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Safety Data Sheets: A User Guide

4th Edition

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Disclaimer

The information contained in this document is given in good faith and believed to be accurate at the time of writing. The CHCS does not accept any liability with regard to the contents of this document. Readers are reminded that the text of the legislation is the only authentic legal reference and that the information in this document does not constitute legal advice. The legislation and related guidance documents are regularly updated, and the reader should use this guide in conjunction with the most up to date versions of these.

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Preface

The Chemical Hazards Communication Society (CHCS) is a non-profit making organization set up and run by safety professionals involved with hazard communication. One of the aims of the Society is to promote the awareness of chemical hazards and improvements in their identification and communication. This includes the classification of substances and mixtures, their clear labelling and the production of understandable Safety Data Sheets (SDSs).

In recent years there have been significant changes to the requirements on format and content of SDSs, as well as updates to the system of classification and labelling of hazardous chemicals. CHCS has published this revised User Guide to assist the user of an SDS in clarifying the jargon and technical terms used in SDSs, and to understand the recent changes.

CHCS is a UK-based Society and accordingly some of the references to legislation in this guide are UK-specific. Following Brexit, the content of a GB SDS is now regulated separately from the EU and Northern Ireland. GB legislation is currently closely aligned with EU regulation and the majority of this guide will be applicable to any SDS supplied to a user in the UK or EU. Where differences occur, these will be highlighted.

Cross reference – topic to Section of safety data sheet

Topic	Relevant Safety Data Sheet Sections
• Worker safety • Health and safety at work • Control of Substances Hazardous to Health • Personal protection	SECTION 2: Hazards identification SECTION 3: Composition/information on ingredients SECTION 8: Exposure controls/personal protection SECTION 9: Physical and chemical properties SECTION 10: Stability and reactivity SECTION 11: Toxicological information SECTION 15: Regulatory information
• Storage • Information for safe storage of product	SECTION 7: Handling and storage SECTION 10: Stability and reactivity
• Engineering controls • Ventilation/extraction	SECTION 8: Exposure controls/personal protection
• Emergency Action • First-aid, Fire and Spillage	SECTION 4: First aid measures SECTION 5: Firefighting measures SECTION 6: Accidental release measures SECTION 9: Physical and chemical properties
• Pollution control • Consequences of release to the environment	SECTION 9: Physical and chemical properties SECTION 12: Ecological information
• Transport • Information regarding road/rail, air and sea transport of products	SECTION 14: Transport information
• Waste disposal • Guidance on safe disposal of product	SECTION 12: Ecological information SECTION 13: Disposal considerations SECTION 14: Transport information
• Mixture classification information • Use when product is component of new mixture/solution.	SECTION 3: Composition/information on ingredients SECTION 11: Toxicological information

Introduction

Legal provisions and formatting of the safety data sheet

A Safety Data Sheet (SDS) is a document that provides health and safety information to the recipient of a hazardous chemical. It is designed to provide the employer with sufficient information to be able to assess the hazards of the product and to put appropriate safety measures and procedures in place.

In recent years the legislation has become much more prescriptive in its requirements on what must appear in the SDS.

In the EU, the required content and format of the SDS is set out in Annex II of the REACH Regulation (EU Regulation 1907/2006), and SDSs should contain information under 16 obligatory headings and sub-headings contained therein.

The EU Annex II of REACH has been updated by EU Regulation 2020/878, which has added some requirements for the SDS. These requirements have not been included in GB version of REACH (UK Statutory Instrument 2019 No. 758), so the formatting for GB SDS conforms to the older REACH amendment (EU Regulation 2015/830). However, GB authorities will accept the newer SDS formatting, so this User Guide will generally refer to it. Also, because the GB guidance often refers to EU guidance for best practice, then this Guide will often use EU references.

A final issue relating to the legislation and formatting is that Northern Ireland uses EU REACH legislation, including that relating to SDS provision and formatting. GB refers to England, Scotland and Wales, and these are the jurisdictions covered by the separate GB REACH legislation. Northern Ireland is exempted from the UK (i.e. GB plus NI) legislation under the Northern Ireland Protocol.

These legal issues are generally more an issue for compilers rather than SDS users, and the practicalities of reading and understanding the SDS are the focus of this Guide, and the principles apply both in the UK and EU.

Content of the SDS

The European Chemical Agency (ECHA) has published the document '*Guidance on the Compilation of Safety Data Sheets*' that gives advice on what information should be provided under the various headings, but this is aimed at those authoring the SDSs rather than those that use them. Also, jargon and technical terms are very often found in SDSs and these may be unfamiliar to the recipients.

SDSs in the REACH-compliant format are legally required for all hazardous chemicals, i.e. both pure substances and mixtures. In almost all cases, the sub-sections of an SDS cannot be left blank; if no information is available, or that particular sub-section is not applicable to the product, then a statement should appear to that effect. In general, an SDS is not required for chemicals that are not classified as hazardous, although there are certain circumstances where an SDS is still required. In practice, suppliers often supply SDSs for all their products whether they are hazardous or not.

It should be noted that while the REACH regulation dictates the content of the SDS, it does not cover the product classification. The rules on how to classify a hazardous material, as well as how this should be communicated on the label, are set out in the CLP regulation (EU Regulation EC No. 1272/2008 or UK Statutory Instrument 2019 No. 720) (See Section 2 for more detail on classification).

Mandatory headings and sub-headings of the SDS (Regulation 2020/878)

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier
1.2. Relevant identified uses of the substance or mixture and uses advised against
1.3. Details of the supplier of the safety data sheet
1.4. Emergency telephone number

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture
2.2. Label elements
2.3. Other hazards

SECTION 3: Composition/information on ingredients

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3.2. Mixtures*
[*Only one of these sub-headings will appear in the SDS, depending on whether the product is a substance or mixture]

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14.5. Environmental hazards
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15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
15.2. Chemical safety assessment

Who receives a safety data sheet?

If the product is hazardous, the supplier has a duty to provide a safety data sheet (SDS) to the recipient of the product either before the first delivery, or at the latest, with the product when it is delivered.

The recipient is the person or organisation to whom the product is supplied. The recipient could be any employee, such as a stores person, health and safety manager, production manager, a self-employed person or the person in control of the premises. The SDS may be addressed to a person, by name or job title, or it may be addressed only to the organisation. It is the responsibility of the recipient to pass any SDS to the right person. There is no obligation in law for employers to pass on the SDSs to employees. The SDS can be sent by post, fax or electronically as an email attachment (i.e. in both paper or electronic form). The supplier cannot simply provide a link to a website where the SDS is available online.

What is the purpose of a Safety Data Sheet?

Under The UK Health and Safety at Work Act and The Control of Substances Hazardous to Health Regulations (COSHH), employers have a duty to provide information on risks to health and precautions to be taken when employees handle or use products in the workplace.

To comply with this duty, the employer carries out a workplace risk assessment. The SDS, sometimes referred to as a COSHH data sheet, provides essential information on the intrinsic hazards and other properties of the product that, when considered together with the conditions and processes in which the product is used, can be used to assess risk.

A central tenet of chemical safety is given in the equation:

Risk = hazard × exposure.

As such, very hazardous products can be used safely (i.e. with low risk) if the exposure is well controlled, using measures as specified in Section 8 of the SDS (Exposure controls/personal protection). In short, the SDS provides the basis for the workplace risk assessment under COSHH.

The SDS is the primary mechanism for the supplier of a substance or mixture to communicate the hazards and other safety information to downstream users. If new hazards or regulatory information on a product becomes available, this must be communicated down the supply chain by provision of an updated SDS.

Your supplier should check regularly whether updates to the product SDS are required, but in particular when changes in the regulations occur. If the SDS is changed significantly, your supplier should issue you with a revised one, with the revisions highlighted, and a new version number and date. If you recognise that this has not been done, then you should request an updated SDS.

What is an extended Safety Data Sheet?

The REACH regulation requires that for substances manufactured or imported above 10 tonnes per year, a chemical safety assessment (CSA) is carried out as part of the REACH Registration process. The CSA is an in-depth risk assessment, including the hazards of the substance, and potential exposures through so called Exposure Scenarios (ESs; see Section 16 for more detail).

The ES is the conditions of use and risk management measures, that the manufacturer or importer recommends to downstream users to control the exposures of humans and the environment to safe levels. An ES often covers only one specific process or use, so that several ESs are required to cover all processes (e.g. unloading, mixing, reactor cleaning, consumer use) throughout the lifecycle of the product.

If a chemical product contains a component that has undergone a CSA and consequently has ESs, the information in the ESs is required in the product SDS (either a substance or mixture), at which point it is referred to as an extended SDS (ext-SDS or e-SDS). For substances, the ESs are usually appended to the SDS as an Annex. For mixtures, the details of the ESs may be included an annex, or the information integrated into the main body of the mixture SDS.

User Guide to safety data sheets

This User Guide presents the information you should expect to find in an SDS. It follows the order of Sections and Sub-sections as given in Annex II of the REACH Regulation. Appendix A contains a glossary of terms to help with technical terms and jargon.

Some data found in an SDS may require detailed information or expert interpretation, e.g. in the provision of engineering controls. We have therefore included recommendations for further reading and relevant legislation at the end of each Section.

Appendix F contains contact details of organisations who may provide assistance.

Links to relevant legislation and guidance are included at the end of each Section and can also be found in Appendix G.

EU Regulations and the UK Regulations (Statutory Instruments) form the definitive texts for the content of the SDS, and are recommended to readers, but the dense legal text can be daunting. The Regulations are available from the European Chemicals Agency (ECHA) website and The Stationery Office, respectively.

ECHA's '*Guidance on the compilation of safety data sheets*' is easier to read and provides expanded commentary on SDS requirements. It is very useful reading for the SDS user. The UK has not yet produced a comprehensive SDS guide.

Chemicals should be suitable for the purpose intended. Suppliers will provide the information relevant to the normal or known uses of the product, but they cannot anticipate all circumstances of use. The user should check the suitability of the product for their intended use.

The Health and Safety Executive (HSE), as part of its remit for health and safety issues, and the Environment Agency (EA), for issues relating to the environment, provide a helpdesk for enquiries (UK REACH Helpdesk:

ukreach.clp@hse.gov.uk). They can provide assistance where the legislation and guidance are unclear.

Legislation that is referred to in this guide is subject to amendment or replacement. The reader should check with current regulations before relying on the information in this User Guide. The User Guide is offered in good faith, but CHCS takes no responsibility for the consequences of the interpretation of its contents. The appearance of a reference to any publication or service in this guide does not imply that CHCS guarantees the quality or suitability of that service or publication. Any telephone or fax numbers or web addresses given are liable to change.

Further reading and Regulations

COSHH and Risk Assessment
The Control of Substance Hazardous to Health Regulations 2002 (S.I. 2002/2677)
http://www.legislation.gov.uk/uksi/2002/2677/contents/made

Numerous guides to carrying out Risk Assessments are available and some of these are given below;

HSE webpage on COSHH
http://www.hse.gov.uk/coshh/index.htm

HSE COSHH Essentials website
http://www.hse.gov.uk/coshh/essentials/index.htm

L5: *Control of substances hazardous to health, Approved Code of Practice and Guidance* (6th Ed.), HSE Books, 2013.
http://www.hse.gov.uk/pubns/priced/l5.pdf

HSG97: *A step by step guide to COSHH assessment* (2nd Ed.), HSE Books, 2004.
http://www.hse.gov.uk/pubns/priced/hsg97.pdf

INDG136: *Working with substances hazardous to health: A brief guide to COSHH* (rev. 5), HSE Books, 2012.
http://www.hse.gov.uk/pubns/indg136.pdf

INDG163: *Five Steps to Risk Assessment* (rev. 4), HSE Books, 2014
http://www.hse.gov.uk/pubns/indg163.pdf

Control of Hazardous Chemicals in the Laboratory: COSHH
https://edu.rsc.org/resources/coshh-resource/1116.article

Guidance on the Compilation of Safety Data Sheets (ver. 4.0), ECHA, 2020.
https://echa.europa.eu/documents/10162/23036412/sds_en.pdf/01c29e23-2cbe-49c0-aca7-72f22e101e20

Safety Data Sheets and Exposure Scenarios - Key Information for Downstream Users, ECHA, 2012
https://echa.europa.eu/documents/10162/22372335/downstream_sds_en.pdf/f3963ab4-4691-427b-97cc-f0d4b39368e9

More detail on the above publications can be found in the Bibliography (Appendix G).

Safety data sheet header information

Your supplier should issue you with up-to-date versions of the SDS for the products they supply. The supplier should have a clear version control so that you can immediately see which of two SDSs is the most up to date. The version information must appear on the first page but is most commonly found in the SDS header. Details of the changes made during updating of the SDS can be given in Section 16, or highlighted within the various Sections of the SDS.

The date of the compilation or revision must be given in the format 'Revision: (date)'. Another form of version identification must also be given, such as a version number. The recommended format for version control is increasing numbers with integer and decimal place, e.g. 1.0 for the first version. The decimal is increased for minor changes (e.g. 1.1) and the integer for significant changes (e.g. 2.0).

All pages, including any Annexes, should be numbered sequentially, and indicate the length of the SDS (e.g. 'page 1 of 10') or an indication whether there is a page following (such as 'continued on next page' or 'end of safety data sheet'). This gives you reassurance that no mistakes have been made in collating the document.

Guidance recommends the product name is also given in the header in case printed pages of the SDS become separated.

SECTION 1: Identification of the substance/mixture and of the company/undertaking

This first section of the Safety Data Sheet (SDS) has two main functions. It should confirm the identity of the product and provide the contact details of the supplier who placed the product on the market.

1.1. Product identifier

Before using the product, it is important to check that the main product name given in this Section is the same name as that shown on the label (for products not supplied in bulk). If this is not the case, or you have other reason for concern, e.g. the physical characteristics given in Section 9 do not match those of the product, you should contact your supplier for clarification before proceeding.

These rules for product identification of substances and mixtures are stated for labelling purposes in Article 18 of the CLP Regulation.

Substances

For simple substances, the main product name will usually be the systematic chemical name of the substance, e.g. '2-ethylhexan-1-ol', as given in regulatory lists such as Annex VI of the CLP Regulation or the Classification and Labelling Inventory. Common substances may have trivial names (e.g. acetic acid) or acronyms (e.g. EDTA) and it is helpful if these are also listed.

Also, at least one identification number will also be given, according to the following hierarchy:

- An identification number from the harmonized classification, given in Annex VI of the CLP Regulation, i.e. Index Number, EC Number, or CAS number,
- An identification number from the Classification and Labelling Inventory, i.e. EC Number, or CAS number,
- CAS number,
- If no CAS number available, then the IUPAC name should be given.

An explanation of each of these identification numbers (CAS number, EC number or Index number) is given in the Glossary (Appendix A).

In addition to the identification number, if a substance has been registered under REACH then the REACH registration number should be given. Registration numbers have the form XX-XXXXXXXXXX-XX-YYYY. The last 4 digits of the registration number identify the supplier of the substance, and these may be withheld (for example replaced by 'XXXX') so that downstream users and distributors can avoid disclosing their supplier.

If the product is not subject to REACH, the reason may be given, e.g. 'polymer exempt', although this is not mandatory.

Mixtures

For mixtures, the product name will be the trade name, e.g. 'Paint Formula X20'.

The Unique Formula Identifier (UFI) may be given as a mixture identifier in the SDS. It is mandatory on the label. The UFI is generated as part of the poison centre notification (PCN) process, as described in Annex VIII of the CLP Regulation. PCN and UFI generation applies to mixtures with classification for physical or health hazards. The PCN process is in a transition phase, so that we are still awaiting a final deadline of 1 January 2024 for products intended for industrial use. Products for consumer or professional use should be notified before being placed on the market.

PCN is applicable in the EU. Official advice has been that it does not apply in the UK, but there is controversy (as of June 2022) over whether the legal provisions for exempting the UK from the PCN requirements have been correctly applied.

This subsection may also specify that 'all components of the mixture are REACH registered or exempt (e.g. for polymers, low-volume materials, or natural products).' If the REACH registration status of a component of the product is unclear, then you should contact the supplier for clarification before proceeding with its use.

1.2. Relevant identified uses of the substance or mixture and uses advised against

This Sub-section should also show the intended or recommended uses, as far as is known, and any uses that are advised against.

Most chemical products are mixtures and are formulated for a specific purpose (e.g. household cleaner, printer ink, aviation fuel). In these cases, the identified use(s) should be clear. Substances are more likely to be commodity chemicals with multiple uses (e.g. solvent, perfume, surfactant).

On a more technical level, manufacturers or importers of substances (> 10 t/a) prepare a chemical safety assessment (CSA) that assesses identified uses and processes in the exposure scenarios (ESs) in the ext-SDS. The CSA should cover all stages of the lifecycle of the substance. If downstream users apply the risk management measures in the appropriate ESs then the use should be safe. These uses are identified uses. Uses assessed in the CSA but where safety cannot be guaranteed are 'uses-advised-against', and a reason why it is not advised should be stated on the SDS.

The recipient of the SDS should make sure that their intended use for the product is consistent with the identified uses described in this section, and in the ESs of an ext-SDS.

In the case of an ext-SDS, if the particular use that the user is planning is not covered, they must either:

- modify their process so that it conforms to one of the ESs,
- ask their supplier to add that particular use so it is included in the SDS/ES, or
- perform their own chemical safety assessment and submit a report to ECHA within 6 months of receiving the extended SDS (see REACH Regulation Article 37).

1.3. Details of the supplier of the safety data sheet

This sub-section should contain details of the company that supplied you with the product. This may be the manufacturer but, in many instances, will be an importer or distributor. The chain of supply may be short or long, but the details shown on the data sheet must be those of the company who directly supplied you with the product. It is their responsibility to ensure the accuracy of the contents of the data sheet, to provide answers to any queries you may have, and to issue new data sheets if there are significant changes.

More than one supplier name might be given. If you purchase from a distributor, the SDS may contain both the distributor and formulator details.

Contact details you can expect to see are:

- The name, address and telephone number of the company.
- An email address for the competent person responsible for the Safety Data Sheet. Note the term 'competent person' is a technical term used in the legislation. The email is usually a generic address.
- For the EU, there may also be a local number of the 'responsible person', appointed by the supplier to handle enquiries in a specific country or language.

1.4. Emergency telephone number

A telephone number or numbers must be given where advice can be provided in case of an emergency involving the product. Some companies may be able to provide their own emergency response. Others may use an independent service-provider who can store SDSs on the company's products and provide emergency response.

In some cases the emergency number will operate 24 hours a day, 7 days a week, but this is not a legal requirement. The operating hours of the emergency number should be stated in this section.

Most EU member states have national telephone numbers on which advice can be obtained in an emergency. As discussed in Section 1.1, this is becoming centralized under the legal provisions of the CLP Regulation, Annex VIII. The UK also has the National Poison Information Service that provides advice only to medical professionals.

Further information

Poison Centre Notification: ECHA Guidance on harmonised information relating to emergency health response – Annex VIII to CLP
https://echa.europa.eu/documents/10162/17235/guidance_on_annex_viii_to_clp_en.pdf/412c5874-f8ec-cf52-fe1e-2fbe08fe2d11?t=1614687077313

National Poisons Information Service - submitting information for mixtures placed on the GB market
https://www.hse.gov.uk/chemical-classification/classification/poison-centres.htm

The organisations given below have useful search engines for identifying the CAS or EC numbers for a particular substance. Further resources are given in Appendix G:

'Search our data' by the European Chemical Agency
https://echa.europa.eu/

Chemspider by the Royal Society of Chemistry
http://www.chemspider.com

The Chemical Abstracts Service, a division of the American Chemical Society, is responsible for issuing CAS numbers.
http://www.cas.org/

SECTION 2: Hazards Identification

This Section contains the hazard classification of the product, and also helps to identify other types of hazards that are not covered by the classification system, such as dust explosion hazards. The Section also includes the graphical elements and text that should appear on the label.

The processes for hazard classification, and assignment of supplemental hazard information and label elements are described in the CLP Regulation (1272/2008, as amended). This EU Regulation, and the GB equivalent (SI 2019 No. 720) are based on the UN Globally Harmonised System of Classification and Labelling of Chemicals (GHS). The GHS provides some consistency of hazard classification and labelling across the world, although there are many differences in the way GHS has been implemented in different jurisdictions.

2.1. Classification of the substance or mixture

The classification of the substance or mixture should be given in this sub-section. The classification consists of the Hazard Classes, Categories, and the associated Hazard Statements (H-statements).

For example:
Hazard Class: Flammable liquid
Hazard Category: 3
Hazard statement: H226 Flammable liquid and vapour.

Often the classification is given in a coded form, e.g. Flam Liq 3, H226. If this is the case, then the full text of the statements should be given elsewhere, usually in Section 16, and a reference to this Section given near the coded classification.

Determination of the hazard classification

The hazard classification of substances and mixtures is assigned by comparing data on their physicochemical, toxicological and ecotoxicological properties against classification criteria set out in the CLP Regulation.

If data for mixtures are not available, the classification can be determined by analogy to a similar mixture for which sufficient data is available, or it can be calculated based on its composition.

Many pure substances are listed in Part 3 of Annex VI of CLP, where they are assigned harmonised classifications (called mandatory classifications in GB legislation, given in the Mandatory Classification List). These classifications are mandatory, but are often only a partial, minimum classification. Only some of the Hazard Classes are stipulated, so the supplier of a particular substance must consider all other Hazard Classes and, if the criteria are met, assign the additional hazard classifications to the substance.

For substances without a harmonized classification, the supplier must evaluate the classification of the product in each Hazard Class. Usually this is achieved through substance classification databases, or evaluation of test results. The ECHA resources are particularly valuable for this purpose.

European manufacturers and importers of hazardous substances must notify ECHA of the classification, which is then placed on the Classification and Labelling (C&L) Inventory. In GB, the notification is made to the HSE, although no public inventory is yet available. As different suppliers may be working from different datasets, there is potential for the same substance to be assigned different hazard classifications by different suppliers. The C&L Inventory is designed to allow suppliers to see how others have classified the substance and to discuss their findings. The intention is that over time suppliers will agree on the most appropriate classification for a particular substance. In some cases, different classifications will continue to be used for a particular substance, for example, where the hazard classification is affected by an impurity, or if the substance is made available in different physical forms that have different hazards. Where this is the case, this is usually indicated in the C&L Inventory, or in the Registered Substance Factsheets, which are also available on the ECHA website.

The hazards are intrinsic properties of the product and indicate the capacity to cause harm. These hazards combined with the use pattern of the product (e.g. amount of product used, its physical properties, and risk management measures) will determine the risks to people and the environment. Thus, as stated in the

Introduction, information in the standard SDS is used to inform the workplace risk assessment (e.g. under COSHH Regulations in the UK). For an ext-SDS, the operational conditions and risk management measures have been assessed in the Chemical Safety Assessment (CSA), and, if they are followed by the user, should ensure the safety of workers and the environment.

Non-classified Products

Safety Data Sheets are often provided for products that are not classified as hazardous for supply, even when there is no regulatory requirement to do so. In this case, a statement such as: '*This product does not meet the criteria for classification in any hazard class according to Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures*' may be included. Such an SDS is still useful for a workplace risk assessment.

The supplier, when describing a product which does not have a hazard classification, should be clear whether this is because there is sufficient data to show that the product does not meet the classification criteria, or that there is no data, or insufficient data, available in which case the hazards could not be determined. In the latter case, you should treat the product with due caution. The statement "Caution: substance not yet fully tested" is often used in such cases.

In the case of non-classified products, the user should remember that there may still be hazards associated with the product that are not covered by the CLP classification scheme:

- a low-level hazard may still exist which is below the classification threshold,
- the product may not be classified due to a lack of data,
- the product may be hazardous in areas not covered by the Hazard Classes of CLP, such as dust explosion, photo-sensitivity, endocrine disruption, or toxicity to terrestrial organisms,
- emerging hazards such as 'persistent, mobile and toxic (PMT)' or 'very persistent, very mobile (vPvM)' may not yet have been considered.

SDSs are also required to be provided for substances that are considered to be PBT (persistent, bioaccumulative, and toxic) or vPvB (very persistent, very bioaccumulative) (criteria in REACH Regulation, Annex XIII), or for a substance appearing on the Candidate List of SVHC for Authorisation, even when the substance itself is not classified as hazardous.

SDSs must be provided on request for non-classified mixtures that contain:

- a component hazardous to health or the environment at ≥ 1 wt % by wt for non-gaseous mixtures and ≥ 0.2 % by volume for gaseous mixtures,
- a component at ≥ 0.1 wt % that is classified as Carc 2, Repr 1A or 1B or 2 or effect on or via lactation, or Skin or Resp Sens 1 for non-gaseous mixtures (REACH Art 31),
- a component at ≥ 0.01 wt % that is Skin Sens 1A (CLP Regulation),
- substances with specific concentration limits (SCL) for skin or respiratory sensitization at below 0.1% present at greater than one tenth of the SCL (CLP Regulation),
- a component at ≥ 0.1 wt % that is a PBT or vPvB (as defined above) or appearing on the Candidate List of SVHC for Authorisation,
- a component with a Community Exposure Limit (no lower limit is given).

2.2. Label elements

This Sub-section contains the hazard communication elements that appear on the label. These are specified in the CLP Regulation. Each Hazard Category in the classification has associated label elements. Not all possible label elements are included on the label, and there are recommendations in the CLP Regulations on prioritization and redundancy.

The label elements listed here should be consistent with those on the actual product label, and with the relevant classification given in sub-section 2.1. If the product is not classified, you may still see some Precautionary Statements (see below) assigned to advise the user of recommended safety measures that should be taken when using the product.

Label elements include:

- pictograms (comprising a black symbol in red 'square set on point' border),
- Signal Word (either danger or warning, not both),
- Hazard Statements (H-statements, given in the CLP Regulation with code starting with a H, such as H400: Very toxic to aquatic life),
- Precautionary Statements (P-statements, given in the CLP Regulation with code starting with a P, such as P363: Wash contaminated clothing before reuse),
- Supplementary hazard information (see below).

Some label elements on small packages may be omitted, so the product label may not have all of the label elements given in the SDS.

Hazard Pictograms

Pictograms are assigned according to Annex I of the CLP Regulation, depending on the hazard classification. For example, flammable liquids have the pictogram:

There are rules of precedence given in CLP Article 26 that help reduce the number of required pictograms. Nevertheless, up to five pictograms may be necessary on the label, depending on the hazard classification of the substance or mixture. Some hazard categories, such as relatively insensitive explosives and the less severe environmental hazard categories, do not have an associated pictogram.

Signal Word

Most hazardous products are assigned a signal word based on the severity of the hazards. Products carrying the most severe hazards are assigned the Signal Word 'Danger', while those with less severe hazards are given the Signal Word 'Warning'. Some hazards, such as those having an effect on lactation and the less severe environmental hazard categories. Do not have an associated Signal Word.

Hazard Statements

Hazard Statements (or H-statements) are legal phrases for each Hazard Category that appear on the label to warn users of the particular hazards. Normally there is one H-statement per Hazard Class. H-statements for health effects often refer to the route of entry into the body, e.g. 'Toxic by inhalation', 'Harmful if swallowed', 'May cause an allergic skin reaction'. H-Statements for specific target organ toxicity (STOT) effects may also specify the affected organ(s), e.g. 'H371: May cause damage to lungs if inhaled.'

Each hazard statement has an associated numerical code; for example, 'H331: Toxic if inhaled', 'H302: Harmful if swallowed', 'H317: May cause an allergic skin reaction. Note that the codes themselves, e.g. H317, do not have to appear on the SDS or label, but it can be useful to include them, for example in checking translations.

Some H-statements may be combined into a single phrase e.g. 'H302 + H312 + H332: Harmful if swallowed, in contact with skin or if inhaled'.

Appendix C of this User Guide contains a list of single and combined hazard statements and their corresponding numerical codes.

