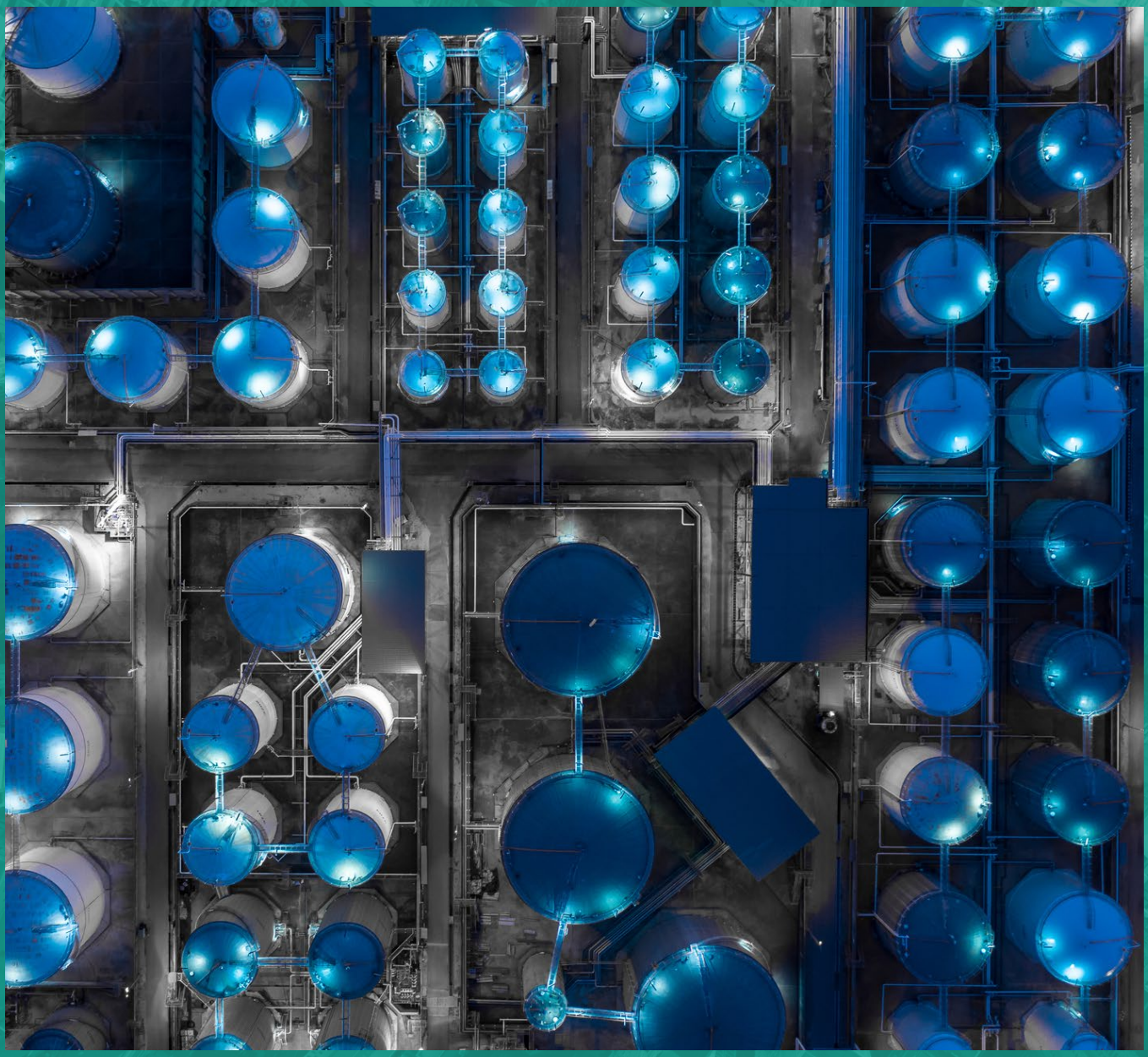


Additional sector guidance
Chemicals

June 2024
Version 1.0

SICS® industry:
Chemicals (RT-CH)

tnfd.global

Taskforce on Nature-related Financial Disclosures

Contents

1. Introduction

1.1. The purpose of this guidance

In September 2023, the TNFD published its recommendations for disclosure of nature-related issues and supporting implementation guidance. This document provides sector-specific additional guidance for the chemicals sector, covering:

- The assessment of nature-related issues using the TNFD's LEAP approach (Section 2); and
- The disclosure of sector-specific metrics in line with the TNFD's recommended approach to metrics (Section 3).

The TNFD's Guidance on the identification and assessment of nature-related issues: The LEAP approach is designed as an iterative process – across business locations and business lines – in line with established risk management processes and corporate reporting cycles. Organisations may choose to start with a narrow scope for a LEAP assessment, and gradually expand the scope of the assessment as they gain experience and insight.

The TNFD recognises that there can be significant differences across sectors for corporates applying the LEAP approach. It has published this additional guidance with significant input from a range of knowledge partners and market participants, to help chemicals sector participants apply the LEAP approach to their context. The overall structure of the LEAP approach is set out in Figure 1. This guidance follows that structure and Table 1 sets out the elements of LEAP for which this document provides additional guidance.

The Taskforce also recognises that investors and other stakeholders require quantitative information to compare performance and nature-related issues within sectors. To facilitate that sector-level analysis, this guidance also includes:

- Guidance on the application of the core global disclosure indicators and metrics to the chemicals sector (Section 3.1); and
- Core and additional sector disclosure indicators and metrics (Sections 3.2 and 3.3).

Figure 2 provides an overview of the TNFD disclosure measurement architecture and where indicators and metrics are listed in the TNFD Recommendations and relevant sector guidance.

Figure 1: The TNFD approach for identification and assessment of nature-related issues – LEAP

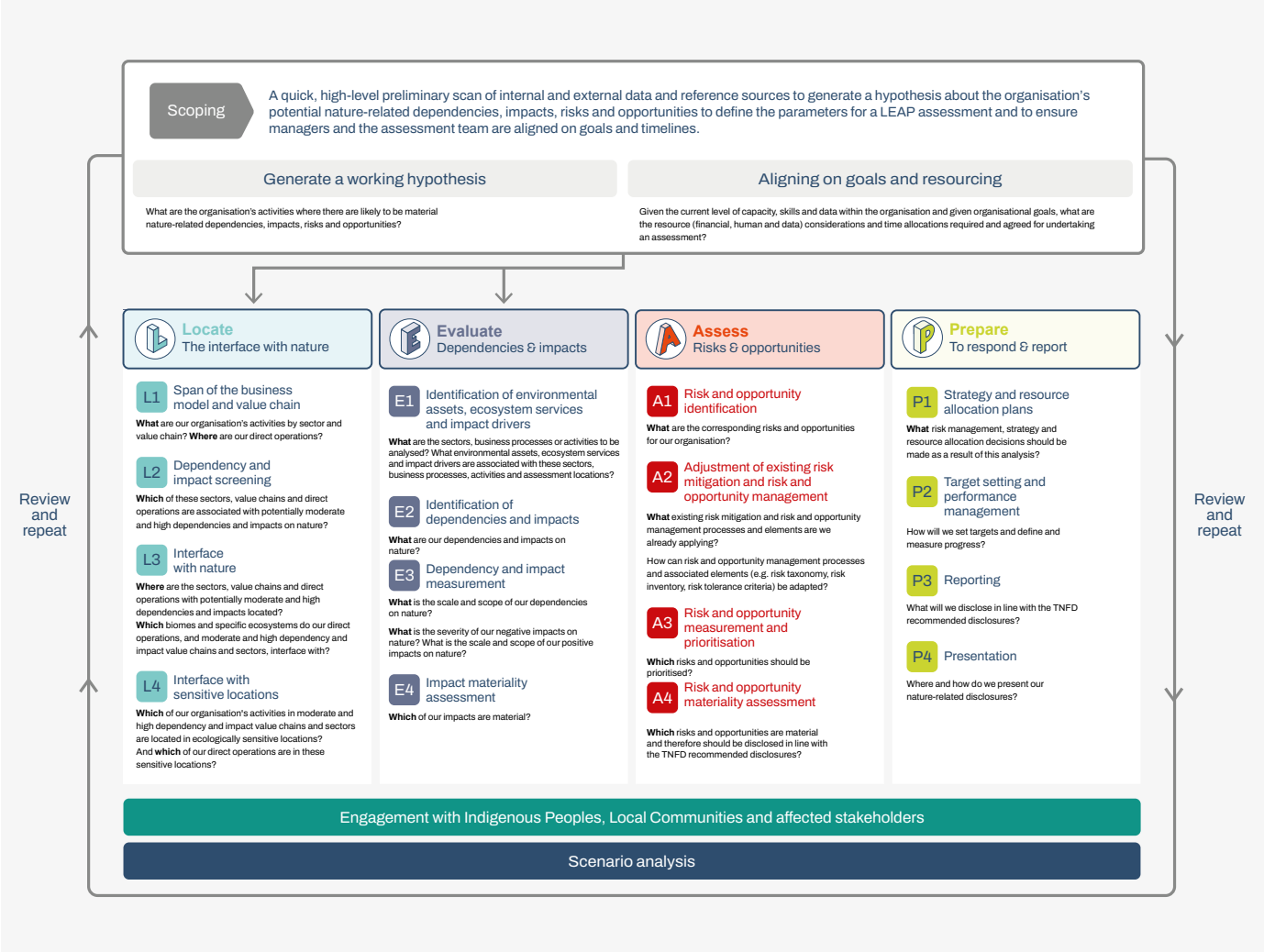
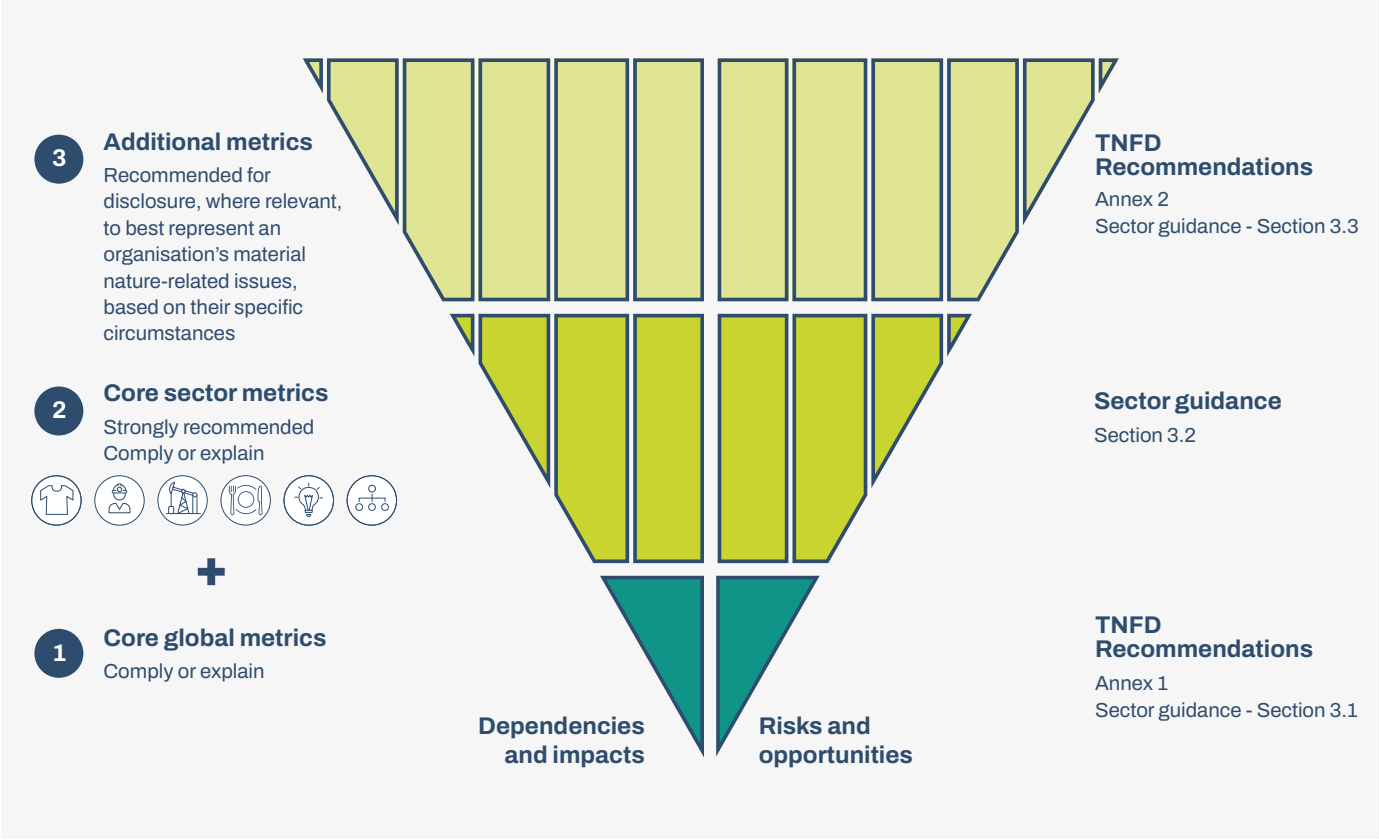


