--							
--pesticide impact: emissions--							
emission fractions	field crop surface	(kg emitted/kg applied)	0.40	0.22	0.62	-	Provided by farmer, else from Nemecek et al. 2022, Excel, sheet "NoBufferRes"*, B31:E31* (scenario found in sheet "ScenarioID", A31*)
	air	(kg emitted/kg applied)	0.15	0.1	0.1	-	
	field soil surface	(kg emitted/kg applied)	0.40	0.67	0.27	-	
	off-field surfaces	(kg emitted/kg applied)	0.048	0.011	0.015	-	
off-field area fractions	agricultural soil	(m^2/m^2)	0.4	0.4	0.4	-	Provided by farmer or regional land use statistics, else from Nemecek et al. 2022, Excel, sheet "Params", A3:A5
	natural soil	(m^2/m^2)	0.58	0.58	0.58	-	
	freshwater	(m^2/m^2)	0.02	0.02	0.02	-	
emission intensity	crop	(kg emitted/ha-yr)	0.385	0.356	0.335	-	-
	air	(kg emitted/ha-yr)	0.144	0.160	0.054	-	-
	agricultural soil	(kg emitted/ha-yr)	0.403	1.067	0.143	-	-
	natural soil	(kg emitted/ha-yr)	0.027	0.010	0.005	-	-
	freshwater	(kg emitted/ha-yr)	0.001	0.0003	0.0002	-	-
annual emissions	crop	(kg emitted/yr)	3.8	17.8	2.0	-	-
	air	(kg emitted/yr)	1.4	8	0.324	-	-
	agricultural soil	(kg emitted/yr)	4.0	53.4	0.9	-	-
	natural soil	(kg emitted/yr)	0.27	0.49	0.03	-	-
	freshwater	(kg emitted/yr)	0.009	0.017	0.001	-	-
--pesticide impact: (eco-)toxicity impacts--							
freshwater ecotoxicity impact factors	cont. rural air	(PDF m^3 d/kg emitted)	9.7E+03	1.2E+03	5.1E+02	-	Derived from USEtox (after free registration), within ZIP archive, "Results" folder, USEtox_results_organics.xlsx, sheet "Ecotox CF", O135:S135*
	cont. agr. soil	(PDF m^3 d/kg emitted)	1.7E+03	1.1E+03	8.6E+01	-	
	cont. nat. soil	(PDF m^3 d/kg emitted)	1.7E+03	1.1E+03	8.6E+01	-	
	cont. freshwater	(PDF m^3 d/kg emitted)	5.6E+05	2.3E+05	2.3E+04	-	
freshwater ecotoxicity impact intensity		(PDF m^3 d/ha-yr)	2.6E+03	1.5E+03	4.4E+01	1.4E+03	Note: total = average of per-ha impact across pesticides
annual freshwater ecotoxicity impact		(PDF m^3 d/yr)	2.6E+04	7.3E+04	2.6E+02	1.0E+05	Note: total = sum of impact across pesticides
--pesticide impact: contribution--							
freshwater ecotoxicity impact intensity		[%]	64%	35%	1%	100%	-
annual freshwater ecotoxicity impact		[%]	27%	73%	0%	100%	-

Figure A1. Pesticide Impact Quantification Tool based on USEtox extended view, including emission fractions and ecotoxicity impact characterization factors. Example farm-level quantification using primary data (black) and results (blue and purple) using generic emission fractions from Nemecek et al., 2022 and USEtox impact characterization factors.

6.3 Use of local information, thresholds, and future directions

Local concentrations, thresholds, and assessment factors

Beyond checking for threshold exceedances, this guidance does not require the reporting of measured concentrations, as not every pesticide used at a farm might be monitored by local authorities, and data might be scarce (Weissner et al., 2022). Moreover, thresholds might fall below analytical detection limits (Bub et al., 2025). Given the high temporal and spatial differences in pesticide concentrations and the challenges with attributing pesticide concentration to potentially more than one farm, the following steps focus on estimating a farm-specific impact to allow for direct influence possibilities.

Quantifying pesticide-related impacts based on combining emissions, fate, exposure, and effect information is crucial for informing percentage impact reduction and, therefore, prioritizing the reduction of the use of pesticides that drive impacts on aquatic ecosystems. At the local level (e.g., at the level of individual water basins or regions), however, the information often available is environmental pesticide concentrations. This information—per pesticide—can already be used to compare actual environmental pesticide levels expressed as predicted (or measured) environmental concentration (PEC) against agreed "acceptable risk" (i.e., so-called "safe") levels expressed as predicted no-effect concentration (PNEC).