Precautionary statements

Precautionary Statements (or P-statements) are legal phrases to advise on safety measures when using the product. The P-statements are given in the CLP Regulation for each Hazard Category. Each Hazard Category may have several associated P-statements, and ECHA's Guidance on Labelling and Packaging gives recommendations on prioritizing those to appear on the label.

P-statements fall into five categories – general, prevention, response, storage and disposal.

ECHA Guidance recommends a maximum of six P-statements are given in this Sub-section and on the label. However, they can be combined, sometimes into lengthy statements: e.g. P305 + P351 + P338 + P310: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Note also that many P-statements specify choices and require editing before use, e.g. 'P260: Do not breathe dust/fume/gas/mist/vapours/spray' should have the irrelevant parts removed. For an inert dust, this would appear as 'P260: Do not breathe dust'.

Note that the codes themselves, e.g. P310, do not have to appear on the SDS or label, but it can be useful to include them, for example in checking translations.

Appendix E contains a list of single and combined precautionary statements and their corresponding numerical codes.

Supplementary hazard information

The GHS does not contain all the hazards that were identified in earlier EU legislation. When the EU was implementing the GHS as the EU CLP Regulation, they included 'supplementary hazard statements' to specify these additional hazards.

Supplementary Hazard Statements have a code beginning EUH in the CLP Regulation, e.g. 'EUH066: Repeated exposure may cause skin dryness or cracking' or 'EUH204: Contains isocyanates. May produce an allergic reaction.'

For some mixtures, you may see the following or similar phrase under supplementary hazard information: 'x per cent of the mixture consists of component(s) of unknown acute toxicity'. The acute toxicity estimate (ATE) of the mixture is calculated based on the concentration of the components in the mixture, and their acute toxicity. If no data is available on the toxicity of a particular ingredient present at >1%, that ingredient is not included in the calculation and the SDS compiler alerts the user to this with the above statement in the SDS and on the label.

Similarly, for mixtures that contain ingredients with no useable data on acute and long-term hazards to the aquatic environment, this should be highlighted to the user with the statement 'Contains x percent of components with unknown hazards to the aquatic environment' in the SDS and on the label.

Labelling elements required by legislation other than CLP may also appear under supplementary hazard information. For example, REACH Authorisation numbers, ingredient declarations according to the Detergents Regulation (648/2004), or the flammability labelling according to the Aerosol Dispensers Directive (75/324/EEC).

2.3. Other hazards

This section should contain information on any additional hazards that are not included in the CLP Regulation, or do not meet the criteria for classification but still present a risk to the user, e.g. lachrymators, photo-toxic materials, strong-smelling products, dust explosion hazards, toxicity to wildlife, or product that cause nuisance irritation but at a level below that for classification.

Also in this Sub-section, suppliers are required to state whether the substance meets the criteria for Persistent Bioaccumulative Toxic (PBT) or very Persistent very Bioaccumulative (vPvB), or if they are considered to be an endocrine disrupter (either by being on the Candidate List, or otherwise meeting the criteria given in legislation). Endocrine disruptors cause harm by acting through the hormone system, either in humans or animals.

The Product Label

The label on the container should be read in conjunction with the SDS. The label should usually match the symbols and text given in sub-section 2.2, although some label parts may be omitted for small containers. If there is discrepancy between the SDS and label, and you are unsure of the reason, you should contact your supplier for clarification.

In addition to the above label elements, the CLP Regulation mandate the following labelling information:

- the product name,
- the name, address and telephone number of the supplier,
- the nominal quantity in the package if made available to the general public (and not indicated elsewhere on the package),
- for mixtures, the names of up to four ingredients that contribute to the product classification for the most serious health hazards (if applicable).

As mentioned, other legislation may have mandatory requirements for additional text on the label, including:

- REACH Authorisation number,
- Text specified in REACH Restrictions (REACH Annex XVII), e.g. ‘restricted to professional users’,
- text and ingredient listing for specialist products, such as detergents and aerosols
- Unique Formula Identifier (see Section 1.1 of this User Guide).

Links to other Sections

Supporting information leading to the overall classification of mixtures	Section 3
Supporting data for identified fire hazards	Section 9
Supporting data for identified reactive hazards	Section 10
Supporting data for identified health hazards	Section 11
Supporting data for identified environmental hazards	Section 12

Further reading and regulations

The CLP Regulation (Regulation (EC) No. 1272/2008) and its amendments.
https://echa.europa.eu/regulations/clp/legislation

ECHA ‘Guidance on Labelling and Packaging’ and ‘Introductory Guidance on the CLP Regulation’.
https://echa.europa.eu/guidance-documents/guidance-on-clp

ECHA ‘Search our data’.
https://echa.europa.eu/

The CLP Regulation (Regulation (EC) No. 1272/2008) as amended for Great Britain
https://www.legislation.gov.uk/eur/2008/1272

HSE Guidance on chemical classification, labelling and packaging (CLP)
https://www.hse.gov.uk/chemical-classification/legal/clp-regulation.htm

SECTION 3: Composition/information on ingredients

The purpose of Section 3 is twofold, namely to tell you whether the product is a substance or a mixture, and to identify the ingredients/impurities which contribute to the hazards of the product.

Is the product a substance or a mixture?

The product is a *substance* if it is a chemical element, e.g. sulphur, or one of its compounds, e.g. sodium sulphate. This does not mean that the product is 100% pure, and impurities may sometimes contribute to the health hazard of the product, even when present at low levels. In the legislation, such products are called mono-constituent substances (i.e., one main component).

The definition of ”substance” also include the product of an industrial process. For example, 40-60 petroleum ether is a mixture of hydrocarbons, but is considered a substance. There are ‘multi-constituent substances’, and ‘substances of Unknown or Variable composition, Complex reaction products or Biological materials’ (UVCB). Some substances may include additives that are necessary to preserve the stability of the product.

The product is a *mixture* if it is a formulated mixture of substances (often also referred to as ingredients or components), e.g. washing powder or paint. Note that a simple solution (e.g. an aqueous salt) is usually regarded as being a mixture.

Section 3 is only required to contain one Sub-section. The choice of Sub-section depends on whether the product concerned is a substance or a mixture. If it is a substance, then Sub-section ‘3.1. Substances’ is included, while if it is a mixture Sub-section ‘3.2. Mixtures’ appears instead. Whichever Sub-section is included, the other sub-section need not appear in the SDS. This can cause confusion, as a mixture SDS will have a Sub-section 3.2, but not Sub-section 3.1. Many suppliers will, therefore, include both sub-sections and write “not applicable”.

The two Sub-sections contain slightly different information, although the overall purpose is the same, i.e., to describe the composition.

3.1. Substances

This Sub-section should identify the main constituents of the substance, as well as any impurities or additives which are classified as hazardous and contribute to the classification of the substance.

For substances there is no requirement to give classifications in this section, as the hazard classification of the substance is already given in Section 2 and should take into account any contribution from impurities or additives.
Each constituent of the substance should be identified by the following information:

Chemical name

Systematic names can be very complicated so you may find an abbreviated or a ‘common’ name is used. If the substance is given in Regulatory lists, particularly Annex VI, Part 3 of the CLP Regulation, the GB Mandatory Classification List, or the Classification and Labelling Inventory, the chemical name that appears in the regulation should be used.

Identification number

As discussed in Section 1, this is the most important identifier, especially when the chemical is structurally complex. At least one identification number (EC number, CAS number, or Index number) should be given if available. If the chemical name is not clear, or has been abbreviated, the identification number will allow you to confirm the chemical identity.

Specific concentration limit

This is a new requirement for SDSs under the EU Regulation 2020/878, amending Annex II of the REACH Regulation. It is mandatory information in the EU, but has not been implemented into GB legislation, although there is no problem with including it voluntarily in GB. It aims to allow verification and transparency of product classification if the substance is used in mixtures.

Most frequently, mixture classification is based on calculations using generic thresholds (i.e. not specific to a particular substance). However, the generic thresholds are not appropriate for some substances, because they are more (and occasionally less) potent than expected. Such substances may have been set Specific Concentration Limits (SCLs) for use in calculating the hazard classification of mixtures.

An example is troclosene sodium (EC 220-767-7), which is listed on Annex VI of the CLP Regulation with a classification (among others) of STOT SE 3, H335: May cause respiratory irritation and EUH031: contact with acids liberates toxic gas. Both hazards have SCLs (both ≥ 10%), that take precedence over generic threshold concentration limits in the calculation of any mixture classifications.

SCLs may be found in Annex VI of the CLP Regulation, or in the REACH Registration dossiers available on the ECHA 'Search our data' webpage.

Multiplication-Factor (M-factor)

This is a new requirement for SDSs under the EU Regulation 2020/878, amending Annex II of the REACH Regulation. It is mandatory information in the EU, but has not been implemented into GB legislation, although there is no problem with including them voluntarily in GB. It aims to allow verification and transparency of product classification if the substance is used in mixtures.

For environmentally hazardous substances, you may see the multiplication factor (M-factor) in addition to the classification [e.g. Aquatic Acute 1, H400 (M = 1)]. The M-factor is used in the calculation to classify mixtures containing substances that are very toxic to aquatic organisms. The M-factor effectively lowers the threshold concentration for classification of a mixture. The higher the M-factor, the more hazardous the substance is to the aquatic environment.

M-factors may be found in Annex VI of the CLP Regulation, or in the REACH Registration dossiers available on the ECHA 'Search our data' webpage.

Acute Toxicity Estimates (ATEs)

This is a new requirement for SDSs under the EU Regulation 2020/878, amending Annex II of the REACH Regulation. It is mandatory information in the EU, but has not been implemented into GB legislation, although there is no problem with including it voluntarily in GB. It aims to allow verification and transparency of product classification if the substance is used in mixtures.

The ATE is an acute toxicity value for a substance that can used in calculating the toxicity of a mixture. The ATE is usually based on animal testing:

- older testing that gives values for lethal concentrations (LD_{50} for oral or dermal routes, or LC_{50} value for the inhalation route);
- more recent testing that gives a range of values (based on toxic effects, rather than mortality).

Separate ATEs may be given for different routes of exposure.

Particle characteristics for nanoforms.

This is a new requirement for SDSs under the EU Regulation 2020/878, amending Annex II of the REACH Regulation. It is mandatory information in the EU, but has not been implemented into GB legislation, although there is no problem with including it voluntarily in GB.

Nano-forms have very small particle size (< 100 nm), and there is concern that such products may show increased or different toxicity compared to products with larger particle sizes. The altered properties arise from:

- small size allowing crossing of biological membranes,
- increased surface area, and surface effects,
- concerns of specific shapes, e.g. tubes,
- increased physico-chemical hazard, e.g. fire or dust explosion.

This is a specialized field, and for details of reporting and interpretation of data on nanoforms the reader is referred to ECHA guidance (Appendix for nanoforms applicable to the Guidance on Registration and Substance Identification; Version 2.0; January 2022).

3.2. Mixtures

In this Sub-section you should find a list of the hazardous substances contained within the mixture. Suppliers will not usually give a full composition of the product. Indeed, if the mixture and its ingredients are not classified as hazardous then no information need be given at all. Although a statement to this effect may appear, e.g. *'Contains no substances classified as hazardous'*.

Components which are classified as hazardous to health or the environment are required to be listed in this Sub-section, but only if they are above a threshold concentration which depends upon the hazard posed. The greater the hazard, the lower the threshold level for disclosure, e.g. a Category 1 carcinogen such as benzene is declared at or above 0.1%.

The following components must be disclosed even if they are not classified as hazardous:

- identified as PBT (persistent, bioaccumulative and toxic) or vPvB (very persistent, very bioaccumulative) present above 0.1%,
- substances appearing the EU Candidate List, i.e. suspected of being substances of very high concern (SVHC), such as endocrine disruptors, present above 0.1%,
- having a Union workplace exposure limit (IOLEVs or ILVs), regardless of their concentration.

Each ingredient in the mixture that is required to be disclosed should be identified by the following information:

Chemical name and Identification number

The same requirements described above for substances apply to the ingredients in mixtures. Note that it is required that the individual substances present in the mixture are disclosed; it is not acceptable to list the trade name of a mixture as an ingredient.

REACH Registration number

If an ingredient has been registered under REACH, the substance will have been assigned a REACH registration number which should be included in this Section. As discussed in Section 1.1., downstream users and distributors are permitted to omit the last four digits of the registration number to avoid disclosing the identity of their supplier.

Concentration or concentration range

The concentration or concentration range of the listed hazardous ingredients for the material should be given as a weight for weight percentage. This information is especially important if the material is being used for further formulating (i.e., as a raw material in another product) because it helps the formulator to establish whether this new product requires a hazard classification.

If a concentration range is used, the mixture classification should be based on each hazardous ingredient being present at the upper limit of the range, so the hazards are not underestimated.

Substance classification

For each disclosed substance the classification according to the CLP Regulations should be given. This allows downstream users using the mixtures in their own formulations to classify and label their own products to CLP criteria.

The classifications consist of the Hazard Classes, Hazard Categories, and associate H-statements. The supplemental hazards, e.g. EUH019: May form explosive peroxides, should also be given. The classification is usually given in coded form (see Section 2.1), and the full text of the H- and EUH-statements provided in Section 16 of the SDS.

Hazard Statements and codes are listed in Appendix C of this User Guide.

M-Factors, ATEs, and details of nano-forms

This is a new requirement for SDSs under the EU Regulation 2020/878, amending Annex II of the REACH Regulation. It is mandatory information in the EU, but has not been implemented into GB legislation, although there is no problem with providing them voluntarily in GB. It aims to allow verification and transparency of the product classification in Section 2.

See Section on substances (above) for explanations of these terms and the information requirements.

Further reading and regulations

Part 3 of Annex VI of CLP Regulation - Table 3.
https://echa.europa.eu/regulations/clp/legislation

GB classification and labelling.
https://www.hse.gov.uk/chemical-classification/classification/harmonised-classification-self-classification.htm

ECHA 'Search our data'.
https://echa.europa.eu/

ECHA Classification and Labelling Inventory.
https://echa.europa.eu/information-on-chemicals/cl-inventory-database

Guidance on the Compilation of Safety Data Sheets, ECHA, Version 4.0, 2020.
https://echa.europa.eu/documents/10162/23036412/sds_en.pdf/01c29e23-2cbe-49c0-aca7-72f22e101e20

SECTION 4: First aid measures

This Section should provide enough information to enable the reader to administer fast and effective first aid to anyone adversely affected by the product. It can be used to identify special provisions for the workplace to be made available before the chemical is handled, such as an eye wash station or shower facilities, decontamination agents or antidotes, and personal protective equipment (PPE) for first-aiders.

The advice given in this Section will depend on the hazards of the particular product, so it is closely linked to Sections 2, 8, 9, 10 and 11. It is strongly recommended that all of these sections of the Safety Data Sheet are reviewed and fully understood before using the product for the first time, in order for preventative measures to be in place, along with emergency procedures in case of accident.

4.1. Description of first aid measures

First aid treatment should be administered as soon as possible after exposure, so that harmful effects are minimised. The advice given in this Sub-section is aimed at personnel who have not necessarily had any training in first aid techniques, so that a worker can help a stricken colleague without having to wait for trained first aiders or doctors. It should be sufficient to enable untrained personnel to:

- limit the worsening of a patient's condition, and in the most serious cases preserve the life of a victim,
- promote recovery of the patient,
- stabilise and comfort the patient until the arrival of professional help.

The advice may also state which treatments are suitable for untrained first aiders, and those that require more expertise. No-one should administer treatments about which they are unsure.

There are four routes of exposure to chemicals, and advice should be provided under sub-headings for each:

- inhalation,
- skin contact,
- eye contact,
- ingestion.

Information on the most important actions should have been prioritised; where multiple actions are needed, they should be listed in the most effective order. The treatments and urgency of their use, as well as the need for the attention of a doctor should be proportionate to the hazard.

Inhalation

This Sub-section advises how to treat someone who has been affected by gas, dust, fumes or vapours. The main requirement is to move the patient from the exposure into fresh air. If possible, prevent further exposure of others by evacuating the area or isolating the source of release.

It is especially important that those providing first aid are fully protected from succumbing to the same hazard. Artificial respiration may be necessary, if it does not place the first aider at risk, but this should only be carried out by someone trained in the technique.

Examples of phrases which might be shown here include:

'Remove patient from exposure.'

'Remove person to fresh air and keep in a position comfortable for breathing.'

'Remove patient to fresh air, allow to rest and keep warm.'

'Apply artificial respiration if breathing shows signs of failing.'

'Do not use mouth-to-mouth resuscitation.'

Skin contact

This Sub-section contains information on the following:

- the best method of decontamination to remove the chemical from the body or clothing so as to reduce immediate local damage, limit further exposure and reduce long-term systemic effects.
- methods of treatment of any adverse effects such as burning.

Examples of phrases that might be shown here include:

'Take off contaminated clothing and wash before reuse.'

'Wash affected area with plenty of water or soap and water.'

'Continue to wash with … for … minutes' (where the washing fluid and duration would be specified, e.g. glycerine for bromine contamination).

Eye contact

Eye contamination should always be treated very seriously and advice or attention from a medically qualified person should be obtained. It is essential to rinse affected eyes with copious amounts of water or eye-wash solution to remove as much of the contaminant as quickly as possible, thus relieving pain and reducing the risk of corneal attack. It is important when rinsing the eyes that the eyelids are held open, to ensure proper removal of the contaminant. Water or eyewash solution should be specified even if the contaminant is not soluble in it, as the use of solvents could worsen effects.

If the patient is wearing contact lenses, their removal is best left to the patient or medical professional, as they know the best way to remove them. Do not worry if the contact lens is washed out during irrigation. The wearing of contact lenses where chemicals are used may be considered during the workplace risk assessment.

Examples of phrases, which might be shown here, include:

'Immediately wash eyes with plenty of eyewash solution or warm water, holding eyelids apart (for at least … minutes).' (where a time would be specified).

'In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.' (or may state obtain immediate medical attention depending on expected severity of effects).

'Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.'

Ingestion

The treatments proposed in this sub-section depend on the toxic effects of the product, the quantity ingested and whether the product has been swallowed or remains in the mouth. Inducing vomiting is often discouraged due to the risk of vomit being breathed into the lungs (aspiration), although for some products the SDS may advise an emetic, if administered by a medical professional.

The usual intervention techniques that will be mentioned here would include:

- rinsing out the mouth,
- giving a small amount of water to drink (do not give milk as it is slightly acidic). Drinking large quantities of liquids may be hazardous, owing to more rapid absorption of the hazardous material into the bloodstream. It may also give off heat of dilution.

Examples of phrases, which might be shown here, include:

'Rinse mouth. Do NOT induce vomiting.'

'Rinse out mouth with plenty of water and give a glass of water to drink.'

'If confined to mouth, do not swallow; rinse out mouth with plenty of water.'

'If swallowed, seek medical advice immediately and show the container/label/safety data sheet.'

Self-protection of the first aider

Advice on protection for first aiders should be given to prevent them becoming contaminated and suffering the same fate as the patient. Such advice may be listed under its own sub-heading or be incorporated under relevant exposure-route sub-headings.

4.2. Most important symptoms and effects, both acute and delayed

A list of symptoms by exposure route, especially if delayed symptoms are possible, should be given in this sub-section. The effects may occur at the point of contact (i.e. local effects such as skin irritation), or through systemic effects on specific organs away from the site of contact (e.g. blindness through ingestion of methanol).

4.3. Indication of any immediate medical attention and special treatment needed

This sub-section is provided for medical professionals and contains any additional information that would help them in treating a person exposed to the product. This may be of a general nature or can include specific treatments or antidotes where these are known.

Further reading and regulations

The Health and Safety (First-Aid) Regulations (SI 1981/917).
http://www.legislation.gov.uk/uksi/1981/917/made

L74: *First aid at work, The Health and Safety (First-Aid) Regulations 1981: Approved Code of Practice and Guidance*; HSE, amended 2018.
.https://www.hse.gov.uk/pubns/priced/l74.pdf

SECTION 5: Firefighting measures

This Section contains information on suitable extinguishants and other information for firefighting. A fire risk assessment should be conducted, and emergency procedures and equipment put in place before beginning work with the substance or mixture. The information provided in this section should help the assessor, but the supplier cannot anticipate the specific conditions of handling, use, or processing.

5.1. Extinguishing media

You should find advice on suitable extinguishants for tackling a fire involving or threatening the chemical. The choice is usually between water, foam, dry powder, and carbon dioxide. Alcohol-resistant foam may be recommended for substances which break down regular firefighting foam. In rare cases halons (halide-containing hydrocarbons) may be mentioned, However, these are now banned from use, except in some specialised applications. It is important that the right extinguishant is available where chemicals are being stored or used.

Advice on extinguishants that should not be used should also be given. Some fires may be worsened by using the wrong medium. For example, if water is used for an immiscible liquid of lower density, such as oil, the burning liquid will float on the surface and the fire could spread. Some chemicals react vigorously or even explosively with water. Burning magnesium will react with carbon dioxide, a common extinguishant.

5.2. Special hazards arising from the substance or mixture

This sub-section often starts with an indication of whether the product is ‘combustible’, i.e. if it will burn in air, for example wood or coal. Combustible products are not the same as the flammable products as defined in the CLP Regulation, although flammable solids are described as ‘readily combustible’. Note the potential confusion with the UN GHS terminology that has an extra Hazard Category of ‘combustible liquid’ that is not included in the EU CLP, but is used elsewhere such as in the USA. The absence of any statement on combustibility should not be taken to indicate that the product is non-combustible.

A product may be described as ‘flammable’, or ‘highly flammable’ or ‘extremely flammable’, depending on how easily it ignites. The glossary contains a more detailed explanation of relative flammability. If flammability is not mentioned, it should not be assumed that the product is non-flammable. This can be checked in Section 2.

Additional hazards should also be included. For example, many petroleum products give off vapours that can form explosive mixtures in air. These vapours are often heavier than air and can travel large distances or fill depressions or pits before being ignited. Sealed containers, including cylinders and aerosol canisters, may explode due to a build-up in pressure if they are heated due to a fire.

This section should also mention potential hazardous combustion products. Although the smoke from any fire is hazardous, some substances will produce very toxic chemicals when they burn. This can be a serious threat to occupants of a building, to those fighting the fire, and to people downwind, possibly even at some distance. In these cases, it is important that firefighters are made aware of this additional risk, so precautions can be taken. It may be necessary to alert police and people likely to be affected by the fumes/smoke.

5.3. Advice for firefighters

This sub-section is aimed particularly at professional firefighters and should give advice on how to tackle a fire involving the product. This might include information on how an extinguishant should be applied, e.g. water as jet or spray. pressurised containers, such as aerosols and gas cylinders, should be kept cool during a fire as there is a risk of explosion.

Recommendations on how to prevent environmental damage may also be given. Bunding or other forms of containment may be necessary in order to prevent pollution from run-off water contaminated with chemicals.

Protective Equipment for Firefighters

Professional firefighters will normally wear thermally protective clothing and self-contained breathing apparatus if they are entering a smoke-filled area. In a fire involving chemicals, additional protection may be required if the product or its combustion products are corrosive, irritant, or toxic by skin absorption. Usually this will involve wearing a chemical protective suit; in certain cases, the type of suit or other necessary equipment may be stipulated.

Further reading and regulations

Fire Safety in the Workplace.
https://www.gov.uk/workplace-fire-safety-your-responsibilities/fire-risk-assessments

Fire Safety Risk Assessment; Factories and Warehouses; Department for Communities and Local Government, 2006.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/14882/fsra-factories-warehouses.pdf

Regulatory Reform (Fire Safety) Order 2005 (S.I. 2005/1541), as amended by the Regulatory Reform (Fire Safety).
https://www.legislation.gov.uk/uksi/2005/1541/made

Subordinate Provisions Order 2006 (S.I. 2006/484).
http://www.legislation.gov.uk/uksi/2006/484/made.

SECTION 6: Accidental release measures

This Section recommends actions in response to spills, leaks, or other unplanned releases, to prevent or minimise the harm to persons, property and the environment for both small scale, and large-scale release and applies to products supplied in packages or in bulk.

These recommendations form the basis of your site risk assessment for foreseeable accidental releases during delivery, use, and disposal. The risk assessment should provide detailed responses relating to workers, and if necessary to the wider public, and also environmental exposures. The result of the assessment could be implementation of risk management measures, such as staff training, the development of emergency procedures, or the provision of clean-up equipment. Waste issues are considered in Section 13.

Two levels of release can be identified in the risk assessment:

- local spills and leaks involving small amounts that are easily contained and require limited response measures,
- bulk releases that require activation of a pre-planned clean-up operation that may involve specialist services.

The Section gives recommendations on:

- personal precautions,
- environmental precautions,
- clean-up methods.

6.1. Personal precautions, protective equipment and emergency procedures

This sub-section contains recommendations to trained workers or professional emergency responders. The advice specifies the wearing of personal protective equipment (PPE) during an incident, and any further measures to make the area safe, such as removing ignition sources, ventilating the area, and evacuating non-essential personnel.

To avoid duplication of information, the advice on PPE in this Sub-section will usually be general, with a reference to Section 8 (Exposure controls/personal protection), where more detailed information is found.

The legislation calls for advice on suitable fabric for personal protective clothing during emergency response (such as '*appropriate*: *butylene*'; '*not appropriate*: PVC'). The PPE in the case of spills is likely to be different from that recommended for normal use.

6.2. Environmental precautions

Here you should find actions to prevent release of the product that might lead to environmental harm. The procedures should be assessed bearing in mind the product itself, the amount involved and the properties. A common phrase is '*keep away from drains, surface and ground water*'.

In the case of large spillages, actions may include calling the emergency services and Environment Agency. In some cases, these organisations could be proactively contacted to help assess the adequacy of the on-site risk assessment and emergency planning for large spillages.

6.3. Methods and material for containment and cleaning up

Advice on how to contain and clean up spills should be given here. The methods often depend on the size of the spillage: it is usually appropriate to specify separate procedures for small and large releases.

The clean-up method also depends on the physical properties of the product, particularly whether it is a solid or liquid.

For liquids, the main concerns are spread of large spills, slipperiness, and evaporation of volatile liquids (particularly if flammable).

Solids are more easily contained, but care should be taken with a dusty material to prevent it becoming airborne, for example if sweeping is recommended.

Examples phrases are given below:
'*Contain spillages with sand, earth or any suitable absorbent material. Transfer to a container for disposal or recovery. Do not allow to enter sewers, drains or watercourses.*' This is probably the most common advice and could apply to both small and large releases.

'*Flush to foul drain with plenty of water.*' This could apply to both small and large spillages. This recommendation is less common due to the consequences of introducing the product into the sewerage system. Even non-hazardous substances such as milk in large amounts can have devastating effects in a sewage plant. See Section 12 for further guidance.

You may see advice to treat the spilled product with another chemical agent to 'neutralise' the hazard, before proceeding with one of the options above. The decision to do this would depend on the hazards of the product, the amount of product involved and its potential impact on the environment. These neutralisation reactions, particularly involving acids and bases, typically generate heat, so should only be applied to small spillages.

Further examples of the kind of advice that might appear in this sub-section:

'*Stop the source of leak or spillage*'.

'*Sweep up the spillage and store in sealed, plastic containers ready for disposal. Wash the area with water*'.

'*Wipe clean or vacuum up solids*'.

'*Don't use a brush or compressed air for cleaning surfaces or clothing*'.

'*Clear spills immediately*'.

Flammable products

Even small spillages should be considered in a fire risk assessment. Clean-up procedures given in this Sub-section may include advice on the use of non-sparking materials, tools, equipment, protective clothing and footwear, and non-combustible absorbent materials. Complete decontamination techniques, post clean-up, may be recommended to remove flammable residues. The total avoidance of ignition sources (e.g. flames, sparks, hot surfaces) may require in-depth consideration of equipment, machinery, vehicles and smoking policy within the vicinity of the operation.