Figure 2: TNFD disclosure metrics architecture signposted to metrics lists



The guidance in Section 3 on the application of the TNFD core global metrics for this sector, as well as the core and additional sector metrics, expand on the disclosure indicators and metrics outlined in Annexes 1 and 2 of the TNFD recommendations. The TNFD has incorporated and sought to build on existing industry standards and disclosure metrics wherever possible to build on current data collection and reporting practices and minimise additional assessment and reporting costs.

1.2. Audience for this guidance

This guidance covers those organisations with business models or value chains in the Sustainable Industry Classification System® (SICS®) Chemicals industry.[1] These are referred to as 'chemicals industry organisations' in this guidance.

1 SASB (2018) SASB's Sustainable Industry Classification System (SICS).

Box 1: SICS industry in the scope of this guidance document

Entities in the Chemicals industry transform organic and inorganic feedstocks into more than 70,000 diverse products with a range of industrial, pharmaceutical, agricultural, housing, automotive and consumer applications. The industry is commonly segmented into:

- Basic (commodity) chemicals, including bulk polymers, petrochemicals, inorganic chemicals and other industrial chemicals (the largest segment by volume produced);
- Agricultural chemicals, including fertilisers, crop chemicals and agricultural biotechnology; and
- Specialty chemicals, including paints and coatings, agrochemicals, sealants, adhesives, dyes, industrial gases, resins and catalysts.

Larger entities may produce basic, agricultural and specialty chemicals, but most entities are specialised.

Chemicals entities typically manufacture and sell products globally.[2] The examples provided in this guidance for the chemicals sector are intended to be illustrative. They are not exhaustive, universally applicable or recommended by the TNFD as examples of measures for all entities within the industry. Each company's context, location and nature-related interactions are unique. The TNFD encourages all companies to consult additional relevant sources, including scientific references and relevant industry standards or best practice guides, and conduct thorough assessments to identify and assess nature-related dependencies, impacts, risks, and opportunities specific to their operations and value chains. This guidance aims to support, not replace, a tailored assessment, which will be necessary for each entity.

This guidance is a supplement to the TNFD's Guidance on the identification and assessment of nature-related issues: The LEAP approach and should be read in conjunction with that guidance.

Table 1: Areas of LEAP with additional guidance for the chemicals sector in this guidance document

Scoping	✓

L1	✓	E1	✓	A1	✓	P1	✓
L2	✓	E2	✓	A2	✓	P2	✓
L3	✓	E3	✓	A3		P3	✓
L4	✓	E4		A4		P4	

2 SASB Standards (2023) Chemicals.

2. Sector-specific LEAP assessment guidance

2.1. Scoping a LEAP assessment

General working hypothesis:

What are the organisation's activities where there are likely to be material nature-related dependencies, impacts, risks and opportunities?

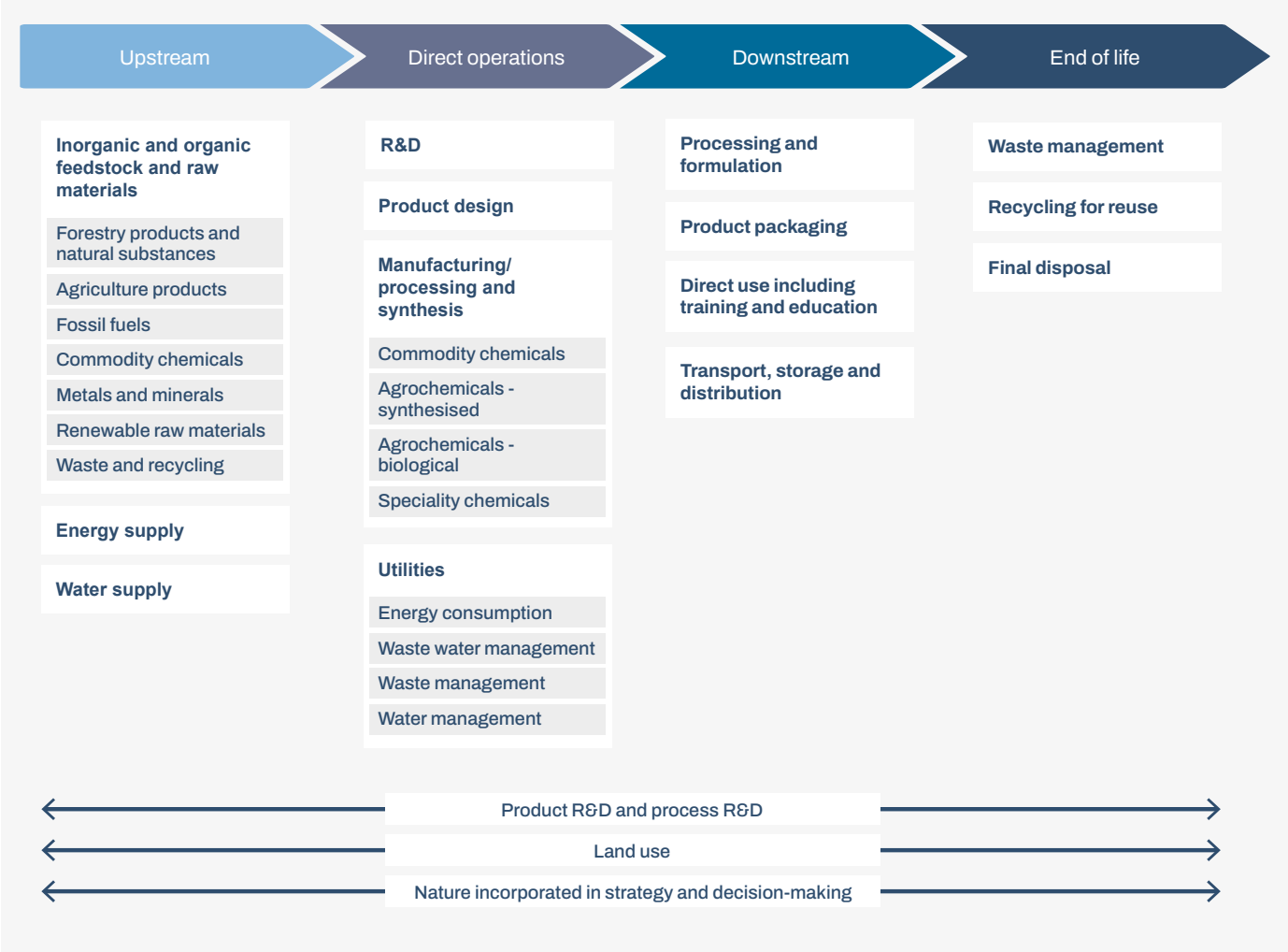
Goals and resourcing alignment:

Given the current level of capacity, skills and data within the organisation and given the organisational goals, what are the resource (financial, human and data) considerations and time allocations required and agreed for undertaking an assessment?

The activities and processes in the chemicals value chain that typically have interfaces with nature are presented in Figure 3.[3] Land use is to be considered in organic feedstock sourcing, building facilities, circularity loops and waste treatment across the value chain, including the end of life of chemical products. For further guidance on downstream use of agrochemicals, organisations should refer to the TNFD food and agriculture guidance.

3 Depending on the level of vertical integration of their business activities, organisations may have different components of the value chain from those represented in Figure 3.

Figure 3: Typical business activities in the value chain of the chemicals sector



The value chain shown in Figure 3 provides an overview of typical activities and processes in the chemicals sector value chain. The TNFD recognises that organisations within the chemicals sector may have varying focuses in their direct operations as well as different suppliers and customers, based on their specific business model. Consequently, each reporting organisation is encouraged to conduct a tailored assessment of its activities across the full value chain.

Value chain considerations when scoping

For the value chain assessment, organisations should ensure the widest possible approach when screening areas of potentially material nature-related issues across their value chain. When scoping a LEAP assessment, organisations may want to take account of the system boundaries of their Life Cycle Assessment (LCA) methodologies[4] as determined by

4 LCA under the standard ISO 14040:2006 and common methods to measure the life cycle environmental performances of Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF).

regulatory requirements for their operations and/or internal risk management processes. However, organisations should include any elements of the value chain that might produce material dependencies, impacts, risks and opportunities, regardless of whether they sit in or outside LCA system boundaries.

Where activities across the value chain overlap with other sectors, organisations are recommended to refer to the relevant TNFD sector guidance, where available.

Table 2 contains questions that could be used by chemicals sector organisations to help scope the boundaries for their nature-related assessments.

Table 2: Questions for the chemicals sector to help scope a LEAP assessment

Direct operations	• Which stakeholders should you engage with in your direct operations?
Upstream	• What inorganic and organic feedstock is sourced from areas where there are potentially material dependencies, impacts, risks and opportunities? • Which suppliers and other stakeholders should you engage with in your upstream operations? • What is your organisation's sphere of control and influence for engagement across your value chain, taking a circular economy approach (i.e. use of post-consumer recycled materials or innovating for recyclability)?
Downstream	• What are the potentially material nature-related impacts associated with downstream use of the products your organisation produces, sells or finances? What is the geographic scope and what are the likely locations of those potentially material impacts? • Which stakeholders should you engage with in your downstream and end of life operations?