Ecotoxicity thresholds, like PNECs for single pesticides, are derived by experiments (in vivo) or approximated through bioassays (in vitro) or modeling (in silico) (Bub et al, 2025). Often, PNECs are divided by additional assessment factors to account for differences in effects, species sensitivity, mode of action, and potentially other aspects—these factors differ based on data quality for each effect test result and can range from a factor of 3 to a factor of >1000, hence introducing imbalances across chemicals, while aiming to ensure that for each chemical the reference concentration is conservative and with that protective enough (see details, e.g., here). Alternatively, in certain jurisdictions, like in the European Union, precautionary water quality standards are set for every pesticide (0.1 µg/L for groundwater). Optimally, these thresholds should be specified in line with locally relevant species and ecosystems; however, often single indicator species are used for tests.

Where a PNEC is based directly on an effect test for a given species, a simple PEC/PNEC ratio informs about whether a pesticide concentration is considered "safe" for a specific species (i.e., PEC/PNEC < 1), and where PNECs are aggregated into a species sensitivity distribution (SSD) to derive, e.g., a hazard concentration, HC5, where 5% of considered species are above their PNEC (or underlying no-effect concentration, NOEC), the PEC/HC5 ratio informs about whether a pesticide concentration is considered "safe" across considered species. While such ratios inform about which pesticide concentrations are considered below or above "acceptable risk" levels, informing a percentage reduction of impact across pesticides cannot be informed by such ratios (unless all pesticides are equally reduced), mainly due to the use of assessment factors that may differ by pesticide and effect test.

How the impact reduction percentage would ideally be set

Calculating a baseline impact of pesticides would require going beyond PEC/PNEC ratios and aggregating the impact across pesticides (e.g., by using metrics such as the multi-substance potentially affected fraction of species, msPAF [Posthuma et al., 2019]). Moreover, defining a local target for overall pesticide-related impact reduction and determining a company's part in achieving this target demands further steps. To derive local targets as benchmarks for percentage impact reduction, the following steps would be needed:

(1) The impact capacity (i.e., the capacity within which no adverse and irreversible damage on an ecosystem would occur) with respect to all chemical inputs in the given local area (e.g., a water catchment) needs to be quantified—including both direct emissions into the considered area as well as down-the-drain contributions in the given area from upstream emissions into other areas, and including both pesticide and industrial chemical inputs from various human activities.

(2) The share of the impact capacity that can be allocated to a given set of pesticides (e.g., associated with pesticide use on a given farm) in the given local area needs to be determined, requiring the application of some sharing principles to fairly distribute the impact capacity among all contributing actors.

(3) The impact of the contributing set of pesticides (e.g., from their use on a given farm) needs to be quantified and compared to the respective impact capacity for the affected local area. Where the impact exceeds the local impact capacity, a percentage reduction is needed until the carrying capacity level is reached.

While such pathways for determining and measuring reduction progress against local reduction targets are currently on their way (e.g., based on absolute environmental sustainability assessment, see Kosnik et al., 2022), current approaches are not mature enough, and data are currently largely missing to assess local target setting. We aim to include this in future versions once further research and data are available. In order to guide companies and farmers toward meaningful impact in the meantime, the 50% target based on the Global Biodiversity Framework focuses on phasing out high-impact pesticides and avoiding burden-shifting.

6.4 Step 4: Resources for reducing pesticide impact and dependence

Companies and farmers can consult the following sources for further guidance on how to reduce pesticide risks and their pesticide dependence and move toward more sustainable agricultural practices:

- International Code of Conduct on Pesticide Management and revisions of the Code of Conduct
- Guidelines on Alternatives to Highly Hazardous Pesticides
- FAO Good Agricultural Practices
- Guidance on integrated pest management for the world's major crop pests and diseases
- FAO and WHO Guidance on options for reducing risk when phasing out pesticides
- Synthesis Report on the Environmental and Health Impacts of Pesticides and Fertilizers and Ways to Minimize Them: Envisioning a Chemical-safe World (2022)
- *Alternatives databases, e.g., https://bioprotectionportal.com/*
- Smallholder-oriented Data Governance Principles

SCIENCE BASED TARGETS NETWORK
GLOBAL COMMONS ALLIANCE