6.4. Reference to other sections

This Sub-section should direct the user to the advice on exposure controls and PPE in Section 8 and the disposal instructions in Section 13, which are of particular relevance to Section 6.

Links to other Sections

For information on hazards	Section 2
For information on personal protective equipment	Section 8
For information on physical and chemical properties	Section 9
For information on stability and reactivity	Section 10
For information on environmental effects	Section 12
For information on disposal	Section 13

SECTION 7: Handling and storage

This Section provides employees, occupational health and safety professionals and employers with information on the safe handling and storage of the product. The information should be consistent with the product uses described in Sub-section 1.2 and also, for an extended SDS, with the Chemical Safety Assessment (CSA) and exposure scenarios (ESs).

7.1. Precautions for safe handling

The Section usually contains brief advice on occupational hygiene (e.g. '*wash hands after use*', '*do not breathe dust*'), considering the hazards (e.g. corrosivity or flammability) and the expected use. The statements should be consistent with the Precautionary Statements for prevention given in Section 2. The supplier should emphasise handling practices that are specific to the product.

General handling precautions and practices are described in order to:

- prevent fire,
- prevent overexposure during contact with the product, including minimising formation of dust/aerosols,
- prevent release to the environment,
- minimise contact during and after handling through good hygiene.

7.2. Conditions for safe storage, including any incompatibilities

Stored containers should not be assumed to be safe. Containers and lids can corrode or leak if not stored properly. Heat may cause pressure within containers or decomposition of the product, sparks or heat can cause fires or explosions. Storing incompatible products close together can lead to dangerous reactions. Safe handling and storage conditions for chemicals prevents potentially dangerous incidents.

This Sub-section should give recommendations on the necessary storage conditions to ensure:

- damage to containers is avoided,
- there is no contact with incompatible chemicals which could cause dangerous chemical reactions,
- volatilisation, evaporation or decomposition of the stored product are prevented,
- flammable and/or explosive atmospheres in the storage areas do not occur.

Information on suitable and unsuitable materials for storage vessels and transfer equipment may also be included in this section.

The statements should be consistent with the Precautionary Statements for storage given in Section 2.

7.3. Specific end use(s)

Specific uses for which the product is designed should be described in this Sub-section. The information given here may be more detailed and specific than the product uses given in sub-section 1.2., but these Sub-sections should be consistent. For an ext-SDS, this Sub-section should also be consistent with the Exposure Scenarios (ESs) in the Annex.

Links to other Sections

Information on recommended uses	Section 1
For information on accidental release measures	Section 6
For information on personal protective equipment	Section 8
For information on physical and chemical properties	Section 9
For information on stability and reactivity	Section 10
For toxicological information	Section 11
For information on environmental effects	Section 12

Further reading and regulations

HSG51: *The storage of flammable liquids in containers* (3rd Ed.), HSE, 2015.
http://www.hse.gov.uk/pubns/priced/hsg51.pdf

HSG176: *The storage of flammable liquids in tanks* (2nd Ed.), HSE, 2015.
http://www.hse.gov.uk/pubns/priced/hsg176.pdf

HSG71: *Chemical Warehousing: The storage of packaged dangerous substances* (4th Ed.), HSE, 2009
http://www.hse.gov.uk/pubns/priced/hsg71.pdf

Regulatory Reform (Fire Safety) Order 2005 (S.I. 2005/1541).
http://www.legislation.gov.uk/uksi/2005/1541/made
as amended by the Regulatory Reform (Fire Safety) Subordinate Provisions Order 2006 (S.I. 2006/484)
http://www.legislation.gov.uk/uksi/2006/484/made.

SECTION 8: Exposure controls/personal protection

This Section is important for all processes with the product:

- receiving a product on site, particularly during transfer from the delivery vehicle to storage or a

processing plant,
- use(s),
- disposal.

Management should ensure all on-site processes are safe through risk assessment and risk management measures. The risk assessment needs to consider for each process the likely exposures to the product, considering:

- the amount of product,
- its physical state (solid, liquid or gas),
- its hazards (e.g. highly flammable, toxic), both to workers and the environment (SDS Sections 2, 9, and 11),
- its physical properties, e.g. volatility (or evaporation rate), dustiness, miscibility with water, chemical reactivity (either with itself or with other substances) (see SDS Sections 9 and 10).

This Section should inform you of the safe limits of exposure, and in selecting the control measures to limit exposure within these limits.

8.1. Control parameters

Occupational exposure limits

Section 8 should provide information on the national occupational exposure limits (OELs) for the substance or ingredients of a mixture. There is no legal limit below which an ingredient in a mixture can be omitted from this Sub-section. The OELs should relate to the countries where the product is marketed, and the SDS is intended. The legal basis of the limit (i.e. the national implementing legislation) should also be given in the SDS.

The OELs usually are for airborne concentrations (either dust, vapour or spray) that can be inhaled. Often there are two limits, one for a full shift for workers (average exposure over 8 h), and another for short-term exposure (usually 15 min).

A small number of substances also have biological limit values (e.g. xylene has a limit value for metabolites found in urine after a worker has undertaken an 8-hour shift).

As well as national limits, some substances will have European harmonised exposure limits. The national legislation will implement these limits in all EU countries. It is recommended to list the harmonized EU limits in the SDS.

In the UK, the OELs are expressed as a Workplace Exposure Limits (WELs). Substances that have been assigned a WEL are subject to the requirements of COSHH. These Regulations require employers to control exposure under the following principles:

- good control practices are applied,
- any WEL is not exceeded,
- exposure to asthmagens, carcinogens and mutagens is reduced to as low as is reasonably practicable.

WELs are listed in the HSE publication EH40 Workplace Exposure Limits (often referred to as just EH40).

As mentioned, other countries' OELs may be seen in this Sub-section, e.g. German MAKs (*maximale Arbeitsplatz-Konzentration*). You can find listings of OELs for many substances at the GESTIS website (https://limitvalue.ifa.dguv.de/).

Nearly all exposure limits relate to personal exposure, and personal air sampling techniques are required. However static and workplace samples can give an indication of engineering controls necessary. Usually monitoring and sampling requires expertise such as can be provided by an occupational hygienist.

The data may be supplied for individual ingredients of a mixture and care is needed in interpretation, because the properties of the mixture may be different from that of the substances involved. If in doubt, adopt the lowest figure given for any one of the ingredients as the exposure limit, or ask the supplier for information available for the mixture itself

Derived-No-Effect Levels and Derived Minimal Effect Level

For substance that have undergone a Chemical Safety Assessment (CSA), Derived No Effect Levels (DNELs) may be listed in this Sub-section. The DNELs are safe limits calculated from the hazard data and are thus similar to OELs. However, DNELs may cover both inhalation and dermal routes, short-term and long-term exposures, and also worker and consumer use. There are many more substances with DNELs than with OELs.

DNELs have been criticized for being set too low, which man make compliance with them difficult.

Derived Minimal Effect Levels (DMELs) serve a similar function to DNELs, but are used for hazards that have no threshold concentration, so that even very low exposures have a small chance of causing harms. The DMELs are therefore not ‘safe’ limits, but a limit where the risk of harm is considered acceptable. Adverse effects that do not have threshold concentrations include carcinogens, mutagens, and reproductive toxins (collectively known as CMRs).

The DNELs and DMELs can be checked in registration dossiers for the substance on the ECHA’s ‘*Search for chemicals*’.

In an extended SDS, the exposure scenarios (ESs) should give risk management measures necessary to keep workplace exposure below the DNELs and DMELs.

In-house limits

The supplier may have provided his own exposure limit information when no data is available from legislation or other sources.

Predicted No Effect Concentration

For substances that have undergone a CSA, Predicted No Effect Concentrations (PNECs) may also be listed in this Sub-section. These are limit values for the environment for the substance or components of a mixture.

The PNECs are the limit concentrations for different parts of the environment, e.g. freshwater, sediment, sewage treatment plant, soil. They are calculated using ecotoxicity data (as reported in Section 12).

In an extended SDS, the exposure scenarios (ESs) should give risk management measures to keep environmental exposure below the DNELs and DMELs.

8.2. Exposure controls

The COSHH Hierarchy of Controls should be borne in mind during use of hazardous products:

- eliminate the hazardous substance,
- substituted it with a safer alternative,
- control exposure with total or partial enclosure, extraction and/or ventilation,
- Personal protective equipment (PPE).

The risk management measures will depend on the hazards of the product, its properties, the amounts involved, and the processes during use. The measures are determined through a workplace risk assessment, considering the possible routes of exposure, e.g. skin, eye, inhalation and potential for harms, both short and long-term. The results of the risk assessment should indicate what risk management measures are necessary: engineering controls in order to remove the substance or mixture from the workspace, PPE, etc.

For a carcinogen (a substance which may cause cancer) special legislation (e.g. EU Directive 2004/37/EC or UK COSHH) and requirements apply. If in doubt, refer to the regulations or get specialist help.

Mechanical or engineering controls may be specified in order to remove vapours, fumes or dusts from the working environment. Local exhaust ventilation extracts the product from a specific area. General ventilation applies to the whole workplace.

PPE consist of gloves, goggles, overalls, etc. It may also be necessary to provide some form of breathing protection such as a dust mask or self-contained respiratory equipment.

In any case the exposure should be below the control parameters of Section 8.1, and consistent with Exposure Scenarios in an extended SDS.

Engineering controls

If hazardous emissions can reach the breathing zone of a user, some kind of extraction or ventilation will be needed. This may be achieved through natural means such as outdoor work, or more usually with local exhaust ventilation (LEV) which draws contaminated air away from the process at, or near, its source. This is a specialist area involving concepts beyond the scope of the SDS and the advice of a chemical ventilation engineer may be necessary.

Where mechanical or engineering controls are impractical or insufficient to reduce exposure to acceptable levels then PPE may be required.

The SDS should not contain vague advice such as using ‘good’ or ‘adequate’ ventilation. If in doubt, ask the supplier for specific information (e.g. type of ventilation, or air changes per hour).

Personal Protective Equipment (PPE)

The supplier will give recommendations based on good practice for use of the product. The equipment must be specified in sufficient detail (e.g. in terms of kind, type and class) to ensure that it will provide adequate and suitable protection during the foreseen uses.

Your company risk assessment, based on conditions of use, determine the best options for risk management measures.

A written record should be kept of the PPE issued and the recipients. Equipment should be regularly inspected and replaced if found to be damaged or malfunctioning or in use beyond its lifetime. All workplace PPE should bear a CE mark.

Gloves

Gloves and gauntlets are common in the workplace. There is a variety of glove materials, which vary widely in their resistance to chemicals. It is therefore important to seek advice when choosing gloves and the glove manufacturers give this information in their literature, via enquiry lines, or on websites.

This Section should indicate the type of material used for the gloves, the required thickness, and typical or minimum breakthrough times. These are difficult to the supplier to specify in the SDS, as other factors, such as abrasion, contact with other chemicals, hot work, and proper use of the gloves, can also influence glove choice.

Workplace allergy to the materials used in glove manufacture is a recognized problem. Cornstarch, sometimes used to facilitate putting on latex gloves, can give rise to skin irritation. Fewer cases have been reported for synthetic materials such as nitrile or neoprene. Some suppliers will recommend the use of barrier creams to provide additional hand protection and lotions to recondition the skin after exposure, but this requires assessment to determine appropriate use.

Manufacturers provide information on the time that it takes specified chemicals to penetrate the glove material when in constant contact (breakthrough time), limiting the time the gloves can give the desired protection. It is advisable to check the data given in this Sub-section and incorporate glove replacement into your risk assessment. Mechanical wear-and-tear needs to be considered as well.

Safety glasses/goggles/face masks

Safety glasses are recommended only for low-risk applications. You will need to consider how likely it is that the glasses may fall off in use or provide protection in the event of splashing. Safety glasses give no protection against vapour or fume. Goggles may be recommended where it is considered that the only risk is to eyes, not to the face in general.

Face shields may be considered when a danger arises from the risk of flying debris, or from splashing to the skin.

Face masks often incorporate a respirator where additional respiratory protection is necessary, e.g. for products with vapour, fume or dust that presents a hazard to eyes, skin and through inhalation.

Clothing

The recommendations may range from the limited protection given by a laboratory coat or overalls for low-risk operations, to chemically resistant full-body coveralls for operations where direct exposure is inevitable. Your company needs to decide and document measures based on the workplace risk assessment.

Respirators

The supplier should give recommendations for a range of respiratory protective equipment, taking into account potential exposures from the expected use. Management needs to consider the specific conditions of handling and use on your premises, and for emergencies from spillage or accidental release. Expert consultation may be required to determine the specific type and class of respirator for the task.

The Exposure Scenario (ES)

Much of the detail on risk management in terms of engineering controls and personal protection will be given in the Exposure Scenarios (ESs) in an extended-SDS. The ESs break down the use of the product into smaller tasks (e.g. mixing in open containers, filling using dedicated equipment, application with roller). The ESs may also contain risk management measures for different industries and conditions of use (e.g. concentrations, temperature, container size).

The ESs have a reputation of being overcomplicated and unintelligible, which is unfortunate as their purpose is clear and sensible.

Further reading and regulations

COSHH Essentials website.
http://www.hse.gov.uk/coshh/essentials

L5: *Control of substances hazardous to health* (6th Ed.), HSE Books, 2013.
www.hse.gov.uk/pubns/priced/l5.pdf

INDG136: Working with substances hazardous to health; A brief guide to COSHH; Revision 5; 10/12.
www.hse.gov.uk/pubns/indg136.pdf

Personal protective equipment (PPE) at work.
https://www.hse.gov.uk/ppe/index.htm

INDG330: *Selecting protective gloves for work with chemicals: Guidance for employers and health and safety specialists*, HSE Books, 2000.
www.hse.gov.uk/pubns/indg330.pdf

HSG258: *Controlling airborne contaminants at work - A guide to local exhaust ventilation (LEV)*, 3rd Edition, 2017.
https://www.hse.gov.uk/pubns/priced/hsg258.pdf

HSG53: *Respiratory protective equipment at work – a practical guide*, 4th Edition, 2013.
http://www.hse.gov.uk/pubns/priced/hsg53.pdf

HSG173: *Monitoring strategies for toxic substances*, 2nd Edition, 2006.
http://www.hse.gov.uk/pubns/priced/hsg173.pdf

SECTION 9: Physical and chemical properties

This Section provides you with information about the physical and chemical properties of a product, for example, its physical form, its pH and its solubility in water.

This will help you when you are carrying out your risk assessment and deciding on safe working practices, protective equipment and the level of training required. This Section should contain numerical information to help you understand how the product will migrate (e.g. to air) and consequent worker and environmental exposures, the fire risk, and how to deal with spillages or accidental discharges.

All products should have certain basic information provided. SI units are generally required, e.g. °C (rather than °F), but you may find suppliers using different units in which case you can apply conversions. If you feel that important information is missing, or if you are not clear about the data or what it applies to, then you should contact the supplier for help.

The material you have received should match the description given in this Section, such as appearance (liquid, powder), colour, odour, and other properties you may measure for quality control purposes on receiving the product, e.g. density, pH (measure of acidity or alkalinity). If it does not, you should check with the supplier.

For substances, or components of mixtures, the data should be consistent with the REACH registration dossier and any Chemical Safety Report (CSR). For a mixture, ingredient information is provided either because:

- the property is applicable only to substances, e.g. octanol–water partition coefficient,
- the mixture property is unknown, but the ingredient property gives a useful indication of the property, e.g. the vapour pressure of a solvent for a solution.

If no information is available for physico-chemical properties, it is generally OK to state this, although the supplier should have made efforts to find relevant information (e.g. from the ingredients, or calculation). The reasons for there being no data should be given, for example if the property is not relevant for a product, e.g. viscosity for a solid.

However, if the product may have physico-chemical hazards (e.g. explosivity, flammability, oxidizing properties) the supplier is obliged to confirm the classification through testing (see CLP Regulation Article 8).

You can check substance data in the substance registration dossier available at the ECHA website.

9.1. Information on basic physical and chemical properties

The REACH Regulation requires that all the properties stated in the legislation are listed in this Sub-section. The recommended order and content of this sub-section has been altered according to the recent EU Regulation 2020/878 which amends Annex II of REACH. This has not yet been adopted in the UK, so the older headings according to Regulation 2015/830 are the current standard, although the UK authorities have stated they will accept SDSs to the newer format. As you may see both, the sub-headings are presented side-by-side for comparison:

	Headings 2020/878	Headings 2015/830
(a)	Physical state	Appearance
(b)	Colour	Odour
(c)	Odour	Odour threshold
(d)	Melting point/freezing point	pH
(e)	Boiling point or initial boiling point and boiling range	Melting point/freezing point
(f)	Flammability	Initial boiling point and boiling range
(g)	Lower and upper explosion limit	Flash point
(h)	Flash point	Evaporation rate
(i)	Auto-ignition temperature	Flammability (solid, gas)
(j)	Decomposition temperature	Upper/lower flammability or explosive limits
(k)	pH	Vapour pressure
(l)	Kinematic viscosity	Vapour density
(m)	Solubility	Relative density
(n)	Partition coefficient n-octanol/water (log value)	Solubility(ies)
(o)	Vapour pressure	Partition coefficient: n-octanol/water
(p)	Density and/or relative density	Auto-ignition temperature
(q)	Relative vapour density	Decomposition temperature
(r)	Particle characteristics	Viscosity
(s)		Explosive properties
(t)		Oxidising properties

The relevance of the data for the SDS user is given below.

Physical state: Whether the product is a solid, liquid or gas (these are defined in the CLP Regulation, Annex I, 1.0). Further detail is useful, e.g. free flowing dust, viscous (slow flowing) liquid.

Colour: Colour should also be given. This may be subjective and vary slightly for some products (or the SDS may cover a range of specifically coloured products).

Odour: The SDS should state whether or not the product has a noticeable odour. For some products the odour may be familiar [e.g. alcohol, ester (fruity), hydrogen sulphide (rotten eggs), triethylamine (fishy)], or may be more general (e.g. aromatic, pungent). Vague statements such as ‘typical’ or ‘characteristic’ are common. Be careful about inhalation hazards before sniffing chemicals.

A few chemicals have odour thresholds (the concentration above which it can be detected by smell, but will vary for individuals), which may be reported here and may have importance for safe handling of the product.

Melting point (Mp)/freezing point: The melting point for a solid is the temperature it turns into a liquid. Mixtures of solids (e.g. soap powder) will melt over a range of temperatures. The Mp may be affected by pressure, so it is assumed to be at atmospheric pressure unless indicated otherwise. Waxes and pastes may have the softening point given instead of a Mp. Solids with high Mps may have a ‘greater than’ value.

The freezing point is the temperature at which a liquid solidifies into a solid. It is usually the same temperature as the melting point of the solid form, and often only one figure is listed in the SDS, but in some cases the freezing point can be lower than the melting point. Liquids with low freezing points may have a 'less than' value.

Boiling point (Bp) or initial boiling point and boiling range: The boiling point tells you at what temperature a liquid (or low Mp solid) turns into a gas. The Bp may be affected by pressure, so it is assumed to be at atmospheric pressure unless indicated otherwise. The lower the boiling point the greater the volatility (i.e. higher vapour pressure) and the more likely you are to get airborne vapour. Mixtures of liquids will boil over a range of temperature. Sometimes decomposition occurs before boiling, or no boiling occurs up to a certain value, and you will see this indicated.

Flammability: Care is needed to interpret flammability data. Firstly, it should be clear from this Sub-section whether the product is classified as being a flammable solid, liquid or gas. Secondly, if the product is not classified for flammability, will it burn or ignite, causing fire or combustion? For example, wax or paper is not classified as flammable, but will burn.

Any special issues with flammability, such as fierce burning, self-heating, or spontaneous combustion should be stated by the supplier.

Lower and upper explosion limit: Applicable to the vapour of volatile liquids (see vapour pressure). Dusts are given in sub-section 9.2. For a vapour to burn or explode, the concentration in the air has to be between certain values. The explosion limits indicate what these are. If the concentration of the vapour in air is outside these limits the product vapour will not burn.

Flash point (Fp): The flash point temperature of a liquid will tell you whether there is a risk of vapour igniting and causing a fire. The lower the Fp temperature the greater the risk, and a product with Fp lower than room temperature indicates an immediate risk of fire from spark or other source of ignition.

Auto-ignition temperature: The auto-ignition temperature of a gas or liquid will tell you if it can spontaneously ignite without the application of spark or other source of ignition. The lower the auto-ignition temperature, the greater the risk. The auto-ignition temperature is commonly much higher than the Fp, e.g. for acetone Fp = –17 °C; auto-ignition temperature 465 °C.

Decomposition temperature: This is commonly regarded as the temperature at which the product begins to chemically break down. Many products will decompose before they melt or boil, so data may be available if those tests have been performed.

The legislation refers more specifically to self-reactive substances and mixtures which is a rare flammability classification from the CLP Regulation. Self-reactive products when heated may undergo a decomposition, even in the absence of air, that produces heat, thereby accelerating the reaction to dangerous rates.

pH: A measure of acidity (low pH) or alkalinity (high pH) of the product, typically within a range of 0 to 14, with pure water having a pH of 7. The pH is important for water soluble liquids and solids.

Extreme pH (< 2 or > 11.5) is an indicator for corrosion to skin an eye (see Section 11). Medical treatment of such injury may be different for acids and alkalis.

Also, reaction of acids and alkalis, or even their neutralization with water may produce heat, and may have implications for mixing or disposal.

Kinematic viscosity: A measure of how easily a liquid will flow (i.e. thick or runny). The higher the value, the thicker the liquid. There are different ways of measuring viscosity, so care is required when comparing viscosity data. The legislation stipulates the units to be mm^2/s, which should makes such comparison easier.

Low viscosity liquids (< 20.5 mm^2/s) are an aspiration hazard and may be fatal if swallowed and enters airways. This hazard particularly applies to hydrocarbon solvents and petroleum products.

The viscosity may also affect general handling and dealing with spillages. The higher the viscosity the more time you have to prevent it from entering drains, etc.

Solubility: This indicates how easily the product dissolves in a solvent. The water solubility is mandatory, and the solubility in other solvents should be given if available.

The solubility is best expressed in standard units, e.g. g/L, although very soluble substances may be in weight percentage, e.g. 10 wt % in water, or as completely miscible (e.g. water and ethanol).

Solubility of mixtures can be complicated, especially if there are wide variations in the solubility of the components or one components affects the solubility of another. The supplier should have presented the information clearly enough for you to understand exactly what is being reported.

General statements are best used as a descriptor to numerical value, rather than on their own. There have been attempts to categorise products as ‘slightly soluble’, ‘moderately soluble’, etc, but the user can never be sure what is meant, and they can mean different things to different SDS users.

Solubilities can help understand cleaning operations, treatment of spills, and first aid measures (can the product be rinsed off with water?).

Partition coefficient n-octanol/water (log value): The CLP Regulation shortens this to log K_{ow} (K indicating rate constant, o to octanol, and w to water). Note that some suppliers may call this log P_{ow} (presumably P for partition), but it is the same thing. It does not have any units.

K_{ow} is a measure of the relative oil/fat solubility (as simulated by the octanol) compared to water solubility. A high K_{ow} indicates that the substance migrates mainly to the octanol, and may build up in the fat tissues of organisms that consume, or are exposed to, the product. It is therefore used as an indicator of bioconcentration.

K_{ow} is a substance-specific property, and it does not usually make sense to quote a value for a mixture. You may see some mixtures or complex substances (e.g. hydrocarbons or petroleum products) quoted as a range.

Vapour pressure: The vapour pressure is the propensity of the liquid product to turn into a vapour, and so indicates whether the substance is likely to become airborne. A volatile liquid with high vapour pressure may cause workplace exposures via inhalation, potentially flammable atmospheres, and emissions to the atmosphere. It is measured in Pascals (Pa) and the temperature of the measurement should be given.

As a general guide, ECHA state that highly volatile substances are those with a vapour pressure greater than 25 kPa (presumably at 20 °C!) (or a boiling point below 50 °C). Substances with low volatility have a vapour pressure of less than 0.5 kPa (or a boiling point above 150 °C).

Density and/or relative density: Density is a measurement of the 'weight' of a given volume of the product. The relative density, also known as the specific gravity, of the product is its density relative to that of water. Water has a density of 1 g/mL, so a relative density greater than 1 tells you that the material is heavier than water (sinks), while a relative density of less than 1 indicates that it is lighter than water (floats), which may be important for firefighting (along with water solubility) or clean up.

Most common liquids and solutions have a specific gravity within the range 0.6 – 2 (but the relative density of mercury is approximately 13).

For solids such as powders, the bulk density is sometimes also quoted. This value takes the spaces between particles into account. This can be useful when determining the required size of storage containers for a given weight of product.

Relative vapour density: The 'weight' of a given volume of vapour for gases or liquids, usually given as a relative value compared with air at a specified temperature. Any value greater than 1.0 will tell you that the vapour will fall towards the floor. This can be important when work has to be carried out in tanks or sumps or below ground level, because vapour may collect and cause issues with displacement of oxygen (asphyxiation) or flammable atmospheres. It can also be important when designing extraction systems.

Particle characteristics: Only apply to solids. The particle size indicates the coarseness of powders, and is relevant for:

- Assessing whether the product is likely to become airborne (i.e. dustiness), and so lead to potential hazards, such as inhalation by workers, dust explosion, or release to the atmosphere.
- Whether it contains nano-forms (tiny particles), which may give hazards additional to those of the normal product, e.g. in crossing biological membranes, or due to greater surface area. The new SDS Regulation (878/2020) has an increased emphasis on providing details of nano-forms, due to such concerns.

Data on the average size, the size distribution, and the shape of particles should be provided if relevant for the safety and handling of the product.

9.2. Other information

This new SDS Regulation (2020/878) gives much more detail than the previous Regulation (2015/830, currently in force in the UK), for this Sub-section. It requires relevant information, i.e. useful for handling and safe use of the product, in the following areas:

- Data relating to CLP Hazard Classes: explosivity, including desensitized explosives; flammable gases; aerosols; oxidizing gases, liquids, and solids; organic peroxides; gases under pressure; flammable liquids; flammable solids; self-reactive products; pyrophoric liquids and solids; self-heating products; and substances that emit flammable gases in contact with water. Such data may include safety characteristics, test results (including negative ones), and test methods.
- Other properties: e.g. mechanical sensitivity; self-accelerating polymerisation temperature; formation of explosible dust/air mixtures; acid/alkaline reserve (important for classification of products with extreme pH); evaporation rate (often in comparison to n-butyl acetate); miscibility; conductivity; corrosiveness; gas group; redox potential; radical formation potential; and photocatalytic properties.

The data that you will find in this sub-section is related to the type of product. The information above is not relevant for all products, but the supplier should provide useful information, so that no clear hazard is overlooked.

The Volatile Organic Compounds (VOC) is relevant for some paint products. Dust explosion is a serious hazard for most organic powders and some inorganic ones (e.g. aluminium powder). Monomers of polymers may undergo hazardous polymerization under certain conditions. The supplier has an obligation to inform their users of physico-chemical properties relevant to the use of the product.

Links to other Sections

For hazard information	Section 2
For information on fighting fires	Section 5
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SECTION 10: Stability and Reactivity

In this Section you will find information on the reactivity of the chemical product under the conditions during use and storage, or in the environment, and also with other chemicals that might be present in the workplace.

This Section may give a more descriptive overview of hazards presented in Section 9: Physical and chemical properties.

Most chemical products are designed to be stable, and this Section is often populated with generic phrases. However, other products have an innate reactivity or are designed to be highly reactive to fulfil their purpose. In these cases, the supplier should provide you with sufficient information for you to handle the product safely.

10.1. Reactivity

This Sub-section should include a general description of any known hazardous reactions that may occur during the transportation, storage or use of the product. There may be some overlap with the information given in Sub-section 10.3. This Sub-section tends to give a more general description of the reactivity, while 10.3 provides specific information on the product reactivity and the conditions that promote reaction.