Chemicals sector organisations may operate across many different sites and have many different suppliers and consumers across their value chains with significant potential nature-related dependencies and impacts. Chemicals organisations may therefore choose to start with a narrow scope to create a manageable starting point, such as a small number of high priority sites and areas of the value chain where material nature-related dependencies, impacts, risks and opportunities are most likely to arise. The LEAP approach is designed as an iterative process in line with established risk management processes and corporate reporting cycles, and organisations should look to expand the breadth and depth of the assessment over time as they gain experience and maturity in applying the process. Further guidance is available in the TNFD guidance on value chains.

2.2. Locate the organisation's interface with nature

This section provides additional information to help chemicals sector organisations with the Locate phase of the LEAP approach.

L1 L1: Span of the business model and value chain

Guiding questions:

What are our organisation's activities by sector, value chain and geography? Where are our direct operations?

Organisations should map their value chains and consider that their nature-related dependencies and impacts could be material at the following stages of the value chain, as well as direct operations:

- Upstream, for example, due to extraction of fossil fuels and/or production of bio-based feedstock;
- Downstream, for example, due to use of products by customers and end consumers; and
- End of life, for example, due to persistent residues and leaks, if appropriate measures are not taken.

L2 L2: Dependency and impact screening

Guiding question:

Which of the sectors, value chains and direct operations are associated with potentially moderate and high dependencies and impacts on nature?

Tables 3a, 3b, 4a and 4b present impact drivers and ecosystem services that may be relevant to the chemicals sector. These tables can be used to help screen an organisation's value chain activities for potentially moderate and high impacts and dependencies on nature.

Table 3a: Materiality ratings of ecosystem services the chemicals sector typically depends on (based on ENCORE 2018-2023 data)

Ecosystem services		Inorganic and organic feedstock and raw materials		Energy supply		Water supply	R&D	Manufacturing/ processing and synthesis				Utilities	Processing and formulation	Product packaging	Distribution	Final disposal
		Large-scale forestry	Large-scale irrigated arable crops	Oil and gas refining	Nuclear and thermal power stations	Water services	Research and experimental development on natural sciences and engineering	Synthetic fertiliser production	Catalytic cracking, fractional distillation and crystallisation	Cryogenic air separation	Polymerisation	Electric/ nuclear power transmission and distribution	Solids processing	Paper packaging production	Distribution	Environmental and facilities services
Provisioning Services	Biomass provisioning	VH	M													
	Genetic material		M				M	VL								
	Groundwater	VH	VH	L	M		M	L	H	L	L		L			VL
	Surface water	VH	H	M	VH		H	L	H	L	L		L			VL
Regulating services	Global climate regulation	VH	H	VL	VL			VL	L	VL		M	VL		H	
	Flood mitigation	VH	VH	M	M			M	M	M		VH	M		M	

Ecosystem services		Inorganic and organic feedstock and raw materials		Energy supply		Water supply	R&D	Manufacturing/ processing and synthesis				Utilities	Processing and formulation	Product packaging	Distribution	Final disposal
		Large-scale forestry	Large-scale irrigated arable crops	Oil and gas refining	Nuclear and thermal power stations	Water services	Research and experimental development on natural sciences and engineering	Synthetic fertiliser production	Catalytic cracking, fractional distillation and crystallisation	Cryogenic air separation	Polymerisation	Electric/ nuclear power transmission and distribution	Solids processing	Paper packaging production	Distribution	Environmental and facilities services
Regulating services	Soil and sediment retention	VH	VH	L	L		L	VL	L	L	L	H	L		M	
	Biological control	H	H													
	Pollination	H	H													
	Soil quality regulation	H	H													
	Water flow regulation	H	H		M		M	L	L	L			L			
	Water purification		H	L	L		L	L		L			L			

Note: VH = Very High; H = High; M = Medium; L = Low; VL = Very Low

Source: 2018-2023 version of the ENCORE knowledge base

Table 3b: Materiality ratings of ecosystem services the chemicals sector typically depends on (based on ENCORE 2024 data)

	ISIC Class	Manufacture of basic chemicals	Manufacture of other chemical products	Manufacture of fertilizers and nitrogen compounds	Silviculture and other forestry activities	Growing of cereals (except rice), leguminous crops and oil seeds	Manufacture of refined petroleum products	Fossil fuels energy production	Research and experimental development on natural sciences and engineering
Provisioning services	Water supply	Medium	Medium	High	High	High	Low	High	Low
	Genetic material	N/A	N/A	N/A	Very high	Very high	N/A	N/A	Medium
	Other provisioning services – Animal-based energy	N/A	N/A	N/A	Low	Medium	N/A	N/A	N/A
	Biomass provisioning	N/A	N/A	N/A	Very high	Very high	N/A	N/A	Low
Regulating & maintenance services	Solid waste remediation	Low	Medium	Medium	Medium	Medium	Low	Medium	Low
	Soil and sediment retention	Medium	Medium	Medium	Very high	Very high	Medium	Medium	Very low
	Water purification	Medium	Medium	Medium	Very high	Very high	High	Medium	Medium
	Soil quality regulation	N/A	N/A	N/A	Very high	Very high	N/A	N/A	N/A
	Other regulating and maintenance service	Low	Low	Low	ND	Medium	Low	N/A	Very low

	ISIC Class	Manufacture of basic chemicals	Manufacture of other chemical products	Manufacture of fertilizers and nitrogen compounds	Silviculture and other forestry activities	Growing of cereals (except rice), leguminous crops and oil seeds	Manufacture of refined petroleum products	Fossil fuels energy production	Research and experimental development on natural sciences and engineering
Regulating & maintenance services	Biological control	N/A	N/A	N/A	High	High	N/A	N/A	Very low
	Air Filtration	Very low	Very low	Very low	Medium	Medium	Very low	Very low	Very low
	Flood control	Medium	Medium	Medium	High	High	Medium	Medium	Very low
	Genetic material	N/A	N/A	N/A	Very high	Very high	N/A	N/A	Medium
	Global climate regulation	Very low	Very low	Very low	Very high	Very high	Very low	Medium	Low
	Nursery population and habitat maintenance	N/A	N/A	N/A	High	Very low	N/A	N/A	N/A
	Noise attenuation	Very low	Very low	Very low	N/A	N/A	Very low	Very low	Very low
	Other regulating and maintenance service	Very low	Very low	Very low	N/A	N/A	N/A	N/A	Very low
	Local (micro and meso) climate regulation	Low	Low	Low	Very high	Very high	Low	Low	Low
	Pollination	N/A	N/A	N/A	Medium	High	N/A	N/A	Low
	Storm mitigation	Medium	Medium	Medium	Medium	High	Medium	Low	Low

	ISIC Class	Manufacture of basic chemicals	Manufacture of other chemical products	Manufacture of fertilizers and nitrogen compounds	Silviculture and other forestry activities	Growing of cereals (except rice), leguminous crops and oil seeds	Manufacture of refined petroleum products	Fossil fuels energy production	Research and experimental development on natural sciences and engineering
Regulating & maintenance services	Water flow regulation	Medium	Medium	High	Medium	High	Medium	High	Low
	Rainfall pattern regulation	Very low	N/A	Medium	Very high	Very high	N/A	N/A	N/A
Cultural services	Recreation related services	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Visual amenity services	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Education, scientific and research services	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Very high
	Spiritual, artistic and symbolic services	N/A	N/A	N/A	ND	N/A	N/A	N/A	N/A

N/A = Non-applicable , ND = No data

Source: ENCORE Partners (Global Canopy, UNEP FI, and UNEP-WCMC) (Unpublished, Expected 2024). ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure. Cambridge, UK: the ENCORE Partners. Available at: https://encorenature.org. *DOI:* https://doi.org/10.34892/dz3x-y059.

Table 4a: Materiality ratings for impact drivers typically relevant for the chemicals sector (based on 2018-2023 version of ENCORE)

Impact drivers		Inorganic and organic feedstock and raw materials		Energy supply		Water supply	R&D	Manufacturing/ processing and synthesis				Utilities	Processing and formulation	Product packaging	Distribution	Final disposal
		Large-scale forestry	Large-scale irrigated arable crops	Oil and gas refining	Nuclear and thermal power stations	Water services	Research and experimental development on natural sciences and engineering	Synthetic fertiliser production	Catalytic cracking, fractional distillation and crystallisation	Cryogenic air separation	Polymerisation	Electric/ nuclear power transmission and distribution	Solids processing	Paper packaging production	Distribution	Environmental and facilities services
Land/ freshwater/ ocean-use change	Land-use change	VH	VH	H		H			H		H	M				
	Freshwater use-change		VH		H	H										
	Ocean use-change															
Resource exploitation	Water use		VH	VH	VH	H	H	H	H	H	VH		VH	VH		
Climate change	GHG emissions	H	H	H	H	H	H		H			H	H	H	H	

Impact drivers		Inorganic and organic feedstock and raw materials		Energy supply		Water supply	R&D		Manufacturing/ processing and synthesis			Utilities	Processing and formulation	Product packaging	Distribution	Final disposal
		Large-scale forestry	Large-scale irrigated arable crops	Oil and gas refining	Nuclear and thermal power stations	Water services	Research and experimental development on natural sciences and engineering	Synthetic fertiliser production	Catalytic cracking, fractional distillation and crystallisation	Cryogenic air separation	Polymerisation	Electric/ nuclear power transmission and distribution	Solids processing	Paper packaging production	Distribution	Environmental and facilities services
Pollution	Non-GHG air pollutants	H	H	H	H	M	M	H	H	L	M		M	M	H	
	Water pollutants	H	H	VH	M	L	H	L	H	M	H	M	H	H	L	
	Soil pollutants		H	VH	M	L	H	H	H	M	H		H	H	L	
	Solid waste	H	L		H	M	H		H				H	H		M
	Disturbances	H			H					H					H	
Invasive species alien introduction /removal	Biological alterations/ interferences		H	L											H	

Note: VH = Very High; H = High; M = Medium; L = Low; VL = Very Low

Source: 2018-2023 version of the ENCORE knowledge base

Table 4b: Materiality ratings for impact drivers typically relevant for the chemicals sector (based on 2024 version of ENCORE)

	ISIC Class	Manufacture of other chemical products	Manufacture of basic chemicals	Growing of cereals (except rice), leguminous crops and oil seeds	Manufacture of refined petroleum products	Fossil fuels energy production	Research and experimental development on natural sciences and engineering	Manufacture of fertilizers and nitrogen compounds	Silviculture and other forestry activities
Land, freshwater and ocean use change	Area of land use	Low	Low	High	Low	Medium	Low	Low	Very high
	Area of seabed use	N/A	N/A	N/A	N/A	ND	ND	N/A	N/A
	Area of freshwater use	N/A	N/A	Medium	N/A	Medium	ND	N/A	N/A
Climate change	Emissions of GHG	Medium	Medium	Medium	Medium	Very high	Low	Medium	ND
Pollution/ pollution removal	Emissions of non-GHG air pollutants	Medium	Medium	High	High	Very high	Low	Medium	Very high
	Disturbances (e.g noise, light)	Very high	Very high	Medium	Very high	Very high	Low	Very high	High
	Emissions of toxic soil and water pollutants	Very high	Very high	High	Very high	Very high	Low	Very high	High
	Emissions of nutrient soil and water pollutants	N/A	N/A	Very high	N/A	N/A	ND	Very high	High
	Generation and release of solid waste	Medium	Medium	High	Medium	High	Medium	Medium	Low

	ISIC Class	Manufacture of other chemical products	Manufacture of basic chemicals	Growing of cereals (except rice), leguminous crops and oil seeds	Manufacture of refined petroleum products	Fossil fuels energy production	Research and experimental development on natural sciences and engineering	Manufacture of fertilizers and nitrogen compounds	Silviculture and other forestry activities
Resource use/ replenishment	Volume of water use	Medium	Medium	Very high	Low	Medium	Medium	Medium	Medium
	Other biotic resource extraction	N/A	N/A	ND	N/A	N/A	Very low	N/A	ND
	Other abiotic resource extraction	N/A	N/A	N/A	N/A	N/A	ND	N/A	N/A
Invasive alien species introduction/ removal	Introduction of invasive species	N/A	N/A	Very high	N/A	N/A	Low	N/A	High

N/A = Non-applicable , ND = No data

Source: ENCORE Partners (Global Canopy, UNEP FI, and UNEP-WCMC) (Unpublished, Expected 2024). ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure. Cambridge, UK: the ENCORE Partners. Available at: https://encorenature.org. *DOI:* https://doi.org/10.34892/dz3x-y059.