For mixtures, information on the reactivity of the components may be given if none are available for the product as a whole.

Example phrases you may see:
'*Strong oxidising agent, may intensify fire*'.

'*Strong acid, corrosive to skin and metal*''.

'*Reacts with water or moisture in the air*'.

10.2. Chemical stability

This Sub-section indicates whether the material is stable or not under the anticipated conditions of transport, storage and use. If the product is stable, then this should be stated, together with some indication of the conditions under which stability would be maintained. If the product may become unstable due to certain processing or conditions then these should be given.

Example phrases you may see in this sub-section:
'*Stable at room temperature (5 to 35 °C).*'

'*No known hazardous reactions when handled and stored according to instructions.*'

'*Catches fire spontaneously if exposed to air. Stable under an argon atmosphere*.'

If the product needs stabilisers to remain stable, then the supplier should give details of the stabiliser and its concentration, and any changes (e.g. in appearance) that indicate the product is becoming unstable.

The word 'stable' does not indicate an infinite shelf life.

10.3. Possibility of hazardous reactions

This Sub-section builds on the information given in Sub-section 10.1., detailing the consequences of any hazardous reactions involving the product. For example, a product described as a strong acid in Sub-section 10.1., may be described here as reacting with alkalis with the generation of a large amount of heat. Or reaction with metals may form flammable hydrogen gas.

For a product that reacts with water to generate carbon dioxide, as mentioned in sub-section 10.1., this Sub-section might highlight the potential pressure build-up in sealed containers with a risk of explosion. Or that this reaction might pose an asphyxiation risk in poorly ventilated areas. Some products may decompose to produce large amounts of gas which could rupture a tank or pipework.

Example phrases you may see in this Sub-section:
'*Undergoes a violent exothermic reaction with strong oxidising agents.*'

'*Reacts with water or moisture in the air, to produce extremely flammable hydrogen gas.*'

10.4. Conditions to avoid

This Sub-section will describe those physical conditions that could cause problems, such as heat, cold, light, moisture, shock or sources of ignition. It should also tell you what might be expected to happen under those conditions. For example:

'*Keep dry. Contact with water releases toxic chlorine gas.*'

'*Keep away from heat, sparks, open flames and hot surfaces. Risk of ignition of flammable liquid and vapour.*'

10.5. Incompatible materials

In this Sub-section you will find information about common materials that might react with the product to create a hazard (e.g. forming heat, or toxic or flammable gases). For stable products, the information is often generic. Some products may have specific incompatible substances. There should be some indication of the hazards you might expect from such a reaction. The supplier should give advice on incompatible agents that are potentially found in the workplace, describing families of chemicals where possible, rather than presenting a long list of individual chemicals.

Typical phrases are:
'*Keep away from acids, alkalis, air, water or oxidising agents*.'
'*Avoid contact with amines - produces hazardous nitrosamines.*'

Where the product is itself an oxidising agent (e.g. a peroxide) or may otherwise assist combustion, the SDS may warn you to keep it away from combustible materials, such as timber, cloth or paper. It may also mention other specific chemicals, such as iron, steel, aluminium or PVC, which may be used for mixing vessels, tanks, pipework, or even the material from which PPE may be manufactured.

10.6. Hazardous decomposition products

Degradation is where the product breaks down chemically. This may occur spontaneously over time, or as the result of a chemical reaction or heating. The resulting chemicals may be hazardous and should be listed in order of severity of the hazard they represent.

Examples of common standard phrases:
'*Does not decompose when used for intended uses.*'
'*No known hazardous decomposition products.*'

Hazardous products from combustion are listed in Section 5: Firefighting measures and are not necessary in this Sub-section.

Further reading

Bretherick's Handbook of Reactive Chemical Hazards (8th Ed.), Ed. P. G. Urban, Elsevier, March 2017; ISBN: eBooke: 9780081010594; hardcover: 9780081009710.

Links to other Sections

For hazard information	Section 2
For information on fighting fires	Section 5
For information on accidental release	Section 6
For information on handling and storage	Section 7
For information on disposal	Section 13

SECTION 11: Toxicological Information

This Section of the SDS is written for medics, occupational health and safety professionals and toxicologists. It may contain technical information which is not relevant for workers, although it is good practice to add explanatory notes. The information is particularly useful for risk assessment, medical evaluation, or further classification of mixtures.

There is a balance between reporting complex toxicological findings, e.g. from animal testing, and providing concise, comprehensible information to the user of the product. The use of technical language should reflect the typical user's ability to understand it, and simply extracting results from test reports or registration dossiers should be avoided. The information should be a concise but complete and comprehensible description of the potential adverse health effects/symptoms after exposure to the product.

If this section does not contain any information, or contains a statement such as 'No data available', this does not mean that the chemical is not hazardous, or does not present a risk to health. In these circumstances, users should seek further guidance from their suppliers or a person competent in the assessment of toxicological data. It is good practice for the supplier to indicate why there is no data.

Toxicology is the study of the effects of chemicals on man and other living organisms. Toxicological information is the basis for evaluating the risk to human health following exposure. All chemicals have the potential to cause harm, but the range, nature and magnitude of effects is dependent on the amount (dose) of chemical to which an individual is exposed and the timeframe.

The toxicological information in Section 11 may be based on:

- tests on animals (*in vivo* studies),
- test done with cells or tissues in the laboratory (*in vitro* studies),
- structure–activity relationships or computational methods (modelling),
- the properties of chemically similar materials (read-across data),
- human studies (epidemiology, case studies and volunteer studies),
- toxicokinetic studies on the adsorption, distribution, metabolism, and excretion of a chemical.

Data can be obtained from many sources. REACH Registration dossiers are a great resource for substances. Other sources include literature searches, chemical compendia, databases, and online resources (see Appendix G), and we recommend the user checks key data. Key references, including REACH registrations, should be cited in Section 16: Other information, if they are not given alongside the data in this Section.

Readers of this Section of the SDS should find information on the following:

- ❖ what adverse effects and symptoms, if any, are expected after contact with the product,
- ❖ how much product is needed to cause an effect (dose–effect relationship),
- ❖ whether the effects are from acute (short-term) or chronic (long-term or repeated) exposure,
- ❖ the effects from different routes of exposure, e.g. via inhalation or absorbed through the skin (the majority of animal data is from the oral route),
- ❖ whether the effects occur locally at the point of contact with the product or systemically due to distribution of the product throughout the body,
- ❖ the severity of the effect, e.g. mild skin irritation, severe lung damage and whether it is reversible or not,
- ❖ the specific organs that can be damaged (target organs), e.g. kidney, liver, lungs,
- ❖ the basis on which this information is provided (e.g. animal or human studies, testing of similar materials).

The main routes of exposure to chemicals are inhalation, skin contact and ingestion. Most often animal tests are available for the oral route, although not an important route for occupational exposure. Effects from other routes can sometimes be assessed using data from the oral route, but this is a specialized process. Inhalation exposure is most relevant for products that easily produce vapours (high vapour pressure), or dusty solids. Occasionally other routes, such as injection through the skin or absorption via the eye, may be important.

Health effects may occur at the site of contact (local, e.g. skin irritation) or be remote from the site of entry into the body (systemic). Effects may develop relatively quickly, following single or short-term exposure (acute) or following repeated or prolonged exposure (chronic). The type of effects and their severity are also likely to change with increasing dose and duration of exposure.

Symptoms at low exposures through to the consequences of severe exposure should also be described, including immediate and delayed effects as well as chronic effects.

Substances

Information for each hazard in Sub-section 11.1. must be provided. Where available, test results should indicate the test method, species, dose/concentration and result. If test data are not available, the hazards can sometimes be estimated using read-across, QSARs (Quantitative Structure–Activity Relationships) or other methods. In these cases, it should be clear that the data has been calculated.

If no data is available for a specific hazard, this should be clearly stated. It is not mandatory to test products to complete the SDS, although basic toxicological data is important for product stewardship.

For substances subject to registration, brief summaries of the information in the publicly available registration dossier should be given.

Other relevant information on adverse health effects, particularly effects not covered by the classification criteria, must be included in Sub-section 11.2.

Mixtures

Most SDSs are for mixtures. It is unusual to have *in vivo* toxicity data on a mixture, because of animal welfare concerns. There are far fewer substances in commerce than mixtures, so it is normal practice to assess the mixture by reference to its component substances. However, sometimes mixture classification can be assessed using *in vitro* techniques (e.g. for irritation or corrosion), which can be useful in overriding generic concentration thresholds used in the calculation method. Valid test results take precedence over the calculation method, so it may allow less severe classification for products, or the derivation of Specific Concentration Limits (as mentioned in Section 3: Composition/information on ingredients).

This Section can present data for the mixture, or when this is not available, for component substances contributing to the hazards of the mixture. It is not acceptable to cite ‘no data available’ when there are data on the components. It should be clear whether the data provided applies to the mixture itself or its component substances.

If a particular component does not contribute to the hazard of a mixture, then the supplier may decide to omit the data from the SDS in order to keep this Section concise and easier to read.

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

An example of how the required information could be provided for a substance is given below.

Hazard class	Test method	Species	Effective dose/ concentration	Result
(a) Acute oral toxicity Acute dermal toxicity Acute inhalation toxicity				
(b) Skin corrosion/ irritation				
(c) Serious eye damage/ irritation				
(d) Respiratory or skin sensitisation				
(e) Germ cell mutagenicity				
(f) Carcinogenicity				
(g) Reproductive toxicity				
(h) Specific organ toxicity (STOT) – single exposure				
(i) Specific organ toxicity (STOT) – repeated exposure				
(j) Aspiration hazard				

(a) Acute toxicity

Many SDSs report the results of acute animal toxicity studies by the three common routes: oral, dermal and inhalation. Older test data often refer to LD_{50} or LC_{50} values. These are the 'lethal dose' or 'lethal concentration' resulting in the death of 50% of the tested animals. Such testing has been banned on in Europe on animal welfare grounds for many years. Some countries, including the US, still permit LD_{50} testing.

Current animal testing methods uses fewer animals and lower doses. Such tests give a 'discriminating' dose. These values can be compared by converting them to Acute Toxic Estimates (ATEs). It is also possible to derive an ATE value from the toxicity classification using the tables in the CLP Regulation, Annex 1. Furthermore, you can calculate the ATE for a mixture from the ATEs of the component substances.

These ATEs should be quoted for chemical products in the sub-section on acute toxicity, and for components of mixtures in Section 3: Composition/information on ingredients. The lower the ATE, the more toxic it is, and requires more control of exposure in the workplace.

ATEs, discriminating doses or LD_{50} values are normally expressed as a weight or volume of the chemical per kilogram of body weight (e.g. mg/kg), whilst LC_{50} values are exposure concentrations in air or water (e.g. mg/m^3). Although the figures provide a measure of the dose required to cause death or overt toxicity, they rarely provide information on the specific effects or the dose–response relationship.

Typical statements for this subsection are:

'Acute oral toxicity: estimated oral ATE > 2000 mg/kg, rats, based on reported toxicity of components.'
'Inhalation may cause headaches and dizziness, proceeding to fainting or unconsciousness; high concentration may result in coma and death.'
'Based on available data the classification criteria are not met for the oral route. No data available for dermal and inhalation routes.'
'Owing to a lack of data, the health effects are not known.'

(b) Skin corrosion/irritation

Skin irritation is reversible damage to the skin following the application of a product for up to 4 hours. Typical reactions are redness, pain, and swelling, which disappear with 14 days.

Corrosion causes irreversible damage to the skin, i.e., a chemical burn destroying the top layer of skin, following the application of a product for up to 4 hours and observation up to 14 days. Corrosive reactions are typified by blisters, bleeding, and scab formation. After 14 days there is often whitening of the skin and scarring.

There are animal and *in vitro* tests to determine whether a product meets these criteria.

(c) Serious eye damage/irritation

Serious eye irritation is damage of the eye following the application of test substance. Typical irritant reactions are redness, pain, and swelling. For irritant products, these effects are fully reversible within 21 days.

Serious eye damage involves tissue damage in the eye, serious physical decay of vision, or permanent discolouration of the eye following application of the product. The effects are not reversible within 21 days.

There are animal and *in vitro* tests to determine whether a product meets these criteria.

A typical phrase might be:
'Based on available data on the ingredients, the classification criteria are met for Category 1 (causes serious eye damage).'

(d) Respiratory or skin sensitisation

Sensitisation concerns an immune response to a chemical. Usually it is a two-stage process:

- induction, which gives a hypersensitivity to a substance,
- elicitation, whereby exposure to a chemical, often at a small dose, will give an allergic reaction.

Respiratory sensitisation concerns asthma and other respiratory conditions. There are no tests for respiratory allergens, although some substances are well known to cause this effect (e.g. isocyanates).

An allergic response in the skin may cause local swelling, redness or rash (dermatitis). There are several *in vitro* tests for skin sensitisation (notably the local lymph node assay, LLNA) that have superseded the *in vivo* maximisation and Buehler tests.

A typical phrase might be:
'Not considered to be a potential sensitizer because none of the components are classified for this effect. '

(e) Germ cell mutagenicity

Germ cell mutagenicity is a complex area.

Germ cells relate to eggs and sperm. Alteration of these may result in the transmission of birth defects to offspring.

Mutagenicity is the propensity of a substance to permanently change the amount or structure of the genetic material in a cell. This can be at the DNA, chromosome, or organism level. Exposure to mutagens may result in tumours and other cancers.

The testing of substances for mutagenic effects occurs stepwise, from simple *in vitro* tests (e.g. Ames test) to multi-generational animal studies.

A typical phrase might be:
'*Negative in an Ames test (in vitro reverse mutation test in bacteria, method OECD 471).*'

(f) Carcinogenicity

Carcinogenicity is the process of forming a cancer cell from a normal cell. This is a multi-step process characterised by successive genetic mutations cause by carcinogens (cancer-causing substances).

Testing for carcinogens involves long-term animal testing.

IARC produces an influential list of known carcinogens.

(g) Reproductive toxicity

Reproductive toxicity includes adverse effects on sexual function and fertility in adult males and females, and developmental toxicity in the offspring. Adverse effects on or via lactation are also included in reproductive toxicity.

Testing for reproductive toxicants involves multi-generation animal testing.

Typical phrase for this sub-section:
'*Naphthalene-1,5-diol: a prenatal developmental toxicity study (oral, rat, method OECD 414) showed no developmental toxicity at 360 mg/kg; NOAEL (maternal toxicity) 60 mg/kg/d; NOAEL (developmental toxicity) 360 mg/kg/day.*'

(h) Specific organ toxicity – single exposure

STOT-SE is non-lethal damage to specific organ following a single exposure to a substance or mixture. It applies to effects not addressed in other sub-sections (e.g. on acute toxicity). The most common effects are for respiratory irritation and '*may cause drowsiness or dizziness*'.

(i) Specific organ toxicity – repeated exposure (STOT-RE)

STOT-RE is arguably the most important health effect classification, because it refers to adverse health effects from prolonged or repeated exposure, and so is highly relevant to the workplace. Specific effects addressed in other sub-sections (reproductive toxicity) do not have to be repeated here.

The data for STOT-RE is usually derived from repeated-dose animal studies. These can be by any of the main routes: oral, dermal, or inhalation. The data from such tests are key for workplace risk assessment, and are the origin for Derived-no-effect levels (DNELs) (see Section 8: Exposure controls/personal protection). The most quoted parameter is the No-observed-adverse-effect level (NOAEL), which the dose below the one that causes overt toxicity in the animal tests.

Typical phrase:
‘*Repeat dose toxicity, component X: NOAEL (oral, rat, 90d, method OECD 408) 150 mg/kg/day*.’

(j) Aspiration hazard

This is the propensity of a product, usually hydrocarbons or other low-viscosity liquids, to be drawn into the lung, either directly or following swallowing and vomiting, with the potential to cause lung damage. Aspiration causes violent coughing, choking, or vomiting and can lead to lethal lung damage.

11.2. Information on other hazards

This is a new Sub-section, introduced with Regulation 2020/878. The toxicological information is now divided between Section 11.1., with information relating to the toxicological Hazard Classes of the CLP classification system, as described above, and this Sub-section for all other hazards. This Regulation is not formally adopted in the UK, but UK authorities have confirmed they accept the new format. The older version (2015/830) required all toxicological information to be placed in Section 11.1.

Endocrine disrupting properties (i.e. those affecting the hormonal system) are specifically mentioned in the legislation. These are defined as substances or mixture that alters the functions of the endocrine system and consequently causes adverse health effects in an intact organism, or its progeny, or (sub)populations.

Known endocrine disrupters are listed in the EU Candidate List (https://echa.europa.eu/candidate-list-table), and if listed for health effects, then they should be mentioned in this Sub-section.

Testing systems for endocrine disruption have been developed for some of the important hormonal pathways.

Other hazards, e.g. asphyxiation by displacing oxygen, formation of toxic substances in contact with water, accumulation in tissues, should be found in this Sub-section.

Links to other Sections

This Section needs to be checked for consistency in particular with the following Sections:

For hazard information	Section 2
For first aid measures	Section 4
For information on accidental release	Section 6
For information on handling and storage	Section 7
For exposure controls and personal protection	Section 8
For physical and chemical properties	Section 9
For information on disposal	Section 13

For transport information	Section 14
For regulatory information	Section 15

SECTION 12: Ecological Information

In this Section, you will find information that tells you about the effects that the substance or mixture will have in the environment in case of release of the product.

Many chemical products ultimately get released into the environment as a result of use or disposal, and the data in this Section will provide the basis for an assessment of required risk management measures for protecting the environment. Such an assessment will ascertain the likely harms from a given exposure.

The main factors of the environmental risk assessment are:
- potential releases of the product to the environment,
- environmental fate and pathways of the product, covering breakdown and distribution between soil, water and the atmosphere,
- toxicity of the product and its breakdown products to organisms. For most substances only the aquatic organisms are considered, unless other environmental compartments might be relevant (e.g. products with wide, dispersive use or very toxic),
- potential for concentration of the product within living tissues, e.g. fish.

Data from this assessment will influence Sections 6: Accidental release measures and 13: Disposal considerations.

Environment fate, distribution, and accumulation can be estimated using physico-chemical data from Section 9. Much of the information may be presented in numerical form which will require interpretation in order to be useful to the user. Where test results are available, test data such as species, media, units, test duration and test conditions should be given. REACH Registration dossiers available at the ECHA website are a key resource for finding and checking environmental data.

Where experimental data are not available, the supplier has to assess other sources of information, e.g. from computation or structure–activity relationship and provide any relevant findings.

Some properties are substance specific, and not applicable to a mixture, e.g. bioaccumulation, persistence and degradability. For these properties, information on key components of a mixture should be given.

12.1. Toxicity

Although the organisms may vary, a good data set will include three ‘*trophic levels*’ covering what is effectively a mini food chain:
- algae are primary producers using sunlight and nutrients in the water to grow,
- invertebrates such as Daphnia (water flea) eat algae,
- fish, predators, in turn eat the Daphnia.

If one of these ‘levels’ is harmed, there can be serious ecological consequences throughout the food chain.

Typically, toxicity values are presented for each of these species, such as:

- fish, expressed as LC_{50} based on mortality,
- daphnia EC_{50} based on immobilisation,
- algal inhibition, E_rC_{50} usually based on growth rate (or sometimes mass),
- also, sludge respiration inhibition IC_{50}, for micro-organisms that can break down chemicals.

The tests are run at different test concentrations and results are reported as the concentration causing 50% reduction in the observed parameter (death of fish, immobilization of Daphnia, growth rate for algae, etc.), so:

- LC_{50} is the concentration causing lethal effects in 50% of the population,
- EC_{50} the concentration causing a 50% reduction in the observed parameter, e.g. movement,
- IC_{50} the concentration causing a 50% inhibition of a process (often used for activity of sewage sludge microorganisms.

Occasionally you will see values other than the 50%, such as EC_{10} which can help build a picture of the dose–response relationship.

Longer term studies may also give a '*no-observed-effect concentration (NOEC)*', effectively and EC_0, which is the test concentration that did not cause obvious harmful effects in terms of death or behaviour or growth rates.

An approximate measure of toxicity is given below (can be complicated by other factors, particularly long-term studies or rapid degradation):

Harmful to aquatic organisms	LC_{50} or EC_{50} 10 to 100 mg/L
Toxic to aquatic organisms	LC_{50} or EC_{50} 1 to 10 mg/L
Very toxic to aquatic organisms	LC_{50} or EC_{50} 0.1 to 1 mg/L (M = 1)
Very toxic to aquatic organisms	LC_{50} or EC_{50} 0.01 to 0.1 mg/L (M = 10)

Note that some substances are extremely toxic to aquatic organism, such as biocides. For such substances you may see a Multiplication-Factor (M-factor) given (e.g. M = 10, 100). The M-factor is a used in the calculation to classify mixtures. The M-factor effectively lowers the threshold concentration for the substance to cause classification of a mixture. The higher the M-factor, the more hazardous to the aquatic environment. The M-factor depend on the short-term toxicity, the availability of NOEC values, and the degradability.

M-factors may be found in Annex VI of the CLP Regulation, or in the REACH Registration dossiers available on the ECHA 'Search our data' webpage.

12.2. Persistence and degradability

Degradability is a measure of how quickly a substance will break down into other chemicals. It is considered a substance-specific property, so does not apply to mixtures. The resulting breakdown products are often more water-soluble than the original product and may be more or less hazardous than the parent substance.

Abiotic degradation is where the product breaks down in the environment usually due to reaction with water (hydrolysis) or sunlight (photolysis) to form new chemicals. You may find data on the degree of abiotic degradation given in this Sub-section, which may have been defined according to the following values, where the half-life is the time taken for 50% of the substance to react:

Readily hydrolysed/photolysed	Half-life < 28 days
Partially hydrolysed/photolysed	Half-life > 28 to 100 days
Not significantly hydrolysed/photolysed	Half-life > 100 days

A material is considered to be readily degradable if > 70% of it is hydrolysed/photolysed within a 28-day period.

Biotic degradation or **biodegradation** is where the product is broken down into simpler fragments by micro-organisms (e.g. bacteria in sewage sludge in the water treatment plant). Ultimately, an organic chemical can be converted into simple inorganic products: e.g. carbon dioxide, water, and other oxides. It should be clear whether the data refers to primary biodegradation (removal of the parent compound), or complete biodegradation (i.e. mineralization - complete breakdown to simple inorganic substances). Biodegradation does not apply to inorganic substances.

Rapid degradation indicates that in the event of release to the environment the effects will be localized and short-lived.

Screening tests for biodegradation are commonly found in the REACH registration dossiers. There are a variety of methods for measuring the breakdown of the parent products:

- the amount of dissolved organic carbon (DOC), which decreases as the product is converted to carbon dioxide and released from the test solution,
- the amount of carbon dioxide produced, which increases as the product is broken down,
- the depletion of oxygen in the test solution, as the microorganism use it to break down the test substance.

Oxygen depletion can harm the environment, for example by causing fish kills in rivers, so it is useful to know how much oxygen will be required to break down a given amount of a product (i.e. the Biochemical Oxygen Demand, BOD). The higher the BOD of a substance, the more oxygen will be required for its break down.

Some products not classified as environmentally hazardous can still cause harm in the environment. Milk, beer, or other food-stuffs may biodegrade and deplete oxygen in the water.

Another parameter you might see in this sub-section is the Chemical Oxygen Demand (COD). This is the theoretical oxygen demand of the substance for complete mineralisation. The ratio of the values of BOD to the COD gives a measurement of the extent to which a substance will biodegrade.

An approximate description of biodegradability may be given as follows:

Rapidly biodegradable	>70% degradation (based on DOC) > 60% of COD (based on oxygen depletion or carbon dioxide generation) BOD > 50% of COD
Substantially biodegradable	> 60% degradation
Partially biodegradable	20 – 60% degradation
Not significantly biodegradable	< 20% degradation

12.3. Bioaccumulative potential

Accumulation indicates that the product can build up in the environment to a point where it becomes a problem, particularly where the product accumulates in one organism and enters the food chain.

Accumulation potential is indicated by the octanol–water partition coefficient (K_{ow}) (see Section 9: Physical and chemical properties). The K_{ow} is a measure of solubility in fat-like substance (octanol; simulating fatty tissue in fish or other aquatic species), compared to the solubility in water.

A log K_{ow} value less than 3 generally indicates a low bioaccumulation potential. Any substance which has a log K_{ow} value greater than 4 should be considered as having a high bioaccumulation potential and will require appropriate precautions such as avoiding release to the environment or further testing on the bioaccumulation potential.

If the log K_{ow} is above 4.5, then there is a risk of serious bioaccumulation (see below Section 12.5. Results of PBT and vPvB assessment), but once the log K_{ow} exceeds 6 or 7, it is likely that other factors will influence bioavailability and accumulation. If this is the case, then you might also find data for test in fish to determine the experimental bioconcentration factor (BCF).

An approximate description of biodegradability may be given as follows:

Low bioaccumulation potential	Log $K_{ow} < 3$
Moderate bioaccumulation potential	Log K_{ow} 3 to 4.5
High bioaccumulation potential	Log $K_{ow} > 4.5$ or BCF > 2000 (bioaccumulative) or > 5000 (very bioaccumulative)

Another potential effect of bioaccumulation, is biomagnification. This is where the product enters the food chain and becomes more concentrated in the predatory organisms as it travels up that food chain [e.g. algae (low concentration) < invertebrate < fish < mammal (high concentration)].

12.4. Mobility in soil

Mobility is the way in which the product disperses into the environment. It is a substance-specific property, so an SDS for mixtures should give information on components in this Sub-section.

There may be mention in this section of the environmental 'compartments'. These are: air, water, soil, sediments and biota (organisms). The processes whereby a product distributes between these compartments will depend on its physical state and chemical properties.

A gas will disperse into the atmosphere, whereas a water-insoluble solid will stay in place unless it becomes windblown. Liquids or water-soluble solids can disperse into drains, watercourses or soil, or if it is volatile, it will evaporate into the air. The more water-soluble a material is, the more likely it is to remain in water, rather than stick to soil or sediment.

Mobility within compartments influenced by water solubility and the partition coefficients. The octanol–water partition coefficient (K_{ow}) is commonly available (see Section 9: Physical and chemical properties), but a more specific coefficient for the environment is the soil adsorption coefficient (K_{oc}). The K_{oc} can be calculated from the K_{ow} or specialized testing in different types of soil gives more accurate results.

The mobility of products in soil is influenced by the composition and properties of the soil (e.g. organic carbon content and pH; clay vs sand). A change in pH may release chemicals which in their bound state are safe but cause problems when released.

An approximate description of biodegradability may be given as follows:

High mobility/low affinity for soil or sediment	K_{ow} < 500 or log K_{ow} < 3	K_{oc} 50 to 150
Moderate mobility/moderate affinity for soil or sediment	K_{ow} 500 – 5000 or log K_{ow} 3 – 4.5	K_{oc} 150 to 500
Low mobility/high affinity for soil or sediment	K_{ow} > 5000 or log K_{ow} > 4.5	K_{oc} 500 to 2000

The supplier may also provide information on the chemical reactivity of the product with clay or particles of sediments.

12.5 Results of PBT and vPvB assessment

Historically there have been problems with chemicals that persist in the environment and can accumulate in living tissues (see Sub-section 12.3. above), including humans. A number of pesticides, flame retardants, and fabric treatments are known to cause such problems.

These properties have not been addressed in the hazard classification scheme of the CLP Regulation, but the REACH Regulation gives criteria (in Annex XIII) for classification of such substances as 'persistent, bioaccumulative and toxic (PBT)' and 'very persistent and very bioaccumulative (vPvB)'. Substances with these properties are 'substances of very high concern (SVHC)', and are placed on the Candidate List for inclusion in the list of substances that require authorization before use (Annex XIV or REACH).

PBT and vPvB assessments relate only to substances, and are included in the registration dossiers available at the ECHA website.

You may see a typical statement such as:
'*No components of the mixture present at > 0.1% are considered PBT or vPvB*'.'

12.6. Endocrine disrupting properties

This is a new Sub-section, introduced with Regulation 2020/878. As mentioned, this Regulation is not formally adopted in the UK, but UK authorities have confirmed they accept the new format. The older version (2015/830) only has six Sub-sections.

Endocrine disrupting properties (i.e. those affecting the hormonal system) are of concern in the environment for causing adverse effects (often reproductive or developmental) in wildlife. There are particular concerns over substance acting synergistically to produce effects even at low concentration (so-called cocktail effect). There are well-documented cases of chemical spills leading to such problems.

Because of the complexity of the hormonal systems in wildlife, the testing strategy is complicated, but some tests are available. It is still unusual to see the result of such testing reported in SDSs.

Known endocrine disrupters are listed in the EU Candidate List (https://echa.europa.eu/candidate-list-table), and if listed for wildlife effects, then they should be mentioned in this Sub-section.

Typical phrase:
'No component of this mixture has endocrine disrupting properties (criteria set out in section B of Regulation (EU) No 2017/2100).'

12.7. Other adverse effects

This sub-section may include any other known environmental effects, such as stratospheric ozone depletion, tropospheric ozone creation, or global warming. Such effects are rare, but are important for some chemical classes such as chlorofluorocarbons (CFCs).

Links to other Sections

For information on accidental release	Section 6
For information on disposal	Section 13
For information on transport hazard classes	Section 14

Further reading and regulations

The Environmental Protection Act 1990.
http://www.legislation.gov.uk/ukpga/1990/43

The Environmental Protection (Prescribed Processes and Substances) (Amendment) Regulations 1992 (S.I. 1992/614).
http://www.legislation.gov.uk/uksi/1992/614/contents/made

Water Resources Act 1991.
http://www.legislation.gov.uk/ukpga/1991/57/contents

The Control of Pollution (Applications, Appeals and Registers) Regulations 1996 (S.I. 1996/2971).
http://www.legislation.gov.uk/uksi/1996/2971/made

SECTION 13: Disposal considerations

13.1. Waste treatment methods

This Section should provide you with sufficient information to ensure the safe disposal of waste in accordance with the regulations, either by your company or a contractor.

The legal responsibility for disposal lies with the disposer and having relied on poor information in the SDS will not be a good legal defence. You must ensure that the information is adequate and correct and, if in doubt, contact your supplier.

The main methods of disposal (subject to legislation described below) are:

- incineration: suitable for flammable products, and organic products that can be converted to simple inorganic products (e.g. carbon dioxide and water) by burning. Not suitable for inorganic substances,
- landfill: may be suitable for non-hazardous products. Not suited to highly hazardous products, volatile liquids, or gases,
- disposal via drains: usually discouraged for industrial products, although may be OK for small volumes of non-hazardous, water-soluble products. Not suited for insoluble, volatile or flammable products. Large industrial sites may have their own waste-water treatments with specification of wastes within the system,
- recycling: suitable for high-value products.

This Sub-section can give advice on any treatment of the product (e.g. dilution or neutralization) that can reduce the hazard and ensure safe disposal.

The method for cleaning contaminated packaging waste (e.g. drums that still contains some of the product) should be indicated.

Often the advice given in this section is '*Dispose of in accordance with all applicable local and national regulations*'. This is not helpful if you are not familiar with the regulations. Safe and legal disposal requires expertise in the assessment of the waste, particularly in understanding complex legislation (see '*Further reading and regulations*' below). If your company lacks such knowledge, you should seek outside advice, e.g. from reputable waste contractors. We recommend you check their competence with the Environment Agency.

All waste from business premises, e.g. commercial, industrial, or agricultural, is termed '*controlled waste*' in the UK Waste Regulations and is subject to legislative control in its handling and disposal. Any transport of the waste must be accompanied by the appropriate documents in order to comply with 'Duty of Care' depending on the nature of the waste. Non-hazardous wastes require a Waste Transfer Note, and '*Hazardous Wastes*' also require a Hazardous Waste Consignment Note.

As a very general guide, anything that has a health hazard such as '*Toxic*', '*Harmful*', '*Corrosive*' or '*Irritant*' (see Section 11: Toxicological information) is likely to be defined as Hazardous Waste, but someone with specialised knowledge of the regulations should decide this. Some guidance is given below.

Classification of the waste to comply with Waste Regulations

Hazardous Waste is defined as a waste possessing one or more of the 15 hazardous properties set out in Annex III of the Waste Framework Directive (WFD) (2008/98/EC). The WFD also contains a list of wastes, known as the European Waste Catalogue (EWC). The EWC groups wastes according to industry, process or waste type, and is used to classify wastes and identify those which are considered to be hazardous.

The EWC differentiates between non-hazardous and hazardous by identifying hazardous waste entries with an asterisk (*). Mirror Entries (M) may be hazardous or non-hazardous depending on the levels of hazardous substances contained within the waste.

The classification of waste as hazardous is based on the Hazard Classes of the CLP Regulation. Also, the EWC links the classification of certain hazardous wastes with the concentration thresholds concept given in the CLP Regulation.

We recommend that the person responsible for the waste classification uses the methodology described in 'The Hazardous Waste (England and Wales) Regulations 2005' and 'Guidance on the classification and assessment of waste (Technical Guidance WM3)' to do this.

Classification of the waste to comply with Transport Regulations

You must also assess the waste to see if it is defined as 'Dangerous Goods' within the meaning of the various transport regulations (see Section 14: Transport information). When classifying the waste for transport, use the methodologies in the transport regulations applicable to the modes of transport to be used.

If waste is moved between countries, then the shipment will also need to comply with regulations relating to border crossing. These include the Basel Convention and EU Council Directive 75/442. Anyone who regularly transports waste they have produced themselves while going about their normal business activities needs to be registered as a waste carrier.

Some typical phrases incorporated in the SDS include:
'Incineration is recommended for disposal of this product. This product is not suitable for landfill or disposal via the drains.'
'Chemical residues generally count as special waste. General EU requirements are given in Directive 2008/98/EC, including procedures for the disposal of waste oils.'
'Wastes of this product are covered in the European Waste Catalogue, suggested code 13 02 05, mineral-based non-chlorinated, engine, gear and lubricating oils.'

Links to other Sections

For health hazard classification	Section 2
For transport classification	Section 14

Further reading and regulations

Waste Framework Directive (2008/98/EC).
http://ec.europa.eu/environment/water/water-framework/index_en.html
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0098:EN:NOT

The Environmental Protection Act, and the Code of Practice on Section 34.
http://www.legislation.gov.uk/ukpga/1990/43/section/34

The Environmental Protection (Duty of Care) Regulations 1991 (S.I. 1991/2839).
http://www.legislation.gov.uk/uksi/1991/2839/contents/made

Controlled Waste Regulations 2012 (UK) (S.I. 2012/811).
http://www.legislation.gov.uk/uksi/2012/811/contents/made

The Waste (England and Wales) Regulations 2011 (S.I. 2011/988).
http://www.legislation.gov.uk/uksi/2011/988/schedules/made

The Hazardous Waste (England and Wales) Regulations 2005 (S.I. 2005/894).
http://www.legislation.gov.uk/uksi/2005/894/contents/made

Technical Guidance Note WM3 on Hazardous waste.
https://www.gov.uk/government/publications/waste-classification-technical-guidance

The Special Waste Regulations (S.I. 1996/972), and its amendments.
http://www.legislation.gov.uk/uksi/1996/972/contents/made

SECTION 14: Transport information

This Section provides you with information to help you comply with the regulations for transporting the product by road, rail, sea or air. It is primarily intended for shipping companies and transport of dangerous goods professionals. It is not a layman's guide to the transportation of dangerous goods. The information does not guarantee that the product, packaging or labelling are suitable for shipment by these modes of transport.

The newer SDS Regulation (EU) 2020/878 requires the following sub-headings.
14.1. UN number or ID number
14.2. UN proper shipping name
14.3. Transport hazard class(es)
14.4. Packing group
14.5. Environmental hazards
14.6. Special precautions for user
14.7. Maritime transport in bulk according to IMO instruments

The older version (2015/830), still applicable in the UK, has a different title for sub-section 14.7.: 'Transport in bulk according to Annex II of Marpol and the IBC Code.'

Transport information will normally be provided for a number of different modes follows:

- air: International Air Transport Association (IATA) Dangerous Goods Regulations (DGRs),
- sea: International Maritime Dangerous Goods (IMDG) Code,
- Inland European Mode: ADR (road), RID (rail), and possibly under ADN (inland waterways).

Some suppliers may provide the information in tabular form with the above Sub-section headings as rows, and the air, road and inland modes as column headings. However, since the modal provisions are closely aligned, others may show the common data against the Sub-sections, with modal information in a voluntary additional sub-section (14.8).

Sub-section 14.7 will often be not applicable. If so, the supplier may indicate that transport in bulk in ships (i.e. directly loaded into the hold) is not foreseen.

The UN number, proper shipping name, transport hazard class, and packing group are found in the Dangerous Goods List in the various regulations dealing with transport classification.

14.1. UN number or ID number

This is a four-digit number, normally preceded by the letters 'UN', which identifies the substance or mixture being transported. Some substances have their own unique number, e.g. UN1603 for ethyl bromoacetate.

Other products may have been given a 'group' number, e.g. 'UN2837, bisulphates, aqueous solution' or an 'N. O. S' (not otherwise specified) number, e.g. 'UN3266, corrosive liquids, basic, inorganic, N.O.S'.

14.2. Proper Shipping Name

The 'Proper Shipping Name' (PSN), sometimes referred to as the 'Designation', the 'Transport Document Description', or more casually the 'Shipping Name', is simply the most appropriate name, chosen from the UN-compiled list of allowable names, for the goods being transported.

Four types of Proper Shipping Names are defined:

- single entries for well-defined substances, e.g. 'ETHYL BROMOACETATE',
- generic entries for well-defined groups of substances, mixtures or articles, e.g. 'CARBAMATE PESTICIDE, SOLID, TOXIC',
- specific Not Otherwise Specified (N.O.S.) entries covering a group of substances, mixtures, or articles, e.g. 'NITRATES, INORGANIC, N.O.S.',
- general N.O.S. entries covering a group of substances, mixtures, or articles of a hazard type meeting the criteria of one or more hazard classes or divisions e.g. 'FLAMMABLE LIQUID, TOXIC, N.O.S.'.

Where the chemical name is used, this may be supplemented with one of the words 'liquid', 'solid', or 'molten', to indicate the physical form. Where the chemical is dissolved in water and/or mixed with other non-hazardous substances, then the words 'solution' or 'mixture' should be used, if appropriate, e.g. 'ETHYL BROMOACETATE, SOLUTION'.

Where the generic or N.O.S. names are used, these usually have to be supplemented with the technical name or names of the chemical(s) responsible for the hazard(s), e.g. 'CORROSIVE LIQUIDS, BASIC, INORGANIC, N.O.S. (hypochlorite and sodium hydroxide)'.

PSNs will often be shown in capital letters as this is how they appear in the surface mode requirements. Air transport regulations use bold type with an initial capital letter. In SDSs, and on transport documents, many prefer to follow the mode(s) treatment, but it is not mandatory to do so.

14.3. Transport hazard class(es)

The following classes/divisions of hazard are specified in the UN Model Regulations (Orange Book) and are used for all modes of transport:

Class 1	Explosive
Division 2.1	Flammable gases
Division 2.2	Non-flammable, non-toxic gases
Division 2.3	Toxic gases (including corrosive gases)
Class 3	Flammable liquids and desensitised liquid explosives
Division 4.1	Flammable solids, self-reactives, and solid desensitized explosives
Division 4.2	Substances liable to spontaneous combustion
Division 4.3	Substances which, in contact with water, emit flammable gases
Division 5.1	Oxidising substances
Division 5.2	Organic peroxides
Division 6.1	Toxic substances
Division 6.2	Infectious substances
Class 7	Radioactive materials
Class 8	Corrosive substances
Class 9	Miscellaneous dangerous substances and articles

Notes:

1. The word ‘Class’ is often used instead of ‘Division’ (e.g. in ADR).
2. ADR/RID/ADN only have Class 2, without the Divisions (though these are reflected in the use of label numbers that equate to the Divisions).
3. All aerosols are assigned to Class 2/applicable Division.
4. Solid or liquid chemicals under [gas] pressure are also assigned to Class 2/applicable Division.

The hazard classification system for transport, as given in UN Regulations, is closely aligned with the classification criteria in the CLP Regulation. Flammable liquids classified for transport (Class 3) are normally also classified under CLP as a Flammable Liquid Category 1, 2 or 3.

However, the transport regulations omit several of the CLP Hazard Classes related to less serious or long-term adverse effects (e.g. skin and eye irritation, sensitization, STOT-RE, carcinogenicity). Transport classification is designed for use by emergency responders who may experience short-term exposures occurring during a transport emergency. Transport classification uses only acute toxicity data for classification. A product may thus bear an ‘exploding man’ pictogram (CLP pictogram GHS08) but not be classified as dangerous for transport.

A product may have more than one hazard, e.g. corrosive (Class 8) and flammable (Class 3). In this case, one hazard will be identified as the primary hazard and the other as the secondary hazard, according to the table on the Precedence of Hazards in the transport regulations. The subsidiary risk is often given in brackets after the primary risk [e.g. 3 (8)] as is required in dangerous goods documentation.

14.4. Packing group

There are three packing groups, identified by the roman numerals I, II, and III. Packing group I is assigned to those products which present the highest level of danger, packing group II to products presenting an intermediate level of danger and packing group III to materials presenting a relatively low level of danger. Not all classes/divisions allocate dangerous goods to packing groups. Accordingly, this Sub-section may say 'not applicable'. Roman numerals are used for the packing group, so they are not confused with the class.

14.5. Environmental hazards

Under the IMDG Code and ADR/RID/ADN, in addition to ascertaining the primary hazard Class/Division and any subsidiary Class/Division, the supplier should determine whether the goods are environmentally hazardous. The criteria are equivalent to CLP Categories Aquatic Acute, Category 1, and Aquatic Chronic, Categories 1 and 2. Such substances are designated Marine Pollutant (MP) for sea carriage and Environmentally Hazardous substance (EHS) for European inland transport.

14.6. Special precautions for user

Any information on special precautions which a user should take or be aware of in connection with transport within or outside their premises, for all relevant modes of transport. The 'additional information' below gives an indication of the information that you may find in this Sub-section.

14.7. Maritime transport in bulk according to IMO instruments

This Sub-section applies only when cargoes are intended to be carried in bulk in ships. Consequently, you will most frequently find phrases such as 'not applicable' or 'product is not transported in bulk.'

Liquid bulk cargoes require the product name (if different from that given in subsection 1.1.) in accordance with the name used in the lists of product names given in the IBC Code or the latest edition of the IMO's Maritime Environment Protection Committee (MEPC).2/Circular (112). Ship type required and pollution category shall be indicated, as well as the IMO hazard class.

Solid bulk cargoes require:

- the bulk cargo shipping name,
- an indication of whether or not the cargo is considered harmful to the marine environment (HME),
- whether it is a material hazardous only in bulk (MHB),
- in which cargo group it should be considered according to the International Maritime Solid Bulk Cargoes (IMSBC) Code.

Liquefied gas cargoes in bulk require the product name, and the ship type required.

Additional Information

The following additional information may also be given in Section 14.

Classification code

Under ADR/RID/ADN dangerous goods are assigned a classification code which identifies groups of dangerous goods within that Class. For example, a dangerous good of Class 3 flammable liquid, with a subsidiary toxic hazard, which is used as a pesticide, would be assigned to classification code ‘FT2’. Classification codes are, apart from explosives, not required to be given on transport documentation or package markings.

Danger labels

The term danger label refers to a relatively large diamond-shaped hazard label which uses a symbol, background colour and number at the bottom point to provide a clear visual indication of the product’s hazard. These may be shown in colour, or just black and white, or referred to by reference number (e.g. ‘Label 3’ is the flammable liquid label).

Emergency Action Code (EAC)

The emergency action code is unique to UK road transport by tanker or bulk carrier and comprises a number between 1 and 4, followed by a letter, and in certain cases by the letter E, e.g. ‘2WE’.

The number indicates the medium suitable for fighting fires or dispersing spillages:

1 = water, 2 = water fog, 3 = foam, 4 = dry agent.

The first letter indicates the type of protective equipment required; whether any spillage should be contained or dispersed; and whether the product presents a risk of violent reaction or explosion. The final letter ‘E’ indicates that a public safety hazard exists, and that certain specified actions should be taken.

Hazard Identification Number or Kemler Code

The Hazard Identification Number (HIN), also known as the Kemler Code, is a ‘hazardous properties’ code used for international road/rail transport. Though used more widely than the EAC, the HIN conveys less useful information. It is normally a two-digit number derived from the hazard class (or classes) of the product and may give an indication of the degree of hazard.

Examples:

- Class 8 (primary hazard), Class 3 (secondary hazard), HIN: 83,
- Class 8 (only), low hazard, HIN: 80,
- Class 8 (only), high hazard, HIN: 88.

Where the numbers are preceded by an ‘X’ this indicates that the substance will react dangerously with water. If ‘9’ is used as the second digit, this indicates a risk of spontaneous violent reaction. However, some combinations have special meanings, e.g. ‘90’ indicates an environmental hazard.

Transport category

The UK Road regulations assign products to one of five transport categories, with values from 0 to 4:

- category 0 is applied to certain extremely dangerous goods,
- categories 1, 2 and 3 correspond to packing groups I, II and III, with some variations,
- Category 4 is for empty un-cleaned packagings and a few very low hazard products.

The transport category is used to determine whether the load is considered to be a small load, in which case certain relaxations from the full requirements of the provisions may be permitted.

Tunnel Code

Under ADR all road tunnels are assigned a code indicating the degree of restriction that apply to the passage of dangerous goods through the tunnel. Tunnels coded as type ‘A’ do not restrict any dangerous goods and progressively through ‘B’ to ‘E’ the degree of restriction increases, with Tunnels of type ‘E’ restricting virtually all dangerous goods carried in significant loads.

Dangerous goods are also assigned a tunnel code, which may be given in Section 14 of the SDS and can easily be found in the ADR dangerous goods list. For example, UN1603 ETHYL BROMOACETATE is assigned tunnel code ‘D/E’, which means that this substance if carried in tankers is prohibited from passing through tunnels of type D and E, while if in packaged form in significant loads it is prohibited from travelling through tunnels of type E only.

EmS and MFAG Numbers

These numbers are used only for transport by sea and are intended to provide rapid emergency advice for the captain and crew.

EmS stands for Emergency Schedules and these detail the action to take, the protective clothing, and equipment required in the event of a spillage or fire involving the dangerous goods. The EmS is only occasionally given in the SDS and is not mandatory.

MFAG stands for Medical First Aid Guide. This is now obsolete and may indicate an out-of-date SDS. The MFAG gives first aid guidance based on the symptoms expressed by the casualty, and not is not directly related to the substance to which the casualty has been exposed.

IMDG Code Segregation Group

For segregation of cargo for sea transport according to the IMDG Code, the consignee may assign goods to one of 18 different Segregation Groups, such as Group 1 (acids), Group 9 (lead and its compounds), Group 18 (alkalis). Any applicable Group may be given in this Sub-section of the SDS and will be included on any transport of dangerous goods document, if the substance is shipped by sea.

Many dangerous goods are listed in the IMDG Code as belonging to a particular segregation group, e.g. UN2401 PIPERIDINE is assigned to Segregation Group 18 (alkalis), but others, such as ‘UN1603 ETHYL BROMOACETATE’, are not assigned in the IMDG Code, and the supplier should decide whether to assign one of the 18 Groups or none at all.

Packing Instructions

Packing Instructions occasionally appear on an SDS. They are assigned to UN Numbers/Packing Groups in the applicable regulations. For air transport they are composed of a three-digit number, sometimes with a 'Y' prefix, e.g. 341 or Y341. They are specific to the substances being shipped, the size of the packaging and the type of aircraft in use (passenger aircraft or cargo only). Note that some products are considered too dangerous to be sent by air and these are classed as 'forbidden'.

Although there is increasing harmonisation of the regulations governing the various modes of transport, you may still find apparent discrepancies. If you have any doubts concerning the accuracy of the information given in Section 14 of the SDS, you should contact your supplier for clarification.

Limited quantities and any specific special provisions may also be listed in Section 14.

Links to other Sections

For hazards identification	Section 2, Section 9
For physico-chemical properties	Section 9
For health effects	Section 11
For information on disposal	Section 13

Further reading and regulations

IATA Dangerous Goods Regulations (IATA DGR).
http://www.iata.org/publications/dgr/Pages/index.aspx

International Maritime Dangerous Goods Code (IMDG).
https://www.imo.org/en/publications/Pages/IMDG%20Code.aspx

European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).
https://unece.org/transportdangerous-goods/adr-2021-files

Regulations concerning the International Carriage of Dangerous Goods by Rail (RID).
https://otif.org/fileadmin/new/3-Reference-Text/3B-RID/RID_2021_e_01_July_2021.pdf

European Provisions concerning the International Carriage of Dangerous Goods by Inland Waterway (ADN).
https://unece.org/transport/dangerous-goods/adn-2021

Carriage of Dangerous Goods and Transportable Pressure Equipment Regulations 2009 (S.I. 2009/1348) – known in short as CDG2009.
http://www.legislation.gov.uk/uksi/2009/1348/contents/made

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment (Amendment) Regulations 2011 (S.I. 2011/1885).
http://www.legislation.gov.uk/uksi/2011/1885/contents/made

Approved Derogations and Transitional Provisions (ADTP) (supports CDG2009).
https://www.gov.uk/government/publications/the-carriage-of-dangerous-goods-approved-derogations-and-transitional-provisions

ADR Multilateral Special Agreements (online only at UN ECE Dangerous Goods website).
http://www.unece.org/?id=6740

SECTION 15: Regulatory information

This section should contain European or UK, and other national regulatory information (depending on the market countries) that is relevant to the product and has not already been mentioned in other Sections.

If you have difficulty in understanding this Section, or any other Sections of the SDS, you should seek assistance from your supplier at the address or phone number given in Sub-section 1.3. (Details of the supplier of the safety data sheet).

However, it is your responsibility, not that of the supplier, to undertake a workplace risk assessment (under COSHH and/or DSEAR in the UK), before using the product, or whenever there has been a significant process change.

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

There is no specific list of regulations that must be referred to in this Sub-section, and the information found here may vary from supplier to supplier and from product to product. SDSs supplied in different EU member states may also contain different information related to national legislation in those countries. The supplier should mention legislation specific to the product that may be of relevance to the user.

Examples of legislation which may apply to a product and be found in this Sub-section include:

- EU Chemical Agents Directive (98/24/EC CAD) (which is implemented in Great Britain by the Control of Substances Hazardous to Health (COSHH) and Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR).
- Seveso Directive (2012/18/EU, Annex I) implemented in Great Britain by COMAH Regulations. This will help the user determine whether their site meets the definition of a COMAH site.
- EU REACH (Regulation 1907/2006), particularly for any substances or components that require authorisation (Annex XIV) before use or whose use is restricted (Annex XVII).
- EU Directives 94/33/EC (young workers) or 92/85/EEC (pregnant workers) or the equivalent national legislation in the country where the product is being placed on the market.
- Legislation for special product types, such as biocides (Regulation 528/2012), detergents (Regulation 648/2004), paint and varnish products (reference to Directive 2004/42/EC on emissions of volatile organic compounds), and cosmetics (Regulation 1223/2009), and related regulatory information (e.g. authorization or registration numbers, biodegradation declarations).
- Water Framework Directive or EU Directives related to Environmental Quality Standards (EQS)
- EU Directives and national legislation on occupational exposure limits,

- Regulation (EC) No. 2037/2000 on substances that deplete the Ozone layer.
- EU Prior Informed Consent (PIC) Regulation (649/2012).
- Regulation (EC) No 850/2004 on persistent organic pollutants.
- Important national legislation such as the German AwSV that specifies the water hazard classification (WGK). National regulations should also be given in their original language.

15.2. Chemical Safety Assessment

This sub-section should have a statement on whether or not the supplier has carried out a Chemical Safety Assessment (CSA) for the product.

Links to other Sections

For hazards identification	Section 2
For occupational exposure limits	Section 8
For references used in compiling Section 15	Section 16

Further reading and regulations

Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work (Chemical Agents Directive)
https://osha.europa.eu/en/legislation/directives/exposure-to-chemical-agents-and-chemical-safety/osh-directives/75
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01998L0024-20190726

The Control of Substances Hazardous to Health Regulations 2002 (COSHH) (S.I. 2002/2677)
www.hse.gov.uk/coshh
http://www.legislation.gov.uk/uksi/2002/2677/regulation/7/made

The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) (S.I. 2002/2776)
http://www.hse.gov.uk/fireandexplosion/dsear.htm
http://www.legislation.gov.uk/uksi/2002/2776/contents/made

Young Workers Directive (94/33/EC)
https://osha.europa.eu/en/legislation/directives/sector-specific-and-worker-related-provisions/osh-directives/18
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01994L0033-20190726

Seveso Directive (2012/18/EU)
http://ec.europa.eu/environment/seveso/index.htm
https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX:32012L0018

Control of Major Accident Hazards Regulations (COMAH)
http://www.hse.gov.uk/comah/index.htm
https://www.hse.gov.uk/pubns/books/l111.htm
https://www.legislation.gov.uk/uksi/2015/483/contents/made

Pregnant Workers Directive (92/85/EEC)
https://osha.europa.eu/en/legislation/directives/sector-specific-and-worker-related-provisions/osh-directives/10
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01992L0085-20190726

Regulation EC No. 1005/2009 on substances that deplete the ozone layer
http://europa.eu/legislation_summaries/environment/air_pollution/ev0021_en.htm
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32009R1005

EC webpage on legislation relating to Plant Protection products
https://ec.europa.eu/food/plants/pesticides/legislation-plant-protection-products-ppps_en

Biocidal Products Regulation (Regulation (EU) No. 528/2012)
https://echa.europa.eu/regulations/biocidal-products-regulation/legislation

Waste Framework Directive (2008/98/EC)
http://ec.europa.eu/environment/water/water-framework/index_en.html
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060

Environmental Quality Standards Directive (2008/105/EC)
http://ec.europa.eu/environment/water/water-dangersub/pri_substances.htm#dir_prior
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:348:0084:0097:EN:PDF

EC webpage on legislation relating to Detergents
https://echa.europa.eu/legislation-profile/-/legislationprofile/EU-DETERGENTS

Prior Informed Consent (PIC) Regulation (Rotterdam Convention)
https://echa.europa.eu/regulations/prior-informed-consent/understanding-pic

German Water Hazard Classification
https://www.umweltbundesamt.de/en/topics/chemicals/substances-hazardous-to-waters

Information on Ocupational Exposure Limit values
https://limitvalue.ifa.dguv.de/

SECTION 16: Other information

This Section of the SDS should provide you with administrative information, to help you understand the other Sections, the differences between versions of the SDS, and the sources of information.

Indication of changes

If an SDS has been revised, the differences compared to previous versions should be listed (if not indicated within the main text of the SDS). You may be directed to the Section (and possibly Sub-section) where changes have been made. These changes may also have been highlighted in the text, for example either by side-lining or underlining.

It is the responsibility of your supplier to issue a revised SDS whenever new information becomes available which might affect a risk assessment, particularly:

- changes in the classification of substance, mixture or its components,
- identification of other hazards, such as endocrine disruption, PBT, or vPvB,
- changes in the regulatory status of ingredients (e.g. listing in the Candidate List of SVHCs, substances subject to restriction (REACH Annex XVII) or Authorization (REACH Annex XIV),
- changes to the recommended safe handling, storage and disposal of the product.