L3 L3: Interface with nature

Guiding questions:

Where are the sectors, value chains and direct operations with potentially moderate and high dependencies and impacts located?

Which biomes and specific ecosystems do our direct operations, and moderate and high dependency and impact value chain and sectors, interface with?

As a general guide and starting point for this analysis, organisations in the chemicals sector typically interface with the following biomes in their direct operations and upstream or downstream value chains:

- Tropical-subtropical forests (T1);
- Temperate-boreal forests and woodlands (T2);
- Shrublands and shrubby woodlands (T3);
- Savannas and grasslands (T4);
- Intensive land-use systems (T7);
- Shoreline systems (MT1);
- Maritime vegetation (MT2);
- Artificial shorelines (MT3);
- Vegetated wetlands (TF1);
- Brackish tidal systems (MFT1);
- Rivers and streams (F1);
- Lakes (F2);
- Artificial wetlands (F3);
- Subterranean freshwaters (SF1);
- Artificial subterranean freshwaters (SF2);
- Coastal inlets and lagoons (FM1);
- Open ocean waters (M2); and
- Deep sea floors (M3).

This list is to be considered as an initial reference. However, organisations should review all applicable biomes across their value chains and associated activities where significant dependencies and impacts in those biomes exist.

Organisations should refer to the TNFD biome guidance for further guidance when analysing their interfaces with these biomes.

L4 L4: Interface with sensitive locations

Guiding questions:

For our organisation's activities in moderate and high dependency and impact value chains and sectors, which of these are in ecologically sensitive locations?

Which of our direct operations are in sensitive locations?

In addition to tools to assess sensitive locations suggested in component L4 of the Guidance on the identification and assessment of nature-related issues: The LEAP approach, organisations can refer to additional credible sources as identified in their own assessments.

An example of a tool that can help organisations in the chemicals sector in the Locate phase is The Nature Conservancy ESII/EI (Field app – ESII Tool). The Field app is a mobile app assisting users of all skill levels to identify and inventory ecosystem services and assess the ecological impact of land-use change.

Another example tool is the Information Platform for Chemical Monitoring (IPCHEM). This database may be used to identify areas characterised by high levels of chemicals present in the environment (i.e. finding sensitive areas for business activities). IPCHEM can be used in combination with other tools, such as the Criteria for Reporting and Evaluating Exposure Datasets (CREED), which aims to help evaluate the quality of monitoring data to enable the development of insights. The combined used of the IPCHEM database and the CREED data evaluation tool can be insightful.

Organisations should consider also referring to other tools presented in the LEAP guidance and TNFD Tools Catalogue, selecting the ones deemed most appropriate for the assessment in scope.

2.3. Evaluate dependencies and impacts on nature

This section provides additional guidance to help chemicals sector organisations with the Evaluate phase of the LEAP approach.

E1 E1: Identification of environmental assets, ecosystem services and impact drivers

Guiding questions:

What are the business processes and activities to be analysed?

What environmental assets, ecosystem services and impact drivers are associated with these business processes, activities and assessment locations?

The definitions and criteria used in impact assessment methodologies and life cycle analysis, such as eco-toxicity or the extent of a producer's responsibility to consider the use and disposal of the chemical products at their end of life, may vary, depending on regional and/or regulatory specificities.

Organisations should refer to the guidance under E2 for examples of specific environmental assets, ecosystem services and impact drivers.

E2 E2: Identification of dependencies and impacts

Guiding question:

What are our dependencies and impacts on nature?

Table 5 and Table 6 present an illustrative (non-exhaustive) list of significant dependencies and impacts that chemicals sector organisations may consider in their evaluation.[5]

5 WEF (2023) Nature Positive: Role of the Chemical Sector; Cefic (2019): Biodiversity and ecosystem services: What are they all about?

Table 5: Examples of dependency pathways for the chemicals sector

Value chain stage	Business process	Environmental assets	Ecosystem services	Considerations for the chemicals sector
Upstream Direct operations	Organic feedstock and raw materials (e.g. agriculture products) Manufacturing (e.g. fractional distillation)	Water resources Freshwater ecosystems Subterranean freshwater ecosystems	Provisioning: Water supply	Water-intensive chemical production processes or sub-processes require freshwater as an essential source. In cases of insufficient water supply, operating facilities might have to be relocated or new operating processes designed.
Direct operations	Research and development Manufacturing	Water resources Freshwater ecosystems Subterranean freshwater ecosystems	Regulating and maintenance: Water purification, water flow regulation	Production processes have water quality-related thresholds. Insufficient freshwater quality leads to additional operational costs such as water treatment. Timely engagement with local regulatory bodies can assist in managing the impact.
Direct operations	Location planning	Land	Regulating and maintenance: Flood mitigation	Specific habitats and ecosystems (e.g. mangroves) can mitigate the effects of natural hazard events, such as floods, which could affect manufacturing installations. Timely engagement with local regulatory bodies can assist in managing this impact.
Upstream	Inorganic and organic feedstock and raw materials	Mineral and energy resources Terrestrial (land based) ecosystems Subterranean terrestrial ecosystems Underwater mineral and energy resources Marine (ocean) ecosystems	Provisioning (other provisioning services)	The chemicals sector uses fossil resources as raw materials for a variety of products. Petroleum products and liquefied natural gas are important feedstocks used in the chemicals sector, as they serve as sources of hydrogen and carbon, which are used as raw materials to produce basic chemicals such as ethylene, propylene and ammonia.[6] Many chemicals are also dependent on mined resources.

6 IEA (2023) Tracking Clean Energy Progress 2023.

Value chain stage	Business process	Environmental assets	Ecosystem services	Considerations for the chemicals sector
Upstream	Inorganic and organic feedstock and raw materials	Land Terrestrial (land based) ecosystems Cultivated biological resources Renewable energy resources	Provisioning (biomass provisioning)	The chemicals sector increasingly uses biomass and plant-based raw materials in bio-based feedstock and in energy production. Chemical industries are dependent on the provisioning of raw materials from both renewable and non-renewable resources. Examples are water, wood, vegetable oils (e.g. for biofuels and other chemicals) and organic materials (e.g. corn and sugarcane to produce bioplastics).
		Land Terrestrial ecosystems Cultivated biological resources	Regulating and maintenance: Pollination	Pollination is essential for crop production – and a substantial part of the raw materials used in the industry are derived from plants that require pollination (e.g. echinacea, arnica and willow tree).
			Provisioning: Genetic material	Genetic material is essential to the development of new enzymes and micro-organisms, increasingly applied by chemical companies active in industrial biotechnology.
Upstream	Energy supply/ Utilities	Water resources Freshwater ecosystems Subterranean freshwater ecosystems	Provisioning: Water supply	The increasing demand for non-fossil based energy will likely increase the demand for green hydrogen, which will depend on water sources.

Table 6: Examples of impact pathways for the chemicals sector

Value chain	Business process	Drivers of nature change/Impact drivers	Considerations for the chemicals sector
Upstream Direct operations	Manufacturing, processing and synthesis	Climate change: Greenhouse gas (GHG) emissions	The chemicals sector is the largest industrial energy consumer and the third largest industry subsector in terms of direct CO2 emissions. Ammonia production is responsible for the highest share of emissions, accounting for 45% of emissions from primary chemical production, followed by methanol (28%) and high-value chemicals (27%).[7] Use of green hydrogen, lower-carbon raw materials and increased energy efficiency through excess heat management can reduce the negative impacts on climate and nature.
Upstream	Inorganic and organic feedstock and raw materials	Land/freshwater/ ocean-use change: Land-use change	Substituting petrochemical feedstock with biobased feedstock requires significant areas of land for production and – if not sustainably produced – this can drive soil degradation, land conversion and deforestation.[8]
		Pollution: Soil pollution, water pollution and disturbances	Mining and crop growing practices may cause soil and water pollution and disturb the hydrological balance. Other potential impacts include noise and light disturbance, dust emissions, traffic mortality, and loss and fragmentation of habitats.
		Resource use/ replenishment: Other resource use	Replacing non-renewable resources with renewable feedstock such as natural biomass-based resources including plant-derived chemical products, food waste and forestry residues could enhance waste recycling and reuse, mitigating soil and water pollution.[9]

7 High value chemicals: ethylene, propylene, benzene, toluene and mixed xylenes. IEA (2023) Tracking Clean Energy Progress 2023.

8 WEF (2023) Nature Positive: Role of the Chemical Sector.

9 Mignogna et al (2023) Production of Biogas and Biomethane as Renewable Energy Sources: A Review.

Value chain	Business process	Drivers of nature change/Impact drivers	Considerations for the chemicals sector
Upstream Direct operations	Inorganic and organic feedstock and raw materials Manufacturing	Resource use/ replenishment: Water use	Production processes are water-intensive and extensive withdrawal of freshwater can contribute to water scarcity and water stress, affecting water quantity, quality, ecosystem health and water access for both the organisation and other stakeholders. Implementing better water management systems can save water, reduce water consumption and enhance recycling.
Direct operations Downstream End of life	Manufacturing/ processing and synthesis Packaging Final disposal	Pollution/pollution removal: Non-GHG air pollutants Water pollutants Soil pollutants Solid waste	The organisation should refer to the TNFD hazard, risk and vulnerability definitions considering the air, soil and water pollution caused by the persistent chemicals, during manufacturing, and/or downstream use and/or at their end of life cycle. Chemicals and associated impacts on nature should be identified as prescribed by international conventions and the conventions for emerging pollutants (e.g. the PFAS family[10]) for new substances or substances already present for a while in the environment-food-human continuum, but causing a new concern.[11] So should plastic pellets, flakes or powders considered to be one of many sources of micro plastics in the environment. Depending on the type of pollutants, impacts appear as eutrophication (N and P depositions), acidification (S deposition), “chemical pollution” (broad variety of chemical substances) and fine dust (PM10, PM2,5). In particular, eutrophication and acidification are disturbing natural ecological processes and as such could represent major threats to biodiversity.[12]

10 The OECD Environment Directorate Chemicals and Biotechnology Committee defines PFASs as fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it), i.e. with a few noted exceptions, any chemical with at least a perfluorinated methyl group (–CF3) or a perfluorinated methylene group (–CF2–).