Reasons for the revisions may also be given in this Section, or you may have to contact the supplier to get an explanation of why the changes were made. The date of first issue of the SDS may also be given.

Abbreviations and acronyms

An explanation of abbreviations or acronyms used should be given, if they are not explained in the main text of the SDS.

Key literature references and sources for data

This should include references to where the supplier obtained the data in the SDS. The data should generally be consistent with the REACH Registration dossiers available at the ECHA website, and this can be referenced thus:
'*Search for chemicals; available at the European Chemicals Agency (ECHA) website: http://echa.europa.eu/*.'

Other sources include supplier SDSs for ingredients in a mixture, the ECHA Classification and Labelling Inventory (CLI), or the GB Mandatory Classification and Labelling List.

The supplier may include general references, e.g. '*Workplace Exposure Limits EH40/2005 (Fourth Edition 2020), Health and Safety Executive*.' If you find more recent information than the supplier has used, you should check the relevance for classification or handling of the product and contact your supplier.

Classification and procedure used to derive the classification for mixtures according to Regulation (EC) 1272/2008 [CLP]

The CLP Regulation describes classification of a mixture by a few different methods (e.g. test, calculation or 'read-across'). If the classification method is stated, this will help any formulators that use the product in their own mixtures when they come to classify them.

H-statements (number and full text)

A list of the hazard statements that appear in the SDS. Where these have been referred to by code numbers (usually in Sections 2 and 3) the full text should appear here.

Training advice

Guidance on any specific training which should be undertaken before using the product to ensure workers and the environment are protected. The supplier may have identified a need for the correct use of PPE, or for handling of toxic substances where specific training is recommended. The UK COSHH Regulations require information, training and instruction for employees who work with substances hazardous to health.

Further information

Other information you may find in Section 16 include full details of the use descriptors used in the Annex (see Annex to the SDS below), details of any trademark registrations. Most SDSs will also include a disclaimer.

Annex to the SDS

Exposure scenarios

If the substance or any of the substances within a mixture have been registered under REACH and are manufactured or imported in excess of 10 tonnes/year per manufacturer or importer, you may receive an extended SDS (ext-SDS or e-SDS) containing exposure scenarios (ESs) as an Annex at the end of the SDS.

ESs are compiled by manufacturers or importers as part of the Chemical Safety Assessment (CSA; mentioned in Section 15.2.) of the REACH registration dossier and included in the Annex of ext-SDS for that substance. The ES concept was introduced by REACH and is designed to inform downstream users on how to work safely with the substance.

The ESs describe the anticipated ways that a product might be used during its life cycle (i.e. manufacture, formulation, end use and disposal). The potential exposures for people and the environment to the substance during each scenario are calculated, and recommendations given on risk management measures to control the exposures to safe levels.

Formulators of mixtures may include the substance ESs for components, when available, as an Annex in their own SDSs. Alternatively, the information in the ESs may be incorporated in the main text of SDS (i.e. Sections 1 to 16).

When you receive an ext-SDS, you should ensure your intended use is covered by one of the ESs. If you are a downstream user (DU) (e.g. a formulator), you also need to confirm that the ESs will cover the intended uses of your customers. If an intended use is not covered by the ESs, you should ask your supplier to provide an additional ES for that use.

If your supplier does not support your intended use, you may consider sourcing the substance from other suppliers, or compiling a downstream user CSA with the ESs of interest to you (See *Practical Guide 13: How downstream users can handle exposure scenarios* – link below).

If no ESs are attached to the SDS, it may be that they are not required for that product, or that the information from the ESs has been incorporated into the main body of the SDS. If in doubt, contact your supplier for clarification.

ESs have a reputation for being too long and incomprehensible. A reason is that much of the data in ESs regards exposure calculation and is highly technical. Furthermore, the description of industry sectors, processes and uses have been codified as 'use descriptors' in the guidance on chemical safety assessment and is not readily understood without reference to guidance. A short description of use descriptors is given below.

Use descriptors

ECHA has created a use descriptor system that is used in Exposure Scenarios (ESs). The system aims to standardise and codify product uses to:

- allow some automation of the exposure calculations and safety assessment using tools (such as CHESAR),
- aid consistency, so that downstream users (DUs) will be able to identify whether their intended use is covered by the ES. It also helps DUs describe an intended use to their supplier, if it is not covered by the existing ESs.

The system comprises of five different types of descriptors which in combination can be used to describe a given product use. Further detail on the use descriptor system can be found in Chapter R.12 of the ECHA guidance document listed at the end of this chapter.

Sector of Use (SU)

This descriptor specifies the sector of the economy that the product is used in. It includes formulation of the product into other mixtures, as well as industrial, professional and consumer end uses.

Examples:

SU1: agriculture, forestry, fishery,
SU10: formulation [mixing] of preparations and/or re-packaging (excluding alloys),
SU24: scientific research and development.

These SU descriptors may be supplemented by NACE (Nomenclature générale des Activités économiques dans les Communautés Européennes) codes which give more specific descriptions of industrial sectors.

Examples:

A: agriculture, forestry and fishing,
A1: crop and animal production, hunting and related service activities,
A1.1: growing of non-perennial crops,
A1.1.1: growing of cereals (except rice), leguminous crops and oil seeds,
A1.1.2: growing of rice,
A1.1.3: growing of vegetables and melons, roots and tubers.

Chemical Product Category (PC)

This descriptor describes type of product that the substance will be used in by the end-user. Product categories are quite broad and are more concerned with giving information on the potential for exposure rather than a technical description of the specific end use.

Examples:

PC1: adhesives, sealants,
PC13: fuels,
PC24: lubricants, greases, release products.

Process category (PROC)

This is an important descriptor that directly influences the likely exposures to the substance. It describes the tasks or processes in which the substance may be used. Different processes can result in different levels and routes of exposure, affecting what risk management measures will need to be considered, e.g. applying paint with a spray gun as compared to with a brush.

Most uses for a substance (or a mixture containing the substance), such as formulation, can be broken down into simpler tasks: attaching hoses and pumping of reactants, pouring, mixing (either in open or closed containers), packing of product, cleaning, etc. Each of these tasks will have a process category (PROC) code that can be used in the Chemical Safety Assessment and Exposure Scenarios.

Examples:

PROC2: use in closed, continuous process with occasional controlled exposure,
PROC7: industrial spraying,
PROC10: roller application or brushing.

Environmental Release Category (ERC)

This is important in calculating environmental exposures and describes aspects of use and release that influence environmental release. Assigning ERCs depends on:

- the fate of the product (what happens to the product during use and how does this affect the release to the environment).
- the life-cycle stage of the product (e.g. formulation, use, disposal),
- the dispersiveness of the use (i.e. concentration in a few small industrial sites, or widespread use for consumer applications),
- use in an open or closed system, indoors or outside, etc.,
- whether the product is incorporated into an article.

Examples:
ERC7: industrial use of substances in closed systems,
ERC8a: wide dispersive indoor use of processing aids in open systems,
ERC10a: wide dispersive outdoor use of long-life articles and materials with low release.

Article category (AC)

An article is object which during production is given a special shape, surface or design, which determines its function to a greater degree than does its chemical composition, for example a plastic sheet, a battery or a telephone.

Article categories describe the type of article that the substance may be processed into. This includes mixtures in their dried or cured form, such as ink printed onto paper or paint coated onto a surface. There are descriptors to cover articles that are designed to intentionally release the substance and those designed to prevent release.

Further Reading

Guidance on information requirements and chemical safety assessment; *Chapter R.12: Use description*; version 3.0; ECHA, 2015
https://echa.europa.eu/guidance-documents/guidance-on-reach

European Commission, Competition: List of NACE Codes (2010.03.25)
https://ec.europa.eu/competition/mergers/cases/index/nace_all.html

Guidance for downstream users; Version 2.1; October 2014; ECHA.
https://echa.europa.eu/regulations/reach/downstream-users

Guidance on the compilation of Safety Data Sheets; Version 4.0; ECHA, 2020
https://echa.europa.eu/guidance-documents/guidance-on-reach

Appendix A: Glossary of terms and abbreviations commonly used in SDSs

~	Mathematical symbol meaning ‘about/approximately equal to’.
<	Mathematical symbol meaning ‘Less than’.
>	Mathematical symbol meaning ‘Greater than’.
≤	Mathematical symbol meaning ‘Less than or equal to’.
≥	Mathematical symbol meaning ‘Greater than or equal to’.
A-	Prefix meaning ‘lack of’”, e.g. aplasia = lack of growth. See ‘An’.
Article	An object which during production is given a special shape, surface or design, which determines its function to a greater degree than does its chemical composition. Examples of articles are a plastic sheet, a battery, or a telephone.
Abiotic degradation	The process whereby a substance is broken down into simpler substances by chemical (e.g. oxidation), physical or mechanical means including photolysis (breaking down by light), and hydrolysis (breaking down by water).
Absorption	A process whereby a substance may be taken up (rather like water into a sponge) but is easily released, i.e. entry into blood stream and consequently being carried to all parts of the body. Absorption can occur through the skin, mucous membranes or the lungs.
ACGIH	See 'American Conference of Governmental Industrial Hygienists'.
Acid	A substance that may be corrosive (to skin or eyes or metals), or irritating, and has a pH less than 7 when dissolved in water.
ACL	See 'Approved Carriage List'.
ACoP	See 'Approved Code of Practice'.
Acronym	Chemical name based on, usually, initial letters of a complex name: e.g. TNT for trinitrotoluene.
Activated sludge	The product of mixing primary effluent with bacteria-laden residual solids and then agitating and aerating to promote biological activity. Used to speed up the breakdown of organic matter in raw sewage undergoing secondary waste treatment.
Acute	Of effects: immediate, or sudden onset or of short duration. Of exposure: a single dose or short exposure.
Adaptation to Technical Progress (ATP)	EC document which amends legislation such as the REACH or CLP Regulations, e.g. 4th ATP to the CLP Regulation.
ADR	Agreement concerning the international carriage of dangerous goods by road.

Adsorption	The physical-chemical process by which a soil binds substances so that they are transported more slowly in the environment.
Aeration	A process which promotes biological degradation of organic matter through the introduction of air (active ingredient oxygen).
Aerobic	In the presence of oxygen.
AFNOR	French system of standards.
Algae	Micro-organisms that live on inorganic nutrients and produce organic matter from carbon dioxide and water by photosynthesis. They are the primary producers of biomass in aquatic systems. Non-rooting, non-vascular aquatic plants.
Alimentary canal	Digestive tract from the mouth to the anus.
Alkali	A substance which may destroy or irritate skin and eyes, or can corrode certain metals, e.g. aluminium, and has a pH greater than 7 when dissolved in water.
Allergy	Abnormal sensitivity to a substance resulting from the presence of antibodies to it, manifested by wheezing, lachrymation, skin rash, etc. See also 'Sensitisation'
American Conference of Governmental Industrial Hygienists (ACGIH)	American Conference of Governmental Industrial Hygienists. The body recommending threshold limit values (TLVs) in the USA.
Ames test	A short-term test for mutagenicity using bacteria (salmonella or E. Coli). Designed primarily as a rapid screen for possible mutagens or carcinogens. A substance with a positive Ames result requires further testing before being meeting the criteria for classification.
An-	Prefix meaning ‘lack of’ used before a vowel. e.g. anaemia = lack of hæmoglobin. See ‘A’
Anaerobic	In the absence of oxygen.
Anaesthesia or anaesthetic effect	Central nervous system effect resulting in dizziness, drowsiness or temporary confusion leading to unconsciousness, as caused by many solvents (preferable description to ‘narcosis’).
Anoxia	Absence of oxygen.
Antidote	Any substance which corrects or neutralises the effect of a poison on the system.
Approved Carriage List (ACL)	Approved Carriage List for the carriage of dangerous goods by road in the UK (HSE publication).
Approved Code Of Practice (ACoP)	A UK guidance publication based on regulations, which, if followed, should ensure compliance with the law.

Approved Supply List (ASL)	HSE publication, now obsolete, which listed substance classifications according to the Dangerous Substances Directive (DSD). This has been replaced by Table 3.1 of Part 3 of Annex VI of the CLP Regulation.
Aquatic	Relating to water or the living things which inhabit it.
Aqueous	Water based; contains water.
ASL	See 'Approved Supply List'
Asphyxia	Cessation of breathing; suffocation.
Asphyxiant	An 'inert' gas or vapour which at high concentrations in air, can suffocate by reducing the oxygen content of the atmosphere.
Aspiration	The breathing of liquid or vomit into the lungs.
Asthma	A reversible constriction of the air ways of the lungs (bronchi) giving rise to difficulty in breathing. Wheezing is the characteristic sign of asthma.
ASTM	American Society for Testing Materials.
ATP	See 'Adaptation to Technical Progress'.
Auto-ignition temperature	Sometimes referred to as 'ignition temperature'. The lowest temperature at which a material will ignite spontaneously and sustain combustion in the absence of a spark or flame.
BA	See 'Breathing apparatus'.
BCF	See 'Bioconcentration Factor'.
Binding Limit Value (BLV)	A European Community Occupational Exposure Limit.
Bioaccumulation	The accumulation of a substance within an organism resulting in a higher concentration than in the surroundings.
Bioassay	A test measuring the metabolic breakdown of organic materials into simpler components or into carbon dioxide and water.
Bioconcentration	Bioaccumulation in aquatic organisms.
Bioconcentration Factor (BCF)	A measure of how easily a substance accumulates within living tissue. It is experimentally determined and considered a more accurate indicator of bioaccumulative potential than K_{ow} or P_{ow}.
Biodegradability or biodegradation	The extent to which a substance is broken down by living organisms.
Biological Oxygen Demand (BOD)	Measure of the amount of dissolved oxygen consumed by organisms using organic material as a source of carbon. These measurements are not regarded as being completely accurate but can be used as an indicator of biodegradability.
Biomagnification	The accumulation of a substance into higher organisms (algae → invertebrates → fish → mammal) via the food chain.

Biota	The complete, biologically-inspired, ecosystem and associated organisms.
Biotic degradation	The process whereby moulds and other naturally occurring micro-organisms break down chemicals into simpler substances.
Biotransformation	A change made to a chemical substance by a living organism.
BLV	See 'Binding Limit Value'
BOD	See 'Biological Oxygen Demand'
Boiling point	The temperature at which a liquid turns to a gas or vapour. This is when its vapour pressure equals that of the atmosphere above the surface of the liquid. In many cases, particularly mixtures, the boiling point will be reported as a range of temperatures.
Breathing Apparatus (BA)	A device which enables the wearer to breathe independently of the ambient atmosphere. Also known as SCBA (self-contained breathing apparatus), or CABA (compressed air breathing apparatus).
Bronchi	Branching tubes in the lungs conducting air between the windpipe (trachea) and the airsacs (alveoli). Muscles in the bronchi walls can cause them to narrow and this produces symptoms of tightness in the chest, wheeze or asthma.
BS	British system of standards.
Bulk density	A term used to indicate the mass to volume ratio of a divided solid, such as a powder. The value takes into account the spaces in between particles and any pores within the particles. This can be useful when determining the required size of storage containers.
Bund or bunding	Defined in the GHS as 'a provision of liquid collection facilities which, in the event of any leak or spillage from tanks or pipe work, will capture well in excess of the volume of liquids held, e.g. an embankment. Bunded areas should drain to a capture tank which should have facilities for water/oil separation.'
CABA	See 'breathing apparatus'.
Carboxyhæmoglobin	A compound of carbon monoxide and hæmoglobin which cannot combine with oxygen.
Carcinogenic or carcinogenicity (Carc.)	Term applied to substances with a potential to produce cancer under some circumstances, but not necessarily relevant to human exposure.
Cardiac	Relating to the heart.

Cardiac sensitisation	An effect in which the heart is rendered more sensitive to the effect of adrenalin and similar substances. This can result in sudden heart failure. Certain chlorinated hydrocarbons can cause this.
Cardiovascular	Relating to the heart and blood vessels.
CAS number	Chemical Abstract Service Registry Numbers (CAS number or CAS RN): A CAS number provides a simple way to identify a substance, particularly as the systematic chemical name may by complicated and poorly understood. There are currently over 160 million CAS numbers, and they are used internationally. Many substances may have more than one CAS number; the later (and longer) numbers providing a more specific description of the substance, e.g. different amounts of water associated with the chemical. Should you wish to find out more about a chemical, for example by means of a literature search, then the CAS number is usually better than the chemical name as a search term. Mixtures and natural products and oils do not have CAS numbers.
Catalyst	A substance which speeds up a reaction without being used up. A catalyst may however deteriorate and become ‘spent’.
Cation exchange capacity (CEC)	A soil characteristic which may affect sorption of substances.
Caustic	Any strongly alkaline material which has a destructive effect on living tissue.
CE Mark	A symbol attached by manufacturers of goods that are tested to or conform to EC technical standards.
CEC	Commission of European Community. May also refer to 'Cation Exchange Capacity' (see separate entry).
CEFIC	European Chemical Industries Council.
Chain of supply	The chain through which a chemical passes, from manufacturer to ultimate user.
Chemical	A common term for a substance or mixture.
Chemical oxygen demand (COD)	A chemical test to determine the amount of oxygen consumed by the breakdown of organic substances in aqueous solution. The COD test is routinely used to characterise substances or effluents in order to establish discharge consents and charges.
Chemical pneumonitis	Inflammation of the lungs due to inhalation of chemical irritants. The extent of injury is related to the concentration of the irritant and the length of exposure.

Chemical safety assessment (CSA)	An evaluation of the potential risks posed by a substance during its manufacture and use. REACH registrants of substances that are manufactured or imported in quantities above 10 tonnes per year must carry out a CSA, and submit a chemical safety report (CSR) to ECHA documenting their findings. Downstream users whose use is not included in their supplier's CSR may also need to carry out their own CSA and submit their CSR to ECHA.
Chemical safety report (CSR)	A report submitted to ECHA which details the findings of a chemical safety assessment. See also 'chemical safety assessment (CSA)'
Chesar	Chemical Safety Assessment and Reporting tool. An application developed by ECHA to help companies to carry out chemical safety assessments (CSAs) and to prepare their chemical safety reports (CSRs) and exposure scenarios (ESs) for communication in the supply chain.
CH-Giftkl.	Swiss toxicity classification.
Child resistant closure (CRC)	A design of cap or seal on a container that requires a complex operation for release, thus making it difficult for a child to open.
CHIP	The Chemical (Hazard Information and Packaging for Supply) Regulations. These directives implemented the EU Dangerous Substances Directive and Dangerous Preparations Directive. CHIP Regulations were replaced in 2015 by CLP, and are now obsolete.
Chronic	Describes the effects or exposure over a long duration (measured in days, months or years).
Chronic bio-assay	A test carried out over a period related to the organism’s life-cycle, which may be months or years depending on the species.
Cirrhosis	Liver disease characterised by slow replacement of normal liver tissue by fibrous (scar) tissue.
Classification	Identification of the hazards of a product by assignment of Hazard Classes, Categories, and Statements using criteria in the CLP Regulation.
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures. This EU Regulation sets out the rules for classifying hazardous substances and mixtures.
CNS	Central Nervous System.
COD	See 'Chemical Oxygen Demand'.
Coma	Unconsciousness.
COMAH	See 'Control Of Major Accident Hazards Regulations'.

Combustion	Ability of a material to burn in a normal atmosphere when a flame is applied to the material and maintained in contact with it.
Conductivity	A measure of the ability of a substance to allow heat (thermal conductivity) or electricity (electrical conductivity) to move through it.
Conjunctiva	The thin transparent mucous membrane which lines the eyelids and covers the white of the eye.
Conjunctivitis	Inflammation of the conjunctiva.
Control of Major Accident Hazards Regulations (COMAH)	UK implementation of the EU Seveso Directive. Requires sites with particularly hazardous substances in quantities above specified thresholds to have emergency plans in place.
Controlled	In the context of a SDS, means that the substance has to be disposed of in accordance with the Special Waste Regulations.
Cornea	The transparent central portion of the front of the eye.
Corrosive	Describes the action of a chemical that attacks and destroys body tissues or metals by chemical attack.
COSHH	UK Control of Substances Hazardous to Health Regulations The Regulations are a Stationery Office publication and the associated Approved Codes of Practice and Guidance are HSE publications.
CRC	See 'child resistant closure'.
CSA	See 'chemical safety assessment'.
CSR	See 'chemical safety report'.
Cutaneous	Relating to the skin. Thus, percutaneous means through the skin; subcutaneous means beneath the skin.
Dangerous goods	A term, which describes substances, mixtures or articles, classified as hazardous for transport.
Dangerous Preparations Directive (DPD)	Obsolete EU Directive 1999/45/EC which set out the mechanism of classification and labelling of hazardous mixtures prior to the CLP Regulation.
Dangerous Substances Directive (DSD)	Obsolete EU Directive 67/548/EEC, which set out the mechanism of classification and labelling of hazardous substances prior to the CLP Regulation.
Daphnia	Small aquatic invertebrates (water fleas) frequently used in ecotoxicity studies.
Dec.	Abbreviation of 'Decomposes'. If given after boiling point may indicate that the substance decomposes at that temperature.
Decomposition temperature	The temperature at which a substance or mixture decomposes.

Defatting (of the skin)	The solvent effect of a chemical, dissolving the fatty or oily substances in the skin and removing their protective effect. Defatted skin may crack or become inflamed.
Deliquescence	The property which some substances possess of being able to absorb moisture from the atmosphere. On so doing they become liquefied or develop a wet appearance. See also 'hygroscopic'.
Density	The ratio of the mass of a product to its bulk or volume. The term is commonly applied to liquids including products that are molten in normal usage. See also ‘specific gravity’, ‘bulk density’ and ‘vapour density’
Derived minimal effect level (DMEL)	Level of exposure calculated to cause minimal effect [used when there is no ‘no-observed-adverse-effect level (NOAEL)]. Usually used for carcinogens or mutagens.
Derived no effect level (DNEL)	Level of exposure (oral, dermal or inhalation) calculated to cause no adverse effect following short- or long-term exposure. Calculated from the ‘no-observed-adverse-effect level (NOAEL) in long-term studies.
Dermal	Relating to the skin or exposure by skin contact.
Dermatitis	Inflammation of the skin caused by external agents, e.g. irritants, or the defatting action of solvents, or due to allergic reactions.
Dilution ventilation	A form of ventilation that allows atmospheric contaminants to be kept below danger levels by using fresh outdoor air.
DIN	German system of standards.
DMEL	See ‘derived minimal effect level’
DNEL	See ‘derived no effect level’
Dominant lethal test	A test for mutagenicity in which male animals are exposed to the test substance and then mated with unexposed females. The females and offspring are then monitored for adverse effects including foetal deaths.
Dose	The amount of a material which enters the body.
DPD	See 'Dangerous Preparations Directive'.
DSD	See 'Dangerous Substances Directive'.
Dust	Solid particles suspended in air. Total dust, all airborne dust. Respirable dust, that portion of dust with particles that are small enough to penetrate to the lower lung (size dependent).

Dyspnoea	Difficult or laboured breathing.
EC No.	The substance reference number in EINECS or ELINCS or NLP lists. EC numbers are specific to the EU, but are superior to CAS numbers in that a substance should have only one EC number, so are a good search term for databases such as the European Chemicals Agency's 'search for chemicals'.
EC_{50}	See 'effective concentration 50%'.
ECHA	European Chemicals Agency.
Ecotoxicity	Effects of a substance on the environmental organisms. These effects are not necessarily related to human health.
Effective concentration 50% (EC_{50})	A measure of ecotoxicity. The estimated effective concentration at which 50% of a group of organisms may be affected by a test material. The effect on the organism and exposure time should be specified. The effect may be immobilisation for Daphnia, growth inhibition for algae or cessation of germination for plants. It may be used for lethal effects (when it is the same as LC_{50}), but may be applied to non-lethal effects, such as when fish cease to swim upstream.
Efflorescence	The loss of water from a crystalline hydrate on exposure to air, indicated by the formation of powder on the crystal surface.
EH40	The document listing UK Workplace Exposure Limits (WELs) (See Appendix G).
EINECS	The European Inventory of Existing Commercial Chemical Substances (obsolete).
ELINCS	The European List of Notified (New) Chemical Substances (obsolete).
Embryo(n)	In mammals, the offspring in the early stages of development before birth. In humans, until the end of seventh or eighth week of pregnancy.
EmS	An Emergency Schedule used during the transport of goods by sea.
Emulsion	A uniform suspension of tiny fat or oil particles in an aqueous continuous phase or of aqueous droplets in an oily continuous phase, e.g. mayonnaise (water in oil), french dressing (oil in water).
EN	European Norm (European system of standards)
Environmental compartment	The atmosphere or water or soil or plants or animal.
Epidemiology	The study of distribution of disease in different groups of people.
ES	See 'exposure scenario'

e-SDS	See 'extended SDS'
Eu-	A prefix meaning comfortable or pleasant.
Evaporation rate	The ratio of the time needed to change a solid or liquid to a gas compared with that for the same quantity of a reference substance (usually *n*-butyl acetate). A low evaporation rate means low volatility.
Explosive	Substances and mixtures which may explode under the effect of flame or shocks or friction.
Explosive or flammability limits	The lower and upper limits of concentration of a material, between which a flammable vapour will form with air at normal ambient conditions of temperature and pressure.
Exposure limit	See 'occupational exposure limit'
Exposure scenario (ES)	A set of conditions that describe how a substance, either on its own or in a mixture or article is manufactured or used during its life-cycle and how the manufacturer or importer or downstream user controls or recommends controlling exposure of humans and the environment.
Extended SDS (e-SDS, ext-SDS)	An SDS that includes one or more exposure scenarios attached in an annex at the end of the document.
Extremely flammable	CLP: liquid substances and mixtures having a flash point < 23 °C and a boiling point ≤ 35 °C.
Fibrosis (of lungs)	Replacement of normal lung tissue with fibrous (scar) tissue. This may be due to long exposure to irritants, or chronic inhalation of certain dusts, gases or vapours.
Flammability	Ability of a material to burn when a source of ignition is briefly applied and to continue to burn when the ignition source is removed.
Flammable	The definition of the term flammable can vary depending on its context: General: substances and mixtures which can burn in air if in contact with an ignition source. CLP: liquid substances and mixtures having a flash point between 23 and 60 °C which continue to burn after the ignition source has been removed. Solid substances that burn along a trail of powder. Transport: a liquid with a flash point of less than 61 °C or a solid substances that burn along a trail of powder.
Flash Point	The lowest temperature at which a liquid, when heated in a test apparatus, gives off sufficient vapour in air to burn or ignite momentarily on the application of a small flame.

Flowthrough test	A procedure used in testing the effects of unstable or volatile substances on target organisms, usually fish or Daphnia. The test solution is supplied as a continuous or intermittent flow at constant rate and concentration.
Foam (for firefighting)	There are several different types of foam used for fire-fighting purposes, but the two commonly found in portable extinguishers are chemical and mechanical foams. When chemical foam is used, a chemical reaction is initiated creating pressure to expel the foam from the container. In the mechanical type, the agent consists of an aqueous solution of a protein-based foaming liquid, which is aerated and expelled by gas stored under pressure in a separate container. Both types of foam are suitable for extinguishing fires involving non water-soluble flammable liquids such as hydrocarbons.
Foam (for firefighting) alcohol type	A type of foam developed for use on fires involving liquids such as alcohols or ketones (e.g. acetone). These liquids will attack and destroy normal protein foam compounds. This type of foam is sometimes referred to as all-purpose foam.
Foetotoxic	Poisonous to the foetus or unborn child.
Foetus	In mammals, the unborn child in the post-embryonic period of development. In humans, after the seventh or eighth week of pregnancy.
Foul drain/foul-water drain	A drain connected to a sewage works; a sewer. See also ‘surface drain’
Freezing point	The temperature at which a liquid turns to a solid. In most cases the freezing point is identical to the melting point.
Fume	A term often used to describe gases and vapours, but if used in the context of OELs, it refers to very small solid particles generated as part of a process or reaction.
Gastrointestinal tract	The gut including the mouth, gullet, stomach, intestines, rectum and anus. See also 'alimentary canal'.
GHS	Globally Harmonised System of Classification and Labelling of Chemicals.
Gland	An organ which produces secretions, either in the bloodstream (endocrine gland) or externally to the surface of the body or intestine (exocrine gland).
Gullet	See ‘esophagus’.

H statement (Hazard Statement)	A standard phrase used under the CLP Regulation giving simple information about the hazards of a chemical in normal use. H Statements are listed in Appendix C.
Hæmoglobin	Iron-containing protein pigment occurring in the red blood cells. Hæmoglobin allows the blood to transport oxygen.
Half-life	In the context of environmental issues, this term means the time taken for a substance to break down to half its original concentration.
Harmful	Substances and mixtures which, if they are inhaled, or ingested, or if they penetrate the skin may involve limited health risks.
Hazard	A hazard is defined as a thing, condition or a situation that is capable of producing an injury, so that hazard is an intrinsic property of the substance.
Highly flammable liquid	CLP: liquid substances and mixtures having a flash point < 23 °C and a boiling point > 35 °C.
HMSO	Her Majesty's Stationery Office. HMSO legally still exists to publish Acts and Statutory Instruments. Publications are obtained from outlets such The Stationery Office.
HSC	The Health and Safety Commission (of the UK)
HSE	The Health and Safety Executive (of the UK)
Hydrolysis	The process by which a substance is broken down by water to form new substances.
Hygroscopic	Refers to the property that some substances possess of being able to absorb moisture from the atmosphere and while doing so, do not undergo any apparent visible changes.
Hyper-	A prefix meaning 'excessive'.
Hypersensitivity	Excessive sensitivity.
Hypo-	A prefix meaning 'insufficient' or 'lack of'.
Hypoxemia	Lack of adequate amount of oxygen in the blood for normal function.
Hypoxia	Lack of oxygen.
IARC	See 'International Agency for Research on Cancer'.
IATA	See 'The International Air Transport Association'.
IC_{50}	See 'Inhibited Concentration 50%'.
ICAO	See 'The International Civil Aviation Organisation'.
Ignition temperature	See 'auto-ignition temperature'.
ILV	See 'indicative limit value'.

IMDG Code	The International Maritime Dangerous Goods Code. Regulations regarding the sea transport of dangerous goods (see Appendix G).
IMO	See 'International Maritime Organisation'.
Index number	Index numbers are another type of European chemical identification number that are assigned to substances which are listed in Annex VI, Part 3 of the CLP Regulation, i.e. those substances which have been assigned a harmonised classification.
In silico	A term sometimes used for predicted test results obtained using a computer model (literally, in silicon, i.e. a silicon chip) instead of an actual experiment.
In vitro (tests)	Toxicity tests undertaken in laboratory apparatus (literally, in glass) rather than an animals or humans.
In vivo (tests)	Toxicity tests undertaken in an animals or humans rather than laboratory apparatus.
Index number	A reference numbering system used in Table 3.1 of Annex VI of the CLP Regulation.
Indicative Occupational Exposure Limit Value (IOELV)	A European Community Occupational Exposure Limit.
Indicative Limit Value (ILV)	A European Community Occupational Exposure Limit.
Inflammable	This has the same meaning as flammable. The term is rarely used today.
Ingestion	Taking in by mouth, or swallowing of food or other substances.
Inhibited concentration 50% (IC_{50})	A measure of ecotoxicity. The estimated test concentration at which a selected activity is inhibited by 50% for a specific group of organisms. The activity and the exposure time should be specified, e.g. growth or respiration inhibition for bacteria and photosynthetic activity for algae.
Initial boiling point and boiling range	See 'boiling point'.
Inorganic	Substances not based on carbon and hydrogen, e.g. minerals or metallic compounds. The complement of ‘organic’.
Instructions in writing (IiW)	Document carried in the cab of vehicles carrying dangerous goods. It contains brief explanations of the meaning of the hazard warning diamonds and advice on what to do in the event of an incident. Instructions in writing replace tremcards, which were used in the past.

International Agency for Research on Cancer (IARC)	A branch of the World Health Organisation which reviews, published data on the carcinogenic potential of chemicals and publishes monographs on the subject.
International Maritime Organisation (IMO)	IMO sets the regulations regarding sea transport of dangerous goods, published as the IMDG Code.
IOELV	See 'Indicative Occupational Exposure Limit Value'.
Irritant	Non-corrosive substances and mixtures which, through immediate, prolonged or repeated contact with skin or mucous membrane, can cause inflammation.
Irritation	The act of causing inflammation (to the skin, eyes or respiratory passages).
ISO	International Standards Organisation.
IUPAC	International Union of Pure and Applied Chemistry. A convention for systematic naming of chemicals, e.g. 'Iron (III) nitrate' instead of 'ferric nitrate'.
K_d	See 'soil–water partition coefficient'.
K_{oc}	See 'soil–water partition coefficient'.
K_{ow}	See 'octanol–water partition coefficient'.
Lachrymation	Excessive watering of the eye.
LC_{50}	See 'lethal concentration 50%'.
LD_{50}	See 'lethal dose 50%'.
LEL	See 'lower explosive limit'.
Lesion	Localised area of injury or disease.
Lethal concentration 50% (LC_{50})	A measure of acute toxicity. It is the concentration of a substance in air or water expected to kill 50% of a population of test animals exposed for a specified period, normally 24 to 96 hours. When related to concentrations in water for fish and aquatic species the term sometimes used is $L(E)C_{50}$.
Lethal Dose 50% (LD_{50})	A measure of acute toxicity. It is the dose of a substance expected to kill 50% of an exposed population of test animals by the specified route (oral, dermal, interperitoneal, intravenous, etc).
LEV	See 'local exhaust ventilation'.
LFL	See 'lower flammability limit'.
LGK	German storage classification system.
Local exhaust ventilation (LEV)	Mechanical or engineered means of extraction of potentially contaminated air from the vicinity of the immediate work area or piece of equipment.
LOEC	See 'lowest-observed-effect concentration'.

Log K_{ow}	See 'octanol–water partition coefficient'.
Log P_{ow}	See 'octanol–water partition coefficient'.
Long-term exposure limit (LTEL)	An OEL for prolonged exposures. Usually quoted for an 8-hour time-weighted average (TWA) reference period.
Lower explosive limit (LEL)	The lowest concentration of a substance in air which can be caused to burn or explode. Often used interchangeably with 'lower flammability limit'
Lower flammability limit (LFL)	The lowest concentration of a substance in air which can be caused to burn or explode. Often used interchangeably with 'lower explosive limit'
Lowest-observed-effect concentration (LOEC)	The lowest concentration in a test which causes a statistically significant adverse effect on the test species in comparison with a control substance.
LTEL	See 'long-term exposure limit'.
MAK	Maximale Arbeitsplatz-Konzentration. German maximum workplace concentration published by the Deutsche Forschungsgemeinschaft (DFG). Influential German OELs (see ‘workplace exposure limits’ for the UK equivalent).
MATC	See 'maximum acceptable toxicant concentration'.
Material safety data sheet (MSDS)	An obsolete term that often refers to safety data sheets which have originated from the USA.
Maximum acceptable toxicant concentration (MATC)	This is applicable in the USA. It is the concentration of a substance, which produces a statistically significant adverse effect. The MATC is a hypothetical concentration which is the mean of the LOEC and NOEC, i.e. MATC = (NOEC + LOEC)/2. MATC is uniquely applicable to aquatic systems.
Maximum exposure limit (MEL)	A obsolete type of OEL at one time published by the HSE. It has been replaced by the WEL. The maximum permitted airborne concentration of a substance to which workers may be exposed by inhalation, averaged over a specified reference period, usually 8 hours. It refers to the concentration of the substance present in the breathing zone of the worker (inside RPE where this is used). Technical, social and economic factors are taken into account when setting MELs.
MEL	See 'maximum exposure limit'.
Melting point	The temperature at which a solid turns to a liquid. In most cases the melting point is identical to the 'freezing point'.
Metabolism	Chemical processes which take place in living cells. They may be divided into constructive or building up processes (anabolism) and destructive or breaking down processes (catabolism).

Methæmoglobin (or methemoglobin)	Hæmoglobin (in red blood cells) which has been altered so that the iron which it contains is in the oxidised state and therefore cannot take up oxygen. Methæmoglobin is formed in the blood by the absorption of substances such as aniline, nitrobenzene, nitrites or chlorates. Its presence in the blood gives rise to methæmoglobinæmia, which produces a blue discolouration of the skin.
M-factor	A multiplication factor used in the classification of environmentally hazardous substances by the summation method. The M-factor effectively lowers the thresholds for classification of mixtures for substances that are particularly hazardous to the environment.
MFAG	'Medical first aid guide' used in transport of goods by sea. An Appendix of the IMDG (see Appendix G in this User Guide).
mg/m^3 or mg.m^{-3}	Units of concentration, i.e. milligrams per cubic metre (usually of vapour or dust in air).
Minimum capture velocity	A term concerned with LEV. The minimum air velocity required to capture and extract particles from the vicinity of the equipment.
Mixture	Regulatory term used to describe a product comprised of two or more substances. The term 'preparation' was used in the past.
Montreal protocol	A multi-national agreement that identifies those substances that may have the potential to deplete the ozone layer.
Mppcf	Million particles per cubic foot.
MSDS	See 'material safety data sheet'.
Mucous membrane	The moist lining of some surfaces and cavities of the body (e.g. mouth, stomach, intestines, respiratory tract), including the conjunctiva lining the eyelid and white of the eye.
Mutagen, Muta.	An agent which induces genetic mutation. In the CLP Regulation, this term is used for agents that induce heritable genetic damage, i.e. in germ cells (eggs, sperm).
Mutagenicity	The capacity under some circumstances to cause genetic mutation.
Mutation	A permanent change in genetic material (DNA) leading to alteration of the characteristics of the cell.
Nanomaterial	Product containing very small particles. A chemical containing particles where, for 50 % or more of the particles in the number size distribution, one or more external dimensions is in the size range 1 to 100 nm.
Narcosis	See 'anaesthesia'.
Narcotic	See 'anaesthetic effect'.
Necrosis	Death of tissue.

Neurological	Pertaining to the nerves and nervous system.
NIOSH	National Institute of Occupational Safety & Health, USA.
NOAEL	See 'no-observed-adverse-effect level'.
NOEC	See 'no-observed-effect concentration'.
No-observed-adverse-effect level (NOAEL)	The highest level of exposure in a test which does not cause a statistically significant adverse effect in the test species.
No-observed-effect concentration (NOEC)	The highest concentration in a test which does not cause a statistically significant adverse effect in the test species.
Nuisance dust	Dusts which do not produce significant particulate-specific disease or toxic effects when exposures are kept under reasonable control.
Occupational exposure limit (OEL)	A general term for maximum concentrations of air contaminants to which people may be exposed at work without significant adverse effect, e.g. WELs in the UK, MAKs in Germany, and TLVs in USA.
Occupational exposure standard	An obsolete type of OEL at one time published by the HSE. It has been replaced by the WEL.
Octanol–water partition coefficient (K_{ow}, P_{ow})	A measure of the equilibrium distribution of a substance between n-octanol and water. This can be measured by vigorously shaking the test substance with a mixture of octanol and water and then measuring the concentration in each layer. It is an indicator of the bioaccumulation or bioconcentration potential of a chemical in the fatty tissue of living organisms. A high coefficient may be associated with environmental persistence.
Ocular	Relating to the eye.
Odour (or odour) threshold	The concentration at which a substance can just be detected by smell. This will vary between individuals. Also referred to as 'olfactory threshold'.
ODP	See 'ozone depletion potential'.
OECD	Organisation for Economic Co-operation and Development. The OECD publishes Guidelines for the Testing of Chemicals, which have been widely adopted by regulatory agencies worldwide.
OEL	See 'occupational exposure limit'.
OES	See 'occupational exposure standard'.
Oesophagus or esophagus (gullet)	A muscular tube leading from throat to stomach.
Olfactory	Relating to the sense of smell.

Olfactory fatigue	The temporary loss of the sense of smell. It may occur when a person is exposed to high concentrations of certain gases, e.g. hydrogen sulphide. Olfactory fatigue is dangerous because anyone having lost the sense of smell may be completely unaware of a toxic atmosphere around them.
Olfactory threshold	The concentration at which a substance can just be detected by smell. This will vary between individuals. Also referred to as 'odour threshold'.
Oncology	The study of tumours.
Organic	Most substances containing carbon except carbonates, oxides and carbides. They historically related to living systems and sometimes have a natural origin. The complement of 'inorganic'.
Organoleptic	Relating to effects on the senses.
Oxidising	Substances and mixtures that may give rise to highly exothermic reactions when in contact with combustible or flammable substances.
Oxidising agent	A substance which may react with other chemicals by providing oxygen atoms. Under fire conditions, an oxidising agent may increase the rate of combustion of combustible materials. Examples of oxidising agents are nitric acid, manganese dioxide, hydrogen peroxide, organic peroxides, ammonium nitrate, chromic acid and potassium permanganate.
Ozone depletion potential (ODP)	Rate at which a chemical may deplete ozone compared to a specific chlorofluorocarbon (CFC). Values have been assigned for substances listed in the Montreal Protocol.
P statement (Precautionary Statement)	A standard phrase used under the CLP Regulation giving advice on safety precautions that may be appropriate when using the chemical. P statements replaced the S phrases used under the DSD/DPD Directives. P statements are listed in Appendix E.
Partition coefficient: n-octanol–water	See 'octanol–water partition coefficient'.
Pathogen	A micro-organism capable of causing diseases. It is assumed to apply to man unless another animal species is specified.
PBT	Persistent, bioaccumulative and toxic (as defined in Annex XIII or the REACH Regulation).
Persistence	The property of a substance denotes extended lifetime in the environment because, for example, it is non-biodegradable, insoluble in water or it is absorbed by either the humus in soil or silt in a river.

pH	A parameter, typically given in the range 0 to 14, which indicates how acidic or alkaline a material is. Acids have pH values of < 7 and alkalis have values > 7, pure water ca. 7.
Pharyngitis	Inflamed or sore throat.
Pharynx	Throat.
Photochemical ozone creation potential (POCP)	The ability of a chemical to form smog.
Photodegradability	The extent to which (or process by which) a substance is broken down by visible or ultraviolet light or solar radiation in air or surface waters.
Photolysis	Splitting by light. Some substances can be broken down into simpler components when exposed to light.
Photosensitisation	Tendency of tissues to react abnormally to light. Certain drugs or chemicals can cause photosensitisation.
PNEC	See ‘predicted-no-effect concentration’.
Pneumoconiosis	Fibrosis or scarring of lung tissue due to long-term exposure to certain dusts.
Pneumonitis	Inflammation of the lungs.
POCP	See 'photochemical ozone creation potential'.
P_{ow}	See 'octanol–water partition coefficient'.
ppb	Parts per billion. 1 ppb is one-thousandth of 1 ppm.
PPE	Personal protective equipment.
ppm	Parts per million (equivalent to 1 mg per litre of liquid or kilogram of solid).
Predicted-no-effect concentration (PNEC)	The concentration calculated to have no effect in different parts of the environment. Typically calculated using ecotoxicity data for the aquatic environment.
Preparation	Obsolete regulatory term previously used to describe a product comprised of two or more substances. The term 'mixture' is used now used instead.
Primary irritant	A substance capable of producing a non-allergic irritation, which is dose-related and may lead to dermatitis.
Pulmonary	Relating to the lung.
Pyrophoric	A pyrophoric substance is one that can catch fire spontaneously on coming into contact with air.

R Phrase (risk phrase)	Obsolete term used under the DSD/DPD system giving simple information about the hazards of a chemical in normal use. The equivalent under the CLP Regulation is the H statement (Hazard Statement).
REACH	Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of CHemicals (REACH).
Reducing agent	A substance which is readily oxidised and may catch fire or cause heat to be generated if in contact with oxidising agents.
Relative density	The ratio of the mass of a given volume of a substance to the mass of an equal volume of water, at a given temperature. Also referred to as 'specific gravity'.
Renal	Relating to the kidneys
Reprotoxic, Repr.	Toxic to the reproductive systems of either the male or female. See also ‘mutagen’, ‘teratogen’.
Resistivity	The opposite of electrical conductivity. A measure of the ability of a substance to inhibit movement of electricity through it.
Respiratory tract	Nose, throat, bronchi and lungs.
RID	European regulations regarding the international carriage of dangerous goods by rail (see Appendix G).
Risk	The likelihood that the hazardous properties of a chemical might cause harm (to people or to the environment).
RMM	Risk management measures.
RPE	Respiratory protective equipment.
RTECS	Registry of Toxic Effects of Chemical Substances. A reference database from the US National Institute for Occupational Safety and Health (NIOSH).
S Phrase (safety phrase)	Obsolete standard phrase used under the DSD/DPD Directives (or UK CHIP) giving advice on safety on the label or in the SDS. The equivalent under the CLP Regulation is the P statement (Precautionary Statement).
S.G.	See 'specific gravity'.
SCBA	See 'breathing apparatus'.
Semi-static test	An EC or OECD test to determine the toxicity of a product to fish. The test conditions are where no flow occurs, but the test solution is renewed after a period of time (e.g. 24 hours).

Sensitisation	Enhanced reaction (hypersensitivity) (usually allergic) especially involving skin and/or lungs that occurs upon re-exposure to sensitising materials. See also 'allergy'.
Sensitiser	A substance which causes sensitisation.
Short-term tests	Short-duration tests (e.g. acute toxicity, irritation, 'Ames test') used to aid in the selection of chemicals for long-term (and expensive) animal testing, e.g. repeated-dose toxicity or carcinogenic potential.
Short-term exposure limit (STEL)	An OEL for brief exposures. Usually quoted for an exposure time of 15 minutes.
Silicosis	Fibrosis or scarring of the lung tissue caused by long-term exposure to certain types of silica dust, e.g. crystalline silica.
Soil–water partition coefficient (K_{oc})	Also known as K_d. A measure of distribution in the environment to organic matter in soil. The K_{oc} value is a number with no units. K_{oc} can be used to predict mobility within the soil and water compartments.
Sorption	A process whereby a substance is taken up by another.
Specific gravity	The ratio of the mass of a given volume of a substance to the mass of an equal volume of water, at the temperature stated. Also referred to as 'relative density'.
Static test	An EC or OECD standardised test to determine the toxicity of a product to fish. The test conditions are those where no flow occurs in the test solution and the solution remains unchanged throughout the test.
STEL	See 'short-term exposure limit'.
Sub-acute	Intermediate between acute and chronic in terms of the duration of a toxicity test.
Subcutaneous	Under the skin.
Substance	A chemical element or one of its compounds, including any impurities. For regulatory purposes, substances may be categorised as mono-constituent substances, multi-constituent substances, or UVCB (unknown, variable composition, complex reaction products, or of biological origin) substances.
Surface drain	One which runs to a watercourse.
SVHC	Substances of very high concern, listing in ECHA's 'Candidate List'.
Synergistic effect	When the combined effect of two or more substances is greater than the sum of their individual effects.

Systemic effect	An effect of a chemical or drug other than at the site of exposure or application.
Tactile Warning of Danger (TWD)	Normally a small raised triangle intended to alert the blind and visually impaired to the fact that they are handling a dangerous chemical.
Teratogen	A substance capable of disrupting foetal growth and producing malformation.
Teratogenicity	The ability to produce malformed foetuses. The usual test for teratogenicity is to expose pregnant female animals to the test substance and examine the offspring for abnormalities.
The International Air Transport Association (IATA)	IATA publishes regulations regarding the air transport of dangerous goods. The IATA Regulations include, and expand, the ICAO Technical Instructions (see Appendix G)
The International Civil Aviation Organisation (ICAO)	A UN agency that produces the international model regulations regarding air transport of dangerous goods known as the ‘Technical Instructions’ (usually TIs) (see Appendix G).
Threshold limit value	An OEL recommended by the American Conference of Governmental Industrial Hygienists and updated annually (ACGIH). The term OEL is more familiar in Europe.
Threshold limit value - ceiling (TLV-C)	The concentration that should not be exceeded, even instantaneously. Substances with a TLV-C will not have a TLV-TWA or TLV-STEL.
Threshold limit value - short term exposure limit (TLV-STEL)	A short-term exposure limit. This TLV is higher than the TWA and is the maximum concentration to which people may be exposed for a period of up to 15 minutes. This replaces an earlier concept in which an excursion factor could be calculated for most substances with a TLV-TWA.
Threshold limit value - skin (TLV-skin)	Listed substances followed by the designation ‘skin’ indicate that potential contribution to the overall exposure may occur by absorption through the skin, mucous membranes and eye.
Threshold limit value - time weighted average (TLV-TWA)	The TLV expressed as a time weighted average concentration for an 8-hour workday and 40-hour week.
Time-weighted average (TWA)	A term used to describe OELs when the exposure is measured over an 8-hour day.
TLV	See 'threshold limit value'.
TLV-C	See 'threshold limit value - ceiling'.
TLV-skin	See 'threshold limit value - skin'.
TLV-STEL	See 'threshold limit value - short term exposure limit'.

TLV-TWA	See 'threshold limit value - time weighted average'.
Topical	An application or effect of a chemical or drug at a site on the body (e.g. skin or eye).
Toxic	The classification of substances and mixtures which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.
Toxicity	This defines the inherent ability of a substance to cause an adverse biological effect once it reaches a target site on or within the body.
Toxicology	The study of the effects of substances on living organisms.
Tremcard	Obsolete CEFIC trade name for a transport emergency card (written instructions for driver). Tremcards have been replaced with 'Instructions in Writing.'
Tumour	A growth of tissue causing a lump which may be benign (non-malignant) or cancerous (malignant).
TWA	See 'time-weighted average'.
TWD	See 'tactile warning of danger'.
UEL	See 'upper explosive limit'.
UFL	See 'upper flammability limit'.
Upper explosive limit (UEL)	The highest concentration of a substance in air which can be caused to burn or explode. Often used interchangeably with 'upper flammability limit'.
Upper flammability limit (UFL)	The highest concentration of a substance in air which can be caused to burn or explode. Often uses interchangeably with 'upper explosive limit'.
Vapour density	The ratio of the density of a vapour relative to that of air at a given temperature.
Vascular	Relating to the system of vessels for transporting fluid in a living organism, e.g. sap or blood vessels.
VbF	German regulation for flammable liquids.
Very toxic	The classification of substances and mixtures which, if they are inhaled or ingested or if they penetrate the skin, may involve extremely serious, acute or chronic health risks and death.
Viscosity	A measure of the 'runniness' of a liquid. It varies with temperature. Important parameter in the classification of hydrocarbons for aspiration hazard.
VOC	See 'volatile organic compound'.

Volatile organic compound (VOC)	Each VOC released into the atmosphere can be assigned a photochemical ozone creation potential (POCP) which is indicative of its relative ability, in the presence of solar radiation, to assist in the formation of ground level ozone or smog.
Volatility	Tendency of a solid or liquid to change to gas or vapour at a given temperature and pressure.
vPvB	very persistent and very bioaccumulative according to the criteria in the REACH Regulation, Annex XIII.
WEL	See 'workplace exposure limit'.
WGK	German water hazard classes (Wassergefärdungsklassen). 0 = Generally non-polluting, 3 = highly polluting.
Workplace Exposure Limit (WEL)	The UK term for an OEL that, if complied with, gives adequate control of the workplace environment. The values are listed in EH40 (see Appendix G)

Appendix B: Hazard Classes and Categories under the CLP Regulation

The following pages show the hazard categories, pictograms and signal words as listed in the CLP Regulation, which may be assigned to a substance or mixture.

The information below is correct at the time of printing and includes the changes made by the 12th Adaptation to Technical Progress (ATP) to the CLP Regulation. Changes to Hazard Categories may be introduced in subsequent ATPs.

Nature of hazard	**Pictogram**	**Hazard Categor(ies)**	**Signal Word**	**Description of hazard**
Physico-chemical	 GHS01	Unstable explosives	Danger	Chemicals that explode.
		Explosive Division 1.1	Danger	
		Explosive Division 1.2	Danger	
		Explosive Division 1.3	Danger	
		Explosive Division 1.4	Warning	
	None	Explosive Division 1.5	Danger	
	None	Explosive Division 1.6	None	
	 GHS02	Flammable gas 1A, including: Pyrophoric Gas Chemically unstable Gas, Categories A and B	Danger	Extremely flammable gas. Pyrophoric gas (may ignite spontaneously if exposed to air) Chemically unstable gas (can explode even in the absence of air.
	 GHS02	Flammable Gas 1B	Danger	Flammable gas
	None	Flammable Gas 2	Warning	Flammable gas
	 GHS02	Aerosol 1	Danger	Aerosols that contain a flammable component
		Aerosol 2	Warning	

Nature of hazard	Pictogram	Hazard Categor(ies)	Signal Word	Description of hazard
	None	Aerosol 3	Warning	Aerosols that are not considered flammable.
Physico-chemical	 GHS03	Oxidising Gas 1	Danger	Gases that react exothermically with other chemicals and aid combustion
	 GHS04	Gases under pressure, including Compressed Gas, Liquefied Gas, Regrigerated Liquefied Gas, and Dissolved Gas	Warning	Gases which are supplied in a receptacle under pressure.
	 GHS02	Flammable Liquid 1	Danger	Liquids that catch fire after only brief contact with an ignition source.
		Flammable Liquid 2	Danger	
		Flammable Liquid 3	Warning	
	 GHS02	Flammable Solid 1	Danger	Solids that catch fire after only brief contact with an ignition source.
		Flammable Solid 2	Warning	
Physico-chemical	 GHS01	Self-reactive A	Danger	Thermally unstable solids or liquids which are likely to decompose exothermically, even in the absence of air, and may cause fire or explosion.