11 See HBM4EU Substances.

12 European Environment Agency (2018) Eutrophication of terrestrial ecosystems due to air pollution.

Value chain	Business process	Drivers of nature change/Impact drivers	Considerations for the chemicals sector
Direct operations	Manufacturing	Land/freshwater/ ocean-use change: Ocean-use change, freshwater-use change Pollution/pollution removal: Water pollution	Local and regional rivers may be subject to global impacts, which may contribute to chemical pollution in the marine environment. At the local and regional levels, pollution could directly affect rivers. This includes contamination from discharges that might introduce toxic substances, disrupt aquatic life and alter water chemistry, which could further impact the species dependent on these water bodies for survival. Chemicals that enter river systems could be transported to seas and oceans, where they contribute to global issues like ocean acidification and the contamination of marine ecosystems. These pollutants could have far-reaching effects on marine biodiversity, affecting everything from microscopic organisms to large marine mammals, and could also impact human communities reliant on marine resources.[13]

E3

E3: Dependency and impact measurement

Guiding questions:

What is the scale and scope of our dependencies on nature?

What is the severity of our negative impacts on nature? What is the scale and scope of our positive impacts on nature?

Table 7 and Table 8 provide additional considerations and examples of assessment metrics to evaluate dependencies and impacts on nature.

13 Environmental Protection Agency (2023) Effects of ocean and coastal acidification on marine life.

Table 7: Typical considerations for the chemicals sector regarding the scale and scope of potential dependencies on nature

Value chain	Ecosystem services	Additional considerations	Examples of assessment metrics
Upstream Direct operations	Provisioning (Water supply)	Consider high water consumption and water diversion from critical habitats and reduction in ecosystem services to the organisation and affected stakeholders.	For ecosystem services, measure change in the availability and quality of the ecosystem services; capacity of reservoirs or alternative forms of storage (m^3) otherwise needed to provide same surface, volume (m^3) of diverted water flow.
Upstream	Provisioning (Biomass provisioning)	Consider biomass availability and sourcing from the agricultural sector and forestry as residues and/or direct use, as well as bio-waste and/or sustainably sourced feedstock.	Gross tonnes of biomass by type of biomass and sourcing location (e.g. cultivated plants, residues, bio-waste, sustainably sourced). Area, and yield of area providing crops, by crop type.

Table 8: Typical considerations for the chemicals sector regarding the scale, scope and severity of potential impacts on nature

Value chain	Impact drivers	Additional considerations	Examples of assessment metrics
Upstream Direct operations	Greenhouse gas (GHG) emissions	Consider energy efficiency, renewable energy and increased electricity and bioenergy use over coal and fossil fuel use to produce energy.	Refer to ISSB's IFRS S2 Climate-related Disclosures.
Upstream	Land-use change	Consider evaluating deforestation/ forest conversion, habitat loss, landslides, fragmentation and biodiversity loss at the landscape level.	Mean Species Abundance; Forest Structural Condition/ Forest Structural Integrity Index; Accounting for Nature Econd®.

Value chain	Impact drivers	Additional considerations	Examples of assessment metrics
Upstream Direct operations	Water use	Consider availability of water flow with involvement of local communities and affected stakeholders. Analysis should cover the water needs of the ecosystem. Organisations should also look to align with UN SDG 6 (Clean Water and Sanitation for All) and efforts to protect local water sources and to improve access to clean water for drinking, sanitation and hygiene (WASH).	Water withdrawal and consumption (m^3) from areas of water scarcity, including identification of water source. Total volume of water withdrawal and consumption (m^3). Volume of water replenished to the environment through replenishment programmes (split into total and to areas of water scarcity).
Direct operations Downstream End of life	Non-GHG air pollutants Water pollutants Soil pollutants Solid waste	Consider relevant regional and national standards (see Annex 1 for examples), including existing international conventions, conventions for emerging pollutants (e.g. PFAS[14] family), as well as new substances and substances that may already be present in the environment–food–human continuum, but causing a new concern for water and soil pollution.[15]	Pollutants released to soil (tonnes) by types. Concentration of key pollutants in the wastewater discharged, by type of pollutant.

14 The OECD Environment Directorate Chemicals and Biotechnology Committee defines PFASs as fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it), i.e. with a few noted exceptions, any chemical with at least a perfluorinated methyl group (–CF3) or a perfluorinated methylene group (–CF2–).

15 See HBM4EU Substances.

E4

E4: Impact materiality assessment

Guiding question:

Which of the identified impacts are material?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

List of datasets and tools

The following tools can help organisations in the chemicals sector with the Evaluate phase of LEAP:

- SimaPro (LCA tool); and
- ReCiPe (LCA tool).

Organisations should also reference tools in the LEAP guidance and TNFD Tools Catalogue.

2.4. Assess nature-related risks and opportunities

The chemicals sector is diverse and has complex processes along its value chain. How organisations in the chemicals sector consider and assess their nature-related risks and opportunities will differ based on their activities, products, assets, the geographical reach of their operations and the regulatory regimes in which they are operating.

Organisations are recommended to refer to TNFD Nature-related Risk and Opportunity Registers as a general guide to frame their material nature-related risks and opportunities in relation to the dependencies and impacts assessed in the Evaluate phase.

A1

A1: Risk and opportunity identification

Guiding question:

What are the corresponding risks and opportunities for our organisation?

Table 9 provides a list of illustrative nature-related risks and Table 10 provides a list of nature-related opportunities for the chemicals sector.

Table 9: Illustrative nature-related risks for the chemicals sector

Risk category	Illustrative risks for the chemicals sector	Impact driver/ ecosystem service associated (illustrative)
Physical		
Acute	Damage to facilities due to extreme events (e.g. flooding and landslides) causing operational downtime and increased costs of repairs. Operational disruptions and financial impacts from hurricanes/storms hitting a coastal region. This could damage chemical storage facilities and lead to leaks of hazardous substances into nearby ecosystems if resilience investments are not placed.	Climate change Soil and sediment retention Storm/flood protection Soil/water pollution
Chronic	Progressive reduction of water supply can cause increased operational costs, changes in production lines or reductions in production capacity due to competing demand for water throughout the process (e.g. cooling, solvent, cleaning).	Water use Water supply Land/ocean-use change
Transition		
Policy	Increased operational costs/taxation from stricter environmental regulations. Some examples are: • The EU's REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulation is a framework that governs the use of chemicals. It requires companies to identify and manage risks linked to the substances they manufacture and market in the EU. • The Stockholm Convention on Persistent Organic Pollutants aims to eliminate or restrict the production and use of POPs, which can have adverse effects on wildlife and ecosystems. Regulations requiring companies to manage the end of life impact of their products can lead to significant financial and operational burdens. For instance, regulations mandating the recovery and recycling of chemical containers can impose additional costs.	Water/soil pollution Waste

Risk category	Illustrative risks for the chemicals sector	Impact driver/ ecosystem service associated (illustrative)
Technological	Potential loss of business for companies sticking to older, more damaging practices as safer and more sustainable chemical products become available. For example, the shift from solvent-based to water-based paints due to lower volatile organic compounds (VOC) emissions has reshaped parts of the chemical industry.	Non-GHG air pollution Water/soil pollution Water use
Market	Loss in market share due to inability to supply green chemicals or challenges in sourcing bio feedstock and biofuels. Supply chain shortages and increased costs from the dependence on natural resources that are at risk from biodiversity loss (e.g. certain minerals used in chemical manufacturing). For example, overexploitation could lead to the scarcity of certain critical minerals essential for specific chemical products.	Waste GHG emissions Provisioning services
Reputational	Divestments or legal actions due to environmental incidents as chemical spills or violations of environmental laws. A company found responsible for a significant environmental incident may face intense negative publicity. For example, fires and subsequent chemical runoff at petrochemical storage facilities could cause extensive nature loss (waste, air pollution) leading also to major public and governmental backlash. Over time, continuous and improper discharge of toxic substances (e.g. heavy metals) from chemical manufacturing into aquatic ecosystems could impact species and all communities depending on them. This can lead to significant public backlash.	Water/soil pollution Non-GHG air pollution
Liability	Chemicals companies may face lawsuits, litigation or claims for damage to nature when incidents occur within their operations. For example, companies operating in a biodiverse region may face class-action lawsuits from local communities and environmental groups after a chemicals spill contaminates a major river. The litigations could result in significant financial penalties, mandated costly cleanup operations and a directive to invest in better pipeline integrity monitoring technologies.	Water/soil pollution Non-GHG air pollution

Table 10: Illustrative nature-related opportunities for the chemicals sector

Opportunity category	Illustrative opportunities for the chemicals sector	Impact driver/ ecosystem service associated (illustrative)
Business performance		
Resource efficiency	Increased productivity and higher margins through reduced use of resources as water, energy, petroleum-based inputs or reduced waste. Cost savings and innovation in production process through industrial symbiosis. This refers to the process where waste or byproducts of one industrial process are used as inputs for another, creating a closed-loop system that minimises waste and maximises resource efficiency. This could involve using waste heat from one process to power another or repurposing chemical byproducts as raw materials in different production cycles.	Provisioning services: Biomass provisioning Water supply Water use Waste
Products and services	Reduced waste and potential access to new markets focused on eco-friendly products through product stewardship. This means developing products that are safer for the environment, require less natural resources and are more easily recyclable or biodegradable. Innovation in product design through employment of biotechnology methods, such as synthetic biology and metabolic engineering, to produce chemical compounds. Synthetic biology allows for the design and creation of new biological parts, devices and systems that can produce chemicals in novel ways. This includes developing organisms that can synthesise complex, high-value chemicals that could be difficult or costly to produce via conventional chemical synthesis. Metabolic engineering involves optimising genetic and regulatory processes within microbial systems to increase the production of specific substances. This could enhance the yield and efficiency of biochemical production processes, reducing waste and improving the viability of using bioprocesses in industrial applications.[16] Considered and careful deployment of technologies is needed to ensure potential negative impacts are limited and adaptive measures undertaken. Innovation in chemical use and potential strengthening of relationships with customers through chemical leasing. This involves a change in business model from selling quantities of chemicals to selling the function that the chemicals provide. This model encourages suppliers and customers to minimise chemical use and waste together, as costs are related to the functionality of the chemical rather than the quantity.	Provisioning services: Biomass provisioning Water supply Waste

16 Lee et al (2012) Systems metabolic engineering, industrial biotechnology and microbial cell factories.

Opportunity category	Illustrative opportunities for the chemicals sector	Impact driver/ ecosystem service associated (illustrative)
Markets	Increased revenues coming from access to new markets, for example, through sustainable agrochemical innovations for fertilisers or precision agriculture.	Soil pollution GHG emissions Non-GHG air pollution
Capital flows and financing	Access to new sources of sustainability-linked finance to pioneer new functionalised or advanced materials. Examples include conductive polymers for electronics that have the potential to be more easily recycled and might require lower energy production processes.[17]	GHG emissions Waste
Sustainability performance		
Sustainable use of natural resources	Reputational benefits and achievement of sustainability targets set from use of certification schemes to ensure biobased feedstock is sustainably produced and upstream impact is defined.	Waste GHG emissions
Ecosystem protection, restoration and regeneration	Reputational benefit and reduced regulatory scrutiny from investments in initiatives to conserve and restore high biodiversity areas, such as water catchment area protection. This could include strategies and practices implemented to safeguard the areas where water is collected, including rivers, lakes and underground sources, from contamination due to chemical manufacturing processes. Increased sustainability ratings and brand reputation by developing a sustainable land use plan to minimise ecosystem fragmentation and support habitats.	Water/soil pollution Water supply Ocean/freshwater/ land-use change

17 Thanh-Hai Le (2017) Electrical and electrochemical properties of conducting polymers.

A2

A2: Adjustment of existing risk mitigation and risk and opportunity management

Guiding questions:

What existing risk and opportunity management processes and elements are we already applying?

How can risk and opportunity management processes and associated elements (e.g. risk taxonomy, risk inventory and risk tolerance criteria) be adapted?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

A3

A3: Risk and opportunity measurement and prioritisation

Guiding question:

Which risks and opportunities should be prioritised?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

A4

A4: Risk and opportunity materiality assessment

Guiding question:

Which risks and opportunities are material and therefore should be disclosed in line with the TNFD recommended disclosures?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

2.5. Prepare to respond and report

This section provides additional considerations to help chemicals industry organisations with the Prepare phase of the LEAP approach.

P1

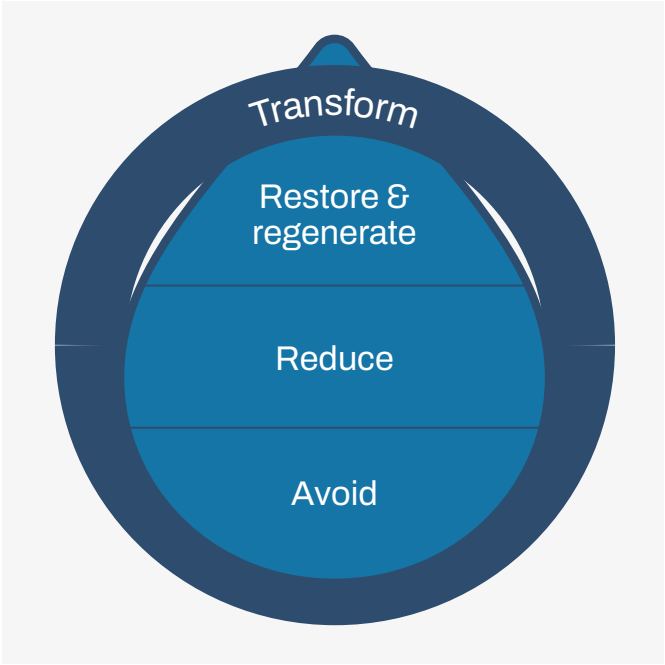
P1: Strategy and resource allocation plans

Guiding question:

What risk management, strategy and resource allocation decisions should be made as a result of this analysis?

Table 11 maps a non-exhaustive list of actions in the chemicals sector based on TNFD's interpretation of SBTN's AR3T framework (and pending alignment with future development of SBTN's Step 4 guidance), which covers mitigation hierarchy principles when determining responses to identified nature-related issues.[18]

Figure 4: The SBTN AR3T framework



18 WEF (2023) Nature Positive: Role of the Chemicals Sector.

Table 11: Illustrative priority and transformative actions for the chemicals sector mapped to AR3T Framework

Impact driver	Value chain (illustrative)	Addressed risk/ opportunity	Examples of actions	SBTN Action Framework (A3RT)				
				Avoid	Reduce	Regenerate	Restore	Transform
Freshwater use-change	Upstream, direct operations	Depletion of surrounding freshwater supply deriving from physical risks	Improve water stewardship through sustainable management strategies and practices (e.g. run periodic water risk assessments)					
			Maximise process water recovery with closed-loop/reuse/recycle systems					
Other resource use	Upstream	Scarcity of material sourcing (e.g. plant-based compounds, mineral) due to over exploitation	Use of sustainable biobased feedstock (e.g. use medicinal plants and animal derivatives as collagen and gelatin as a source of feedstock once their use has been fulfilled)					
			Use of regenerative agriculture to produce bio-based feedstock (e.g. foster the use of practices such as swales and keyline design to better manage water for agriculture)					

Impact driver	Value chain (illustrative)	Addressed risk/ opportunity	Examples of actions	SBTN Action Framework (A3RT)				
				Avoid	Reduce	Regenerate	Restore	Transform
Solid waste	Direct operations, downstream, end of life	Reduction in market share due to inability to meet client's sustainability demands	Invest in circular economy solutions to minimise hazardous waste and maximise end of life product reuse (e.g. transition to eco-design of chemical compounds and solutions, considering the reduced use of hazardous substances and the ease of disassembly)					
Pollution/ pollution removal	Direct operations	Increased operational costs/ taxation from stricter environmental regulations related to waste and emissions	Eliminate, remediate and minimise pollution of water and soil at molecular level (e.g. adopt the 12 principles of green chemistry)					
			Invest in recycling solutions for waste and waste minimisation (e.g. improve process efficiency by maximising atom economy)					
			Increase use of renewable energy as an energy source for production					

Impact driver	Value chain (illustrative)	Addressed risk/ opportunity	Examples of actions	SBTN Action Framework (A3RT)				
				Avoid	Reduce	Regenerate	Restore	Transform
Resource use	Upstream, direct operations, downstream	Improve reputational capital by engaging with sustainable suppliers	Establish nature-aligned procurement policies and supplier engagement actions (e.g. introduce supplier sustainability as a selection criteria in tender processes)					
Resource use/ replenishment	Downstream	Improve sustainability positioning and have a stronger competitive positioning in the market	Collaborate with customers to improve product transparency and traceability (e.g. implement advanced digital solutions, like blockchain, to create permanent records of origin, production and end use)					

P2

P2: Target setting and performance management

Guiding question:

How will we set targets and define and measure progress?

Table 12 illustrates high-level targets based on the five priority actions indicated by the World Economic Forum (WEF) in its report Nature positive: Role of the Chemical Sector.

Table 12: Illustrative list of targets based on five priority actions identified by the WEF

Areas	Example of targets for the chemicals sector	Illustrative indicator
Driver of nature change: Climate change	Increase efficiency in the manufacturing process and expand the use of renewable energy to reduce greenhouse gas emissions and achieve net zero emissions by 2050, with at least 32.5% improvement in energy efficiency by 2030[19] and a 40% reduction of the sector's long-term emissions reduction targets by 2030[20]	GHG emissions
Ecosystem services: Water supply	Improve water stewardship through sustainable water management strategies and practices to reduce the organisation's water withdrawal and consumption by up to 30% by 2030[21]	Water withdrawal and consumption from areas of water scarcity
Ecosystem services: Biomass provisioning	Source responsibly and explore switching to sustainably sourced bio-based or recycled materials by setting a target for the share of biobased feedstock used by 2030, while enabling land restoration and regeneration	Quantity (or ratio of total use) of bio-based feedstock sourced sustainably; quantity (or ratio of total use) of bio-based feedstock sourced from regenerative practice
State of nature	Support nature conservation and restoration and advocate for policy changes that protect nature and support the halt and reversal of nature loss by 2030 and help protect the long-term viability of the chemicals sector	Cost-benefit analysis of different strategic and resource allocation decisions (e.g. options for threat abatement or restoration based on STAR, or relative positive or negative impacts from land-use change using Persistence Score)
Driver of nature change: Pollution/ pollution removal	Expand circularity, product innovation and customer education on product use and disposal. Set a target for generated sales or share of revenue by 2030 for solutions that contribute to the circular economy	Quantity (or ratio of total use) of hazardous waste recycled at end of product life for reuse (circularity); generated sales or percentage of generated sales with solutions contributing to circular economy

Source: WEF (2023) Nature Positive: Role of the Chemicals Sector.

19 European Commission (2023) Transition pathway for the chemical industry.

20 IEA (2023) Tracking Clean Energy Progress 2023.

21 Cefic (2023) Is water management the next priority for Europe and the chemical industry?

P3

P3: Reporting

Guiding question:

What will we disclose in line with the TNFD recommended disclosures?

Organisations are recommended to prepare to disclose their strategy and management plans to:

- Manage substances of concern including production, sales and waste handling; and
- Develop alternatives with reduced negative human and environmental impacts across their value chains.[22]

P4

P4: Presentation

Guiding question:

Where and how do we present our nature-related disclosures?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

22 SASB Standards (2023) Chemicals.

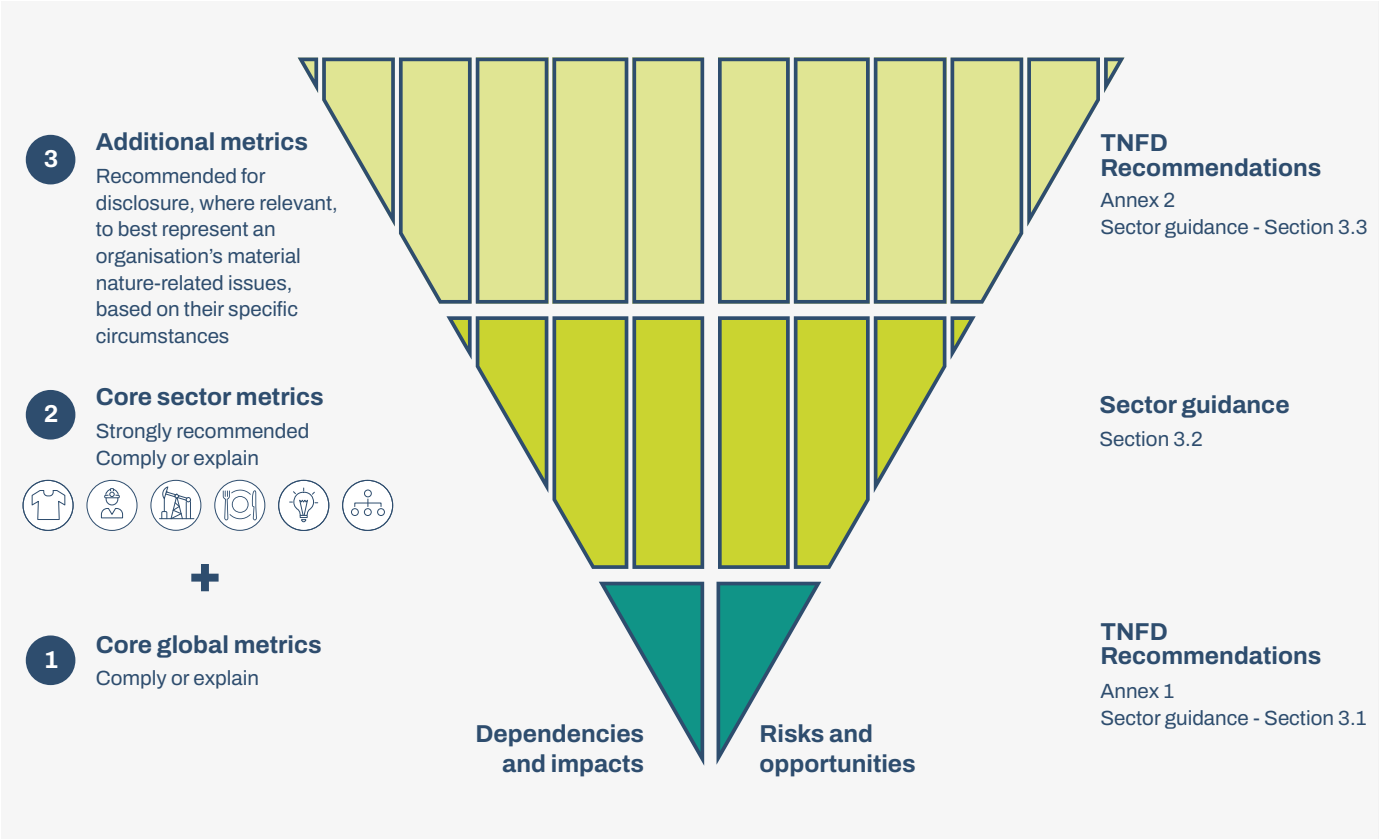
3. Sector-specific disclosure metrics and related guidance – chemicals