Nature of hazard	Pictogram	Hazard Categor(ies)	Signal Word	Description of hazard
Physico-chemical	 GHS01  GHS02	Self-reactive B	Danger	
	 GHS02	Self-reactive C	Danger	
		Self-reactive D	Danger	
		Self-reactive E	Warning	
		Self-reactive F	Warning	
	None	Self-reactive G	None	
	 GHS02	Pyrophoric Liquid 1	Danger	Liquids that even in small quantities will ignite within five minutes of coming into contact with air.
	 GHS02	Pyrophoric Solid 1	Danger	Solids that even in small quantities will ignite within five minutes of coming into contact with air.
	 GHS02	Self-heating 1	Danger	Liquids or solids that in large quantities will react with air generating heat. This may lead to self-ignition.
		Self-heating 2	Warning	
		Water-reactive 1	Danger	Liquids or solids

Nature of hazard	**Pictogram**	**Hazard Categor(ies)**	**Signal Word**	**Description of hazard**
Physico-chemical	 GHS02	Water-reactive 2	Danger	which emit flammable gases in contact with water.
		Water-reactive 3	Warning	
	 GHS03	Oxidising Liquid 1	Danger	Liquids that react exothermically with other chemicals and aid combustion.
		Oxidising Liquid 2	Danger	
		Oxidising Liquid 3	Warning	
	 GHS03	Oxidising Solid 1	Danger	Solids that react exothermically with other chemicals and aid combustion.
		Oxidising Solid 2	Danger	
		Oxidising Solid 3	Warning	
	 GHS01	Organic Peroxides A	Danger	Organic liquids or solids containing the bivalent -O-O- structure. They are thermally unstable and can undergo self-accelerating exothermic decomposition. They can explode, burn rapidly, be impact or friction sensitive and react dangerously with other chemicals.
	 GHS01  GHS02	Organic Peroxides B	Danger	
		Organic Peroxides C	Danger	

Nature of hazard	Pictogram	Hazard Categor(ies)	Signal Word	Description of hazard
Physico-chemical	 GHS02	Organic Peroxides D	Danger	
		Organic Peroxides E	Warning	
		Organic Peroxides F	Warning	
	 GHS05	Metal Corrosion 1	Warning	Chemicals that will react with metals, damaging or destroying them.
	 GHS02	Desensitised explosive 1	Danger	Solid or liquid explosive substances or mixtures which are phlegmatised to suppress their explosive properties and are exempted from the classification as 'Explosives'.
		Desensitised explosive 2	Danger	
		Desensitised explosive 3	Warning	
		Desensitised explosive 4	Warning	

Health	 GHS06	Acute Toxicity 1	Danger	Chemicals that at very low levels can cause serious damage to health.
		Acute Toxicity 2	Danger	Chemicals that at low levels can cause damage to health.
		Acute Toxicity 3	Danger	Chemicals that at moderate levels can cause damage to health.
	 GHS07	Acute Toxicity 4	Warning	Chemicals that may cause damage to health.
		Category 1, which is sometimes sub-divided as	Danger	Chemicals that may destroy living tissue

	 GHS05	below			on contact.
		Skin Corrosion 1A		Danger	
		Skin Corrosion 1B		Danger	
		Skin Corrosion 1C		Danger	
Health	 GHS07	Skin irritation 2		Warning	Chemicals that may cause inflammation of the skin.
	 GHS05	Eye Damage 1		Danger	Chemicals that may cause permanent damage to the eyes.
	 GHS07	Eye Irritation 2		Warning	Chemicals that may cause inflammation of the eyes.
	 GHS08	Respiratory Sensitiser 1	Respiratory Sensitiser 1A	Danger	Chemicals that when inhaled lead to hypersensitivity of the airways.
			Respiratory Sensitiser 1B	Danger	
	 GHS07	Skin Sensitiser 1	Skin Sensitiser 1A	Warning	Chemicals that will lead to an allergic response following skin contact.
			Skin Sensitiser 1B	Warning	
	 GHS08	Category 1, which is usually sub-divided as below		Danger	Chemicals that induce heritable genetic defects or increase their incidence.
		Mutagen 1A		Danger	
		Mutagen 1B		Danger	
		Mutagen 2		Warning	

Health	 GHS08	Category 1, which is usually sub-divided as below	Danger	Chemicals that may cause cancer or increase its incidence.
		Carcinogen 1A	Danger	
		Carcinogen 1B	Danger	
		Carcinogen 2	Warning	
	 GHS08	Category 1, which is usually sub-divided as below	Danger	Chemicals that produce or increase the incidence of non-heritable effects in progeny and/or an impairment in reproductive functions or capacity.
		Reproductive Toxicant 1A	Danger	
		Reproductive Toxicant 1B	Danger	
		Reproductive Toxicant 2	Warning	
	None	Effects on or via lactation	None	Chemicals that interfere with lactation or which may accumulate in breast milk in amounts sufficient to give cause for concern.
	 GHS08	Specific Target Organ Toxicity after Single Exposure 1	Danger	Chemicals that cause non-lethal harm to specific organs following a single exposure. The particular organ(s) affected and the route(s) of the exposure which lead to the effects may be indicated. The effects may be reversible or irreversible.
		Specific Target Organ Toxicity after Single Exposure 2	Warning	
	 GHS07	Specific Target Organ Toxicity after Single Exposure 3	Warning	Chemicals that cause irritation to the respiratory tract and/or drowsiness and dizziness.
		Specific Target Organ Toxicity after Repeated Exposure 1	Danger	Chemicals that cause non-lethal harm to specific organs

Health	 GHS08	Specific Target Organ Toxicity after Repeated Exposure 2	Warning	following repeated exposure. The particular organ(s) affected and the route(s) of the exposure which lead to the effects may be indicated. The effects may be reversible or irreversible.
	 GHS08	Aspiration Hazard 1	Danger	Liquids or solids that pose an aspiration hazard if swallowed.

Environmental	 GHS09	Aquatic Acute Toxicity 1	Warning	Chemicals that may present an immediate danger to one or more compartments of the environment.
	 **GHS09**	Aquatic Chronic Toxicity 1	Warning	Chemicals that may present an immediate or delayed danger to one or more compartments of the environment.
		Aquatic Chronic Toxicity 2	None	
	None	Aquatic Chronic Toxicity 3	None	
		Aquatic Chronic Toxicity 4	None	

Appendix C: Hazard Statements

The following pages show the Hazard Statements, as listed in the CLP Regulation, which may be assigned to a substance or mixture.

This list of phrases is correct at the time of printing and includes changes made by the 12th ATP to CLP. Phrases may be added, or the text associated with a particular code may be changed in subsequent ATPs.

Physico-chemical Hazard Statements

H200	Unstable explosives.
H201	Explosive; mass explosion hazard.
H202	Explosive; severe projection hazard.
H203	Explosive; fire, blast or projection hazard.
H204	Fire or projection hazard.
H205	May mass explode in fire.
H206	Fire, blast or projection hazard; increased risk of explosion if desensitising agent is reduced.
H207	Fire or projection hazard; increased risk of explosion if desensitising agent is reduced.
H208	Fire hazard; increased risk of explosion if desensitising agent is reduced.
H220	Extremely flammable gas.
H221	Flammable gas.
H222	Extremely flammable aerosol.
H223	Flammable aerosol.
H224	Extremely flammable liquid and vapour.
H225	Highly flammable liquid and vapour.
H226	Flammable liquid and vapour.
H228	Flammable solid.
H229	Pressurised container: May burst if heated.
H230	May react explosively even in the absence of air.
H231	May react explosively even in the absence of air at elevated pressure and/or temperature.
H232	May ignite spontaneously if exposed to air.
H240	Heating may cause an explosion.
H241	Heating may cause a fire or explosion.
H242	Heating may cause a fire.
H250	Catches fire spontaneously if exposed to air.
H251	Self-heating: may catch fire.
H252	Self-heating in large quantities; may catch fire.

H260	In contact with water releases flammable gases which may ignite spontaneously.
H261	In contact with water releases flammable gases.
H270	May cause or intensify fire; oxidiser.
H271	May cause fire or explosion; strong oxidiser.
H272	May intensify fire; oxidiser.
H280	Contains gas under pressure; may explode if heated.
H281	Contains refrigerated gas; may cause cryogenic burns or injury.
H290	May be corrosive to metals.

Toxicological Hazard Statements

H300	Fatal if swallowed.
H301	Toxic if swallowed.
H302	Harmful if swallowed.
H304	May be fatal if swallowed and enters airways.
H310	Fatal in contact with skin.
H311	Toxic in contact with skin.
H312	Harmful in contact with skin.
H314	Causes severe skin burns and eye damage.
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H318	Causes serious eye damage.
H319	Causes serious eye irritation.
H330	Fatal if inhaled.
H331	Toxic if inhaled.
H332	Harmful if inhaled.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H335	May cause respiratory irritation.
H336	May cause drowsiness or dizziness.
H340	May cause genetic defects <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.
H341	Suspected of causing genetic defects <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.
H350	May cause cancer <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.
H351	Suspected of causing cancer <state route of exposure if it is conclusively proven that no other routs of exposure cause the hazard>.
H360	May damage fertility or the unborn child <state specific effect if known > <state route of exposure if it is conclusively proven that no other routes of

	exposure cause the hazard>.
H361	Suspected of damaging fertility or the unborn child <state specific effect if known> <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.
H362	May cause harm to breast-fed children.
H370	Causes damage to organs <or state all organs affected, if known> <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.
H371	May cause damage to organs <or state all organs affected, if known> <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.
H372	Causes damage to organs <or state all organs affected, if known> through prolonged or repeated exposure <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.
H373	May cause damage to organs <or state all organs affected, if known> through prolonged or repeated exposure <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.

Combined toxicological H-statements

H300 + H310	Fatal if swallowed or in contact with skin.
H300 + H330	Fatal if swallowed or if inhaled.
H310 + H330	Fatal in contact with skin or if inhaled.
H300 + H310 + H330	Fatal if swallowed, in contact with skin or if inhaled.
H301 + H311	Toxic if swallowed or in contact with skin.
H301 + H331	Toxic if swallowed or if inhaled.
H311 + H331	Toxic in contact with skin or if inhaled.
H301 + H311 + H331	Toxic if swallowed, in contact with skin or if inhaled.
H302 + H312	Harmful if swallowed or in contact with skin.
H302 + H332	Harmful if swallowed or if inhaled.
H312 + H332	Harmful in contact with skin or if inhaled.
H302 + H312 + H332	Harmful if swallowed, in contact with skin or if inhaled.

Environmental H-statements

H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
H411	Toxic to aquatic life with long lasting effects.
H412	Harmful to aquatic life with long lasting effects.

H413	May cause long lasting harmful effects to aquatic life.
H420	Harms public health and the environment by destroying ozone in the upper atmosphere.

Appendix D: Supplemental hazard information

The following pages show the supplemental hazard information, as listed in the CLP Regulation, which may be assigned to a substance or mixture.

This list of phrases is correct at the time of printing and includes changes made by the 12th ATP to CLP. Phrases may be added, or the text associated with a particular code may be changed in subsequent ATPs.

EUH014	Reacts violently with water.
EUH018	In use may form flammable/explosive vapour–air mixture.
EUH019	May form explosive peroxides.
EUH044	Risk of explosion if heated under confinement.
EUH029	Contact with water liberates toxic gas.
EUH031	Contact with acids liberates toxic gas.
EUH032	Contact with acids liberates very toxic gas.
EUH066	Repeated exposure may cause skin dryness or cracking.
EUH070	Toxic by eye contact.
EUH071	Corrosive to the respiratory tract.
EUH201/ EUH201A	Contains lead. Should not be used on surfaces liable to be chewed or sucked by children. Warning! Contains lead.
EUH202	Cyanoacrylate. Danger. Bonds skin and eyes in seconds. Keep out of the reach of children.
EUH203	Contains chromium (VI). May produce an allergic reaction.
EUH204	Contains isocyanates. May produce an allergic reaction.
EUH205	Contains epoxy constituents. May produce an allergic reaction.
EUH206	Warning! Do not use together with other products. May release dangerous gases (chlorine).
EUH207	Warning! Contains cadmium. Dangerous fumes are formed during use. See information supplied by the manufacturer. Comply with the safety instructions.
EUH208	Contains <name of sensitising substance>. May produce an allergic reaction.
EUH209/ EUH209A	Can become highly flammable in use. Can become flammable in use.
EUH210	Safety data sheet available on request.
EUH401	To avoid risks to human health and the environment, comply with the instructions for use.

Appendix E: Precautionary Statements

The following pages show the precautionary statements, as listed in the CLP Regulation, which may be assigned to a substance or mixture.

This list of phrases is correct at the time of printing and includes changes made by the 12th ATP to CLP. Phrases may be added, or the text associated with a particular code may be changed in subsequent ATPs.

Precautionary Statements – general

P101	If medical advice is needed, have product container or label at hand.
P102	Keep out of reach of children.
P103	Read carefully and follow all instructions.

Precautionary Statements - prevention

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P211	Do not spray on an open flame or other ignition source.
P212	Avoid heating under confinement or reduction of the desensitising agent.
P220	Keep/Store away from clothing and other combustible materials.
P222	Do not allow contact with air.
P223	Do not allow contact with water.
P230	Keep wetted with … (Manufacturer/supplier to specify appropriate material)
P231	Handle and store contents under inert gas/… (Manufacturer/supplier to specify appropriate liquid or gas if 'inert gas' is not appropriate.)
P232	Protect from moisture.
P233	Keep container tightly closed.
P234	Keep only in original packaging.
P235	Keep cool.
P240	Ground and bond container and receiving equipment.
P241	Use explosion-proof [electrical/ventilating/lighting/ …] equipment. (Manufacturer/supplier to specify specific equipment.)
P242	Use non-sparking tools.
P243	Take action to prevent static discharges.
P244	Keep valves and fittings free from oil and grease.
P250	Do not subject to grinding/shock/friction ….

	(Manufacturer/supplier to specify applicable rough handling)
P251	Do not pierce or burn, even after use.
P260	Do not breathe dust/fume/gas/mist/vapours/spray. (Manufacturer/supplier to specify applicable conditions)
P261	Avoid breathing dust/fume/gas/mist/vapours/spray. (Manufacturer/supplier to specify applicable conditions.)
P262	Do not get in eyes, on skin, or on clothing.
P263	Avoid contact during pregnancy and while nursing.
P264	Wash … thoroughly after handling. (Manufacturer/supplier to specify parts of the body to be washed after handling)
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P272	Contaminated work clothing should not be allowed out of the workplace.
P273	Avoid release to the environment.
P280	Wear protective gloves/protective clothing/eye protection/face protection/hearing protection. (Manufacturer/supplier to specify type of equipment.)
P282	Wear cold insulating gloves and either face shield or eye protection.
P283	Wear fire resistant or flame-retardant clothing.
P284	[In case of inadequate ventilation] wear respiratory protection. (Manufacturer/supplier to specify equipment) (text in square brackets can be used if it is explained in the SDS what ventilation would be considered adequate.)

Combined P-statements - prevention

P231 + P232	Handle and store contents under inert gas/… Protect from moisture. (Manufacturer/supplier to specify the appropriate liquid or gas if 'inert gas' is not appropriate.)

Precautionary Statements - response

P301	IF SWALLOWED:
P302	IF ON SKIN:
P303	IF ON SKIN (or hair):
P304	IF INHALED:
P305	IF IN EYES:
P306	IF ON CLOTHING:
P308	IF exposed or concerned:
P310	Immediately call a POISON CENTER/doctor/…
P311	Call a POISON CENTER/ doctor/…

P312	Call a POISON CENTER/ doctor/… if you feel unwell.
P313	Get medical advice/attention.
P314	Get medical advice/attention if you feel unwell.
P315	Get immediate medical advice/attention.
P320	Specific treatment is urgent (see … on this label). (Reference to supplemental first aid instruction)
P321	Specific treatment (see … on this label). (Reference to supplemental first aid instruction)
P330	Rinse mouth.
P331	Do NOT induce vomiting.
P332	If skin irritation occurs:
P333	If skin irritation or rash occurs:
P334	Immerse in cool water [or wrap in wet bandages].
P335	Brush off loose particles from skin.
P336	Thaw frosted parts with lukewarm water. Do not rub affected area.
P337	If eye irritation persists:
P338	Remove contact lenses, if present and easy to do. Continue rinsing.
P340	Remove person to fresh air and keep comfortable for breathing.
P342	If experiencing respiratory symptoms:
P351	Rinse cautiously with water for several minutes.
P352	Wash with plenty of water/… (Manufacturer/supplier to specify appropriate cleansing agent.)
P353	Rinse skin with water [or shower].
P360	Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.
P361	Take off immediately all contaminated clothing.
P362	Take off contaminated clothing.
P363	Wash contaminated clothing before reuse.
P364	And wash it before reuse.
P370	In case of fire:
P371	In case of major fire and large quantities:
P372	Explosion risk.
P373	DO NOT fight fire when fire reaches explosives.
P375	Fight fire remotely due to the risk of explosion.
P376	Stop leak if safe to do so.
P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P378	Use…to extinguish. (Manufacturer/supplier to specify appropriate media)
P380	Evacuate area.
P381	In case of leakage, eliminate all ignition sources.

P390	Absorb spillage to prevent material damage.
P391	Collect spillage.

Combined P-statements - response

P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/…
P301 + P312	IF SWALLOWED: Call a POISON CENTER/doctor/…/if you feel unwell.
P302 + P334	IF ON SKIN: Immerse in cool water or wrap in wet bandages.
P302 + P352	IF ON SKIN: Wash with plenty of water/… (Manufacturer/supplier to specify appropriate cleansing agent.)
P304 + P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P306 + P360	IF ON CLOTHING: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.
P308 + P311	IF exposed or concerned: Call a POISON CENTER/ doctor/…
P308 + P313	IF exposed or concerned: Get medical advice/attention.
P332 + P313	If skin irritation occurs: Get medical advice/attention.
P333 + P313	If skin irritation or rash occurs: Get medical advice/attention.
P336 + P315	Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice/attention. ??
P337 + P313	If eye irritation persists: Get medical advice/attention.
P342 + P311	If experiencing respiratory symptoms: Call a POISON CENTER/doctor/…
P361 + P364	Take off immediately all contaminated clothing and wash it before reuse.
P362 + P364	Take off contaminated clothing and wash it before reuse.
P370 + P376	In case of fire: Stop leak if safe to do so.
P370 + P378	In case of fire: Use … to extinguish. (Manufacturer/supplier to specify appropriate media).

P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P302 + P335 + P334	IF ON SKIN: Brush off loose particles from skin. Immerse in cool water [or wrap in wet bandages].
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower].
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P370 + P380 + P375	In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.
P371 + P380 + P375	In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.

P370 + P372	In case of fire: Explosion risk. Evacuate area. DO NOT fight fire when fire

+ P380 + P373	reaches explosives.
P370 + P380 + P375 [+ P378]	In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion. [Use … to extinguish].

Precautionary Statements – storage

P401	Store in accordance with...
P402	Store in a dry place.
P403	Store in a well-ventilated place.
P404	Store in a closed container.
P405	Store locked up.
P406	Store in corrosive resistant/ … container with a resistant inner liner. (Manufacturer/supplier to specify other compatible materials)
P407	Maintain air gap between stacks or pallets.
P410	Protect from sunlight.
P411	Store at temperatures not exceeding … °C/… °F. (Manufacturer/supplier to specify temperature).
P412	Do not expose to temperatures exceeding 50 °C/122 °F.
P413	Store bulk masses greater than … kg/…lbs at temperatures not exceeding … °C/… °F. (Manufacturer/supplier to specify mass and temperature).
P420	Store separately.

Combined P-statements - storage

P402 + P404	Store in a dry place. Store in a closed container.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P410 + P403	Protect from sunlight. Store in a well-ventilated place.
P410 + P412	Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F.

Precautionary Statements – disposal

P501	Dispose of contents/container to …
P502	Refer to manufacturer or supplier for information on recovery or recycling.

Appendix F: Useful addresses and contacts

ADR	Regulation of transport of dangerous goods in Europe (and some neighbouring states). The UN Economic Commission for Europe Address: Palais des Nations, Avenue de la Paix 8-14, CH–1211 Geneva 10, Switzerland. Tel: +41 22 917 12 34; Fax: +41 022 917 01 23 Website: http://www.unece.org/trans/danger/danger.html
British Standards Institution (BSI)	Address: 389 Chiswick High Road, London, W4 4AL, United Kingdom. Tel: +44 (0)845 086 9001. Fax: +44 (0)20 8996 7001. Website: http://www.bsigroup.com/en-GB
Canadian Centre for Occupational Health and Safety (CCOHS)	Promotes a safe and healthy working environment by providing information and advice about occupational health and safety. The Internet links to 1500 health safety resources. Website: www.ccohs.ca
European Chemical Industry Council (CEFIC)	The European Chemical Industry Council is both the forum and the voice of the European chemical industry. It represents, directly or indirectly, about 40 000 large, medium and small chemical companies in Europe. Belliard, 40; 1040 Brussels; Belgium. Tel: +32 2 436 93 00. Email: mail@cefic.be Website: www.cefic.org
Chemical Hazards Communication Society (CHCS)	Address: 49 Station Road, Polegate, East Sussex, BN26 6EA, United Kingdom. Tel: + 44 (0) 333 210 2427. Email: enquiries@chcs.org.uk Website: www.chcs.org.uk
Chemical Industries Association (CIA)	Address: Kings Buildings, Smith Square, London SW1P 3JJ, UK. Tel: +44 (0)20 7834 3399. Email: enquiries@cia.org.uk Website: www.cia.org.uk
Environment Agency	Address: National Customer Contact Centre, PO Box 544, Rotherham S60 1BY, UK. Tel: 03708 506 506 - General enquiry number that connects to the caller's local office. Email: enquiries@environment-agency.gov.uk 24-hour Emergency Hotline: 0800 807 060 For emergencies, such

	as reporting a pollution incident. Environmental matters in Wales are now handled by Natural Resources Wales (see below). Website: https://www.gov.uk/government/organisations/environment-agency
European Chemicals Agency (ECHA)	European regulatory authority concerning chemicals. Address: PO Box 400, 00121 Helsinki, Finland. Tel: +358-9-686180 (switchboard). Website: http://echa.europa.eu
EU National Chemical Helpdesks	Each EU member state has its own national helpdesk for matters involving chemicals. A list of the national helpdesks can be found here: https://echa.europa.eu/support/helpdesks The UK national helpdesk is provided by the HSE (See HSE REACH and CLP UK Competent Authority Help Desk below for details)
Fire Protection Association	The FPA provides free basic advice on workplace fire safety but may levy charge for more detailed information. The FPA also produces training material and publications on fire safety. Address: London Road, Moreton-in-Marsh, Gloucestershire, GL56 0RH, UK. Tel: +44 (0)1608 812 500. Email: enquiries@thefpa.co.uk Website: www.thefpa.co.uk
Governments on the WWW	A website linking to government sites world-wide Website: http://www.gksoft.com/govt
HSE	UK Health and Safety Executive. Government body concerning health and safety within the UK. Contact page: https://www.hse.gov.uk/contact/index.htm Website: www.hse.gov.uk The website has a useful search engine and gives access to lots of free information. For REACH and CLP matters, contact the REACH helpdesk (details below).
HSE REACH and CLP UK Competent Authority Help Desk	The HSE provide the national helpdesk for the UK for matters involving REACH and CLP. Address: The Agency, The Health and Safety Executive, 1.1 Redgrave Court, Bootle, Merseyside L20 7HS, UK. UK Chemicals helpline: Tel: 0330 159 1985. REACH and CLP Helpdesk: email: ukreach.clp@hse.gov.uk E-mail: ukreach.clp@hse.gov.uk REACH Website: http://www.hse.gov.uk/reach CLP Website: https://www.hse.gov.uk/chemical-classification/legal/clp-regulation.htm
HSE Books	Free and priced Health and Safety booklets and leaflets.

	Address: PO Box 29, Norwich, NR3 1GN, UK. Tel: +44 (0)333 202 5070. Email: hseorders@tso.co.uk Website (on-line catalogue): http://books.hse.gov.uk
International Air Transport Association (IATA)	IATA publishes regulations regarding the air transport of dangerous goods. Address: IATA UK The Metro Building, 1 Butterwick, Hammersmith Floor 8, office 808, London W6 8DL, United Kingdom. Phone: +44 207 660 0068. Customer portal: https://portal.iata.org/ Website: www.iata.org
International Civil Aviation Organisation (ICAO)	UN agency that produces the international model regulations regarding air transport of dangerous goods. Address: 999 Robert-Bourassa Boulevard, Montréal, Quebec H3C 5H7, Canada. Tel: +1 514-954-8219. Fax: +1 514-954-6077. Email: icaohq@icao.int Website: www.icao.int
International Maritime Organization (IMO)	IMO sets the regulations regarding sea transport of dangerous goods, published as the IMDG Code. Address: 4 Albert Embankment, London, SE1 7SR, UK. Tel +44 (0)2077 357 611. Fax +44 (0)2075 873 210. Email: info@imo.org Website: www.imo.org
Legislation.gov.uk	Archive of UK legislation run by the National Archives. Website: http://www.legislation.gov.uk
National Chemical Emergency Centre (NCEC)	Address: The Gemini Building, Fermi Avenue, Harwell, Didcot, Oxfordshire, OX11 0QR, UK. Tel: +44 (0) 1235 753654. Website: www.the-ncec.com
National Institute for Occupational Safety and Health (NIOSH)	US organisation established by the Occupational Safety and Health Act of 1970. NIOSH is part of the Centers for Disease Control and Prevention (CDC) and is the only federal institute responsible for conducting research and making recommendations for the prevention of work-related illnesses and injuries. NIOSH identifies the causes of work-related diseases and injuries and the potential hazards of new work technologies and practices. Website: www.cdc.gov/niosh

Natural Resources Wales	The Welsh government body responsible for the environment. The Environment Agency's responsibilities in Wales were taken over by National Resources Wales in April 2013. Tel: 0300 065 3000 (to report an incident). Website: http://naturalresourceswales.gov.uk
Royal Society of Chemistry (RSC)	Professional association for the chemical sciences. Address: Burlington House, Piccadilly, London, W1J 0BA Tel: +44 (0)2074 378 656. Website: www.rsc.org The RSC run Chemspider, a useful and free chemical data resource: http://www.chemspider.com
Scottish Environment Protection Agency (SEPA)	The Scottish government body responsible for the environment. Address: Angus Smith Building, 6 Parklands Avenue, Eurocentral, Holytown, North Lanarkshire ML1 4WQ, UK. Tel: 0800 80 70 60 (Pollution Hotline). Website: http://www.sepa.org.uk
TUC – Trades Union Congress	Address: Congress House, Great Russell Street, London, WC1B 3LS, UK. Tel: 02076 364 030. Email: info@tuc.org.uk Website: www.tuc.org.uk
UK Government, departments, etc.	This service provides a first entry point to UK public sector information on the Internet. Website: https://www.gov.uk
United Nations Publications	Publisher of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and Recommendations on the Transport of Dangerous Goods: Model Regulations. Website: https://www.un.org/en/publications/

Appendix G: Bibliography

NOTE: All references in this appendix are correct at time of going to press; it is vital to ensure that any reading of any legislation includes all the subsequent amendments.

European legislation and guidance

Available online on the ECHA website.

European regulations

Regulation EC No. 1907/2006 concerning Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).
http://echa.europa.eu/regulations/reach/legislation

Regulation EC No. 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP).
http://echa.europa.eu/regulations/clp/legislation

Regulation (EU) No. 528/2012 concerning the making available on the market and use of biocidal products (BPR).
https://echa.europa.eu/regulations/biocidal-products-regulation/legislation

Regulation EC No. 1005/2009 on substances affecting the ozone layer
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32009R1005

Regulation (EC) No. 648/2004 on detergents
https://echa.europa.eu/legislation-profile/-/legislationprofile/EU-DETERGENTS

Regulation (EC) No 1107/2009 on plant protection products
https://echa.europa.eu/legislation-profile/-/legislationprofile/EU-PLANT_PROTECTION

EU directives

Directive 2000/60/EC establishing a framework for Community action in the field of water policy (Water Framework Directive; WFD).
https://echa.europa.eu/legislation-profile/-/legislationprofile/EU-COMMUNITY_WATER

Directive 2008/105/EC on environmental quality standards in the field of water policy (Environmental Quality Standards Directive; EQSD).
https://echa.europa.eu/environmental-quality-standards

Directive 2008/98/EC on waste (Waste Framework Directive).
https://ec.europa.eu/environment/topics/waste-and-recycling/waste-framework-directive_en

Directive 94/33/EC on the protection of young people at work.
https://osha.europa.eu/en/legislation/directives/18

Directive 92/85/EEC on the introduction of measures to encourage improvements in the safety and health at

work of pregnant workers and workers who have recently given birth or are breastfeeding.
https://osha.europa.eu/en/legislation/directives/10

Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances (Seveso III Directive).
https://ec.europa.eu/environment/seveso/

EU guidance

Guidance for Downstream Users, ECHA, Version 2.1, 2014.
https://echa.europa.eu/documents/10162/2324906/du_en.pdf

Safety Data Sheets and Exposure Scenarios - Key Information for Downstream Users, ECHA, 2016, ECHA-16-FS-05-EN.
https://echa.europa.eu/documents/10162/22372335/downstream_sds_en.pdf

Guidance on the Compilation of Safety Data Sheets, ECHA, version 4.0, December 2020.
https://echa.europa.eu/documents/10162/2324906/sds_en.pdf

Practical guide 13: How downstream users can handle exposure scenarios, ECHA, May 2016, ECHA-16-B-21-EN.
http://echa.europa.eu/documents/10162/13655/du_practical_guide_13_en.pdf

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