Sector-specific metrics form an important part of the TNFD's measurement architecture (see Figure 5). This reflects the diversity of business models across value chains and their interface with nature across and within sectors. Sector-specific metrics help financial institutions to compare organisations within the same sector, which often face similar nature-related issues.

This section provides the TNFD sector-specific metrics for the chemicals sector. It includes:

- Guidance on the application of the core global disclosure indicators and metrics to the chemicals sector (Section 3.1); and
- Core and additional disclosure indicators and metrics for the chemicals sector (Sections 3.2 and 3.3).

Figure 5: TNFD disclosure measurement architecture



Where available, the TNFD's recommended metrics for disclosure draw from a range of existing standards and frameworks including the IFRS Sustainability Disclosure Standards, SASB Standards, GRI Standards, the CDP disclosure platform, the Kunming-Montreal Global Biodiversity Framework and other relevant UN frameworks, ESRS and others. A number of organisations, including standard-setting organisations, continue to work on identifying relevant sector-level assessment and reporting metrics. The Taskforce recommends that report preparers stay engaged with year-on-year progress on these developments and implement the latest definitions within their risk management processes and disclosures. The TNFD is working closely with standard-setting organisations and others and will periodically update this guidance on recommended sector metrics for disclosure in line with these ongoing initiatives such as the OECD's work on PFAS.

Organisations in the chemicals sector should refer to Annex 1 of the TNFD Recommendations for further information on the core global disclosure metrics. As outlined in the TNFD Recommendations, core global disclosure metrics should be reported on a comply or explain basis, with the exception of the placeholder metrics.

Where organisations are unable to report against any of the core global metrics, they should provide a short explanatory statement as to why they have not reported those metrics. An organisation should report on the core global disclosure metrics unless:

- It has not been identified as relevant and material to the organisation, e.g. not relevant to business activities or the location the organisation is operating in, or not found to be a material issue for the organisation; or
- It has been identified as relevant and material, but the organisation is unable to measure it due to limitations with methodologies, access to data or because the information is commercially sensitive. In this case, organisations should explain how they plan to address this in future reporting periods.

Companies should report on the same basis for the core sector disclosure metrics outlined in Section 3.2.

Organisations are also encouraged to draw on the TNFD additional sector disclosure indicators and metrics outlined in Section 3.3 and any other relevant metrics to represent most accurately the organisation's nature-related dependencies, impacts, risks and opportunities.

1 Core global metrics

3.1. Guidance on the application of the core global disclosure metrics

This section provides guidance, where relevant, on how to apply the TNFD core global disclosure metrics in the chemicals sector. If no further sector specific guidance is provided, organisations should refer to the core global disclosure metrics.

As outlined above, core global disclosure metrics should be reported on a comply or explain basis following the guidance for the chemicals sector where provided.

For the placeholder indicators on invasive alien species and the state of nature, the TNFD encourages organisations to consider and report against these indicators where possible, but are not expected on a comply or explain basis. There are not yet widely accepted metrics for these indicators, but the Taskforce recognises their importance, and will continue to work with knowledge partners to develop further guidance on these metrics.

Table 13: Guidance on the application of the core global disclosure metrics

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Land/freshwater/ ocean-use change	C1.0	Total spatial footprint	Total spatial footprint (km^2) (sum of): • Total surface area controlled/ managed by the organisation, where the organisation has control (km^2); • Total disturbed area (km^2); and • Total rehabilitated/restored area (km^2).	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Land/freshwater/ ocean-use change	C1.1	Extent of land/ freshwater/ocean-use change	Extent of land/freshwater/ ocean ecosystem use change (km^2) by: • Type of ecosystem;[23] and • Type of business activity.	An organisation may provide information additional to the IUCN Global Ecosystem Typology (GET) to define the type of ecosystem they refer to, such as regional or local classifications.	TNFD
Land/freshwater/ ocean-use change	C1.1	Extent of land/ freshwater/ocean-use change	Extent of land/freshwater/ ocean ecosystem conserved or restored (km^2), split into: • Voluntary; and • Required by statutes or regulations.	An organisation should report area conserved and restored separately, if data is available.	TNFD
Land/freshwater/ ocean-use change	C1.1	Extent of land/ freshwater/ocean-use change	Extent of land/freshwater/ ocean ecosystem that is sustainably managed (km^2) by: • Type of ecosystem;[24] and • Type of business activity.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

23 When disclosing on ecosystem types, refer to the International Union for Conservation of Nature Global Ecosystem Typology.

24 When disclosing on ecosystem types, refer to the International Union for Conservation of Nature Global Ecosystem Typology.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Pollution/pollution removal	C2.0	Pollutants released to soil split by type	Pollutants released to soil (tonnes) by type, referring to sector-specific guidance on types of pollutants.	**Direct operations, downstream and end of life** In reporting this core global disclosure metric, an organisation should identify pollutants referring to the environmental quality standards in Annex 2 of this guidance.	TNFD
Pollution/pollution removal	C2.1	Wastewater discharged	Volume of water discharged (m^3), split into: • Total; • Freshwater; and • Other.[25] Including: • Concentrations of key pollutants in the wastewater discharged, by type of pollutant, referring to sector-specific guidance for types of pollutants; and • Temperature of water discharged, where relevant.	**Direct operations, downstream and end of life** In reporting this core global disclosure metric, an organisation should identify pollutants referring to the environmental quality standards in Annex 2 of this guidance.	TNFD

25 Freshwater: (≤1,000 mg/L Total Dissolved Solids). Other: (>1,000 mg/L Total Dissolved Solids). Reference: GRI (2018) GRI 303-4 Water discharge

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Pollution/pollution removal	C2.2	Waste generation and disposal	Weight of hazardous and non-hazardous waste generated by type (tonnes), referring to sector-specific guidance for types of waste. Weight of hazardous and non-hazardous waste (tonnes) disposed of, split into: • Waste incinerated (with and without energy recovery); • Waste sent to landfill; and • Other disposal methods. Weight of hazardous and non-hazardous waste (tonnes) diverted from landfill, split into waste: • Reused; • Recycled; and • Other recovery operations.	**Direct operations, downstream and end of life** In reporting this core global disclosure metric, an organisation should define hazardous wastes in line with the Basel Convention. If the legal or regulatory framework(s) applicable to the jurisdiction(s) where the waste is generated impose greater or more stringent requirements, then those frameworks should prevail.	GRI 306 Waste (2020); SASB Standard (2023) Disclosure RT-CH-150a.1

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Pollution/pollution removal	C2.3	Plastic pollution	Plastic footprint as measured by total weight (tonnes) of plastics (polymers, durable goods and packaging) used or sold broken down into the raw material content.[26] For plastic packaging, percentage of plastics that is: • Re-usable; • Compostable; • Technically recyclable; and • Recyclable in practice and at scale.	**Direct operations, downstream and end of life** In reporting this core global disclosure metric, an organisation should consider its plastic footprint to include the leakage of plastic pellets, flakes and powders during production processes.	TNFD
Pollution/pollution removal	C2.4	Non-GHG air pollutants	Non-GHG air pollutants (tonnes) by type: • Particulate matter ($PM_{2.5}$ and/or PM_{10}); • Nitrogen oxides (NO_2, NO and NO_3); • Volatile organic compounds (VOC or NMVOC); • Sulphur oxides (SO_2, SO, SO_3, SO_x); and • Ammonia (NH_3).	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

26 Raw material content: % of virgin fossil-fuel feedstock; % of post-consumer recycled feedstock; % of post-industrial recycled feedstock; % of virgin renewable feedstock.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Resource use/ replenishment	C3.0	Water withdrawal and consumption from areas of water scarcity	Water withdrawal and consumption[27] (m^3) from areas of water scarcity, including identification of water source.[28]	No further sector specific guidance; refer to the core global disclosure metric.	TNFD
Resource use/ replenishment	C3.1	Quantity of high-risk natural commodities sourced from land/ ocean/ freshwater	Quantity of high-risk natural commodities[29] (tonnes) sourced from land/ocean/ freshwater, split into types, including proportion of total natural commodities.	In reporting this core global disclosure metric, an organisation should include any bio-based feedstock and raw materials, commodities on the SBTN High Impact Commodity List and threatened species used on the IUCN Red List.	SBTN High Impact Commodity list, IUCN Red List, CITES (2024) Appendix I, II or II

27 Water consumption is equal to water withdrawal less water discharge. Reference: GRI (2018) GRI 303-5

28 Surface water; groundwater; seawater; produced water; third-party water. Reference: GRI (2018) GRI 303-3

29 Users should refer to the Science Based Targets Network (SBTN) High Impact Commodity List (HICL), species listed as vulnerable, endangered or critically endangered on the IUCN red list, and species listed in appendix I, II and III of CITES.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Resource use/ replenishment	C3.1	Quantity of high-risk natural commodities sourced from land/ ocean/ freshwater	Quantity of high-risk natural commodities[30] (tonnes) sourced under a sustainable management plan or certification programme, including proportion of total high-risk natural commodities.	In reporting this core global disclosure metric, an organisation should include: • Any bio-based feedstock and raw materials, commodities on the SBTN High Impact Commodity List and threatened species used on the IUCN Red List; and • Under sustainable management programmes, production using regenerative practices, including any standard adhered to and definition of 'regenerative' used.	SBTN High Impact Commodity list, IUCN Red List, CITES (2024) Appendix I, II or II
Invasive alien species and other	C4.0	Placeholder indicator: Measures against unintentional introduction of invasive alien species (IAS)[31]	Proportion of high-risk activities operated under appropriate measures to prevent unintentional introduction of IAS, or low-risk designed activities.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

30 Users should refer to the Science Based Targets Network (SBTN) High Impact Commodity List (HICL), species listed as vulnerable, endangered or critically endangered on the IUCN red list, and species listed in appendix I, II and III of CITES.

31 Due to the measurement of levels of invasive species for organisations being a developing area, the chosen indicator focuses on whether an appropriate management response is in place for the organisation. The additional sets of metrics contain measurement of the level of invasive species within an area. The TNFD intends to do further work with experts to define "high-risk activities" and "low-risk designated activities".

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
State of nature	C5.0	Placeholder indicator: Ecosystem condition	For those organisations that choose to report on state of nature metrics, the TNFD encourages them to report the following indicators, and to refer to the TNFD additional guidance on measurement of the state of nature in Annex 2 of the LEAP approach: • Level of ecosystem condition by type of ecosystem and business activity; • Species extinction risk. There are a number of different measurement options for these indicators. The TNFD does not currently specify one metric as there is no single metric that will capture all relevant dimensions of changes to the state of nature and a consensus is still developing. The TNFD will continue to work with knowledge partners to increase alignment.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
State of nature	C5.0	Placeholder indicator: Species extinction risk	For those organisations that choose to report on state of nature metrics, the TNFD encourages them to report the following indicators, and to refer to the TNFD additional guidance on measurement of the state of nature in Annex 2 of the LEAP approach: • Level of ecosystem condition by type of ecosystem and business activity; • Species extinction risk. There are a number of different measurement options for these indicators. The TNFD does not currently specify one metric as there is no single metric that will capture all relevant dimensions of changes to the state of nature and a consensus is still developing. The TNFD will continue to work with knowledge partners to increase alignment.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD
Climate change		GHG emissions	Refer to IFRS S2 Climate-related Disclosures	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

2 Core sector metrics

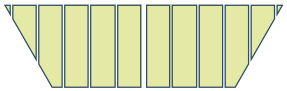
3.2. Core sector disclosure indicators and metrics

The TNFD core sector disclosure metrics for the chemicals sector are outlined below. These metrics are recommended by the TNFD to be disclosed by all report preparers in the sector on a comply or explain basis.

Table 14: Core sector disclosure indicators and metrics

Metric category	Metric subcategory	Metric no.	Indicator	Core sector metrics	Source
Impact driver	Pollution/ pollution removal	C.C2.0	Hazardous waste recycling at end-of-life	**Direct operations, downstream, and end-of-life** Proportion (%) of hazardous waste recycled at end-of-product life for reuse (circularity), defined as total weight of hazardous waste recycled from end-of-life or final disposal for reuse, divided by the weight of total input (e.g. same substance from new and recycled sources) used in production.	GRI 306; SASB RT-CH-150a.1
Impact driver	Pollution/ pollution removal	C.C2.1	Hazardous waste recycling during production	**Direct operations, downstream, and end-of-life** Proportion (%) of hazardous waste recycled for reuse, defined as total weight of hazardous waste generated during production that was recycled (circularity), divided by the total weight of hazardous waste generated.	GRI 306; SASB RT-CH-150a.1
Impact driver	Pollution/ pollution removal	C.C2.2	Non-compliance incidents	**Direct operations, downstream, and end-of-life** Number and volume (m^3) of accidental spills of hydrocarbons or chemicals of high concern.	TNFD; GRI306
Impact driver	Pollution/ pollution removal	C.C2.3	Plastic pollution	**Direct operations, downstream, and end-of-life** Proportion (%) of plastic resin volume attributed to single-use plastic.	Directive (EU) 2019/904 Doc. 32019L0904, Reduction of the impact of certain plastic products on the environment.
Impact driver	Resource use/ replenishment	C.C3.0	Water replenished	**Direct operations** Volume of water (m^3) replenished in the basin where extraction has occurred or is occurring through replenishment programmes.	TNFD ; ESRS E3 Water and Marine Resources

3 Additional metrics



3.3. Additional sector disclosure indicators and metrics

The TNFD additional sector disclosure metrics for the chemicals sector are outlined below. The TNFD encourages all report preparers in the sector to draw on these and any other relevant metrics where relevant to best represent an organisation's material nature-related dependencies, impacts, risks and opportunities.

Table 15: Additional sector disclosure indicators and metrics

Metric category	Metric subcategory	Metric no.	Indicator	Additional sector metrics	Source
Impact driver	Pollution/pollution removal	C.A2.0	Persistent chemicals manufactured	**Direct operations, downstream, and end-of-life** Quantity (tonnes) of chemicals manufactured and used as defined in EU REACH Annex XIV, REACH SVHCs, PIC, POP substances, by chemical.	Refer to Annex 2 of the chemicals guidance
Impact driver	Pollution/pollution removal	C.A2.1	Revenue generated from pesticides used by toxicity level	**Direct operations, downstream, and end-of-life** Quantity of pesticides manufactured (tonnes) by toxicity hazard level (Ia extremely hazardous, Ib highly hazardous, II moderately hazardous, III slightly hazardous, or U unlikely to present an acute hazard) according to the WHO classification[32]. An organisation should also refer to Annex 2 of this document for EU definitions of hazardous pesticides	TNFD ; WHO
Impact driver	Pollution/pollution removal	C.A2.2	Revenue generated from substances hazardous to health and environment	**Direct operations, downstream, and end-of-life** Quantity of products (tonnes) that contain Globally Harmonised System of Classification and Labelling of Chemicals (GHS) Category 1 and 2 Health and Environmental Hazardous Substances, by product.	TNFD; United Nations Economic Commission for Europe

32 WHO (2019) The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2019

Metric category	Metric subcategory	Metric no.	Indicator	Additional sector metrics	Source
Impact driver	Resource use/replenishment	C.A3.0	Bio-based feedstock	**Upstream** Proportion (%) of total feedstock/raw materials by weight or mass that is bio-based, by material.	SBTN HICL, as well as species classified by the IUCN Red List as threatened (vulnerable: VU; endangered: EN; or critically endangered: CE), and species listed on CITES Appendix I, II or II.
Impact driver	Resource use/replenishment	C.A3.1	Bio-based feedstock sourced from regenerative practices	**Upstream** Proportion (%) of bio-based feedstock produced under regenerative practices by weight/mass and material.	SBTN HICL, as well as species classified by the IUCN Red List as threatened (vulnerable: VU; endangered: EN; or critically endangered: CE), and species listed on CITES Appendix I, II or II.
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	C.A23.0	Hazard assessment	**Direct operations, downstream and end-of-life** Proportion (%) of products that have undergone a hazard assessment as defined in SASB RT-CH-410b.2.	SASB RT-CH-410b.1 and RT-CH-410b.2
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	C.A23.1	Products under LCA assessment	**Upstream, direct operations, downstream, and end-of-life** Proportion (%) of products that undergo a full or simplified Life Cycle Assessment (LCA).	TNFD

4. References

CEFIC (2022) Is water management the next priority for Europe and the chemical industry? The European Chemical Industry Council.

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European Centre for Disease Prevention and Control (2021) JIACRA III – Antimicrobial consumption and resistance in bacteria from humans and animals.

European Commission (no date) European Platform on LCA | EPLCA.

European Commission (no date) Single-use plastics.

European Commission (2021) Bio-based product.

European Commission (2021) Pathway to a Healthy Planet for All – EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil'.

European Commission (2023) EU Pesticides Database.

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European Parliament and the Council of the European Union (2000) 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.

GRI (2018) GRI 303: Water and Effluents.

GRI (2020) GRI 306: Waste https://www.globalreporting.org/standards/standards-development/topic-standard-for-waste/.

HBM4EU (no date) HBM4EU Substances.

IEA (2023) Tracking Clean Energy Progress 2023. International Energy Agency.

ISO (2023) ISO/DIS 59004(en) Circular Economy – Terminology , Principles and Guidance for Implementation.

OECD (2021) Reconciling Terminology of the Universe of Per- and Polyfluoroalkyl Substances: Recommendations and Practical Guidance.

OECD (2018) Due Diligence Guidance for Responsible Business Conduct.

SASB Standards (2023) Chemicalst.

SBTN (2024) High Impact Commodity List. Science Based Targets Network.

UNICEF (2022) Water, Sanitation and Hygiene (WASH). United Nations International Children's Fund.

US EPA (2023) Addition of Certain PFAS to the TRI by the National Defense Authorization Act. United States Environmental Protection Agency.

WEF (2023) Nature Positive: Role of the Chemical Sector. World Economic Forum.

Annex 1: List of environmental quality standards for pollutants

Chemical sector organisations should refer to the lists of standards below that are contained in relevant regional and national regulations, including existing international conventions, conventions for emerging pollutants (e.g. PFAS[33] family), as well as new substances and substances possibly already present in the environment-food-human continuum, but causing a new concern for water and soil pollution.[34]

Table 16: Selected examples of environmental regulations for pollutants

List	Number of substances	Link to resource
EU REACH Annex XIV Authorisation list	59 substances	Authorisation List – ECHA
REACH SVHCs	476 substances	Candidate list of substances of very high concern for authorisation
EU POP Regulation (EU) 2019/2021	31 unique substances/entries 10 unique new proposed substances	POPs Regulation – ECHA The new POPs
EU PIC Regulation (EU) No 649/2012	287 substances	Chemicals subject to PIC – ECHA
EU Water Framework Directive, Annex X	Priority substances	Pollutants in EU waters: Update of chemical substances listed for control
Annex to Sustainable Use of Pesticides Directive 1107/2009	Approval criteria for active substances by specifying the approval procedure	Regulation (EC) No 1107/2009 EU Pesticides Database
MRL residues lists 396/2005	29 449 unique substances/entries	EUCLEF Annexes II, III, IV, VII
SVHC Intentions List (to be used as a proxy)	269 substances	Registry of SVHC intentions until outcome

33 OECD, Environment Directorate Chemicals and Biotechnology Committee defines PFASs are defined as fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it), i.e. with a few noted exceptions, any chemical with at least a perfluorinated methyl group (–CF3) or a perfluorinated methylene group (–CF2–).

34 HBM4EU Substances.

Table 17: Selected examples of environmental quality standards for pollutants

List	Number of substances	Link to resource
Emerging chemicals – HBM4EU – science and policy for a healthy future	The first round of HBM4EU priority substances in 2016 (and family of substances) and the second round of prioritisation between 2017 and 2018	HBM4EU substances
For AMR classifications and indicators, refer to JIACRA III Report	Refer to antimicrobial classes identified	JIACRA III – Antimicrobial consumption and resistance in bacteria from humans and animals
PFAS	PFAS TRI disclosures	Toxics Release Inventory (TRI)

Entities should stay abreast of further development on PFAS, such as the OECD PFAS definition in Europe, grounded in ECHA and EPA methodologies.

List of applicable disclosures should adhere to relevant regional and national chemicals regulations.

Annex 2: List of hazardous pesticides

The list of hazardous pesticides in Table 18 can be referenced in addition to the requirements in Annex 1 Table 16 and Table 17.

Table 18: Hazardous pesticides in the European Union

List	Number of pesticides	Link to resource
Annex to Sustainable Use of Pesticides Directive 1107/2009	Approval criteria for active substances by specifying the approval procedure	EU Pesticides Database
MRL residues lists 396/2005	29 449 unique substances/entries	EUCLEF Annexes II, III, IV, VII

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